Board of Education

5 Minortown Road ~ Woodbury, CT 06798
www.ctreg14.org

Mission: The mission of Connecticut Region 14 Schools is to educate all students to their highest level of academic potential and to teach them the skills and knowledge to become capable, creative, collaborative lifelong learners and responsible members of the world community.

Board of Education Goals*:*
Academic Performance - The district will strive to improve academic performance for all students on multiple assessment indicators and the staff will be committed to continuous improvement.
Communication - Region 14 will develop partnerships with all stakeholders in the school community to highlight the exemplary programs the district offers
Safety - Region 14 will provide safe and secure facilities equipped with technology, enabling a 21st century learning environment that supports the values of the district
Budget - Region 14 will prepare a budget that meets the needs of every student and communicates the needs and priorities of Region 14 in a clear and concise manner.

A G E N D A

Special Meeting

Curriculum Committee Meeting
Wednesday, December 11, 2024; 2:30 p.m.
Central Office Conference Room

I. Call to order

II. Curriculum Documents for Approval
   A. English: Creative Writing Curriculum
   B. English: Global Contexts/Multicultural Perspectives Curriculum
   C. Math: Pre-calculus Curriculum
   D. Science: Forensics Curriculum

III. Proposed Revisions to Graduation Requirements

IV. Adjourn

CREATIVE WRITING CURRICULUM

Grade Level(s): 11-12

Curriculum Author(s): Katy Aseltine, Kelly Nichols, Conor Gereg

Course Description:
Creative Writing is a course designed to afford students the opportunity to develop their writing skills across a range of genres while also honing abilities in research, multimodal communication, and collaboration. Students will read a wide range of literary texts that will serve as samples for the kind of writing the students will produce; these include one-act plays/screenplays, poetry, short stories, and personal narratives/memoirs. Additionally, the class will focus on producing work rooted in non-fiction research, citing historical and contemporary events grounded in real-world details. Students will share their work regularly with their peers while also developing skills in self-editing. At the conclusion of the academic year, students will select a culminating work from the course to be submitted for publication. This course may only be taken once to fulfill the English graduation requirement. Upon successful completion, students will be eligible to earn college credit through SCSU (pending college approval)

Year At A Glance			
Unit Title	**Overarching Essential Question**	**Overarching Enduring Understanding**	**Vision of A Learner "I Can" Statements**
Author's Voice and Toolbox: The Personal Narrative & Personal Essay	What makes each writer's voice unique?	Writers use narrative strategies to create an engaging first person account of an event	TCC1; CCE4;DE1;TI2; P4; AA4
Fiction Exploration: Short Fiction & Drama	How does the intersection of writer, subject and audience shape a story?	Short fiction and drama are crafted using specific structures and devices.	TCC2; CCE2; DE1; TI1; P3; AA3
Creating Written Worlds: The Research Story & Sci-Fi/Fantasy	How does research build a "written world" in writing?	Writers use research to build fictional worlds that comment on individual and societal expectations	TCC1; CCE3; DE1; TI3; P1; AA3
Words Matter: Poetry Collection & Children's Literature	What stylistic and structural differences exist between poetry and prose? How does a child audience impact an author's decisions?	Poetry and Children's Literature are unique forms of writing that require a thoughtful review of word choices.	TCC2; CCE1; DE2; TI1; P2; AA
Becoming a Critic: Crafting Critical Reviews in Film, Music, Literature	How does an author convey his or her opinions regarding a piece of art?	Understanding other artists' choices is essential to understanding the value of the art itself.	TCC3, CCE4, DE2, TI4:P4, AA4:

Unit 1 - Author's Voice and Toolbox: The Personal Narrative & Personal Essay	
Desired Results - Goals, Transfer, Meaning, Acquisition	
Established Goals: **Common Core State Standards** CCSS.ELA-LITERACY.W.11-12.9.A Apply grades 11-12 Reading standards to literature (e.g., "Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature CCSS.ELA-LITERACY.W.11-12.3.B Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters. CCSS.ELA-LITERACY.W.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1-3 up to and including grades 11-12 here.) CCSS.ELA-LITERACY.W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.	
Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated) ● TCC4 (9-12): I can integrate my learning to adapt to experiences in the classroom, career and life. ● CCE4 CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression. ● DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives. ● T2(9-12): I can evaluate my objectives and a variety of credible resources to find the best solutions for any challenge. ● P4(9-12): I can take-on challenges and continuously engage in my own long-term strategies to overcome them to demonstrate through personal experience that failures are more instructive than discouraging. ● AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.	
Understandings: Students will understand that... ● Memoir writing asks that an author focuses on specific moments from one's life and understand how these moments serve as formative experiences. ● Personal writing benefits from the same figurative writing skills	**Essential Questions:** ● What makes each writer's voice unique? ● What stylistic techniques can help bring personal writing to life? ● How can an author make specific life experiences universal to his or her audience?

<table>
<tr><td>
that enrich all types of creative prose.
● Composing personal writing will help us better understand ourselves.
● The most powerful types of personal writing will engage an audience about universal topics that are accessible to all readers.
</td><td>
● Why is storytelling such a vital part of being human?
● How does looking at the world as a writer change our perspective regarding our own lives?
</td></tr>
<tr><td>
Students will know...
● how to provide constructive and appropriate feedback to peers.
● understand the difference between suggestive feedback vs. praise-based feedback
● how to integrate particular details to relay the most important elements of an experience
● the foundations of dialogue usage in prose
</td><td>
Students will be able to...
● respond to constructive feedback and participate in the recursive writing process.
● provide constructive feedback to a peer
● carefully consider the connotation of particular words or phrases
● integrate figurative language techniques to enrich writing
● discern how a particular experience speaks to an individual’s collective growth
</td></tr>
<tr><td colspan="2">Key Vocabulary: Misdirection, Point of View/P.O.V., Memoir, Recursive, Selection of detail, Syntax (asyndeton, polysyndeton)</td></tr>
<tr><th colspan="2">Assessment Evidence</th></tr>
<tr><td>
Performance Tasks:

The Personal Narrative/Memoir (Summative)

The Personal Essay (“Open Letters to People or Entities Who Are Unlikely to Respond” Draft, Letters to My Younger Self modeled after The Players’ Tribune, How To Be…) (Summative)
</td><td>
Other Evidence:

Formative Assessment:
1) Analyzing model essays to inform instruction
2) Teacher conferences/discussion of texts studied,
3) Writing conferences
4) Graphic organizers for Narrative Essay
5) Graphic Organizer for Personal Essay

Interim Assessments:
1) Narrative essay first draft
2) Personal essay first draft
3) Devices and Strategies Quizzes
</td></tr>
<tr><th colspan="2">Learning Plan</th></tr>
<tr><td colspan="2">
TCC4 (9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.
Formative Assessment 1: Analyzing model essays
</td></tr>
</table>

CCE4 CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression. Summative 1: The Personal Narrative Summative 2: The Personal Essay **DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives.** Formative Assessment 3: Writing Conferences **TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions.** Formative Assessment 2: Teacher Conferences **P4(9-12): I can take-on challenges and continuously engage in my own long-term strategies to overcome them to demonstrate through personal experience that failures are more instructive than discouraging.** Drafting Process: Interim Assessment Drafts that will become Final Drafts **AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.** Summative 2: The Personal Essay. Selecting a type of personal essay to write.
Teacher Resources: Matthew Dicks Podcast from NPR (How to tell a story); Excerpts from Stephen King's What Writing Is ; The Players' Tribune Personal Essay Models; "The Basement" (student sample); "Let it Snow" and "Us and Them" by David Sedaris; "Mother Tongue" by Amy Tan; Excerpt from Tina Fey's Bossy Pants; Excerpts from McSweeny's "Open Letters to People or Entities Who Are Unlikely to Respond"; Excerpts from Ron Carlson Writes a Story (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 2 - Fiction Exploration: Short Fiction and Drama

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

- CCSS.ELA-LITERACY.W.11-12.9.A

Apply grades 11-12 Reading standards to literature (e.g., "Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature

- CCSS.ELA-LITERACY.W.11-12.3.B

Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.

- CCSS.ELA-LITERACY.W.11-12.5

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1-3 up to and including grades 11-12 here.)

- CCSS.ELA-LITERACY.W.11-12.10

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.
- CCE2(9-12): I can give and receive actionable and relevant feedback with openness to be able to determine meaningful revisions for success.
- DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives.
- TI1(9-12): I can implement a realistic plan and adapt when necessary to achieve my goals.
- P3(9-12): I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.
- AA3(9-12): I can adjust my expectations and behaviors to succeed in a changing and unpredictable environment.

Understandings: Students will understand that...	**Essential Questions:**
• writers bring life to their writing through a variety of language techniques that can be used in creative prose and dramatic composition. • the conventions of writing within a particular medium • stage direction and narration play a vital role in communicating with an audience	• How does setting shape a story? How would it be different in a different time or place? • What techniques and strategies help enrich an author's prose? • What techniques help enrich an author's prose? • How can we manipulate language so that it reflects the complex ideas we wish to communicate?

<table>
<tr>
<td>● different genres of writing achieve the author’s purpose and allow an author to deliver his or her message through creative composition.</td>
<td>● How does setting shape a story? How would it be different in a different time or place?
● What role do stage directions play in character development? Are the requirements to a stage interpretation or more of a suggestion? Why?
● How does the intersection of writer, subject and audience shape a story?</td>
</tr>
<tr>
<td>Students will know...
● how writers bring life to their writing through a variety of language techniques.
● the conventions of writing within a particular medium
● how stage direction and narration play a vital role in communicating with an audience.
● how different genres of writing achieve the author’s purpose.</td>
<td>Students will be able to...
● Integrate figurative language into their writing as a means of crafting engaging prose.
● Craft a screenplay or short piece of drama that adheres to the conventions of the medium
● Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).
● Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1-3 up to and including grades 11-12 here.)</td>
</tr>
<tr>
<td colspan="2">Key Vocabulary: Adjective Order, Allusion, alliteration, cacophony, epistrophe, hyperbole, simile, extended metaphor</td>
</tr>
<tr>
<td colspan="2">Assessment Evidence</td>
</tr>
<tr>
<td>Performance Tasks:
Short Fiction/Short Story (Summative)
One-Act Play (Drama Summative)</td>
<td>Other Evidence:
Formative Assessment:
1) Analyzing model essays to inform instruction
2) Teacher conferences/discussion of texts studied,
3) Writing conferences
4) Graphic organizers for Narrative Essay
5) Graphic Organizer for Personal Essay

Interim Assessments:
1) Short fiction first draft
2) One-Act play first draft</td>
</tr>
</table>

	3) Devices and Strategies Quizzes

Learning Plan
TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. Formative Assessment: Analyzing model essays and utilizing peer feedback **CCE2(9-12): I can give and receive actionable and relevant feedback with openness to be able to determine meaningful revisions for success.** Interim Assessment: Utilizing feedback from peer editors and instructors to improve written drafts **DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives.** Formative Assessment: Conferencing with peer editors and instructors **TI1(9-12): I can implement a realistic plan and adapt when necessary to achieve my goals.** Summative Assessment: Developing a plan that utilizes the recursive process when drafting a culminating assessment/draft. **P3(9-12): I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.** Formative Assessment: Integration of suggestions and improvement strategies to student writing to attain writing goals. **AA3(9-12): I can adjust my expectations and behaviors to succeed in a changing and unpredictable environment.** Interim Assessment: Flexibility in accepting feedback, adjusting writing goals, and amending drafts to address success criteria throughout the drafting process.
Teacher Resources: *A Streetcar Named Desire*, by Tennessee Williams; *Oedipus Rex* by Sophocles (or instructor choice of Greek Drama); "One Teen Story" (Review of National Student Work from Annual Publication, *What can teen writing look like?*); Excerpt from John Steinbeck's *Of Mice & Men* (Designing a Scene & Delivery of Imagery Act.); "Popular Mechanics" by Raymond Carver; "The Leopard" by Wells Tower; "Snow" by Charles Baxter; "The Death of the Right Fielder" by Stuard Dybek; "The Man Who Knew Belle Starr" by Richard Bausch; "The Sandbox" by Edward Albee *and/or other anchor texts for drama;* Student samples and exemplars; *The New Yorker Fiction Podcast;* Screenwriting excerpts (i.e. - *The Office*, *Saturday Night Live*, etc.) (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 3 - Creating Written Worlds: The Research Story & Sci-Fi/Fantasy

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

- CCSS.ELA-LITERACY.RL.11-12.7

Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)

- CCSS.ELA-LITERACY.W.11-12.3.C

Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).

- CCSS.ELA-LITERACY.W.11-12.7

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

- CCSS.ELA-LITERACY.SL.11-12.1.A

Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions.
- CCE3(9-12): I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.
- DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives.
- TI3(9-12): I can formulate and investigate probing questions to further my learning.
- P1(9-12): I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others.
- AA3(9-12): I can adjust my expectations and behaviors to succeed in a changing and unpredictable environment.

Understandings	Essential Questions
Understandings: Students will understand that… • Effective research can add authenticity to creative writing and contribute to theme. • Genres such as science fiction and fantasy can function as social commentary.	**Essential Questions:** • What qualities of writing help to make a story uniquely your own? How does research help to add authenticity to our writing? • Why is it important to credit another writer for his or her work? (Author’s Voice)

• Genres such as historical fiction can influence a reader's perspective on historical events • Authors use devices like foreshadowing, symbolism, and imagery to convey and enhance theme and meaning	• How can the connotation of a particular word influence an audience? • Why might researching the perspectives of historical events help build empathy for the trials of those before us? • How does literature influence the audience's reactions (i.e. mass hysteria)?
Students will know… • standard English conventions in writing • how to navigate a research database to supplement their creative work. • how to assess the credibility of a research source. • how to integrate researched content in a way that's appropriate for student needs. • how to identify and create science fiction • how science fiction connects to the real world • the characteristics of dystopian literature • the role of dystopian literature in challenging readers' perspectives about society	**Students will be able to…** • synthesize research from a research database. • cite information that has been researched and vetted. • correctly format a Works Cited • collaborate with their peers to work together effectively in the creation of a group project • implement the stages of the writing process: prewriting, drafting, editing and publication • incorporate technology in the creation of a broadcast performance
Key Vocabulary: Works Cited, Database, credible and reliable sources, Recursive writing, parenthetical citation, in-text citation, paraphrase, ICE Method, block quotes	
Assessment Evidence	
Performance Tasks: Summative 1: Historical Fiction Short Story: Students conduct research about a time, place, or era and then write a historical fiction short story. Summative 2: Research Sci-Fi: Using War of the Worlds as inspiration, students conduct research about a time, place, or topic and then create a sci-fi play. The final product will be a performed broadcast of their play that includes the skills of storytelling and effectively chosen audio.	**Other Evidence:** Formative Assessments: 1. Analyzing model essays to inform instruction 2. Teacher conferences/discussion of texts studied 3. Writing conferences 4. Graphic organizers for Historical Fiction Short Story 5. Graphic Organizer for Research SciFi Assignment or Fantasy Short Story

OR: Fantasy Short Story: Students write a short story using components of fantasy writing, including world-building, fantastical characters, etc.	Interim Assessments: 1. Historical Fiction Short Story first draft 2. Research SciFi Assignment or Fantasy Short Story graphic organizer or first draft

Learning Plan
TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions. Formative Assessment 2: Teacher conferences/discussion of texts studied **CCE3(9-12): I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.** Interim 1: Historical Fiction Short Story first draft Interim 2: Research SciFi Assignment or Fantasy Short Story graphic organizer or first draft **DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives.** Formative Assessment 3: Writing Conferences **TI3(9-12): I can formulate and investigate probing questions to further my learning.** Summative 1: Historical Fiction Short Story **P1(9-12): I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others.** Formative Assessment 3: Writing Conferences
Teacher Resources: "Miracle Polish" by Steven Millhauser; Art to Text Story Starter Image Prompts by Erik Johansson; "The Pedestrian" by Ray Bradbury; Selected excerpts from Dan Brown and Michael Crichton; Student exemplars (Sci Fi); Student exemplars (Research Story); War of the Worlds: 1938; https://casn.berkeley.edu/wp-content/uploads/resource_files/War_of_Worlds_script.pdf Full Transcript of the 1938 play (New Jersey); https://www.youtube.com/watch?v=Xs0K4ApWl4g Full 1938 Radio Broadcast of War of the Worlds; Supplemental materials from 1938 describing the impact of the broadcast; https://www.youtube.com/watch?v=7amqdrVO-E0 The War of the Worlds Mass Hysteria (That Never Happened) (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 4 - Words Matter: Poetry Collection & Children’s Literature

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

- CCSS.ELA-LITERACY.RL.11-12.7

Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)

- CCSS.ELA-LITERACY.RL.11-12.6

Analyze a case in which grasping a point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).

- CCSS.ELA-LITERACY.RL.11-12.2

Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.
- CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias.
- DE2(9-12): I can honor my own feelings and show empathy toward others through my actions.
- TI1(9-12): I can implement a realistic plan and adapt when necessary to achieve my goals.
- P2(9-12): I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my ability to overcome my challenges.
- AA1(9-12): I can evaluate different approaches and justify the best pathway to success.

