Mathematics

Geometry Public Overview

1st 9 Weeks
Assessments
MAP Growth Math: September 2nd – September 3rd

What are we learning?
How can I help at home?

Topic 1: Foundations of Geometry

In this topic, students develop foundational geometry skills by exploring points, lines, segments, rays, and angles. They learn to measure and construct line segments and angles using geometric tools and apply the distance and midpoint formulas in the coordinate plane. Students also strengthen their reasoning skills by identifying patterns, making conjectures, and testing conclusions using inductive reasoning. They analyze conditional statements and use deductive reasoning, including the Law of Detachment and the Law of Syllogism, to draw logical conclusions. As the topic progresses, students learn to write and justify formal geometric proofs using properties of equality and congruence. They also explore indirect proofs, using logical reasoning to show that a statement must be true by demonstrating that its opposite leads to a contradiction. Through these experiences, students build a strong foundation in geometric thinking, reasoning, and proof.

Essential Question:

What are some of the fundamentals of geometry?

Timeline: August 11th – August 28th
Essential Standards: G.2B, G.4C, G.5A, G.6A
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
- Topic Family Engagement aligned to the topics are available through the students' digital access.

Content:

- Identify and describe points, lines, segments, rays, and angles.
- Measure and classify angles and segments.
- Copy and construct line segments and angles using geometric tools.
- Find the midpoint of a segment.
- Use the distance formula to find the length of a segment.
- Identify patterns and make conjectures.
- Use counterexamples to test conjectures.
- Analyze conditional statements and their related forms.

- Apply the Law of Detachment and the Law of Syllogism.
- Use deductive reasoning to justify conclusions.
- Write and justify two-column proofs.
- Apply properties of equality and congruence in proofs.
- Use indirect reasoning to prove statements.
- Explain my mathematical thinking clearly and logically.

At-Home Connection:

- **Look for Geometry in Everyday Life:** Identify points, lines, angles, and segments in buildings, road signs, furniture, or household objects. Ask your child to describe the geometric figures they observe.
- **Practice Logical Thinking:** Encourage your child to explain their reasoning when solving everyday problems. Asking "How do you know?" helps develop the logical thinking used in geometric proofs.
- **Explore Distances and Midpoints:** Use a map, floor plan, or coordinate grid and ask your child to find distances between locations or determine a midpoint between two places. This reinforces coordinate geometry concepts in a real-world context.

Topic 2: Parallel and Perpendicular Lines

In this topic, students explore relationships between angles, lines, and triangles to develop a deeper understanding of geometric reasoning. They investigate angle relationships formed when parallel lines are cut by a transversal and use these relationships to determine whether lines are parallel. Students apply their knowledge of angle relationships to prove the Triangle Angle-Sum Theorem and find missing angle measures in triangles. They also examine the relationship between the slopes of parallel and perpendicular lines and use this understanding to analyze geometric figures in the coordinate plane. Finally, students compare Euclidean and spherical geometry, exploring how geometric relationships can differ depending on the surface on which they are studied. Through these experiences, students strengthen their reasoning, proof, and problem-solving skills in geometry.

Essential Question:

How can angle and slope relationships help us prove geometric relationships and solve problems?

Timeline: August 31st – September 22nd
Essential Standards: G.2B, G.5A, G.6A, G.2C
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
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Content:

- Identify angle relationships formed by parallel lines and a transversal.
- Use angle relationships to determine if lines are parallel.

- Find missing angle measures in geometric figures.
- Apply the Triangle Angle-Sum Theorem.
- Solve problems involving angles in triangles.
- Identify and describe the slopes of parallel lines.
- Identify and describe the slopes of perpendicular lines.
- Use slope relationships to solve geometric problems.
- Compare Euclidean and spherical geometry.
- Justify my reasoning using geometric vocabulary and mathematical evidence.

