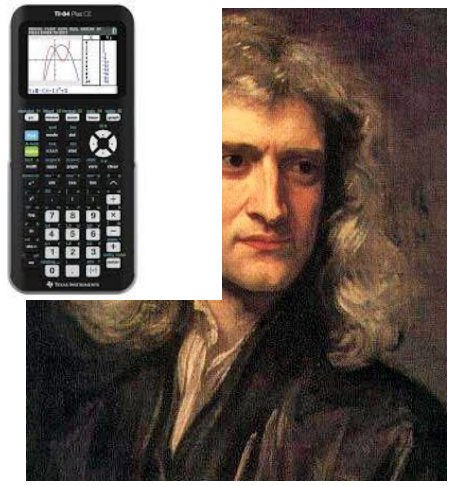
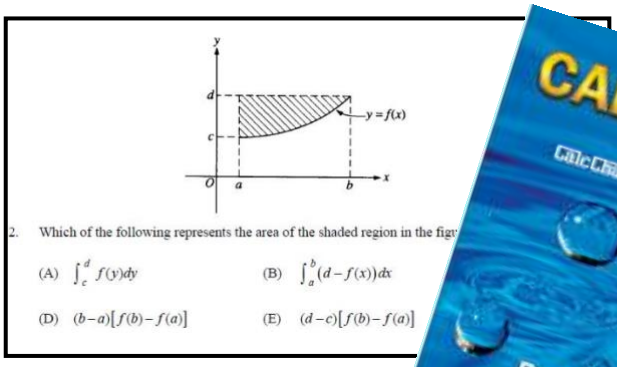
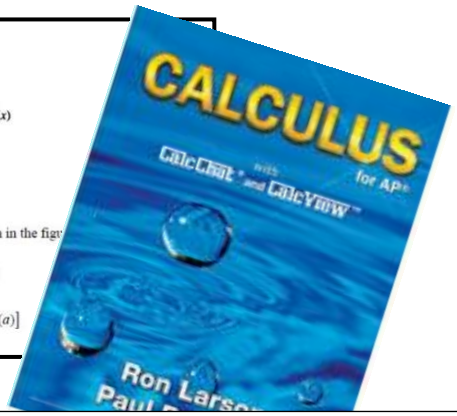
Briarwood
AP Calculus AB

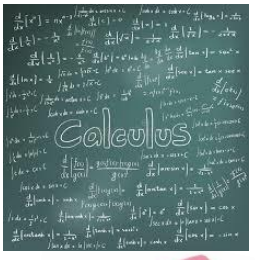
Isaac Newton



Gottfried Wilhelm Leibniz







Summer Packet – 2025

Name _____ Period _____

Topics A-Q and V: Due Tuesday, August 12, 2025

Topics R-U: Due Monday, October 27, 2025

Post any questions to the Google Classroom AP Calculus Group

Be sure to show all your work. Credit will not be given for answers not supported by adequate work.

Topics A-Q,V Correctness Score ____ / 10 **Topics R-U Correctness Score ____ / 5**

Topics A-Q,V Completeness Score ____ / 20 **Topics R-U Completeness Score ____ / 10**

Summer Packet grades will be entered in the Minor Category

Briarwood High School **Name** _____
AP Calculus AB
Summer Review Packet **Score** _____ **Period** _____

Topic A: Functions

1.) If $f(x)=4x-x^2$, find:

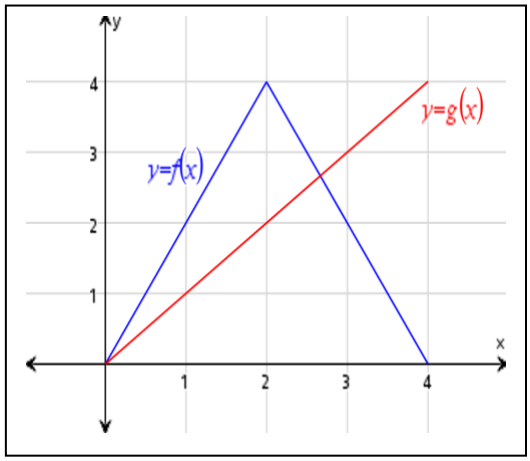
a.) $f(4)-f(-4)$ b.) $\sqrt{f\left(\frac{3}{2}\right)}$ c.) $\frac{f(x+h)-f(x)}{2h}$

2.) If $V(r)=\frac{4}{3}\pi r^3$, find:

a.) $V\left(\frac{3}{4}\right)$ b.) $V(r+1)-V(r-1)$ c.) $\frac{V(2r)}{V(r)}$

3.) If $f(x)$ and $g(x)$ are given in the graph to the right, find:

a.) $(f-g)(3)$ b.) $f(g(3))$



4.) If $f(x)=\begin{cases}-x, & x<0\\ x^2-1, & 0\le x<2\\ \sqrt{x+2}-2, & x\ge 2\end{cases}$, find:

a.) $f(0)-f(2)$ b.) $\sqrt{5-f(-4)}$ c.) $f(f(3))$

Topic B: Domain and Range

Find the domain of the following functions using interval notation. You must show any necessary work and not rely only on the graph produced by a calculator.