Understandings: Students will understand that...

- The prosody of the English language can impact the way a creative work is interpreted by an audience.
- Children’s literature and poetry can help to reflect the ideas or attitudes an author wishes to convey.
- Poetry can sometimes assist a writer in conveying concepts that prose or drama cannot.

Essential Questions:

- What stylistic and structural differences exist between poetry and prose?
- How does a child audience impact an author’s decisions?
- How does the prosody of a creative text impact both its delivery and its interpretation?
- When can sound devices assist in communicating an author’s message?

<table>
<tr><td>

- Poetry is a communication tool uniquely different from other styles of communication.

</td><td></td></tr>
<tr><td>

Students will know…

how to craft literature based on a particular audience

- how the connotations of particular words can impact an author’s message
- the importance of language’s prosody and how the sounds the spoken word an influence an audience
- the impact of figurative language on the reader
- the ability of a poem to tell a story
- poetry comes in many forms and styles; it magnifies a variety of voices and reflects and even influences the world around us

</td><td>

Students will be able to…

- Justify their decisions as writers
- Build a collection of ideas tethered to a particular theme a student feels is essential to communicate (Poetry Collection)
- Capture an enduring meaning within a text and deliver that meaning to an audience (Children’s Book)
- Students will consider how visual art can reflect written meaning (Poetry Collection Cover Design & Children’s Book Illustrations)

</td></tr>
<tr><td colspan="2">

Key Vocabulary: Alliteration, Anaphora, Anastrophe, Cacophony, Counter-argument/counterclaim, Diction, Epistrophe,, Hyperbole, Metaphor, Pathos, Personification, Rhetorical Question, Simile, Anapestic, Iambic, Trociac, Spondiac, Elegy, Sonnet, Concrete [Poem], Meter, Rhyme, Free verse, Blank verse

</td></tr>
<tr><td colspan="2">

Assessment Evidence

</td></tr>
<tr><td>

Performance Tasks:

- Poetry Collection (Summative)
- Children’s Book & Analysis Document (Summative; Project to include student video narration of assignment prior to being sent to elementary schools for viewing)

</td><td>

Other Evidence:
Formative Assessments:
1. Analyzing and discussing model poetry collections and published children’s texts.
2. Teacher conferences/discussion of texts studied
3. Writing conferences and workshops
4. Design checkpoints (cover design for poetry anthology, cover design and interior imagery for children’s book)

Interim Assessments:
1. Draft checkpoints for both summative assignments
2. Vocabulary quiz on advanced poetry devices (figurative language, sound techniques, meter and rhyme)

</td></tr>
</table>

Learning Plan
TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. Summative Assessment 2: Students will explore the role of specific connotations connected to an author's diction and its collective impact on how an audience perceives these nuances. **CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias.** Formative Assessment 1: Students will workshop and constructively respond to one another in presenting their poetry collection draft. **DE2(9-12): I can honor my own feelings and show empathy toward others through my actions.** Interim Assessment: Students will present a draft version of their children's fiction summative, reflecting the themes that each individual justifies as important to communicate to a younger audience. **TI1(9-12): I can implement a realistic plan and adapt when necessary to achieve my goals.** Formative Assessment 3: Students will plan and adapt a comprehensive set of individual criteria and checkpoints while drafting a poetry collective anthology. **P2(9-12): I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my ability to overcome my challenges.** Interim Assessment: Both the Poetry Collection Anthology and the Children's Fiction summatives will ask students to take part in composing projects in entirely new realms of writing, and thus all students will utilize new learning strategies in order be successful in these projects. **AA1(9-12): I can evaluate different approaches and justify the best pathway to success.** Formative Assessment: Short writing exercises designed to give students insight into unique ways to foster creative ideas (image to text, music and poetry connections, story starters, sentence stems for poetry, etc.).
Teacher Resources: Google Drawings (Cover Design Application); "Girl on a Tractor" by Joyce Sutphen; "Je suis Charlie"; "To One Coming North" Claude McKay; "Phenomenal Woman" by Maya Angelou; Gary Soto "Oranges" (Poem); "I Will Keep Broken Things" Alice Walker; "Life is Boring" by John Berryman; "Nighthawks" (Painting to Poem); "Southern Gothic" (Painting to Poem); Billy Collins "Weighing the Dog" (Poem); "The Hills of Little Cornwall" (Poems about Place); "Hairbands" Julia Alvarez; William Shakespeare "Sonnet 18"; E.E. Cummings "[i carry your heart with me(i carry it in]"; Gwendelyn Brooks "We Real Cool"(Poem); Rupi Kaur selected poems and illustrations; Student Poetry Collection exemplars; Songs as Poetry; iMovie (or similar technology so students can record & narrate children's book creation prior to being sent to elementary schools) (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 5 - Becoming a Critic: Crafting Critical Reviews in Film, Music, Literature

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

CCSS.ELA-Literacy.W.11-12.10
Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

CCSS.ELA-Literacy.W.11-12.4
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1-3 above.)

CCSS.ELA-Literacy.SL.11-12.4
Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.
- CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.
- DE2(9-12): I can honor my own feelings and show empathy toward others through my actions.
- TI4(9-12): I can apply my strengths and anticipate challenges to reach my current and future goals.
- P4(9-12): I can take-on challenges and continuously engage in my own long-term strategies to overcome them to demonstrate through personal experience that failures are more instructive than discouraging.
- AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.

Understandings: Students will understand that...	Essential Questions:
• Being a critical thinker requires students to understand how techniques and strategies are implemented by a director or writer	• How is a critical review different from other types of writing studied this year?

• Studying iconic works, strengthens one's own abilities and develops foundational skills • Differences in opinion regarding seminal works of literature, film, and music only helps individuals better understand the world in which they live • No artistic work is without areas of improvement. Writing is a constant effort at revision.	• How do techniques in film and music differ from the techniques used in writing? Where is the overlap in these techniques. (foreshadowing, imagery, point of view, suspense) • Who is the audience for a critical review? • Where can I find critical reviews? Where are critical reviews published?
Students will know... • how to use a graphic organizer to analyze a film, piece of writing, or musical piece • how devices and techniques such as foreshadowing, suspense, point of view, imagery are incorporated into multiple media • How to select a work for critical review • The set up of a critical review and common features within this type of writing • How to use technology to research and develop a piece of writing. • How peers and teachers can help support a writer's aim throughout the feedback process	**Students will be able to…** • Justify their decisions as writers • Build a set of critical reviews based on their viewing, reading, and listening to various works (Critical Review Collection) • Reflect on what an artist does well and what an artist could work on • Use creative strategies to engage the audience of their writing
Key Vocabulary: script, soundtrack, producer, director, cast, flashback, flashforward,scene, sound effect, voiceover, montage, mise en scene, storyboard, continuity, track liner notes, album art, melody, harmony, rhythm, foreshadowing, imagery, suspense, point of view	
Assessment Evidence	
Performance Tasks: Series of Critical Reviews: Summative Collection of 3-5 Critical Reviews of Films, Music Albums, and Poetry and Prose	**Other Evidence:** **Other Evidence:** Formative Assessments: 1. Analyzing and discussing model critical reviews. 2. Teacher conferences/discussion of texts studied 3. Writing conferences and workshops 4. Review checkpoints

	Interim Assessments: 1. Draft checkpoints for summative assignments 2. Vocabulary quiz on film terms 3. Peer Editing Workshop

Learning Plan
TCC3(9-12): I can integrate relevant information to produce multiple valid solutions. Formative Assessment. Students will develop background knowledge on works studied including directors, authors, inspirations for stories, and techniques used to craft work. Students will take notes on this information in a relevant graphic organizer. **CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.** Summative Assessment:Students will craft music, film, and text reviews based on strengths and weaknesses within the works studied. Students will draw on various strategies to craft a review that is effective and develops strong and unique points about the works studied. **DE2(9-12): I can honor my own feelings and show empathy toward others through my actions.** Interim Assessment:Students will workshop their reviews with a partner and implement feedback regarding their peers' work as well as their own. **TI4(9-12): I can apply my strengths and anticipate challenges to reach my current and future goals.** Formative Assessment 2: Student will meet with the teacher to discuss their plans for the unit and what strengths and challenges they will face in selecting materials and crafting their reviews. **P4(9-12): I can take-on challenges and continuously engage in my own long-term strategies to overcome them to demonstrate through personal experience that failures are more instructive than discouraging.** Summative Assessment: By crafting a series of reviews, students will see that each piece has its own failures, and that through the eyes of a critic, there is always room for improvement in any art form. **AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.** Formative Assessment: Teacher will select pieces for review that may not exactly fit the student's idea of a strong piece of art, music, or writing. In this way the student will need to remain open-minded when analyzing the works.
Teacher Resources: Critical Reviews from Sources Like the *New York Times, The Guardian, and RogerEbert.com;* Teacher and student selected films including but not limited to *Jaws, The Illusionist, Back to the Future;* Teacher and student selected music albums including but not limited to *Thriller* by Michael Jackson, *The Dark Side of the Moon* by Pink Floyd, *Rumours* by Fleetwood Mac, *The Beatles (The White Album), The Miseducation of Lauryn Hill*, *21* by Adele; Teacher and student selected texts including but not limited to "Cathedral" by Raymond Carver and "The Lottery" by Shirley Jackson (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

ENGLISH 11/12: GLOBAL CONTEXTS/MULTICULTURAL PERSPECTIVES CURRICULUM

Grade Level(s):11/12	**Curriculum Author(s):** Kathryn Aseltine and Marisa Holtman

Course Description: What shapes our global society? While studying art, music, and literature from cultures around the world, students will grapple with this question. This course focuses on the works of diverse authors, poets, and speakers, contending with the issues and concerns of a global society. Throughout the course, students analyze a variety of texts in order to communicate a clearly developed argument. Students will also develop reading skills in order to comprehend, interpret, and evaluate a variety of popular print and non-print texts including novels, short stories, poetry, speeches, nonfiction texts, graphic novels, and other visual media. This course will explore such themes as diversity, identity, ethics, and society and grapple with how they impact the human experience.

Year At A Glance			
Unit Title	**Overarching Essential Question**	**Overarching Enduring Understanding**	**Vision of A Learner “I Can” Statements**
Exploring and Explaining Global Issues	How can a person/society overcome oppression?	Through research and knowledge we can overcome oppression.	TCC2(9-12); CCE4(9-12); DE1(9-12); TI3(9-12); P3(9-12); AA4(9-12)
Seeking and Finding Refuge	How does a person find refuge?	Authors craft stories based on the contexts/time periods in which they write.	TCC4(9-12); CCE1(9-12); DE1(9-12); TI3(9-12); P4(9-12); AA4(9-12)
Understanding Divisions and Effecting Change	How can a person create change?	Authors and artists create change as they participate/contribute to social movements.	TCC3(9-12); DE2(9-12); TI1(9-12); P2(9-12); AA3(9-12)
Progress in the Modern Era	What is progress and how does one reflect on it?	It is important to view change through the lens of progress.	TCC3(9-12); CCE1(9-12); DE4(9-12); TI3(9-12); P1(9-12); AA2(9-12)

Unit 1 - Exploring and Explaining Global Issues	
Desired Results - Goals, Transfer, Meaning, Acquisition	
Established Goals: CCSS.ELA-LITERACY.W.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. CCSS.ELA-LITERACY.W.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. CCSS.ELA-LITERACY.RI.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.	
Vision of A Learner Attributes: *Students will be able to independently use their learning to... ("I can" statements to be demonstrated)* ● TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. ● CCE4CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression. ● DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives. ● TI3(9-12): I can formulate and investigate probing questions to further my learning. ● P3(9-12): I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals. ● AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.	
Understandings: *Students will understand that…* ● People from all over the world grapple with issues within their society	**Essential Questions:** ● What are the major global issues in society today? ● How can society find solutions to these global problems?

• In order to find solutions to global problems, we must research and understand the origins of these issues • Global issues can be related to oppression and power	• Are there situations in which global issues are related to oppression and power? • How does being a well educated member of society inform your understanding of global issues?
Students will know… • People are oppressed for a variety of reasons • Fighting against oppression comes in various forms • Authors pull inspiration from a variety of texts, experiences, and opinions in order to portray a unique perspective of an event or idea • Different texts can illustrate the universality of a theme/concept • Critical thinkers evaluate and make judgments about the strategies authors use to convey a message	**Students will be able to...** • Use technology to produce, publish, and update individual or shared written and digital projects • Conduct sustained research projects to answer a question • Gather relevant information from multiple authoritative print and digital sources • Analyze/Evaluate a work's commentary and contribution to issues and ideas by comparing its theme(s) to others from the same historical period • Edit and revise for consistent voice and Conventions of Standard Written English
Key Vocabulary: sustainability, biodiversity, food security, poverty, renewable energy, globalization, ecological footprint, culture, multicultural, oppression, refuge, identity, society, individual, perspectives	
Assessment Evidence	
Performance Tasks: PBA #1: Personal Narrative/College Essay. Respond to one of the seven Common Application prompts in a 200-600 word essay. PBA #2: Research Paper and Presentation on a Global Issue. What issue is this group of people facing? How is this group fighting against the issue?	**Other Evidence:** **Formative Assessment:** Analyzing model essays to inform instruction Teacher conferences/discussion of texts studied, Writing conferences Graphic organizers for Personal Narrative Research Notes on Global Issue **Interim Assessments:** Narrative essay first draft Annotated Bibliography on Global Issue

	Rough draft Global Issue Essay Slide outline: Global Issue Presentation Devices and Strategies Quizzes

Learning Plan
TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. Formative Assessment: Researching a Global Issue **CCE4(6-8): I can express my thoughts and ideas, both verbally and in writing, in order to defend my perspective.** I can do this via essays, performance-based projects, whole group, and/or small group discussions. PBA #1 and PBA #2 **DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives.** Formative Assessments: Teacher and peer conferencing of essay drafts **TI3(9-12): I can formulate and investigate probing questions to further my learning.** Formative Assessment: Identifying a global issue to research and crafting research questions **P3(9-12): I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.** Formative Assessment: Writing Conference **AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.** Formative Assessment: Discussion of topics and texts studied
Teacher Resources: Riding the Rails and Ken Burns Jazz, Fire in Paradise, “The Weary Blues” by Langston Hughes; Technology Resources: Research Databases, Student Research Paper Models, Google Slides, and Slide Models; Supplemental Resources:Student and Teacher Selected Articles, Speeches, Images Based on Harlem Renaissance Era and the Great Depression; Student and Teacher Selected nonfiction, poetry, and short stories (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 2 - Seeking and Finding Refuge

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

CCSS.ELA-LITERACY.W.11-12.5
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-LITERACY.RL.11-12.3
Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).

CCSS.ELA-LITERACY.L.11-12.3
Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.
- CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias.
- DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives
- TI3(9-12): I can formulate and investigate probing questions to further my learning.
- P4(9-12): I can take-on challenges and continuously engage in my own long-term strategies to overcome them to demonstrate through personal experience that failures are more instructive than discouraging.
- AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.

Understandings: Students will understand that…

- The Harlem Renaissance was a refuge for artists during the time period
- Literature by people of color can provide insights into the time period in which they lived
- Character development and theme are a direct result of conflict

Essential Questions:

- What causes a person to seek refuge from a conflict?
- Where do people find refuge?
- What can the music, art, and literature of a generation tell us about a society?
- How does adversity help us develop as human beings?

<table>
<tr>
<td>Students will know...

People seek refuge for a variety of reasons
Refuge can be found through writing, art, and music
In the process of seeking refuge, people influence change.
Authors create characters that grow and change in order to develop themes in literature
The setting and time period of a text effects the meaning and message of the piece
A variety of texts can illustrate the universality of a theme/concept
Critical thinkers evaluate and make judgments about the strategies authors use to convey a message

</td>
<td>Students will be able to...

Analyze, evaluate, and critique how multiple central ideas or themes develop in a text
Analyze how a text provides insights on settings and places
Analyze, evaluate, and critique how multiple central ideas or themes develop in a text and how these themes work together
Analyze/Evaluate how word choice, controlling images, and figurative language convey meaning, and critique their effectiveness
Edit and revise for consistent voice and conventions of Standard Written English

</td>
</tr>
<tr>
<td colspan="2">Key Vocabulary: Conflict, character development, theme, Harlem Renaissance, jazz, symbolism, folklore, narrative structure, flashback, and flashforward</td>
</tr>
<tr>
<th colspan="2">Assessment Evidence</th>
</tr>
<tr>
<td>Performance Tasks:

PBA #1: Literary Analysis based on Their Eyes Were Watching God: How does Janie seek and find refuge from her society’s expectations of her? What does this reveal about the theme of the text?