At-Home Connection:

- **Find Parallel Lines Around You**: Look for examples of parallel lines and transversals in roads, fences, railroad tracks, windows, or stair railings. Ask your child to identify angle relationships they observe.
- **Explore Angles and Shapes:** While looking at signs, buildings, or artwork, have your child identify triangles and estimate or calculate missing angle measures using what they know about angle relationships.
- **Connect Geometry to Maps and Globes:** Compare a flat map to a globe and discuss how lines and shapes can appear different on curved surfaces. This helps reinforce the difference between Euclidean and spherical geometry.

Topic 3: Transformations

In this topic, students explore rigid motions and symmetry as ways to describe and analyze geometric figures. They investigate how reflections, rotations, and translations create images from preimages while preserving size and shape. Students examine the relationships between preimages and images and use multiple transformations, called compositions of rigid motions, to create new figures. They analyze how transformations can be combined and describe the effects of those transformations on geometric figures. Students also apply their understanding of rigid motions to identify and analyze symmetry, including line symmetry, point symmetry, reflectional symmetry, and rotational symmetry. Through these experiences, students develop a deeper understanding of congruence, transformations, and geometric relationships.

Essential Question:

How can rigid motions and symmetry help us describe and analyze geometric figures?

Timeline: September 23rd – October 8th
Essential Standards: G.3B
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
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Content:

- Identify reflections, rotations, and translations.
- Describe the relationship between a preimage and its image.

- Perform rigid motions on geometric figures.
- Predict the results of a transformation.
- Use coordinates to describe transformations.
- Apply multiple transformations to a figure.
- Describe compositions of rigid motions.
- Determine whether two figures are congruent using rigid motions.
- Identify lines of symmetry.
- Identify reflectional and rotational symmetry.
- Identify point symmetry.
- Explain how symmetry relates to transformations.
- Justify my reasoning using geometric vocabulary.

At-Home Connection:

- **Find Symmetry Around You:** Look for examples of symmetry in nature, artwork, logos, architecture, and household objects. Ask your child to identify lines of symmetry or rotational symmetry.
- **Explore Transformations in Daily Life:** Notice reflections in mirrors, translations in sliding doors, and rotations in wheels or ceiling fans. Ask your child to describe the transformation they observe.
- **Create Geometric Designs:** Draw or build patterns using shapes and challenge your child to identify the transformations and symmetries used in the design.

2nd 9 Weeks

Assessments

Semester Exams: December 15th – December 18th

What are we learning?
How can I help at home?

Topic 4: Triangle Congruence

In this topic, students explore congruence and triangle relationships using rigid motions and geometric reasoning. They learn to identify corresponding parts of congruent figures and use congruence transformations to determine missing side lengths and angle measures. Students investigate the special properties of isosceles and equilateral triangles and use these relationships to solve problems and justify conclusions. They develop formal proof skills by applying the SSS, SAS, ASA, and AAS Congruence Theorems to prove that triangles are congruent. Students also extend their understanding of congruence to right triangles through the HL Theorem and analyze congruence in overlapping triangles. Through these experiences, students strengthen their ability to reason, justify, and prove geometric relationships.

Essential Question:

How can triangle congruence help us prove geometric relationships and solve problems?

Timeline: October 19th – November 6th
Essential Standards: G.5A, G.6B
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
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Content:

- Define and identify congruent figures.
- Identify corresponding sides and angles of congruent figures.
- Use rigid motions to determine whether figures are congruent.
- Find missing side lengths and angle measures in congruent figures.
- Apply properties of isosceles triangles.
- Apply properties of equilateral triangles.
- Prove triangles congruent using SSS.
- Prove triangles congruent using SAS.
- Prove triangles congruent using ASA and AAS.
- Prove right triangles congruent using HL.
- Identify congruent parts in overlapping triangles.
- Use congruence theorems to justify geometric relationships.
- Write and explain geometric proofs

At-Home Connection:

- **Look for Congruent Shapes:** Find examples of congruent figures in floor tiles, windows, picture frames, or logos. Ask your child to identify corresponding sides and angles.
- **Explore Triangle Properties:** Challenge your child to find isosceles and equilateral triangles in everyday objects and explain the relationships between their sides and angles.
- **Practice Justifying Answers:** When solving everyday problems, ask your child to explain *why* their answer makes sense. This builds the reasoning and proof skills used in geometry.