1.) $f(x)=3$

2.) $y=x^3-x^2+x$

3.) $y=\dfrac{x^3-x^2+x}{x}$

4.) $y=\dfrac{x-4}{x^2-16}$

5.) $f(x)=\dfrac{1}{4x^2-4x-3}$

6.) $y=\sqrt{2x-9}$

7.) $y=\log(x-10)$

8.) $y=\dfrac{\sqrt{2x+14}}{x^2-49}$

Find the range of the following functions:

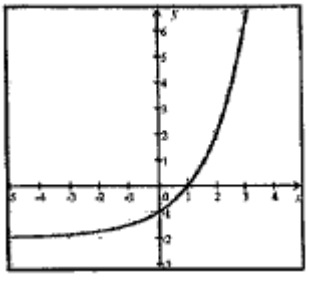
9.) $y=x^4+x^2-1$

10.) $y=e^x$

11.) $y=\sqrt{x^2+1}+1$

Find the domain and range of the following functions using interval notation.

12.)



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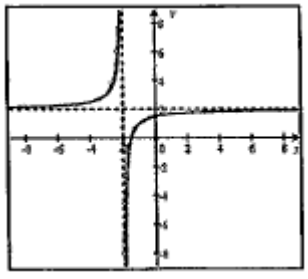

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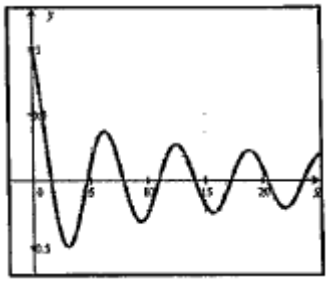
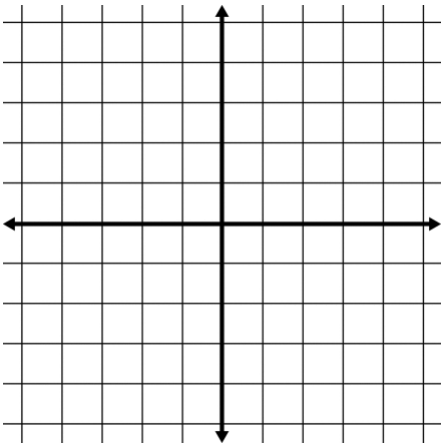


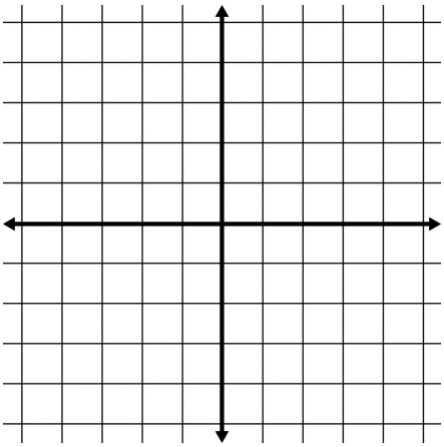
Topic C: Graphs of Common Functions

Sketch each of the following as accurately as possible. **You will need to be VERY familiar with each of these graphs throughout the year**. You may use a graphing calculator for some of them if you have access to one over the summer. If you plan on renting a TI-Nspire and thus do not have one for the summer, I strongly recommend you use try www.desmos.com. There is an app for Desmos as well that is free that you can install on your phones. Again, these are VERY important graphs to know. Be very accurate with regards to "open circles" and "closed circles" as those features may not be revealed on a graphing utility. For students who have not taken Trigonometry yet, Problem #'s 9-14 can wait until the middle of the year.