PBA #2: “Sonny’s Blues” Project connecting to the text</td>
<td>Other Evidence:

Formative Assessments:
Analyzing model essays to inform instruction
Teacher conferences/discussion of texts studied
Writing conferences
Graphic organizer for essay on Their Eyes Were Watching God
Reading notes on Their Eyes Were Watching God
Project check in-teacher conference “Sonny’s Blues” Project

Interim Assessments:
Reading quiz on Their Eyes Were Watching God
Vocabulary quiz on Terms related to the text
Rough draft essay on the text
Project check in-teacher conference “Sonny’s Blues” Project</td>
</tr>
</table>

Learning Plan
TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life. **CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias.** Formative Assessment: Class Discussion on Their Eyes Were Watching God **DE1(9-12): I can acknowledge, process, and respond appropriately to others' comments and perspectives** Formative Assessment: Class Discussion on Their Eyes Were Watching God **TI3(9-12): I can formulate and investigate probing questions to further my learning.** Formative Assessment: Students will takes notes and craft discussion questions as they read the texts this quarter **P4(9-12): I can take-on challenges and continuously engage in my own long-term strategies to overcome them to demonstrate through personal experience that failures are more instructive than discouraging.** PBA #1 and 2: Working on developing final drafts of papers and projects; Literary Analysis based on Their Eyes Were Watching God and "Sonny's Blues" Project connecting to the text **AA4(9-12): I can create opportunities to extend my learning by remaining open-minded in any situation.** PBA #1: Literary Analysis based on Their Eyes Were Watching God
Teacher Resources: Unit Implementation Guide; Reading and Writing Units of Study; Mentor Text: Their Eyes Were Watching God by Zora Neale Hurston and "Sonny's Blues" by James Baldwin; Supplemental Resources: Student and Teacher selected short stories, poems, informational texts and artwork based on student interest and need; Student and Teacher Selected Fiction/Non-Fiction Including But Not Limited To "The Country Husband", Happy Daze documentary, Songs from the 1950s from Various Artists. (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 3 - Understanding Divisions and Effecting Change

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

CCSS.ELA-LITERACY.W.11-12.1.A
Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.

CCSS.ELA-LITERACY.RL.11-12.2
Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.

CCSS.ELA-LITERACY.RL.11-12.5
Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.
- CCE4: CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.
- DE2(9-12): I can honor my own feelings and show empathy toward others through my actions.
- TI1(9-12): I can implement a realistic plan and adapt when necessary to achieve my goals.
- P2(9-12): I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my ability to overcome my challenges.
- AA3(9-12): I can adjust my expectations and behaviors to succeed in a changing and unpredictable environment.

Understandings: Students will understand that…	**Essential Questions:**
• There is a process that leads to social change • Artists and writers contribute meaningful messages when it comes to social change	• What causes divisions in a society? • How can words and images inspire change?

● Social movements like the Civil Rights movement have made society what it is today	● How can a theme be universal and timeless? ● How can others' experiences help us better understand our world? ● How can looking at a society's past help us understand the present? ● How does an author's craft impact his or her message?
Students will know… ● Rhetorical strategies and literary devices such as theme, setting, irony, diction, symbolism, etc. ● Authors strategically develop characters and themes to convey messages. ● Strategies for critical reading of images, poems, short stories, plays, and novels. ● That theme is multifaceted and emerges over time.	**Students will be able to...** ● Explain how a narrator's voice and persona affect characterization, plot, and tone. ● Analyze main ideas and supporting ideas in a text to draw larger conclusions about the text meaning and/or significance. ● Implement technology effectively in order to collaborate with other students and, produce and publish for various audiences
Key Vocabulary: Thesis Statements, Claim, Analysis, Argument/Counterargument, Sentence Variety, Tone, Allusion, Irony, Figurative Language, Foreshadowing, Symbolism, Character Development; Text Specific Vocabulary: Division, Socio-Economics, Segregation, Class Struggle, Societal Expectations, Civil Rights Movement, Apartheid, Death Penalty	
Assessment Evidence	
Performance Tasks: PBA #1: Literary Analysis on How Character Fits and Goes Against Society for any text studied this quarter PBA #2: Test on Rhetorical Devices in Johnson's "Voting Rights Act Speech" Speech, Selma, and the Civil Rights Movement	**Other Evidence:** **Formative Assessment:** Analyzing model essays to inform instruction Teacher conferences/discussion of texts studied Writing conferences Graphic organizer for Short Story Essay Reading notes on Short Stories Read During Class Notes on Rhetorical Devices and Strategies, Selma, Johnson's "Voting Rights Act" Speech

	Interim Assessments: Rough draft essay on the text Presentation on Short Story Studied this Quarter Slide Project on Johnson's Speech

Learning Plan
TCC3(9-12): I can integrate relevant information to produce multiple valid solutions. Formative Assessment: Analyzing model essays **CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.** PBA #1 **DE2(9-12): I can honor my own feelings and show empathy toward others through my actions.** Formative Assessment: Teacher conferences/Discussion of Texts Studies **TI1(9-12): I can implement a realistic plan and adapt when necessary to achieve my goals.** Interim Assessment: Crafting a Rough Draft of the Essay on One of the short stories studied this quarter **P2(9-12): I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my ability to overcome my challenges.** Formative Assessment: Peer Editing Process for Essay Writing **AA3(9-12): I can adjust my expectations and behaviors to succeed in a changing and unpredictable environment.** Formative Assessment: Analyzing model essays to inform instruction.
Teacher Resources: Unit Implementation Guide; Reading and Writing Units of Study; Mentor Text: "The War of the Wall" by Toni Cade Bambara, "The Bet" by Anton Chekhov, "The Prisoner Who Wore Glasses" by Bessie Head, "The Censors" by Luisa Valenzuela, Selma Film Study, Johnson's "Voting Rights Act" Speech; Supplemental Resources: Student and Teacher selected short stories, poems, informational texts and artwork based on student interest and need and the thematic concept of social rebellion including music and documentaries from the 1960s depicting the culture and values of this time period. (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)

Unit 4 - Progress in the Modern Era	
Desired Results - Goals, Transfer, Meaning, Acquisition	
Established Goals: CCSS.ELA-LITERACY.W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1-3 above.) CCSS.ELA-LITERACY.RL.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. CCSS.ELA-LITERACY.RL.11-12.6 Analyze a case in which grasping a point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).	
Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated) ● TCC3(9-12): I can integrate relevant information to produce multiple valid solutions. ● CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias. ● DE4(9-12): I can work respectfully with all members of my community and support the needs of others. ● TI3(9-12): I can formulate and investigate probing questions to further my learning. ● P1(9-12): I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others. ● AA2(9-12): I can assess my past successes and mistakes to change my approach.	
Understandings: Students will understand that… ● Identity is a complex concept that changes over time ● Societal views can affect an individual's viewpoint ● Writers reflect on the culture and society in which they live	**Essential Questions:** ● What is the role of an individual in society? ● How can the views of a society affect the individual? ● What is the difference between individual identity, national identity, global identity, cultural identity, etc.?

● In order to better understand the priorities of society today, it is important to mark progress on global issues.	● What contributes to one's sense of self-perception? ● How can a person expand his or her perspective and understanding of other cultures? ● How has American society changed or progressed? What progress still needs to be made?
Students will know... ● Rhetorical strategies and literary devices such as theme, setting, irony, diction, symbolism, etc. ● That authors strategically develop characters and themes to convey messages. ● Strategies for critical reading of images, poems, short stories, plays, and novels. ● That theme is multifaceted and emerges over time.	**Students will be able to…** ● Continue to analyze and critique how the author's use of language and rhetorical strategies affects the meaning/purpose of a piece of writing ● Analyze/Evaluate the cumulative connotative impact of a word or phrase on the meaning and tone of a passage ● Continue to analyze, evaluate, and critique how multiple central ideas or themes develop in a text and how these themes work together ● Analyze and critique how the author's use of language, organizational structures, techniques, and rhetorical devices further or detract from the author's purpose ● Analyze/Evaluate rhetorical devices used in an argument for their effectiveness in persuading or affecting the reader or in giving power to an argument or its meaning
Key Vocabulary: Task Specific Vocabulary: Interpretation, Analysis, Compare and Contrast, Synthesis, Argumentation, Evaluation, Rhetorical Strategies Specific to Chosen Texts ; Text Specific Vocabulary: alienation, assimilation, identity, self-perception, progress, culture, redemption, guilt, exile, coup	
Assessment Evidence	
PBA #1: Literary Analysis on The Kite Runner: Analyze the search for identity that one of the character's faces within the text. PBA #2: Paper or Project based on a global issue text	**Other Evidence:** **Formative Assessment:** Analyzing model essays to inform instruction Teacher conferences/discussion of texts studied Writing conferences Graphic organizer for The Kite Runner Reading notes on The Kite Runner and Choice book

	Interim Assessments: Rough draft essay on The Kite Runner Project/Paper Conference on Choice Text SAT-Style Assessment Based on "Walking the Path Between Worlds" by Lori Arviso Alvord
Learning Plan	
TCC3(9-12): I can integrate relevant information to produce multiple valid solutions. **CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias.** Formative Assessment: The Kite Runner Discussion Formative Assessment: Writing about Alienation **DE4(9-12): I can work respectfully with all members of my community and support the needs of others.** Formative Assessment: Writing Conference on Rough Draft of The Kite Runner essay **TI3(9-12): I can formulate and investigate probing questions to further my learning.** Formative Assessment: Students will craft discussion questions throughout their reading of The Kite Runner **P1(9-12): I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others.** Formative Assessment: Teacher conferencing on projects and papers during the unit **AA2(9-12): I can assess my past successes and mistakes to change my approach.** Final Prep and Review: How to Prepare for the Final Exam	
Teacher Resources: Unit Implementation Guide, Reading and Writing Units of Study; Mentor Texts: The Kite Runner by Khaled Hosseini and "Walking the Path between Worlds" by Lori Arviso Alvord; Supplemental Resources: Student and Teacher selected short stories, poems, informational texts and artwork based on student interest and need; Student and Teacher Selected Fiction/Non-Fiction Including But Not Limited To: Round House, TED Talk by Maria Hinojosa, and other texts based on the theme of progress in society (these resources will be reviewed annually and adjustments may be made to align with the unit theme and provide the students with diverse perspectives over time)	

Precalculus CURRICULUM

(Refer to the Curriculum Template Explanation document while writing curriculum)

	
Grade Level(s): 10-12	**Curriculum Author(s):** Laurenn Bertoglio, Jamie Lisevick, and Kristen Pisano

Course Description:
Pre-Calculus is designed to equip students with the mathematical knowledge and skills necessary for success in calculus and other advanced mathematical disciplines. The course focuses on developing a deep understanding of algebraic, trigonometric, and transcendental functions, as well as their applications.

Year At A Glance			
Unit Title	**Overarching Essential Question**	**Overarching Enduring Understanding**	**Vision of A Learner "I Can" Statements**
Prerequisite	How do foundational algebraic and geometric concepts form the basis for understanding more advanced mathematical topics in Precalculus?	Students will reflect on the importance of mastering foundational concepts in algebra such as functions, equations, and graphing, which are crucial for tackling the more complex ideas in Pre-Calculus.	TCC1(9-12); P3(9-12); TI3(9-12); CCE4(9-12); TCC3(9-12); P1(9-12)
Functions	How do functions and their inverses help us understand and solve real-world problems, and what are the key principles that govern their relationships and transformations?	Functions can be built and represented verbally, graphically, numerically, and algebraically. Students will understand that while many functions behave very differently, transformations can still be applied to each function, and inverse functions essentially reverses the effect of the original function.	TCC1(9-12); CCE4(9-12); TI1(9-12); P1(9-12); AA1(9-12)
Polynomials	How do the algebraic properties and graphical characteristics of polynomial functions help us model, analyze, and solve real-world problems, and how can understanding these properties inform predictions about the behavior of complex systems?	Polynomial functions exhibit predictable patterns and behaviors based on their degree, coefficients, and roots, allowing them to model complex relationships and solve real-world problems. Understanding the algebraic structure and graphical characteristics of polynomials enables students to analyze, predict, and interpret the behavior of these functions in various contexts.	P3 (9-12), TCC3(9-12)

Exponential/Logs (Honors Only)	How do exponential and logarithmic functions model real-world phenomena, and how can understanding these functions help us solve complex problems in various fields?	Exponential and logarithmic functions are fundamental mathematical tools that model and analyze dynamic processes involving growth, decay, and scaling. Understanding these functions enables us to interpret complex relationships, solve practical problems, and make informed predictions across diverse fields such as science, finance, and engineering.	TCC4(9-12); CCE3(9-12); AA1(9-12); TI3(9-12)
Rational Functions (CP Only)	How do rational functions model real-world phenomena and how can understanding these functions and interpreting their graphs help us solve complex problems?	Rational functions represent relationships where the dependent and independent variables are interconnected through a ratio of polynomials. Understanding these functions involves analyzing their asymptotic behavior, intercepts, and domain restrictions, which collectively describe how changes in one variable impact the other. Mastery of rational functions equips students with the tools to model and interpret real-world scenarios involving rates, proportions, and optimization, revealing the underlying patterns and structures of complex relationships.	TCC3(9-12); TCC4(9-12); TCC1(9-12); CCE3(9-12); TI3(9-12); P2(9-12); P3(9-12)
Trigonometric Functions	How do the relationships between angles, triangles, and trigonometric functions allow us to model, solve, and interpret real-world problems?	Trigonometry provides a framework for understanding and modeling the relationships between angles, lengths, and periodic phenomena.	P3 (9-12), TCC3(9-12)

Trigonometric Identities	How can manipulating and solving trigonomic functions help us master skills for solving real-world problems in fields such as physics, engineering, and signal processing?	Trigonometric identities are foundational tools that reveal the inherent relationships between trigonometric functions and their angles. Mastery of these identities enables students to simplify complex trigonometric expressions, solve equations, and analyze periodic phenomena.	TCC3(9-12); CCE2(9-12); CCE3(9-12); CCE4(9-12); DE1(9-12); TI3(9-12); P1(9-12); P3(9-12); AA1(9-12)
Modeling with Law of Sines and Cosines	How can the Law of Sines and the Law of Cosines be used to solve real-world problems involving triangles, and what do these methods reveal about the relationships between the angles and sides of a triangle?	The Law of Sines and the Law of Cosines provide systematic methods for analyzing and solving problems involving non-right triangles, revealing the intrinsic relationships between angles and sides. Mastery of these laws enables the accurate modeling of real-world scenarios and geometrical problems where triangle dimensions need to be determined or inferred.	TCC3(9-12); TCC2(9-12); DE1(9-12); P1(9-12); P3(9-12); AA2(9-12)
Matrices ★	How can matrices be used to solve systems of linear equations, and why is this method sometimes more efficient than traditional methods?	Matrices provide a powerful way to represent and solve systems of linear equations, with each system corresponding to a matrix equation.	P3(9-12), TCC3(9-12)

Unit 1 - Prerequisite

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections)

- **A.SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
    - **A.SSE.3a.** Factor a quadratic expression to reveal the zeros of the function it defines.
    - **A.SSE.3b.** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
    - **A.SSE.3c.** Use the properties of exponents to transform expressions for exponential functions
- **A.APR.7** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.★
- **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple (rational★) and exponential functions.*
- **A.REI.2** Solve simple (rational★) and radical equations in one variable, and give examples showing how extraneous solutions may arise.
- **A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.★
- **A.REI.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- **A.REI.4** Solve quadratic equation in one variable
    - **A.REI.3a** Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
    - **A.REI.3b** Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
- **A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solution of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and /or g(x) are linear, polynomial, (rational★), absolute value, exponential, and logarithmic functions.*
- **S.ID.7** Interpret the slope (rate of change) and the intercept of a linear model in the context of data

Standards for Mathematical Practice

- **MP1:** Make sense of problems and persevere in solving them.
- **MP2:** Reason abstractly and quantitatively.
- **MP3:** Construct viable arguments and critique the reasoning of others.

- **MP4:** Model with mathematics.
- **MP5:** Use appropriate tools strategically.
- **MP6:** Attend to precision.
- **MP7:** Look for and make use of structure.
- **MP8:** Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- **TCC1(9-12)**: I can ask purposeful, insightful questions to find a variety of innovative solutions.
- **P3(9-12)**: I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.
- **TI3(9-12)**: I can formulate and investigate probing questions to further my learning
- **CCE4(9-12)**: I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.
- **TCC3(9-12)**: I can integrate relevant information to produce multiple valid solutions.
- **P1(9-12)**: I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others.
- **CCE3(9-12)**: I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.

Understandings: Students will understand that…
- Expressions can be written in multiple ways using the rules of algebra; each version of the expression tells something about the problem it represents.
- There is often an optimal method of manipulating equations to solve a mathematical problem; however other methods, which may not be as efficient, can still provide insight to the problem.
- Algebraic expressions such as polynomials and rational expressions, symbolize numerical relationships and can be manipulated in much the same way as numbers.★

Essential Questions:
- Why do we structure expressions in different ways?
- In what ways can the problem be solved, and why should one method be chosen over another?
- How can the properties of the real number system be useful when working with polynomials and rational expressions?★
- Which function is being modeled in specific real world applications and how can I use acquired knowledge to solve the problem?

Students will know…
- Linear functions may be represented by equations, graphs, tables, and words. The graph of a function is often a useful way of visualizing the relationship the function models.
- For linear applications, the y-intercept is the starting point and the slope is the rate of change.

Students will be able to...
- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
- Create equations in one variable and use them to solve problems.