Topic 5: Relationships in Triangles

In this topic, students explore important relationships within triangles by investigating special segments and points of concurrency. They study perpendicular bisectors, angle bisectors, medians, and altitudes to locate and describe the circumcenter, incenter, centroid, and orthocenter of a triangle. Students apply these concepts to prove geometric theorems and solve problems involving distance and location. They also examine relationships between the sides and angles of triangles, learning that larger angles are opposite longer sides and vice versa. Students use the Triangle Inequality Theorem to determine whether three lengths can form a triangle and apply the Hinge Theorem to compare measurements between triangles. Through these experiences, students strengthen their geometric reasoning, proof-writing skills, and understanding of triangle relationships.

Essential Question:

How can relationships within a triangle help us solve problems and prove geometric theorems?

Timeline: November 9th – November 20th
Essential Standards: G.5A, G.6A
Link to TEKS/Parent Guide:

- **Texas Essential Knowledge and Skills for Mathematics Geometry**
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Identify and construct perpendicular bisectors and angle bisectors.
- Apply the Perpendicular Bisector Theorem.
- Apply the Angle Bisector Theorem.
- Locate and describe the circumcenter of a triangle.
- Locate and describe the incenter of a triangle.
- Locate and describe the centroid of a triangle.
- Locate and describe the orthocenter of a triangle.
- Use triangle centers to solve geometric problems.
- Compare side lengths and angle measures in triangles.
- Apply the Triangle Inequality Theorem.
- Determine whether three lengths can form a triangle.
- Use the Hinge Theorem and its converse.
- Justify conclusions using geometric reasoning and theorems.

At-Home Connection:

- **Explore Triangles Around You:** Look for triangles in bridges, roofs, signs, or structures and discuss how their side lengths and angles relate to one another.
- **Find Centers and Balance Points:** Cut out a paper triangle and try balancing it on a pencil tip to locate its centroid, the triangle's center of gravity.
- **Use Geometry in Problem Solving:** Challenge your child to determine whether three given lengths could form a triangle and explain their reasoning using the Triangle Inequality Theorem.

Topic 6: Quadrilaterals and Other Polygons

In this topic, students explore the properties of polygons and special quadrilaterals. They investigate interior and exterior angle sums and use patterns to develop and apply the Polygon Interior Angle-Sum Theorem. Students analyze the properties of kites, trapezoids, and isosceles trapezoids, including angle relationships, diagonals, and midsegments. They also study parallelograms and learn how the relationships among sides, angles, and diagonals can be used to identify and prove a figure is a parallelogram. Students extend their understanding to rhombuses, rectangles, and squares, comparing their properties and determining the conditions required to classify each figure. Through these experiences, students strengthen their geometric reasoning and use properties of polygons to solve problems and justify conclusions.

Essential Question:

How can the properties of polygons and quadrilaterals help us classify figures and solve geometric problems?

Timeline: November 30th – January 15th
Essential Standards: G.5A
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Find the sum of the interior angles of a polygon.
- Find the sum of the exterior angles of a polygon.
- Use angle relationships to solve problems involving polygons.
- Identify and apply properties of kites.
- Identify and apply properties of trapezoids and isosceles trapezoids.
- Use the Trapezoid Midsegment Theorem.
- Identify and apply properties of parallelograms.
- Determine whether a quadrilateral is a parallelogram.
- Identify and apply properties of rhombuses.
- Identify and apply properties of rectangles.
- Identify and apply properties of squares.
- Classify quadrilaterals based on their properties.
- Justify conclusions using geometric reasoning and theorems.

At-Home Connection:

- **Find Quadrilaterals Around You:** Look for windows, doors, picture frames, tiles, and signs. Ask your child to classify the shapes as rectangles, squares, trapezoids, or parallelograms and explain their reasoning.
- **Explore Angles in Everyday Objects:** Identify polygons in floor patterns, artwork, or architecture and discuss how the interior and exterior angles are related.
- **Compare Special Quadrilaterals:** Have your child explain how a square is related to a rectangle and a rhombus. Discuss which properties the shapes share, and which make them unique.