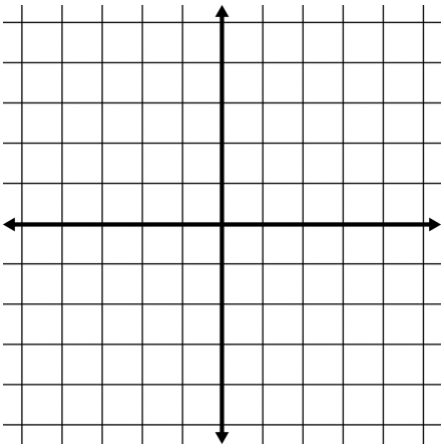
1. $y = x$



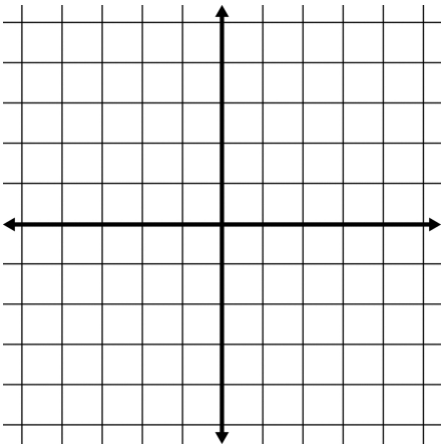
2. $y = x^2$



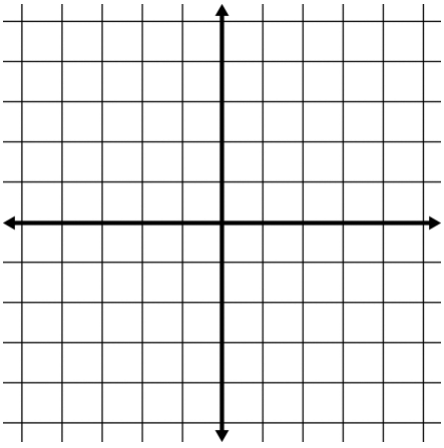
3. $y = x^3$



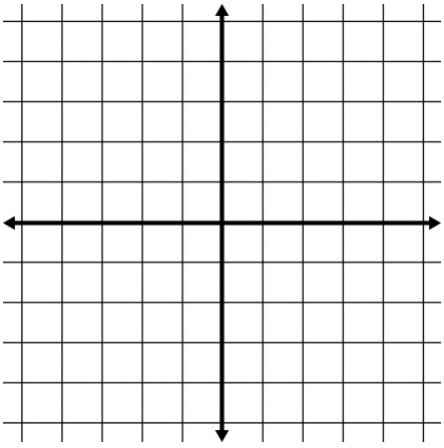
4. $y = \sqrt{x}$



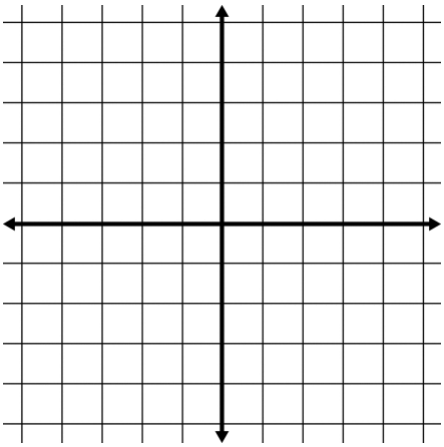
5. $y = |x|$



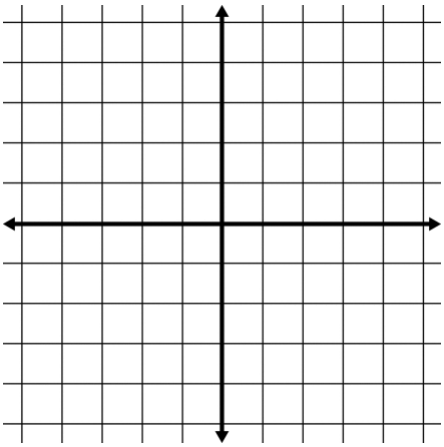
6. $y = \dfrac{|x|}{x}$



7. $y = x^{1/3}$

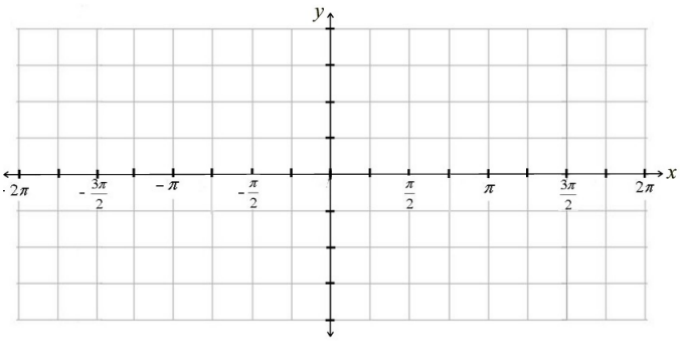