- The form of the equation determines which solution method (graphing or algebraic) is most efficient or appropriate. - Understand solving equations as a process of reasoning and explain the reasoning - Determine and explain the best solving method for a quadratic equation in one variable. - How to apply solving techniques to interpret and solve mathematical models	- Solve linear equations including equations with coefficients represented by letters. - Interpret the slope (rate of change) and the intercept (constant term)of a linear model in the context of the data. - Add, subtract, multiply, simplify rational exponents and radical expressions - Add, subtract, multiply, simplify rational expressions ★ - Solve rational equations.★ - Factor a quadratic expression to reveal the zeros of the function it defines. - Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. - Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. - Solve radical equations. - Interpret and solve literal equations ★ - Define extraneous solutions and determine which numbers cannot be solutions of radical and (rational★) equations.

Key Vocabulary:

Linear Equations	Extraneous Solution	Completing the square★
Slope, Y-intercept	Literal Equation★	Quadratic Formula
Radical Equation	Quadratic Equation	Radicand
Rational Exponent	Polynomial	Complex Number
Rational Expression★	Factoring	Imaginary
Rational Equation★	Square root method	Solution

Assessment Evidence

Performance Tasks: **Summative Unit Assessment: TCC3(9-12)** Topics will include: Simplify: Quadratics, rational exponents, radical expressions, (rational expressions★).	**Other Evidence:** **Activities:** - Desmos discover and practice activities **P1(9-12)** - Around the room solving applications activity

• Solve: Quadratics
  ○ Factoring
  ○ Square Root Method
  ○ Completing the Square
  ○ Quadratic Formula
• Solve: Absolute value, (rational★), and radical equations.
• Apply solving skills to mathematical applications including area, perimeter, and pythagorean theorem, calculating the area of a space, determining the trajectory of a projectile (like a ball thrown in sports), optimizing profit in business based on price and quantity, or designing curved structures in engineering, where the path follows a parabolic shape
	• Hot Seat game Review★
	• Escape Room Review activities ★ **CCE3**
	
	Interims:
	• **Interim 1**:**P1(9-12**)
	  ○ Simplify Exponents
	  ○ Simplify radicals
	  ○ Factor quadratics and polynomials
	    ■ Greatest Common Factor
	    ■ Grouping
	    ■ Trinomial a=1
	    ■ Trinomial a≠1
	    ■ Difference of Squares
	    ■ Sum/Difference of Cubes★
	• **Interim 2★**: (Pre-Calc CP will address this in a separate unit)
	  ○ Simplify rational expressions
	  ○ Multiply and divide rational expressions
	  ○ Add and subtract rational expressions
	• **Interim 3**: (Pre-Calc CP only) **P1(9-12**)
	  ○ Solving quadratics
	    ■ Factoring
	    ■ Square root method
	    ■ Quadratic formula
	  ○ Solving radical equations

Learning Plan
The prerequisite unit for Pre-Calculus focuses on foundational concepts necessary for success in the course.This unit will review solving functions such as: Linear, Absolute Value, Quadratic, Radicals, Rational, and exponential and logs. • Students will complete textbook practice problems working in groups during class and individually outside of class. • Class discourse on correct solutions to textbook problems - compare strategies and ask questions. **TCC1(9-12)** • Desmos Exploratory and review activities **P1(9-12**), **TI3(9-12)** • Extra practice on graphing rational functions- students will work in groups-class discourse on correct solutions- compare strategies and ask questions. ★**CCE3(9-12)** • Individual/group in class practice on concepts that will be measured on the summative assessment.**P3(9-12)TCC3(9-12)**
Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheet

Unit 2 - Functions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections)

- **F.IF.A.1** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
- **F.IF.A.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- **F.IF.B.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*
- **F.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
  - **F.IF.C.7.B** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.*
- **F.BF.A.1** Write a function that describes a relationship between two quantities.*
  - **F.BF.A.1.A** Determine an explicit expression, a recursive process, or steps for calculation from a context.
  - **F.BF.A.1.C** (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.
- **F.BF.B.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
- **F.BF.B.4** Find inverse functions.
  - **F.BF.4a** Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2(x^3) or f(x) = (x+1)/(x-1) for x ≠ 1 (x not equal to 1).
  - **F.BF.4b** (+) Verify by composition that one function is the inverse of another.
  - **F.BF.4c** (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.
  - **F.BF.4d** (+) Produce an invertible function from a non-invertible function by restricting the domain.

Standards for Mathematical Practice • MP1: Make sense of problems and persevere in solving them. • MP2: Reason abstractly and quantitatively. • MP3: Construct viable arguments and critique the reasoning of others. • MP4: Model with mathematics. • MP5: Use appropriate tools strategically. • MP6: Attend to precision. • MP7: Look for and make use of structure. • MP8: Look for and express regularity in repeated reasoning.
Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated) • **TCC1(9-12):** I can ask purposeful, insightful questions to find a variety of innovative solutions. • **CCE4(9-12)**: I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression. • **TI1(9-12)**: I can implement a realistic plan and adapt when necessary to achieve my goals.I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others. • **AA1(9-12)**: I can evaluate different approaches and justify the best pathway to success. • **TI3(9-12)**: I can formulate and investigate probing questions to further my learning.

Understandings: Students will understand that...	**Essential Questions:**
• A function is a specific type of relation where each input is associated with exactly one output. This concept is fundamental in describing how variables interact and is a building block for analyzing more complex mathematical relationships. • Functions can be transformed through translations, reflections, stretches, and compressions. These transformations affect the graph of the function and help in understanding how changes in the function's formula impact its graph. • Functions can be combined through addition, subtraction, multiplication, and division, and can be composed with each other. Understanding these operations is essential for building more complex functions and analyzing their behavior. • An inverse function essentially reverses the effect of the original function. Understanding how to find and use inverse functions is important for solving equations and understanding the	• What is a function and what are the different ways they can be represented? • How are functions used in the real world? • What are the key characteristics of a graph and why are they important? • How does composing functions affect the domain? • What is the relationship between a function and its inverse?

relationship between functions and their inverses. ● Functions are used to model and solve real-world problems in various fields such as physics, economics, biology, and engineering. Applying functions to practical situations helps in interpreting data and making predictions.	
Students will know… ● A function is a specific type of relation in which each element in the domain is paired with a unique element of the range. Functions can be represented verbally, numerically, graphically, and algebraically. ● The terms domain, input and independent can be used interchangeably. ● The terms range, output and dependent variable can be used interchangeably. ● An independent variable is the controlling factor of the function. ● The dependent variable changes based on the value of the independent variable. ● Functions can model many important phenomena ● Every function creates a unique graph. Graphs are used to illustrate solutions and solve problems. ● Key characteristics such as zeros, extrema, increasing, decreasing, symmetry, and end behavior are important because they describe the behavior of the outputs. ● Having an understanding of the basic characteristics of a variety of functions facilitates the solving of complex problems. ● Arithmetic operations (addition, subtraction, multiplication, composition) can be performed on functions. ● When composing functions the restrictions on the domain of each original function must be considered in determining the domain of the composite function. ● Every function has an inverse and that inverse is not necessarily a function, which is graphically represented by its reflection over the y = x line.	**Students will be able to...** ● Determine if a relationship is a function. ● Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. ● For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ● Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ● Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ● Graph linear and quadratic functions and show intercepts, maxima, and minima. ● Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ● Write a function that describes a relationship between two quantities. ● Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative) and find the value of k given the graphs. ● Combine standard function types using arithmetic operations. ● Compose functions. ● Find inverse functions. ● Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. ● Verify by composition that one function is the inverse of another.

● An inverse relation interchanges the domain and range of the original function, and therefore "undoes" the original function.	● Read values of an inverse function from a graph or a table, given that the function has an inverse. ● Produce an invertible function from a non-invertible function by restricting the domain.

Key Vocabulary:

Function	Parent function	Piecewise function
Input	Transformation	Vertical line test
Output	Translations	One-to-one function
Independent variable	Vertical stretch	Inverse function
Dependent variable	Vertical compression	Domain
Domain	Vertical reflection	Restricted domain
Range	Horizontal reflection	Composition
Function notation: f(x)		

Assessment Evidence

Performance Tasks:	Other Evidence:
Summative Unit Assessment: TI1(9-12); AA1(9-12) Topics will include: ● Determine if a relationship is a function ● Identify and perform transformations of functions ● Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes ● Graph quadratic, cubic, square root, cube root, and piecewise-defined functions, including step functions*(honors only)* and absolute value functions. ● Compose functions ● Verify by composition that one functions is the inverse of another ● Evaluating inverse functions Real world applications of functions include: ● Physics - motion and trajectory of a projectile	**Interim:** Characteristics of graphs of functions and domain.**P1(9-12)** **Interim:** Transformations of graphs of functions, operations and inverse functions.**P1(9-12)** **Interim:** Function operations and composition and domain and on inverses.**P1(9-12)** **Interim**: Piecewise project- students create their own piecewise function with a partner. **CCE3(9-12)**

• Financing - calculate interest, investments, loan payments, maximizing profit for business • Engineering - to model systems to predict outcomes in relationships, materials, or electrical circuits • Also used in computer science, economics, and statistics	

Learning Plan
Precalculus continues the learning of the study of functions. Students will use prior knowledge of functions from Algebra 2. They will use this knowledge to create connections throughout the year including transformations of trigonometric functions. • Students will explore how transformations (translations, reflections, stretches and compressions) affect all functions through discovery methods including desmos and noticing patterns through graphs. **TI3(9-12)** • Students will create a graphic organizer when revisiting and adding new functions to their learning. **CCE4(9-12)** • Students will practice identifying the transformations of a given function and create a graph that represents the function. They will be able to discuss the domain and range for each. **TCC1(9-12)**
Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheet

Unit 3 - Polynomials

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections)

- **N.CN.A 1** Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real.
- **N.CN.A 2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
- **N.CN.3** Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
- **N.CN.C 7** Solve quadratic equations with real coefficients that have complex solutions.
- **N.CN.C 8** Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$. (Honors)
- **N.CN.C 9** Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
- **A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.*
- **A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
- **A.APR.A.1** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
- **A.APR.B.2** Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).
- **A.APR.B.3** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
  - **F.IF.C.7.C** Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.*
- **F.IF.C.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
- **F.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.

- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC1(9-12)**: I can ask purposeful, insightful questions to find a variety of innovative solutions.
- **TCC3(9-12)**: I can integrate relevant information to produce multiple valid solutions.
- **P2(9-12):** I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my abilities to overcome my challenges.
- **P3(9-12):** I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.
- **TI3(9-12)**: I can formulate and investigate probing questions to further my learning.
- **CCE2(9-12)**: I can give and receive actionable and relevant feedback with openness to be able to determine meaningful revisions for success.

Understandings: Students will understand that…	**Essential Questions:**
- Polynomial functions can be classified by their degree, which determines their general shape and the maximum number of roots they can have. - The degree and leading coefficient determine the end behavior of a polynomial function, which helps in sketching and analyzing graphs. - The zeros/roots of a polynomial function correspond to the x-intercepts of its graph. The multiplicity of a zero affects the behavior of the graph at that intercept, such as whether it touches or crosses the x-axis. - Polynomial functions model various real-world phenomena, from projectile motion to economics. - The complex number set is composed and the real numbers and the imaginary numbers. - Complex solutions will not be x-intercepts. - The intermediate value theorem can be used to determine the zeros of a function. ★ - Recognizing symmetry in polynomial functions (even, odd, or neither) helps in graphing and analyzing these functions. - The remainder theorem tells us that if a polynomial f(x) is divided	- What are the defining characteristics of polynomial functions and how do their degrees and coefficients affect their behavior? - Why are there different methods of finding the zeros of a polynomial and how do we decide which method is appropriate? - How can polynomial functions represent real-life situations? - What is the Fundamental Theorem of Algebra, and how does it relate to the existence of complex roots? - How can you use the Factor Theorem and synthetic division to factorize polynomials? - How do different types of variation apply to real-world problems, and how can understanding these relationships help solve those problems? ★

by x-c, then the remainder is f(c). ● The factor theorem tells us that if f(c)=0, then x - c is a factor of f(x). ● Graphs of rational functions have asymptotes and have many forms ★ ● Many real-life quantities can be modeled by types of variation including: direct, inverse, and joint. ★	
Students will know… ● When performing operations with complex numbers to combine the real numbers and combine the imaginary numbers ● The quantity i squared must be replaced with negative 1. ● To rationalize the denominator of a complex fraction, multiply the numerator and denominator by the complex conjugate ● Dividing polynomials can produce the zeros of a function. ● Synthetic division is a preferred method of long division of polynomials, but may only be used when the divisor is of the form x ± k ● The Rational Zero Theorem (rational root theorem) helps to find a zero/root of a polynomial. ● The remainder theorem, along with synthetic division, provides a handy shortcut for evaluating polynomials. ● Key characteristics such as continuity, zeros, multiplicity of zeros, and end behavior are important because they describe the behavior of the outputs. These characteristics can be used to sketch a graph of the polynomial. ● Polynomials can represent real-life situations, including simple financial modeling and wooden roller coasters. ● The intermediate value theorem determines if there is a real zero between two x values. ★ ● The graph of the parent function of 1/x and 1/x^2 and how to use transformations with them. ★ ● Vertical asymptotes occur at x values that make a denominator zero. ★ ● Horizontal asymptotes are found by comparing the largest exponents in the numerator and denominator. ★ ● Slant asymptotes are found by using long division. ★	**Students will be able to…** ● Simplify expressions with complex numbers including add, subtract, multiply and divide. ● Rationalize the denominator of a complex fraction ● Divide polynomial expressions using both long division and synthetic division. ● Apply the Fundamental Theorem of Algebra to write the simplest polynomial with the given roots. ● Use the rational zero theorem and the factor theorem to find all the zeros of a polynomial function. ● Sketch the graph of a polynomial using the end behavior, zeros, multiplicities, y-intercept, and turning points. ● Solve application problems that involve representing a real life situation with a polynomial function. ● Create a polynomial model and make predictions for real-world phenomena. ● Use the intermediate value theorem. ★ ● Graph the functions 1/x and 1/x^2 using transformations. ★ ● Graph a rational function by finding horizontal and vertical (or slant) asymptotes, intercepts, symmetry, and holes. ★ ● Write variation equations that model real-life situations and solve problems related to that equation. ★

● Keywords that indicate direct, inverse, or joint variation in a real-life situation. ★	

Key Vocabulary:

Complex Number	Intermediate Value Theorem	Vertical Asymptote
Complex Conjugate	Turning Points	Horizontal Asymptote
Polynomial Function	Synthetic Division	Slant Asymptote
Leading coefficient test	Remainder Theorem	Direct Variation
End Behavior	Factor Theorem	Inverse Variation
Multiplicities	Rational Zero Theorem	Joint Variation

Assessment Evidence

Performance Tasks:	Other Evidence:
Summative Unit Assessment: TCC3(9-12): Topics include: ● Add, subtract, multiply and divide complex numbers ● Find all the zeros of a polynomial function ● Sketch the graph of a polynomial function ● Model a real-life situation with a polynomial function ● Use the intermediate value theorem ★ ● Graph rational functions with transformations and without. ★ ● Solve variation problems ★	**Interim: P3(9-12):** ● Quiz on complex numbers and graphing polynomial functions ● Quiz on finding all zeros of a polynomial (including complex) **Common Formative Assessments: P3(9-12)** ● Graphing rational functions- stations activity ★ ● Variation practice ★

Learning Plan

- Students will complete textbook practice problems working in groups during class and individually outside of class **TCC1(9-12**)
- Class discourse on correct solutions to textbook problems - compare strategies and ask questions **P2(9-12):**
- Extra practice on graphing rational functions- work in groups-class discourse on correct solutions- compare strategies and ask questions **CCE2(9-12)★**
- Individual/group in class practice on concepts that will be measured on the summative assessment**TCC3(9-12)**

Teacher Resources: Blitzer Precalculus textbook, teacher created notes pages and extra practice, graphing calculators

Unit 4 - Rational Functions (CP only)

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard)

- **A.APR.D.7** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
- **A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
    - **A.SSE.B.3.A** Factor a quadratic expression to reveal the zeros of the function it defines.
- **A.REI.A.2** Solve simple rational equations in one variable, and give examples showing how extraneous solutions may arise.
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases*
    - **F.IF.C.7.D** (+)Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC3(9-12)**: I can integrate relevant information to produce multiple valid solutions.
- **TCC4(9-12)**: I can integrate my learning to adapt to experiences in the classroom, career and life.
- **TCC1(9-12)**: I can ask purposeful, insightful questions to find a variety of innovative solutions.
- **CCE3(9-12):** I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.
- **TI3(9-12)**: I can formulate and investigate probing questions to further my learning.

• **P2(9-12)**: I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my ability to overcome my challenges. • **P3(9-12)**: I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.