3rd 9 Weeks
Assessments
MAP Growth Math: January 20th – January 21st

What are we learning?
How can I help at home?

Topic 6: Quadrilaterals and Other Polygons *(Continued)*
See 2nd 9 weeks for details

Topic 7: Similarity

In this topic, students explore similarity, dilations, and proportional relationships in triangles. They learn how dilations change the size of figures while preserving their shape and analyze the relationship between scale factor and side lengths. Students use similarity transformations, including rigid motions and dilations, to determine whether figures are similar. They apply the AA, SAS, and SSS Similarity Theorems to prove triangles are similar and solve problems involving corresponding sides and angles. Students also investigate special relationships within right triangles, using geometric means and similar triangles to find missing lengths. Additionally, they explore proportional relationships created by parallel lines, triangle midsegments, and angle bisectors. Through these experiences, students develop a deeper understanding of similarity and use proportional reasoning to solve geometric problems.

Essential Question:

How can similarity and proportional reasoning help us analyze and solve geometric problems?

Timeline: January 19th – February 5th
Essential Standards: G.3BB, G.7B, G.5A
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Perform and describe dilations.
- Determine the scale factor of a dilation.
- Identify corresponding parts of similar figures.
- Determine whether two figures are similar.
- Use similarity transformations to map one figure to another.
- Prove triangles similar using AA Similarity.
- Prove triangles similar using SAS Similarity.
- Prove triangles similar using SSS Similarity.
- Use proportions to find missing side lengths.
- Apply similarity relationships in right triangles.
- Use geometric means to solve problems.
- Apply the Triangle Midsegment Theorem.
- Apply the Triangle Proportionality Theorem.
- Apply the Angle Bisector Theorem.
- Explain my reasoning using geometric vocabulary and mathematical evidence.

At-Home Connection:

- **Explore Scale Drawings and Maps:** Look at maps, floor plans, or online images and discuss how scale factors are used to enlarge or reduce figures while keeping their shape the same.
- **Find Similar Shapes Around You:** Identify objects that have the same shape but different sizes, such as picture frames, screens, or signs. Ask your child how they know the figures are similar.
- **Use Proportions in Everyday Situations:** When cooking, building, or resizing recipes, discuss how proportions help maintain the same relationships between measurements, like proportional reasoning used in geometry.

Topic 8: Right Triangles and Trigonometry

In this topic, students explore the Pythagorean Theorem and trigonometric ratios to solve problems involving right triangles. They use similar triangles to understand and prove the Pythagorean Theorem and investigate the special relationships found in 45°-45°-90° and 30°-60°-90° triangles. Students learn how the ratios of side lengths in similar right triangles lead to the trigonometric ratios of sine, cosine, and tangent. They apply these ratios to find missing side lengths and angle measures in right triangles and use inverse trigonometric functions to determine unknown angles. Through these experiences, students develop powerful tools for modeling and solving real-world problems involving distance, measurement, and geometry.

Essential Question:

How can the Pythagorean Theorem and trigonometric ratios help us solve problems involving right triangles?

Timeline: February 8th – February 19th
Essential Standards: G.9A, G.9B
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Apply the Pythagorean Theorem to find missing side lengths.
- Explain how the Pythagorean Theorem is related to similar triangles.
- Identify and use relationships in 45°-45°-90° triangles.
- Identify and use relationships in 30°-60°-90° triangles.
- Define and apply sine, cosine, and tangent ratios.
- Use trigonometric ratios to find missing side lengths.
- Use inverse trigonometric functions to find missing angle measures.
- Solve real-world problems involving right triangles.
- Select an appropriate strategy to solve geometric problems.
- Explain my mathematical reasoning using diagrams, equations, and vocabulary.