Understandings: Students will understand that… • Equations, verbal descriptions, graphs and tables provide insight into the relationship between quantities • Students will learn what rational functions are, including their structure as the ratio of two polynomials. They will understand how to identify and work with these functions in various mathematical contexts.	**Essential Questions:** • How can the relationship between quantities best be represented? • How do the properties of rational functions affect their graphs and behaviors • What are the strategies for simplifying and solving equations involving rational functions? • How can you use rational functions to model and solve real-world problems? • In what ways do the characteristics of rational functions differ from those of polynomial functions and how do these differences influence their application? • How do vertical and horizontal asymptotes of rational functions help in predicting the long-term behavior of the function?
Students will know… • The domain restrictions and the end behavior define the asymptotes in the graph. • Holes occur when the numerator and denominator have a common linear factor. • The asymptotes, intercepts, and domains are used to create the graph of the rational function. • How to apply simplifying and solving skills to solve rational function applications • Students will develop skills to graph rational functions by considering asymptotic behavior, intercepts, and any discontinuities. They will practice sketching accurate graphs and understanding the function's overall shape and behavior.	**Students will be able to…** • Define rational function as the ratio of two polynomials • State the end behavior of a rational function when looking at the graph of the function • Find y-intercept of a rational function • Find the x-intercepts of a rational function • Determine if a rational function has a horizontal asymptote and find the asymptote • Determine domain and range of a rational function • Determine if a rational function has a hole • Sketch a graph of a rational function based on its domain, x-intercepts, y-intercept, and end behavior • Use technology to graph rational functions and to find precise values for the x-intercepts and the maximums and minimum • Simplify, multiply,divide rational functions • Add and subtract rational functions

	● Solve rational functions

Key Vocabulary:

Rational Equation	Vertical Asymptote	End Behavior
X-Intercept	Horizontal Asymptote	Factor
Y-Intercept	Hole	Polynomial

Assessment Evidence

Performance Tasks:	Other Evidence:
Summative: ● **Test:** Rational Expressions and Equations **TCC3(9-12)** ○ Simplify, add, subtract, multiply divide rational expressions ○ Solve rational equations ● **Graphing Rational Equations Project**: Students are randomly assigned a rational function. Students find all necessary information and graph the function. Projects will be assessed using department rubric. **CCE3(9-12)**	Class Activities: ● Error Analysis: Multiplying and dividing Rational Expressions activity ● Partner Multiplying/dividing activity **CCE3(9-12)** ● Google Slides Adding and subtracting Rational Expressions digital activity ● Solving rational equations partner activity **CCE3(9-12)** ● Pass the Graph Activity **CCE3(9-12)** ● Graphing Rational Functions Flip book activity**P2(9-12)** **Interims:** ● Quiz: Simplify, Multiply, Divide Rational Expressions **P2(9-12)** ● Quiz Adding and Subtracting Rational Expressions **P3(9-12)**

Learning Plan

The unit will emphasize the importance of simplifying rational functions by factoring both the numerator and the denominator, and canceling common factors. This process helps in identifying features such as holes in the graph.

- Students will complete textbook practice problems working in groups during class and individually outside of class **TI3(9-12), TCC3(9-12)**
- Class discourse on correct solutions to textbook problems - compare strategies and ask questions**TCC1(9-12)**
- Extra practice on simplifying radicals- white board practice-class discourse on correct solutions- compare strategies and ask questions **CCE3(9-12)**
- Individual/group in class practice on concepts that will be measured on the summative assessment**TCC3(9-12), TCC3(9-12)**

Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheets

Unit 4 - Exponential Functions/Logs (*Honors only)

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections)

- **A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.*
  - **A.SSE.A.1.B** Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)^n as the product of P and a factor not depending on P.
- **A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
  - **A.SSE.B.3.C** Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as [1.15^(1/12)]^(12t) ≈ 1.012^(12t) to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
- **A.CED.A.2** Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **A.REI.D.11** Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
  - **F.IF.C.7.E** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*
- **F.IF.C.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
  - **F.IF.C.8.B** Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)^t, y = (0.97)^t, y = (1.01)^(12t), y = (1.2)^(t/10), and classify them as representing exponential growth and decay.
- **F.BF.A.1** Write a function that describes a relationship between two quantities.*
- **F.BF.B.5 (+)** Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
- **F.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.
  - **F.LE.A.1.C** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- **F.LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

- **F.LE.A.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **F.LE.A.4** For exponential models, express as a logarithm the solution to ab^(ct) = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **F.LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context.
- **S.ID.B.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
    - **S.ID.B.6.A** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

Standards for Mathematical Practice
- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC4(9-12):** I can integrate my learning to adapt to experiences in the classroom, career and life.
- **CCE3(9-12):** I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.
- **AA1(9-12):** I can evaluate different approaches and justify the best pathway to success.
- **TI3(9-12):** I can formulate and investigate probing questions to further my learning.

Understandings: Students will understand that…

- Exponential functions model situations which grow or decline at a constant percent rate.
- Graphing exponential functions and logarithmic functions will result in asymptotic behavior. Transformations (shifts, stretches, reflections) will affect the graphs.

Essential Questions:

- How can exponential functions be used to model growth and decay?
- What is the purpose of logarithms and exponential functions and how are they related to each other?
- How do you graph exponential and logarithmic functions by analyzing intercepts and end behavior?

• Logarithms can be used to solve exponential functions; and conversely, exponents are used to solve logarithmic equations. • Logarithms can be used to solve equations for which no other algebraic method exists. • Exponential functions model situations involving growth or decay, such as population growth, radioactive decay, and interest calculations, while logarithmic functions are used to model phenomena like the Richter scale for earthquakes and pH in chemistry. • Exponential and logarithmic functions are inverse functions.	• How are exponential and logarithmic functions used to model real-world phenomena?
Students will know… • The graph of exponential growth and decay functions has a horizontal asymptote. • Exponential functions to model real-world situations, such as student loan interest, car depreciation, and • The constant *e* is an irrational number that appears in many different areas of mathematics, including continuous interest. • Expressions can be translated between exponential and logarithmic forms. • The common log has base 10 and the natural log has base *e*. • Exponential and logarithmic functions have restrictions on the value of the base *b*. This then influences the range or domain. • The graph of a logarithmic function has a vertical asymptote. • Condensing and expanding logarithmic expressions are techniques used when solving. • Solving exponential and logarithmic equations involves applying properties of exponents and logarithms, such as the power rule, product rule, and change of base formula, to isolate the variable and find solutions. • Techniques for solving equations involving exponential and logarithmic functions include using properties of logarithms, isolating the exponential or logarithmic expression, and applying logarithms to both sides of the equation.	**Students will be able to...** • Graph exponential growth and decay functions. • Identify the asymptote and transformation and solve for the intercepts of the graph. • Apply transformations with exponential and logarithmic functions to graph • Interpret graphs of exponential and logarithmic functions. • Model exponential functions for both growth (e.g. population growth and compound interest).and decay (e.g. depreciation and half-life). • Use compound interest to discover the number *e*. • Evaluate logarithms • Expand and condense logarithms • Solve exponential and logarithmic equations. • Solve real-world problems involving the common base *e*. • Model practical uses of logarithms (e.g., measuring sound intensity, pH scale). • Create and apply exponential and logarithmic functions to model and make predictions. • Solve problems using Newton's Law of Cooling. ★ • Model functions using logistic growth and solve application problems. ★

• The exponential function $y=b^x$ is one-to-one, so its inverse $x=b^y$ is a function. To express "y as a function of x" for the inverse you write $y=\log_b x$. • Logistic growth is a model used when there is an upper limit on the size of a population, called the carrying capacity. ★	

Key Vocabulary:

Exponential Growth	Asymptote	Common Logarithm
Exponential Decay	Base	Natural Logarithm
Exponential Function	Natural base e	Power Function
Exponential Regression	Compounded continuously	Logarithmic Equation
Growth Factor	Logarithm	Extraneous Solution
Decay Factor	Logarithmic Regression	Inverse functions
Compounded monthly, quarterly, etc.		

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Summative: Students will research colleges in state and out of state specifically focused on tuition prices over the years. Through the use of graphing calculators they will use the data to create an exponential regression model to make predictions for the future. Students will work collaboratively in small groups and will present their findings to the class. **TCC4(9-12)**, **CCE3(9-12)** **Summative Unit Assessment TCC4(9-12)** Topics will include: • Graphing exponential and logarithmic functions. • Identifying key features of the graph. • Simplify logarithms • Expand and condense logarithmic expressions • Solve exponential and logarithmic equations. • Model real-world applications. • Inverse functions	• **Activity - Which will grow faster?** Introduction to exponential growth. If you double a penny every day for 30 days what will happen? **AA1(9-12), TI3(9-12)** • **Activity - Discovery of the number e:** Students will explore the number e through a discovery based lesson to attempt to see what happens when you increase the compounding interest. They will discuss practical applications of e in various fields like finance, population growth, and physics. **AA1(9-12), TI3(9-12)** • **Interim:** Graphing exponential functions, comprehension of key features such as growth/decay factor, growth/decay rate, asymptote and transformations. • **Interim:** Applications involving compound growth/decay including continuously. Simplifying with the number e. • **Interim:** Evaluating logarithms, comprehension of natural logs, common logs and expanding and condensing. Using logarithms to solve exponential equations, which may have extraneous solutions. **AA1(9-12)**

Learning Plan
In this unit, students will extend their knowledge of exponential functions to model growth and decay in numerous applications.Students will explore how transformations (translations, reflections, stretches and compressions) affect exponential and logarithmic functions. Students will learn and apply the fundamental properties of logarithms including the production, quotient, and power rules. Students will solve complex logarithmic and exponential equations and apply them to real world problems and make predictions. ● Students will extend their knowledge of transformations of functions by graphing exponential and logarithmic functions. Discussion around similarities and differences both between these two functions graphically and algebraically to discover they are inverse functions of each other. **CCE3(9-12)** ● Students will evaluate different approaches when solving exponential and logarithmic equations. This may include needing to use the properties of expanding and condensing, as well as utilizing their previous skills for solving and checking for extraneous solutions. **AA1(9-12)** ● Students will model exponential growth and decay models involving applications with simple interest, compound interest, depreciation. As they explore which model grows faster and complete the discovery activity for the number *e*, students will work on collaborating and adjusting to meet their learning needs. **TI3(9-12)** Then students will complete the College Tuition Project (described above) **TCC4(9-12); CCE3(9-12)**
Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheets

Unit 5 - Trigonometric Functions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections)

- **F.TF.A.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- **F.TF.A.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
- **F.TF.A.3 (+)** Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
- **F.TF.A.4 (+)** Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
- **F.TF.B.6 (+)** Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.★
- **G.SRT.C.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
- **G.SRT.C.7** Explain and use the relationship between the sine and cosine of complementary angles.
- **G.SRT.C.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- **TCC3(9-12):** I can integrate relevant information to produce multiple valid solutions.
- **P2(9-12):** I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my abilities to overcome my challenges.

- **P3(9-12):** I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.
- **TI4(9-12):** I can apply my strengths and anticipate challenges to reach my current and future goals
- **CCE3(9-12):** I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.

Understandings: Students will understand that…

- The trigonometric functions (sine, cosine, tangent, and their reciprocals) represent specific relationships between the angles and side lengths of a right triangle. Understanding these functions as ratios helps students connect geometric intuition with algebraic representation.
- The unit circle is a foundational concept in trigonometry that connects the angle measures in radians with the coordinates of points on the circle. This understanding leads to the concept of periodicity in trigonometric functions, where patterns repeat over regular intervals.
- The graphs of sine, cosine, and tangent functions exhibit unique characteristics such as amplitude, period, phase shift, and vertical shift. Recognizing these properties allows students to model real-world phenomena and understand oscillatory behavior.
- Inverse trigonometric functions, such as arcsine, arccosine, and arctangent, are essential for finding angles when given a trigonometric ratio. Understanding their domains, ranges, and interpretations is crucial for solving trigonometric equations and modeling. ★
- Trigonometric functions can be represented analytically (using equations) and graphically (using graphs). Understanding both forms and how they interrelate is important for solving problems and interpreting data.
- Understanding different units of angle measurement, such as degrees and radians, and how to convert between them is crucial for working with trigonometric functions and applying them in various contexts.

Essential Questions:

- How are sine, cosine, and tangent defined using the sides of a right triangle?
- What are the reciprocal trigonometric ratios (cosecant, secant, cotangent)?
- How do the coordinates of points on the unit circle relate to trigonometric functions?
- What are the radian and degree measures, and how do they relate to each other?
- How do amplitude, period, phase shift, and vertical shift affect the graphs of trigonometric functions?
- What are the key features of the graphs of sine, cosine, tangent, cosecant, secant, and cotangent functions?
- What are the definitions and domains of the inverse sine, cosine, and tangent functions? ★
- How are the inverse functions used to find angles given a trigonometric ratio? ★

Students will know…	Students will be able to…
● A positive angle is formed by rotating a ray about its endpoint in a counterclockwise direction ● 180 degrees is equivalent to pi radians. ● That coterminal angles are formed by adding or subtracting 2 pi radians or 360 degrees/ ● All six exact trigonometric values of π, π/2, π/4, π/3, π/6 and their reference angles. ● The domain of sine and cosine is all real numbers and the range is from -1 to 1, inclusive. ● How to use the calculator to find the values of the six trig functions. ● How to graph the sine and cosine functions with transformations including changes in amplitude, period, and phase shift. ● How to graph the parent function of tangent, cosecant, secant, and cotangent functions ★ ● How to evaluate inverse sine, cosine, and tangent functions using the unit circle values including composition functions. ★ ● How to write a sine or cosine function given a graph of the function ★	● Draw angles in standard position ● Covert angles between radian and degree measures ● Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle ● Find coterminal angles ● Use the unit circle to find the exact values of the six trigonometric functions ● Recognize the domain and range of sine and cosine ● Evaluate trigonometric functions with a calculator ● Graph the sine and cosine functions using transformations ● Graph the tangent, cosecant, secant, and cotangent functions ★ ● Understand and use the inverse sine, cosine, and tangent functions ★ ● Find the exact values of the composite functions with inverse trigonometric functions ★ ● Write a sine or cosine equation that represents a given graph ★

Key Vocabulary: Radian, Degree, Coterminal Angles, Complement, Supplement, Sine, Cosine, Tangent, Secant, Cosecant, Cotangent, Reference Angle, Unit Circle, Amplitude, period

Assessment Evidence	
Performance Tasks: **Summative Assessment:** Unit 5 Test **(TCC3(9-12), TI4(9-12))** Topics to include: ● Sketch angles in standard position ● Find coterminal angles ● Convert between degrees and radians ● Find points on the unit circle given and angle in radians ● Find exact values of the 6 trig functions ● Graph sine and cosine functions (with transformations) ● Graph tangent, cotangent, secant, cosecant parent functions	**Other Evidence:** **Interim assessments: P3(9-12)** ● Unit circle quiz ● Graphing sine and cosine quiz **Common Formative Assessments: P3(9-12)** ● Unit circle practice ● Graphing sine and cosine practice ● Inverse trig function practice ★

(Honors) ● Graph inverse sine, cosine, tangent (Honors) ● Evaluate inverse trig function values including composition and algebraic quantities (Honors) Real World applications are most prevalent when: ● Calculating sound waves ● Projectile motion	

Learning Plan
● Students will complete textbook practice problems working in groups during class and individually outside of class **TCC3(9-12)** ● Class discourse on correct solutions to textbook problems - compare strategies and ask questions **CCE3(9-12), P2(9-12)** ● Extra practice on unit circle, graphing functions, and inverse trig functions(★)- white board practice-class discourse, on correct solutions- compare strategies and ask questions **P2(9-12), CCE3(9-12)** ● Individual/group in class practice on concepts that will be measured on the summative assessment**TCC3(9-12)**
Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheets

Unit 6 - Trigonometric Identities
Desired Results - Goals, Transfer, Meaning, Acquisition
Established Goals: **Common Core State Standards** (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections) ● **F.TF.C.8** Prove the Pythagorean identity $sin^2(\theta) + cos^2(\theta) = 1$ and use it to find $sin(\theta)$, $cos(\theta)$, or $tan(\theta)$ given $sin(\theta)$, $cos(\theta)$, or $tan(\theta)$ and the quadrant of the angle. ● **F.TF.C.9** (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems ● **A.SSE.A.2** Use the structure of an expression to identify ways to rewrite it. **Standards for Mathematical Practice** ● **MP1:** Make sense of problems and persevere in solving them. ● **MP2:** Reason abstractly and quantitatively. ● **MP3:** Construct viable arguments and critique the reasoning of others. ● **MP4:** Model with mathematics. ● **MP5:** Use appropriate tools strategically. ● **MP6:** Attend to precision. ● **MP7:** Look for and make use of structure. ● **MP8**: Look for and express regularity in repeated reasoning.
Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated) ● **TCC3(9-12)**: I can integrate relevant information to produce multiple valid solutions. ● **CCE2(9-12)**: I can give and receive actionable and relevant feedback with openness to be able to determine meaningful revisions for success. ● **CCE3(9-12)**: I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products. ● **CCE4(9-12)**: I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression. ● **DE1(9-12)**: I can acknowledge, process, and respond appropriately to others' comments and perspectives. ● **TI3(9-12)**: I can formulate and investigate probing questions to further my learning. ● **P1(9-12)**: I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others. ● **P3(9-12)**: I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.

● **AA1(9-12)**: I can evaluate different approaches and justify the best pathway to success. ● **AA2(9-12)**: I can assess my past successes and mistakes to change my approach.

Understandings: Students will understand that… ● Trigonometric functions are useful for modeling periodic phenomena. ● Expressions can be written in multiple ways using the rules of Trigonometry and Algebra and used to solve trigonometric functions.	**Essential Questions:** ● Why do we structure trig functions in different ways? ● What is the difference between solving an equation and verifying a trigonometric identity? ● How do you decide which strategies to use when verifying a trigonometric identity? ● How are trigonometric identities used in the process of solving trig equations?
Students will know… ● How to use right triangles to prove the sum of angles identities for cosine and sine ● How to convert the sum of angles identities into the difference of angles identities ● How to apply the sum and difference formulas for sine and cosine to prove the sum and difference formulas for tangent ● Double and half angle math lib activity ● How to recognize angles that can be written using sums of $\Pi/6,\ \Pi/4,\ and\ \Pi/3.$ ● How to use the sum and difference formulas for sine, cosine, and tangent to solve for exact values of the trigonometric functions of other angles	**Students will be able to…** ● Conduct Trigonometric proofs using the Pythagorean Identities ● Conduct Trigonometric proofs using Reciprocal identities ● Conduct Trigonometric proofs using Quotient identities ● Conduct Trigonometric proofs using Angle sum and difference identities for sine, cosine, and tangent. ● Conduct Trigonometric proofs using the Double-Angle Identities for sine, cosine, and tangent.★ ● Conduct Trigonometric proofs using the Half-angle Identities for sine, cosine, and tangent★ ● Solve trigonometric equations using identities ● Solve using Half-Angle and Double-Angle Identities★

Key Vocabulary:

Sine	Cotangent	Pythagorean identity
Cosine	Sum Formula	Pythagorean theorem
Tangen	Difference Formula	Unit circle
Secant	Double Angle Formula	Quotient identity
Cosecant	Half Angle Formulas	

Assessment Evidence	
Performance Tasks: **Summative Assessment:** Trigonometric Identities Test **TCC3(9-12), AA1(9-12), AA1(9-12)** Topics to include: ● Verify trig identities using ○ Pythagorean Identities ○ reciprocal identities ○ Quotient identities ○ Angle sum and difference Formulas★ ● Find all solutions of all six trig functions given a domain interval ● Use Double-Angle and Half-Angle Identities to solve ★ ● Use right triangles to solve trig functions ★ Real World Examples include: ● Solving real-word problems involving periodicity,angles and wave-like behavior ● Engineering and construction: calculating forces, stresses, and angles in bridges, buildings, and other structures ● Physics and Engineering (Waves and Oscillations) such as sound and light waves. ● Computer graphic and animations ● Medical imaging.	**Other Evidence:** **Interim assessments:** ● Identities Quiz **AA1(9-12), P3(9-12), AA1(9-12, AA2(9-12)** ○ Verify trig identities using reciprocal, quotient, and pythagorean identities ○ Use rationalizing and factoring strategies to verify trig identities.★ ● Quiz 2: Solving Trig Functions on a restricted interval using: **TCC3(9-12), P3(9-12), AA1(9-12, AA2(9-12)** ○ Reciprocal Identities ○ Quotient Identities ○ Pythagorean Identities ○ Sum and Difference Formulas

Learning Plan
Precalculus continues the learning of the study of functions. Students will learn strategies to solve trig functions on a restricted domain in order to choose trigonometric functions to model periodic phenomena. ● Students will complete textbook practice problems working in groups during class and individually outside of class ● Class discourse on correct solutions to textbook problems - compare strategies and ask questions ● Extra practice on trig identities- white board practice-class discourse on correct solutions- compare strategies and ask questions ● Verifying Trig Identities Google slides digital activity with immediate feedback **AA1(9-12)** ● Trigonometric Identities Triangle puzzle group project activity **CCE2(9-12), CCE3(9-12), CCE4(9-12)** ● Check your mate partner activity for solving Trig functions **CCE2(9-12), DE1(9-12)**

● Graphic organizer for referencing All trig identities ● Individual/group in class practice on concepts that will be measured on the summative assessment
Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheets, Google Slides, chrome book

Unit 7 - Modeling with Law of Sines and Cosines/ Sinusoids

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections)

- **G.SRT.D.9 (+)** *Apply trigonometry to general triangles.* Derive the formula A = (1/2)ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- **G.SRT.D.10 (+)** *Apply trigonometry to general triangles.* Prove the Laws of Sines and Cosines and use them to solve problems.
- **G.SRT.D.11 (+)** *Apply trigonometry to general triangles.* Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Standards for Mathematical Practice

- **MP1:** Make sense of problems and persevere in solving them.
- **MP2:** Reason abstractly and quantitatively.
- **MP3:** Construct viable arguments and critique the reasoning of others.
- **MP4:** Model with mathematics.
- **MP5:** Use appropriate tools strategically.
- **MP6:** Attend to precision.
- **MP7:** Look for and make use of structure.
- **MP8:** Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes:

- **TCC3(9-12)**: I can integrate relevant information to produce multiple valid solutions.
- **TCC2(9-12)**: I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.
- **DE1(9-12)**: I can acknowledge, process, and respond appropriately to others' comments and perspectives.
- **P1(9-12)**: I can self-reflect and seek feedback to build upon my strengths, apply those strengths to overcome obstacles, and share my strategies with others.
- **P3(9-12)**: I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.
- **AA2(9-12)**: I can assess my past successes and mistakes to change my approach.

Understandings: Students will understand that…	**Essential Questions:**
• The law of sines and cosines are fundamental trigonometry laws that can be used to solve problems involving the sides and angles of non-right triangles. • In a non-right triangle the given information determines which law is most appropriate to solve a problem. • When you know two sides and a non-included angle (SSA), there can be zero, one, or two possible triangles, known as the "ambiguous case." • If the altitude of a non-right triangle is not given, it can be expressed using trigonometry and used to calculate its area.	• How are trigonometric ratios used in solving real-world problems? • How do you determine whether the law of sines or law of cosines is most appropriate for solving a particular problem? • In ambiguous cases, how many possible triangles can the Law of Sines produce? • Is it possible to solve for the area of a triangle if the altitude is not known? • What kind of real-life situations can be modeled by sinusoidal equations? • How can sinusoidal equations be used to predict future values? • How can the area of a triangle be found using the law of sines and cosines?
Students will know...	**Students will be able to…**
• Law of Sines is most effective for angle-side pairs, especially when dealing with two angles and one side or two sides and a non-included angle. • Law of Cosines is more versatile for side-side-angle scenarios or when working with three sides of the triangle, as it can handle cases where the triangle is not right-angled. • Trigonometry can be used to calculate the area of a non-right triangle when you have the lengths of two sides and the included angle or only the length of the 3 sides • Many real-life situations are cyclical in nature and can be represented with sinusoidal equations.	• Prove the Laws of Sines and Cosines and use them to solve problems. • Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. • Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, bearing problems) • Model a real-life situation with a sinusoidal equation and use the graphing calculator to predict other values. • Use the law of sines area formula or Heron's formula to find the area of a triangle.

Key Vocabulary:

Law of Sines	Heron's Formula	Acute Triangle
Law of Cosines	Ambiguous Case	Right Triangle
Angle of Elevation	Included Angle	Obtuse Triangle
Angle of Depression	Solving Triangles	Oblique Triangle
Bearings		

<table>
<tr><th colspan="2">Assessment Evidence</th></tr>
<tr><td>Performance Tasks:

Performance Task 1: Create one creative application problem that would be solved by the law of sines/law of cosines. Students will follow a rubric to help guide them to clearly express their problem as well as get peer feedback. TCC3(9-12), DE1(9-12), P1(9-12)

Summative Unit Assessment: TCC2(9-12), AA2(9-12)
Topics will include:
● Law of Sines
● Law of Cosines
● Solving Triangles
● Recognizing and solving ambiguous case situations
● Area of a triangle using trigonometry
● Modeling with the Law of Sines/Cosine
● Create sinusoidal equations that represent real-life situations
● Enter sinusoids in the calculator and make predictions</td><td>Other Evidence:

● Interim: Solving non-right triangles for missing sides and angles with the Law of Sines. Students will also show their knowledge of the ambiguous case and if two triangles exist they will be asked to produce both possible solutions. TCC3(9-12), P3(9-12)

● Interim: Solving a triangle for missing sides and angles and calculating the area of a triangle A=1/2bh with the Law of Cosines. TCC2(9-12)

● Interim: Solving application problems involving the Law of Sines and the Law of Cosines. Application problems may involve bearings as well as angles of elevation or depression. P3(9-12)</td></tr>
<tr><th colspan="2">Learning Plan</th></tr>
<tr><td colspan="2">In this unit, students will extend their knowledge of solving right triangles with trigonometry to non-right triangles with trigonometry. They will also create a formula for finding the area of a triangle with trigonometry. Students will apply this learning to real world problems.

● Students will extend their knowledge of right triangle trigonometry through discovery lessons of the Law of Sines, Law of Cosines and area formulas through an investigative approach. TCC2(9-12)
● Students will evaluate different scenarios when solving with the Law of Sines and Law of Cosines and decipher which is more appropriate to utilize in solving for the missing parts of a non-right triangle. TCC3(9-12)
● Students will solve real world application problems involving different scenarios including bearings and angles of elevation and depression. P1(9-12), P3(9-12)</td></tr>
<tr><td colspan="2">Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator, Desmos calculator, mini white boards, teacher created worksheets</td></tr>
</table>

Unit 8 - Matrices	
Desired Results - Goals, Transfer, Meaning, Acquisition	
Established Goals: **Common Core State Standards** (* indicates a modeling standard; ★ indicates greater emphasis in the Honors sections) ● **N.VM.C.6** (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. ● **N.VM.C.7** (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. ● **N.VM.C.8** (+) Add, subtract, and multiply matrices of appropriate dimensions. ● **N.VM.C.9** (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. ● **N.VM.C.10** (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. **Standards for Mathematical Practice** ● **MP1:** Make sense of problems and persevere in solving them. ● **MP2:** Reason abstractly and quantitatively. ● **MP3:** Construct viable arguments and critique the reasoning of others. ● **MP4:** Model with mathematics. ● **MP5:** Use appropriate tools strategically. ● **MP6:** Attend to precision. ● **MP7:** Look for and make use of structure. ● **MP8:** Look for and express regularity in repeated reasoning.	
Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated) ● **TCC3(9-12):** I can integrate relevant information to produce multiple valid solutions. ● **P2(9-12):** I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my abilities to overcome my challenges. ● **P3(9-12):** I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals. ● **TI4(9-12):** I can apply my strengths and anticipate challenges to reach my current and future goals.	
Understandings: Students will understand that… ● A matrix is a rectangular array of numbers arranged in rows and columns, representing a set of data or a system of linear equations.	**Essential Questions:** ● What is a matrix, and how does it represent data or systems of equations in a structured way?

• The size or dimension of a matrix (rows × columns) is a fundamental concept that affects how matrices can be manipulated and used in calculations. • Students should understand that matrices of the same dimensions can be added or subtracted element-wise, with each element in the result being the sum or difference of corresponding elements. • Multiplying a matrix by a scalar (a single number) scales each element of the matrix, maintaining its structure while altering its magnitude. • Matrix multiplication is not commutative, meaning the order of multiplication matters. Students should understand the conditions under which matrix multiplication is defined and how to perform it. • Matrices provide a powerful way to represent and solve systems of linear equations, with each system corresponding to a matrix equation. • Matrices can be used to model and solve problems in fields such as economics, engineering, computer graphics, and more. • The determinant of a square matrix is a special number that can provide insights into the matrix's properties, such as whether it is invertible. • A matrix that has an inverse (i.e., it is invertible) can be used to solve systems of linear equations. Students should understand the conditions under which a matrix has an inverse and how to compute it. • The identity matrix acts as the multiplicative identity in matrix multiplication, analogous to the number 1 in regular multiplication. • As matrices grow in size, operations involving them can become computationally intensive. Understanding the complexity of these operations is important for practical applications. • While manual computation with matrices is important for learning, recognizing the role of technology in handling large and complex matrices is also essential.	• How can matrices be used to solve systems of linear equations, and why is this method sometimes more efficient than traditional methods? • In what ways do matrices model real-world phenomena, such as geometric transformations, computer graphics, and economic systems? • Under what conditions does a matrix have an inverse, and why is the inverse of a matrix important in solving systems of equations and other applications?

Students will know…	**Students will be able to…**
• The order of a matrix is represented by the number of rows by the number of columns. • Only matrices of the same dimensions can be added and subtracted. • It is only possible to multiply two matrices when the number of columns in the first matrix is the same as the number of rows in the second matrix. • Matrix operations can be performed on the graphing calculator. • A determinant is a real number associated with a square matrix and can be used to find the inverse of a matrix. • Matrices can be used to solve a system of equations by multiplying the inverse of the coefficient matrix by the constant matrix. • How to represent a real-life situation with matrices.	• State the order of a matrix • Add, subtract, and multiply matrices by hand and on the graphing calculator • Find the determinant of a 2 X 2 matrix and of a 3 X 3 matrix on the calculator and by hand. • Find the inverse of a 2X2 matrix by hand and of a 3X3 matrix on the calculator • Translate a system of equations into a matrix equation • Use matrices to solve a system of linear equations: a 2X2 system by hand and a 3X3 system on the calculator • Solve a real-life application problem using matrices

Key Vocabulary:

Matrix	Order of a matrix	Inverse Matrix
Matrices	Square Matrix	Coefficient Matrix
Row	Row Matrix	Constant Matrix
Column	Column Matrix	Determinant

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Summative Unit Assessment TCC3(9-12) Topics include: • Add, subtract and multiply matrices by hand • Find the determinant of a matrix • Find the inverse of a matrix • Solve a system of equations using matrices by hand and on the calculator • Solve application problems using matrices	Note: these will be given if time permits at the end of the year: **Interim: P3(9-12)** • Quiz on adding, subtracting, and multiplying matrices by hand • Quiz on solving a system by hand using matrices

Learning Plan

- Students will complete textbook practice problems working in groups during class and individually outside of class **TCC3(9-12)**

● Class discourse on correct solutions to textbook problems - compare strategies and ask questions **P2(9-12) P3(9-12)** ● Strategies on the graphing calculator will be stressed in this unit ● Individual/group in class practice on concepts that will be measured on the summative assessment **TCC3(9-12)**
Teacher Resources: Blitzer Precalculus Textbook, TI-84 graphing calculator

FORENSICS CURRICULUM

NGSS link

Grade Level(s): 11-12

Curriculum Author(s): Kathleen Yocis

Course Description: Forensics L-2 is designed to meet the needs of students wishing to take a one semester elective science course above and beyond the required science courses. This class is designed around authentic performance assessments where students, both as individuals and groups, will use scientific knowledge and reasoning to solve mock crime scenes. This course will include the following units:

- Power of Observation/Introduction to Forensics
- Crime Scene Investigation and Evidence Collection
- Time of Death
- Hair & Fiber Analysis
- Fingerprint Analysis/ DNA Fingerprint Analysis
- Blood & Blood Spatter Analysis
- Handwriting / Shoeprint Analysis

Year At A Glance			
Unit Title	**Overarching Essential Question**	**Overarching Enduring Understanding**	**Vision of A Learner "I Can" Statements**
Power of Observation /Introduction to Forensics (2-3 weeks)	How are observational skills and deductive reasoning used to solve crimes in forensic science?	Forensic science uses an investigator's ability to observe and document physical evidence, behavioral cues, and environmental factors at scenes to solve crimes.	TCC1(9-12); TCC2(9-12); TCC4(9-12)
Crime Scene Investigation and Evidence Collection (3-4 weeks)	How can meticulous observation and systematic evidence collection contribute to solving crimes and ensuring justice?	Thorough and methodical crime scene investigation and evidence collection are essential to establishing facts, reconstructing events, and facilitating justice in criminal investigations.	TCC1(9-12); TCC2(9-12); TCC3(9-12); TI3(9-12)
Time of Death (2-3 weeks)	How do forensic scientists use evidence and scientific methods to estimate the time of death accurately?	Determining the time of death is a complex and multifaceted process that integrates pathology, entomology, and environmental science to analyze postmortem changes and establish a timeline of events surrounding a death.	TCC4(9-12)
Hair & Fiber Analysis (2-3 weeks)	How can microscopic examination and chemical analysis of hair and fibers contribute to identifying individuals and reconstructing crime scenes?	Hair and fiber analysis plays a crucial role in forensic investigations by providing valuable evidence that can link individuals to crime scenes, establish timelines, and contribute to the reconstruction of events.	TCC2(9-12)
Fingerprint Analysis/ DNA fingerprinting (3-4 weeks)	How do fingerprints and DNA profiles provide unique identifiers and critical evidence in criminal investigations?	Fingerprinting and DNA fingerprinting are powerful tools in forensic science that provide unique identifiers, enabling accurate identification of individuals and aiding in criminal investigations.	TCC2(9-12); TCC4(9-12); CCE3(9-12)

Blood & Blood Spatter Analysis (3-4 weeks)	How can the analysis of blood and blood spatter patterns help reconstruct crime scenes and determine key details of violent events?	Blood and blood spatter analysis provides critical insights into crime scene dynamics, helping forensic investigators reconstruct events, determine mechanisms of injury, and contribute to the resolution of criminal cases.	TCC2(9-12); TCC3(9-12); TI3(9-12)
Handwriting/ Shoeprint Analysis (1 week)	How do the unique characteristics of handwriting and shoeprints contribute to identifying individuals and reconstructing events in forensic investigations?	Handwriting and shoeprint analysis are essential forensic tools that leverage unique characteristics to establish individual identities, reconstruct timelines, and provide critical evidence in criminal investigations.	TCC4(9-12)