At-Home Connection:

- **Measure and Calculate:** Use a tape measure to estimate the height of a tree, flagpole, or building. Discuss how right triangles and trigonometry can be used to find unknown heights and distances.
- **Find Right Triangles Around You:** Look for right triangles in stairs, roofs, ramps, or playground equipment. Ask your child to identify the legs, hypotenuse, and any special triangle relationships.
- **Connect Math to Careers:** Discuss how architects, engineers, surveyors, and construction workers use the Pythagorean Theorem and trigonometry to design structures and solve real-world problems.

Topic 9: Coordinate Geometry

In this topic, students apply coordinate geometry to analyze and prove properties of geometric figures. They use the coordinates of vertices to classify figures and determine properties such as side lengths, slopes, and angle relationships. Students extend this understanding by writing coordinate proofs, using algebra and geometry together to justify properties of shapes on the coordinate plane. They also explore circles, learning that a circle is the set of all points equidistant from a center and using coordinate geometry to develop and apply the equation of a circle. Through these experiences, students strengthen their ability to connect algebraic and geometric concepts to solve problems and justify mathematical reasoning.

Essential Question:

How can coordinate geometry be used to classify figures, prove geometric relationships, and analyze circles?

Timeline: February 22nd – March 1st
Essential Standards: G.2B
Link to TEKS/Parent Guide:

- **Texas Essential Knowledge and Skills for Mathematics Geometry**
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Classify geometric figures using coordinates.
- Use slope to analyze geometric relationships.
- Use the distance formula to find side lengths.
- Use the midpoint formula to analyze figures.
- Identify properties of figures on the coordinate plane.
- Write coordinate proofs to justify geometric relationships.
- Apply algebraic methods to geometric problems.
- Identify the center and radius of a circle.
- Write and use the equation of a circle.

- Solve problems involving circles on the coordinate plane.
- Explain my mathematical reasoning using coordinates, equations, and geometric vocabulary.

At-Home Connection:

- **Explore Maps and Grids:** Use a map, game board, or coordinate grid and have your child locate points, calculate distances, and describe locations using coordinates.
- **Identify Shapes Around You:** Ask your child to sketch common objects on a coordinate plane and classify the resulting figures using slopes, distances, and midpoints.
- **Find Circles in Everyday Life:** Look for circular objects such as clocks, wheels, or plates and discuss the center, radius, and how all points on the circle are the same distance from the center.

4th 9 Weeks

Assessments

MAP Growth Math: May 5th – May 6th

What are we learning?
How can I help at home?

Topic 10: Circles

In this topic, students explore relationships within circles and apply geometric concepts to solve problems involving arcs, angles, and segments. They learn that arc length and sector area are proportional to the measure of a circle's central angle and use these relationships to calculate arc lengths, sector areas, and segment areas. Students investigate the properties of tangents and chords, examining how they relate to a circle's center and to one another. They also study inscribed angles and discover how angle measures are connected to intercepted arcs. Finally, students analyze angles and segments formed by intersecting chords, secants, and tangents both inside and outside a circle, applying these relationships to solve geometric problems and justify their reasoning. Through these experiences, students deepen their understanding of circle geometry and strengthen their problem-solving skills.

Essential Question:

How can relationships among arcs, angles, chords, secants, and tangents help us solve problems involving circles?

Timeline: March 15th – March 31st
Essential Standards: G.5A
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Geometry
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Find arc lengths and sector areas.

- Use radians and degrees to describe angles in circles.
- Relate central angles to arc length and sector area.
- Find the area of a segment of a circle.
- Identify and apply properties of tangents.
- Identify and apply properties of chords.
- Use properties of inscribed angles.
- Relate angle measures to intercepted arcs.
- Solve problems involving secants and tangents.
- Apply relationships among angles and segments in circles.
- Justify solutions using circle theorems and geometric reasoning.
- Explain my mathematical thinking using diagrams, formulas, and vocabulary.

At-Home Connection:

- **Explore Circles Around You:** Look for circles in clocks, wheels, plates, or sports equipment. Discuss the center, radius, diameter, and arcs you observe.
- **Connect to Real-World Measurements:** Use items such as pizza slices, pie charts, or clock faces to discuss sectors, central angles, and portions of a circle.
- **Look for Tangents and Chords:** Identify examples of lines that touch or cross circular objects and ask your child to explain how tangents, chords, and secants are different.