Unit 1 - Power of Observation /Introduction to Forensics	
Desired Results - Students will use Observations and Deductive Reasoning to Solve Crimes	
Established Goals: **Common Core State Standards:** RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. RI.9-10.7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in print and multimedia), determining which details are emphasized in each account. W.9-10.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. **NGSS Standards:** **Systems and System Models (CCC 4):** Investigate how different components of a forensic investigation system (e.g., evidence collection, analysis, interpretation) work together.	
Vision of A Learner Attributes: Students will be able to independently use their learning to: TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions. TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life. CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.	
Understandings: ● Witness testimony relies on how accurately individuals perceive events and how well they can recall them later. Factors like stress, distractions, and the passage of time can all affect these abilities ● Forensic science intrigues people because it combines the rigor of scientific investigation with the drama of solving mysteries, offering insights into the human condition and justice system. ● Forensic science has undergone significant changes and advancements over time; such as utilization of sophisticated instruments and techniques for analyzing various types of evidence, including fingerprints, ballistics, trace evidence (e.g.,	**Essential Questions:** ● Are people reliable witnesses? ● Why does Forensic science intrigue people? ● How has forensic science changed over time? ● What career pathways can be used in Forensics?

fibers, hair), and digital evidence (e.g., computer forensics) leading to more accurate and reliable methods for investigating crimes. ● Forensics offers diverse career pathways across various disciplines; such as Crime Scene Investigator, Forensic Anthropologist, Forensic Psychologist, Digital Forensics Expert, Forensic Pathologist, Forensic Entomologist and toxicologist.	
Students will know... ● the difference between observation and perception. ● examples of factors that influence eyewitness accounts. ● how forensic science has changed over time. ● the divisions of a crime lab and what happens in each department of a crime lab ● what the "CSI Effect" is and how it relates to juries. ● examples of different education disciplines that can lead to a career in forensic science.	**Students will be able to...** ● compare, critically, an eyewitness account to what actually happened. ● relate observational skills to forensic science. ● practice improving their observational skills. ● explain what happens when a person gets arrested. ● investigate Locard's Exchange Principle. ● research a forensic career and present it to the class.
Key Vocabulary: forensic science, deductive reasoning, eyewitness, perception, Bill of Rights, Miranda Rights, Locard's Principle, Frye Standard	
Assessment Evidence	
Performance Tasks: Jane's Crime scene activity used to improve observation skills Perception Activity: evaluate the differences between observation and perception. The Deadly Picnic: Using deductive reasoning to solve a crime Unit #1 Mini Crime Scene Forensics Career Project	**Other Evidence:** Kenneth Ireland article Answer Questions on Kenneth Ireland article Unit #1 Reading Guide Worksheet Review for Quiz on Unit #1 Topics for Unit #1 Quiz Unit #1 Quiz
Learning Plan	
RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. ● *Reading guide fill-in notes o text* ● *Picture activities including Jane's Crime Scene* ● *Questions on Case Study of Kenneth Ireland*	

- *Solving the Deadly Picnic using deductive reasoning*

RI.9-10.7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in print and multimedia), determining which details are emphasized in each account.

- *Questions on Case Study of Kenneth Ireland*
- *Solving the Deadly Picnic using deductive reasoning*

W.9-10.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

- *Forensic Science Career Project research and presentation*

Systems and System Models (CCC 4): Investigate how different components of a forensic investigation system (e.g., evidence collection, analysis, interpretation) work together.

- *Picture activities including Jane's Crime Scene*
- *Questions on Case Study of Kenneth Ireland*
- *Solving the Deadly Picnic using deductive reasoning*

Vision of A Learner Attributes:

TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions.

- *Picture activities including Jane's Crime Scene*
- *Questions on Case Study of Kenneth Ireland*
- *Solving the Deadly Picnic using deductive reasoning*

TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.

- *Picture activities including Jane's Crime Scene*
- *Questions on Case Study of Kenneth Ireland*
- *Solving the Deadly Picnic using deductive reasoning*

TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.

- *Forensic Science Career Project research and presentation*

CCE4(9-12): I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.

- *Forensic Science Career Project research and presentation*

Teacher Resources: Bertino Forensics textbook 3rd Edition Chapter 1

Unit 2 - Crime Scene Investigation and Evidence Collection

Desired Results - Students will use thorough and methodical crime scene investigation and evidence collection to establish facts, reconstruct events, and facilitate justice in criminal investigations.

Established Goals:
[Common Core State Standards:]
RI.9-10.7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in print and multimedia), determining which details are emphasized in each account.
W.9-10.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
S-ID.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

[NGSS Standards:]
Constructing Explanations and Designing Solutions (SEP 6): Develop explanations based on evidence collected from crime scenes or design solutions for analyzing and preserving evidence.
Systems and System Models (CCC 4): Investigate how different components of a forensic investigation system (e.g., evidence collection, analysis, interpretation) work together.
HS-PS1-3 (PS1.A): Plan and conduct investigations to gather evidence and use the evidence to construct an explanation of the crime scene using atomic and molecular interactions.
HS-ESS2-7 (ESS2.D): Investigate crime scene evidence and use models to predict how Earth's systems impact the evidence found.
HS-PS2-1 (PS2.A): Use mathematical representations to support claims for the motions and interactions of objects in crime scene reconstructions.

Vision of A Learner Attributes: Students will be able to independently use their learning to:
TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions.
TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.
TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.
TI3(9-12): I can formulate and investigate probing questions to further my learning.

Enduring Understandings:	Essential Questions:
• Crime scenes are sketched to provide a visual representation of the scene's layout, the placement of evidence, and the spatial relationships between various elements.	• How are crime scenes sketched? • What happens once a crime scene is found? • How does the police process crime scenes? • How is evidence classified?

• Once a crime scene is found, a series of critical steps such as securing the scene, documenting the scene, searching for evidence, collecting and packaging evidence, interviewing witnesses, processing forensic evidence to ensure the preservation of evidence and the thorough investigation of the incident. • Processing a crime scene is a meticulous and systematic process conducted by law enforcement personnel to gather evidence, document findings, and preserve the integrity of the scene. • Evidence in the context of criminal investigations is classified into different types based on its nature, relevance, and potential to support or refute a hypothesis or allegation. • Police investigators look for anything that appears out of place, unusual, or potentially connected to the crime. This could include weapons, bloodstains, damaged property, or items that may have been moved or tampered with. • Effective crime scene preservation and evidence collection require collaboration between forensic scientists, law enforcement officers, and other experts to ensure thorough examination and analysis. Also, accurate documentation and maintaining a clear chain of custody are critical to ensure the admissibility of evidence in legal proceedings.	• How do the police know what is evidence and what is not? • How are different types of evidence collected properly?
Students will know... • what constitutes a crime scene. • the importance of first responding officer/crime scene investigator's actions in maintaining the integrity of the crime scene during the investigation. • crime scenes are sketched and the types of information that must be included in the final sketch. • what types of information need to be recorded at the crime scene. • evidence is classified as individual or class. • how different pieces of evidence are collected and packaged properly (ex. hair, DNA, blood, fibers, firearms, etc.) • how to fill out the chain of custody of the evidence.	**Students will be able to...** • explain the jobs of the first responder and the first responding officer in securing and maintaining the integrity of the crime scene. • create a rough sketch of a crime scene. • use triangulation to locate evidence within a crime scene so that it can be put into the crime scene sketch. • create a final crime scene sketch to scale and include all of the necessary information on that sketch. • package different types of evidence and complete a chain of custody properly. • determine the probability of an occurrence using the product rule.

- the different types of evidence databases that are available to police.

Key Vocabulary: crime scene, chain of custody, first responder, crime-scene reconstruction, paper bindle (druggist fold), primary and secondary crime scenes, circumstantial evidence, direct evidence, class evidence, individual evidence, trace evidence, product rule

Assessment Evidence

Performance Tasks:	Other Evidence:
Search Warrants Activity to determine what is a legal vs. illegal search Product Rule Probability Calculations Sketching a crime scene lab activity Mini Crime scene activity: Collecting Evidence Physical Evidence Collecting Lab Activity	Quiz on performing proper evidence collection Units #1 & 2 Test

Learning Plan

RI.9-10.7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in print and multimedia), determining which details are emphasized in each account.

- *Mini Crime scene activity: Collecting Evidence*
- *Search Warrant Activity*

W.9-10.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

- *Mini Crime scene activity: Collecting Evidence*
- *Physical Evidence Collecting Activity*

S-ID.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

- *Sketching a crime scene*
- *Product Rule and Probability Activity*

Constructing Explanations and Designing Solutions (SEP 6): Develop explanations based on evidence collected from crime scenes or design solutions for analyzing and preserving evidence.

- *Mini Crime scene activity: Collecting Evidence*
- *Physical Evidence Collecting Activity*
- *Sketching a Crime Scene*
- *Search Warrant Activity*

Systems and System Models (CCC 4): Investigate how different components of a forensic investigation system (e.g., evidence collection, analysis, interpretation) work together.

- *Mini Crime scene activity: Collecting Evidence*
- *Physical Evidence Collecting Activity*

HS-PS1-3 (PS1.A): Plan and conduct investigations to gather evidence and use the evidence to construct an explanation of the crime scene using atomic and molecular interactions.

- *Mini Crime scene activity: Collecting Evidence*
- *Physical Evidence Collecting Activity*

HS-PS2-1 (PS2.A): Use mathematical representations to support claims for the motions and interactions of objects in crime scene reconstructions.

- *Sketching a crime scene with evidence measured from two stationary points.*

HS-ESS2-7 (ESS2.D): Investigate crime scene evidence and use models to predict how Earth's systems impact the evidence found.

- *Sketching a crime scene with evidence measured from two stationary points.*
- *Product rule and probability Calculations*

Vision of A Learner Attributes:

TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions.

- *Mini Crime scene activity: Collecting Evidence*
- *Sketching a Crime Scene*

TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.

- *Mini Crime scene activity: Collecting Evidence*
- *Physical Evidence Collecting Activity*
- *Search Warrant Activity*

TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.

- *Mini Crime scene activity: Collecting Evidence*
- *Physical Evidence Collecting Activity*
- *Search Warrant Activity*
- *Sketching a Crime Scene*

TI3(9-12): I can formulate and investigate probing questions to further my learning.

- *Mini Crime scene activity: Collecting Evidence*
- *Search Warrant Activity*

Teacher Resources: Bertino Forensics textbook 3rd Edition

Unit 3 - Time of Death	
Desired Results - Students will be able to determine the time of death using pathology, entomology, and environmental science.	
Established Goals: [Common Core State Standards:]() RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. [NGSS Standards:]() **HS-LS1-2 (LS1.B):** Develop and use a model to illustrate the key steps of decomposition and how they relate to the time of death. **HS-PS1-7 (PS1.A):** Use mathematical representations to support explanations of factors that affect the rate of chemical reactions in decomposition processes. **HS-ESS2-5 (ESS2.C):** Develop and use a model to describe how changes in temperature and other environmental factors affect the rate of decomposition and time of death estimation.	
Vision of A Learner Attributes: Students will be able to independently use their learning to: TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.	
Understandings: ● Different countries and jurisdictions may have specific legal definitions and criteria for declaring death, which may include the involvement of specialized medical experts and protocols to ensure accuracy and consistency in determining the end of life. ● Medical examiners estimate time of death based on characteristics of the body and stages of insect development. ● Insects have predictable life cycles, including egg, larval (maggot), pupal, and adult stages. Forensic entomologists can examine the developmental stage of insect larvae found on or near the body to estimate the time since colonization (minimum PMI). ● Environmental factors such as ambient temperature, humidity, exposure to sunlight, moisture and air circulation	**Essential Questions:** ● How is death defined? ● How does the medical examiner estimate the time of death? ● How can insects help estimate the time of death? ● How do environmental factors influence the estimated time of death? ● How is an autopsy done?

play a significant role in influencing the estimated time of death (postmortem interval, PMI) in forensic investigations. ● An autopsy, also known as a postmortem examination, is a medical procedure performed by a forensic pathologist to examine a deceased person's body in order to determine the cause of death, understand the circumstances surrounding death, and gather forensic evidence.	
Students will know… ● the manner, cause and mechanism of death and how "death" itself is defined by experts. ● time of death can be estimated based on biological processes, such as rigor mortis, livor mortis, and decomposition. ● what environmental factors will affect body decomposition. ● the succession of different types of insects that are found on a body as it decomposes and what each stage of development indicates about time of death. ● how to explain what is involved in the forensic analysis of a deceased body, including conducting an autopsy, establishing post mortem interval, and determining a probable cause of death.	**Students will be able to...** ● distinguish between the four manners of death: natural, accidental, suicidal and homicidal. ● describe the stages of decomposition of a corpse. ● calculate the approximate time of death using algor mortis, rigor mortis and livor mortis, stomach contents ● calculate time of death using the insect stage of development of blow flies. ● predict the influence of environmental factors on body decomposition
Key Vocabulary: cause of death, manner of death, mechanism of death, algor mortis, rigor mortis, livor mortis, autolysis, entomology, larva, instar, spiracle, pupa, autopsy	
Assessment Evidence	
Performance Tasks: Estimating time of death using a graph Algor mortis: time of death calculations Time of death discovery based on stomach contents, environmental conditions and algor, liver & rigor mortis When did Zelda die? Mystery	**Other Evidence:** Case Studies on "A Maggot for the Prosecution" and Stella Nickell cases. Unit #3: Time of Death Test

Learning Plan
RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. ● *Evaluation of Stella Nickell Case Study & “A Maggot for the Prosecution” Article* ● *Fill-in Notes* ● *“When did Zelda Die?” Activity* **HS-LS1-2 (LS1.B):** Develop and use a model to illustrate the key steps of decomposition and how they relate to the time of death. ● *Estimating Time of Death Graphing Exercise* **HS-PS1-7 (PS1.A):** Use mathematical representations to support explanations of factors that affect the rate of chemical reactions in decomposition processes. ● *Estimating Time of Death Graphing Exercise* ● *Algor mortis Calculation problems* ● *“When did Zelda Die?” Activity* ● *Determining Time of Death using algor, livor & rigor mortis, stomach contents and environmental factors Activity* **HS-ESS2-5 (ESS2.C):** Develop and use a model to describe how changes in temperature and other environmental factors affect the rate of decomposition and time of death estimation. ● *Estimating Time of Death Graphing Exercise* ● *Algor mortis Calculation problems* ● *“When did Zelda Die?” Activity* ● *Determining Time of Death using algor, livor & rigor mortis, stomach contents and environmental factors Activity* **Vision of A Learner Attributes:** TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life. ● *“When did Zelda Die?” Activity* ● *Determining Time of Death using algor, livor & rigor mortis, stomach contents and environmental factors Activity*
Teacher Resources: Bertino Forensics textbook 3rd Edition

Unit 4 - Hair & Fiber Analysis	
Desired Results - Students will use hair and fiber analysis to link individuals to crime scenes.	
Established Goals: **Common Core State Standards:** RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **NGSS Standards:** **HS-LS1-1 (LS1.A):** Use models and evidence to explain the role of cellular structures in the functioning of living organisms, which can be applied to understanding hair structure and growth. **HS-PS1-3 (PS1.A):** Plan and conduct investigations to gather evidence to compare the substances found in different types of fibers and their interactions with other substances. **HS-ETS1-3 (ETS1.B):** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, which could relate to improving forensic methods for hair and fiber analysis.	
Vision of A Learner Attributes: Students will be able to independently use their learning to: TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.	
Understandings: ● Hair and fibers possess unique microscopic characteristics that can be used to associate them with a particular individual, location, or source. ● Human and animal hairs differ in several key aspects, including their structure, composition, growth patterns, and microscopic characteristics. ● Forensic scientists use a combination of macroscopic and microscopic characteristics such as color, length, diameter, cuticle pattern, and medullary index to differentiate between different hairs, whether they are from different individuals or different species. ● Forensic scientists use various methods to differentiate between different types of fibers found at a crime scene or associated with evidence such as structure, color, dye analysis, flame tests, texture and diameter measurements.	**Essential Questions:** ● How are hair & fibers used in forensics? ● How do human and animal hairs differ? ● How do forensic scientists tell different hairs apart? ● How do forensic scientists tell different fibers apart? ● How are natural and synthetic fibers different?

Students will know...	**Students will be able to...**
• the structural makeup of a hair. • the different places hair is found on the human body and how it is collected. • how to determine if hair is human or animal origin. • how to measure and calculate the medullary index of a hair. • the different techniques that can be used in hair analysis. • where DNA can be found in hair. • the different techniques that can be used in fiber analysis. • how to determine if a fiber is natural or synthetic.	• use a microscope to draw different types of human and animal hair. • label and describe the structure of hair. • analyze an unknown hair to determine if it is of human or animal origin. • calculate the medullary index of hair (if a medulla is present) • create a cuticle imprint from a hair. • use a microscope to draw different types of fibers: cotton, wool, polyester, rayon, nylon and acrylic. • perform a burn test on a fiber to determine the type of fiber material. • analyze an unknown fiber to determine the type of fiber.

Key Vocabulary: medulla, cortex, cuticle, hair follicle, follicular tag, keratin, melanin, neutron activation analysis, comparison microscope, natural fiber, synthetic fiber, textile, warp, weft, monomer, polymer, yarn, amorphous, flame test

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Hair Lab: evaluating human & animal hairs under the microscope to determine identifiable characteristics. Fiber lab: evaluating natural & synthetic hairs under the microscope to determine identifiable characteristics.	Dead Reckoning and Enrique Camerena Case Studies Test on Hair & Fibers

Learning Plan

RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

- *Dead Reckoning and Enrique Camerena Case Studies*

HS-LS1-1 (LS1.A): Use models and evidence to explain the role of cellular structures in the functioning of living organisms, which can be applied to understanding hair structure and growth.

- *Hair Lab*
- *Fiber lab*

HS-PS1-3 (PS1.A): Plan and conduct investigations to gather evidence to compare the substances found in different types of fibers and their interactions with other substances.

- *Hair Lab*
- *Fiber lab*

HS-ETS1-3 (ETS1.B): Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, which could relate to improving forensic methods for hair and fiber analysis. ● *Hair Lab* ● *Fiber lab* **Vision of A Learner Attributes:** Students will be able to independently use their learning to: TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. ● *Hair Lab* ● *Fiber lab*
Teacher Resources: Bertino Forensics textbook 3rd Edition

Unit 5 - Fingerprint Analysis/ DNA Fingerprinting	
Desired Results - Students will use fingerprinting and DNA fingerprinting to identify individuals in criminal investigations.	
Established Goals: [Common Core State Standards:] RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. S-ID.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). [NGSS Standards:] **Analyzing and Interpreting Data (SEP 4):** Students can analyze patterns in data related to crime scenes, DNA analysis, or other forensic evidence. **Using Mathematics and Computational Thinking (SEP 5):** Apply mathematical reasoning and computational tools to analyze forensic data, such as DNA sequences or statistical analyses of evidence. **Patterns (CCC 1):** Identify patterns in evidence, such as blood spatter patterns or fingerprint ridge characteristics. **Systems and System Models (CCC 4):** Investigate how different components of a forensic investigation system (e.g., evidence collection, analysis, interpretation) work together. **LS1: From Molecules to Organisms: Structures and Processes:** Relate concepts of DNA structure and function to forensic DNA analysis. **LS4: Biological Evolution: Unity and Diversity:** Explore concepts of genetic variation and inheritance in forensic genetics. **HS-LS3-1 (LS3.A):** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms, including DNA structure and function.	
Vision of A Learner Attributes: Students will be able to independently use their learning to: CCE3(9-12): I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products. TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.	
Understandings: ● Fingerprints are unique to each individual and can be used as reliable identifiers in forensic investigations because they have patterns that can be classified into distinct categories (arches, loops, whorls) to aid in identification and comparison. ● Forensic technicians use fingerprint powder, which is often a fine, colored powder (e.g., black, white, or fluorescent) that	**Essential Questions:** ● How are fingerprints unique to each person? ● How are fingerprints lifted at a crime scene? ● How do forensic scientists match a fingerprint to a person? ● How is DNA unique to each individual (except identical twins)? ● How does the structure of DNA lend itself to be used in forensic analysis?

adheres to the oils and residues left behind by fingers and lifts the dusted prints with adhesive tape. ● Forensic scientists use points of similarity and minutiae in fingerprints to match questioned prints with known prints from suspects or databases such as AFIS. ● DNA profiles are unique to each individual (except identical twins) and provide highly specific identification. ● DNA sequences vary among individuals, allowing for differentiation and identification through separation of different lengths of fragments by gel electrophoresis. ● DNA profiling is used to match biological evidence (such as blood, saliva, or hair) with individuals, establish paternity, and identify victims and suspects. ● DNA sequencing technologies, such as PCR (which creates millions of copies of DNA), gel electrophoresis and next-generation sequencing, have revolutionized forensic DNA analysis, making it faster and more sensitive.	● Where can DNA be found in a crime scene? ● How can forensic scientists create copies of DNA and analyze to match suspects?
Students will know... ● fingerprints are caused by dermal skin ridges that form in utero and serve a purpose. ● no two people have the same fingerprints based on their ridge patterns called minutiae. ● how fingerprints are classified. ● how the Henry system is used to classify fingerprints. ● fingerprints may be visible or invisible to the naked eye at a crime scene. ● how fingerprints can be lifted at a crime scene and analyzed. ● how some criminals attempted to alter their fingerprints. ● IAFIS is the database for fingerprints. ● that DNA, except for identical twins, is unique to each individual. ● the basic structure and components of DNA ● PCR (Polymerase Chain Reaction) is a technique used by forensic scientists to make copies of DNA. ● that restriction enzymes are used to cut DNA into fragments. ● Gel Electrophoresis is a technique used to separate strands of DNA by length and match to specific individuals.	**Students will be able to...** ● create a 10 print card of their fingerprints. ● identify the characteristics of fingerprints (loop, whorl or arch and what type). ● calculate their Henry system number using their ten-print card. ● identify whether a fingerprint is a patent, latent or plastic print. ● match prints if given samples. ● identify minutiae patterns in fingerprints. ● properly collect fingerprints using charcoal dusting powder, magnetic powder, cyanoacrylate fuming, iodine fuming. ● explain the structure & significance of DNA in a human. ● explain the base-pairing rules for the nitrogen bases and use it to create the complementary strand of DNA if given one side of the strand. ● explain how PCR works and its benefits. ● model how a restriction enzyme is used to cut DNA and how gel electrophoresis is used to separate the fragments of DNA. ● conduct a gel electrophoresis experiment using DNA samples including: making the gel, loading the samples in the gel, staining the gel and analyzing the gel.

• DNA can be found in saliva, skin, semen, blood, sweat or hair found at crime scenes, • CODIS is the database for DNA samples.	

Key Vocabulary: loop, whorl, arch, delta, core, minutiae (bridge, bifurcation, island, eye, ridge, dot, spur, trifurcation), ten-print card, Henry System, plastic fingerprint, latent fingerprint, patent fingerprint, ridge pattern, ninhydrin, cyanoacrylate fuming, silver nitrate, iodine fuming, magnetic powder, double helix, nucleotide, nitrogen bases (adenine, thymine, guanine, and cytosine), deoxyribose, allele, chromosome, DNA fingerprint, restriction enzymes, gene, gel electrophoresis, PCR(polymerase chain reaction), STR (short tandem repeat), polymorphisms

Assessment Evidence

Performance Tasks:	Other Evidence:
10 Fingerprints Card Lab and analysis: students take their own fingerprints, identity characteristics, minutiae and calculate Henry system value. Lifting Fingerprints Lab: students dust or fingerprints, lift them and analyze characteristics. Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates. Matching DNA fingerprinting to correct suspect	Should the Government be able to collect DNA?: Class debate/discussion Fingerprinting & DNA fingerprinting Test

Learning Plan

RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

- *Should the Government be able to collect DNA?*
- *Matching DNA fingerprinting to correct suspect*

S-ID.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

- *10 Fingerprints Card Lab and analysis: students calculate Henry system value.*
- *Lifting Fingerprints Lab: students dust or fingerprints, lift them and analyze characteristics.*
- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*
- *Matching DNA fingerprinting to correct suspect*

Analyzing and Interpreting Data (SEP 4): Students can analyze patterns in data related to crime scenes, DNA analysis, or other forensic evidence.

- *10 Fingerprints Card Lab and analysis: students calculate Henry system value.*

- *Lifting Fingerprints Lab: students dust or fingerprints, lift them and analyze characteristics.*
- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*
- *Matching DNA fingerprinting to correct suspect*

Using Mathematics and Computational Thinking (SEP 5): Apply mathematical reasoning and computational tools to analyze forensic data, such as DNA sequences or statistical analyses of evidence.

- *10 Fingerprints Card Lab and analysis: students calculate Henry system value.*

Patterns (CCC 1): Identify patterns in evidence, such as blood spatter patterns or fingerprint ridge characteristics.

- *10 Fingerprints Card Lab and analysis: students calculate Henry system value.*
- *Lifting Fingerprints Lab: students dust or fingerprints, lift them and analyze characteristics.*
- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*
- *Matching DNA fingerprinting to correct suspect*

Systems and System Models (CCC 4): Investigate how different components of a forensic investigation system (e.g., evidence collection, analysis, interpretation) work together.

- *Lifting Fingerprints Lab: students dust or fingerprints, lift them and analyze characteristics.*
- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*

LS1: From Molecules to Organisms: Structures and Processes: Relate concepts of DNA structure and function to forensic DNA analysis.

- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*

LS4: Biological Evolution: Unity and Diversity: Explore concepts of genetic variation and inheritance in forensic genetics.

- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*
- *Matching DNA fingerprinting to correct suspect*

HS-LS3-1 (LS3.A): Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms, including DNA structure and function.

- *Online Gel electrophoresis lab: students separate DNA fragments using virtual gel plates.*
- *Matching DNA fingerprinting to correct suspect*

Vision of A Learner Attributes:

CCE3(9-12): I can show initiative in prompting group discourse and fostering collaboration among others, providing actionable feedback, and working with others to solve problems and/or design products.

- *Should the Government be able to collect DNA?*

TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.

- *Should the Government be able to collect DNA?*

TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.

- *10 Fingerprints Card Lab and analysis: students calculate Henry system value.*
- *Lifting Fingerprints Lab: students dust or fingerprints, lift them and analyze characteristics.*
- *Should the Government be able to collect DNA?*

Teacher Resources: Bertino Forensics textbook 3rd Edition

Unit 6 - Blood & Blood Spatter Analysis	
Desired Results - Students will use blood and blood spatter analysis to reconstruct events, determine mechanisms of injury, and solve criminal cases.	
Established Goals: **Common Core State Standards:** RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. W.9-10.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. **NGSS Standards:** **Patterns (CCC 1):** Identify patterns in evidence, such as blood spatter patterns or fingerprint ridge characteristics. **LS4: Biological Evolution: Unity and Diversity:** Explore concepts of genetic variation and inheritance in forensic genetics. **HS-PS2-1 (PS2.A):** Investigate and explain the relationships between the motion of objects and the forces acting on them to analyze blood spatter patterns and trajectories.	
Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated) TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions. TCC3(9-12): I can integrate relevant information to produce multiple valid solutions. TI3(9-12): I can formulate and investigate probing questions to further my learning.	
Understandings: ● Blood is a crucial form of physical evidence at crime scenes, providing information about the events that occurred. Blood typing is class evidence; DNA analysis of blood can identify individuals, link suspects to crime scenes, and exclude innocent parties. ● Blood spatter patterns can provide insights into the direction, angle, and velocity of impacts, helping to interpret patterns to reconstruct the sequence of events at a crime scene, considering factors such as weapon type, force, and victim position. ● Students will understand that various forensic techniques, such as luminol testing, pattern analysis, and DNA profiling of	**Essential Questions:** ● How is blood type at a crime scene used in forensics? ● What can blood or blood spatter at a crime scene tell forensic scientists about the crime? ● How can you tell if blood found at a crime scene is human blood, animal blood or something else?

blood stains, contribute to the identification of blood as human or animal and aid in the prosecution of crimes	
Students will know... • the composition of blood and the function of its components. • that blood types (ABO system) are based on antigens found on the surface of red blood cells. • that blood typing is based on antigen-antibody complexes that are part of the normal immune system function in humans. • how to calculate the probability of certain blood types or blood proteins in a population. • the different tests that can be used to determine the presence of blood: hemastix, Kastle-Meyer, blood typing, precipitin, etc. • that blood spatter can tell forensic scientists: the velocity of blood drop, direction the blood came from and at what angle, what type of weapon may have been used, the height the victim was at when they were attacked, where the person was when they were attacked, etc.	**Students will be able to...** • explain the components in blood and their functions. • explain the antigen-antibody complex and how it relates to blood typing. • conduct a blood typing analysis with simulated blood to determine blood types. • calculate the probability of certain blood types/ blood proteins in a given population. • conduct an experiment to determine if blood is present or not. • conduct an experiment, gather data and analyze the effect of impact angle on blood drops. • conduct an experiment, gather data, and analyze the effect of height of a blood drop on blood spatter patterns. • conduct experiments, gather data and analyze the effect of arterial spurts, walking, running, velocity, etc. have on blood spatter patterns.

Key Vocabulary: agglutination, antibodies, antigens, antigen-antibody response, plasma membrane proteins, red blood cells, white blood cells, plasma, , platelets, blood clotting, ABO blood groups, point of origin, line of convergence, satellite drop, spike, velocity

Assessment Evidence

Performance Tasks: Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests Punnett Squares Activity Blood Spatter Lab: students create various blood spatter patterns and take measurements of blood drops and angles of impact.	**Other Evidence:** Blood & Blood Spatter Test

Learning Plan

RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*

W.9-10.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*

Patterns (CCC 1): Identify patterns in evidence, such as blood spatter patterns or fingerprint ridge characteristics.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*
- *Blood Spatter Lab: students create various blood spatter patterns and take measurements of blood drops and angles of impact.*

LS4: Biological Evolution: Unity and Diversity: Explore concepts of genetic variation and inheritance in forensic genetics.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*
- *Punnett Squares Activity*

HS-PS2-1 (PS2.A): Investigate and explain the relationships between the motion of objects and the forces acting on them to analyze blood spatter patterns and trajectories.

- *Blood Spatter Lab: students create various blood spatter patterns and take measurements of blood drops and angles of impact.*

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

TCC2(9-12): I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*
- *Blood Spatter Lab: students create various blood spatter patterns and take measurements of blood drops and angles of impact.*

TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*
- *Blood Spatter Lab: students create various blood spatter patterns and take measurements of blood drops and angles of impact.*
- *Punnett Squares Activity*

TI3(9-12): I can formulate and investigate probing questions to further my learning.

- *Blood Typing Lab: students identify which child belongs to which couple by completing multiple blood typing tests*
- *Blood Spatter Lab: students create various blood spatter patterns and take measurements of blood drops and angles of impact.*

Teacher Resources: Bertino Forensics textbook 3rd Edition

Unit 7 - Handwriting/ Shoeprint Analysis

Desired Results - Students will use the unique characteristics of handwriting and shoeprints to solve criminal investigations.

Established Goals:
[Common Core State Standards:]
RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
[NGSS Standards:]
Patterns (CCC 1): Identify patterns in evidence, such as blood spatter patterns or fingerprint ridge characteristics.

Vision of A Learner Attributes: Students will be able to independently use their learning to:
TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.

Understandings:
- Handwriting has unique features that can be used to identify individuals, including stroke formation, spacing, and letter forms.
- Forensic document examiners use comparative analysis to determine the likelihood of a match between questioned handwriting and known examples.
- Shoe Prints can be collected as impression evidence from crime scenes and compared to known shoe impressions or databases.
- Shoe Prints exhibit both class characteristics (related to shoe type and size) and individual characteristics (wear patterns, unique markings.

Essential Questions:
- How can handwriting analysis be used to identify individuals in forensic investigations?
- What are the key characteristics of handwriting that forensic experts look for in their analysis?
- How are shoeprints left at crime scenes and what information can they provide to investigators?
- What are the methods and technologies used to collect and analyze shoeprint evidence?

Students will know...
- handwriting analysis relies on the unique characteristics and habits of individuals, which can be systematically identified and compared.
- handwriting analysis requires a combination of observational skills, scientific methods, and forensic techniques to establish connections between individuals and written documents.
- that the analysis of shoeprints involves understanding how various factors, such as shoe design, wear patterns, and environmental conditions, influence the impressions left at crime

Students will be able to...
- list handwriting characteristics that are used to identify a suspect.
- compare and identify the suspect from various handwriting samples.
- create a shoe print cast .
- compare and identify the suspect from various shoe print samples.

scenes. ● the limitations in shoeprint analysis, such as variations in footwear manufacturing and degradation of impression quality over time, must be considered when drawing conclusions in forensic investigations.	

Key Vocabulary: Exemplar, graphology, individual characteristics, class characteristics, forgery, footwear impression, tread pattern, wear patterns, casting, impression evidence, forensic document examiner, ridge characteristics

Assessment Evidence	
Performance Tasks: Handwriting Lab Shoeprint cast creation lab & Analysis (if time permits) Final Crime Scene Performance Assessment	**Other Evidence:** Handwriting analysis

Learning Plan

RI.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

- *Handwriting Lab*
- *Shoeprint cast creation lab & Analysis (if time permits)*
- *Final Crime Scene Performance Assessment*

NGSS Standards:

Patterns (CCC 1): Identify patterns in evidence, such as blood spatter patterns or fingerprint ridge characteristics.

- *Handwriting Lab*
- *Shoeprint cast creation lab & Analysis (if time permits)*
- *Final Crime Scene Performance Assessment*

Vision of A Learner Attributes:

TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.

- *Handwriting Lab*
- *Shoeprint cast creation lab & Analysis (if time permits)*
- *Final Crime Scene Performance Assessment*

Teacher Resources: Bertino Forensics textbook 3rd Edition