Topic 11: Two- and Three-Dimensional Models

In this topic, students explore three-dimensional figures and apply volume concepts to real-world situations. They examine the properties of three-dimensional shapes, including the relationships between faces, edges, and vertices, and analyze cross sections formed when solids are sliced. Students use cross sections to develop an understanding of Cavalieri's Principle and how it relates to volume. They also calculate and compare the volumes of prisms, cylinders, pyramids, cones, and spheres, applying formulas and geometric reasoning to solve mathematical and real-world problems. Through these experiences, students strengthen their spatial reasoning, visualization, and problem-solving skills.

Essential Question:

How can the properties of three-dimensional figures help us understand and calculate volume?

Timeline: April 1st – April 23rd
Essential Standards: G.11B, G.11C, G.11D
Link to TEKS/Parent Guide:

- **Texas Essential Knowledge and Skills for Mathematics Geometry**
- Topic Family Engagement aligned to the topics are available through the students' digital access

Content:

- Identify and describe properties of three-dimensional figures.

- Determine the number of faces, edges, and vertices of a solid.
- Analyze cross sections of three-dimensional figures.
- Use cross sections to compare solids.
- Apply Cavalieri's Principle to understand volume.
- Calculate the volume of prisms and cylinders.
- Calculate the volume of pyramids and cones.
- Calculate the volume of spheres.
- Compare volumes of different three-dimensional figures.
- Solve real-world problems involving volume.
- Explain my mathematical reasoning using models, diagrams, and formulas.

At-Home Connection:

- **Explore 3D Shapes Around You:** Identify prisms, cylinders, cones, and spheres in everyday objects such as cereal boxes, cans, ice cream cones, and sports balls. Discuss their attributes and how they are alike or different.
- **Estimate and Compare Volumes:** Compare the capacities of containers around the house and ask your child to predict which holds more and explain their reasoning.
- **Connect Geometry to Real Life:** When cooking, filling containers, or organizing storage spaces, discuss how volume helps determine how much space an object occupies or how much it can hold.

Topic 12: Probability

In this topic, students explore probability and statistics to analyze events and make informed decisions. They learn to determine whether events are independent or dependent and calculate probabilities involving multiple events. Students use conditional probability to examine how the occurrence of one event affects another. They also distinguish between permutations and combinations and apply these counting methods to solve probability problems. Students use combinations to calculate binomial probabilities and develop theoretical probability distributions. As the topic progresses, they calculate expected values and use probability models to analyze situations and make predictions or decisions. Through these experiences, students strengthen their ability to apply mathematical reasoning to real-world scenarios involving uncertainty and chance.

Essential Question:

Timeline: April 26th – May 27th
Essential Standards: G.13C
Link to TEKS/Parent Guide:

- **Texas Essential Knowledge and Skills for Mathematics Geometry**
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Content:

- Determine whether events are independent or dependent.

- Calculate probabilities of independent events.
- Use conditional probability to analyze events.
- Explain the relationship between independence and conditional probability.
- Distinguish between permutations and combinations.
- Calculate permutations and combinations.
- Use combinations to solve probability problems.
- Find binomial probabilities.
- Create and interpret probability distributions.
- Calculate expected value.
- Use expected value to make decisions.
- Apply probability concepts to real-world situations.
- Explain my mathematical reasoning using probability vocabulary and calculations.

At-Home Connection:

- **Analyze Games of Chance:** While playing cards, board games, or dice games, ask your child to predict outcomes and discuss the probability of different events occurring.
- **Make Everyday Predictions:** Discuss real-life situations involving probability, such as weather forecasts, sports outcomes, or product reliability. Have your child explain how probability can help make decisions.
- **Explore Counting Methods:** When arranging outfits, planning schedules, or choosing menu items, ask your child whether the situation involves a permutation (order matters) or a combination (order does not matter) and explain why.