8. $y = x^{2/3}$

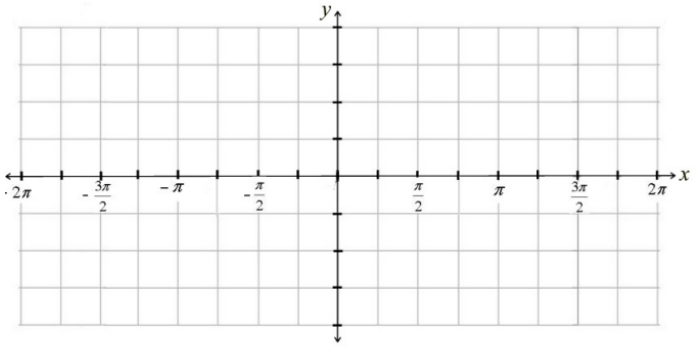


Note: For all trigonometric coordinate planes, use a scale of ¼ unit per square on the *y*-axis.

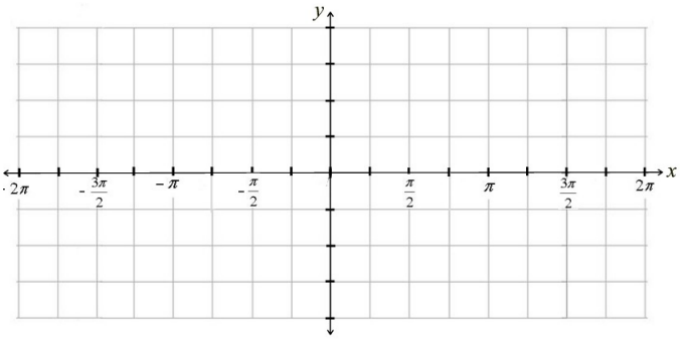
9. $y = \sin x$



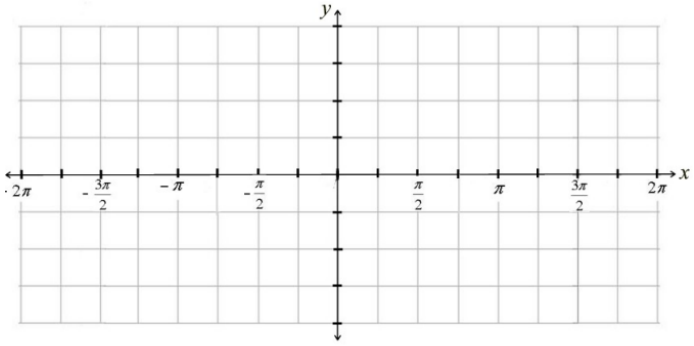
10. $y = \cos x$



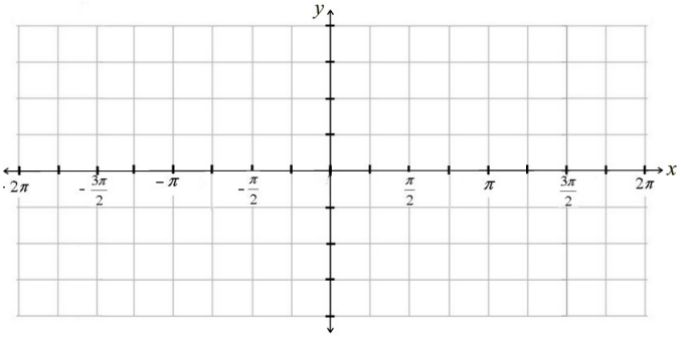
11. $y = \tan x$



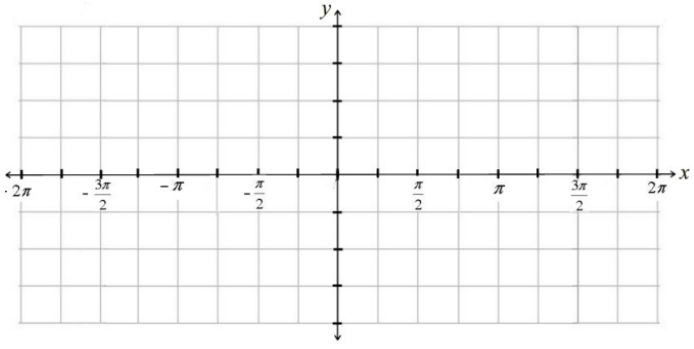
12. $y = \cot x$



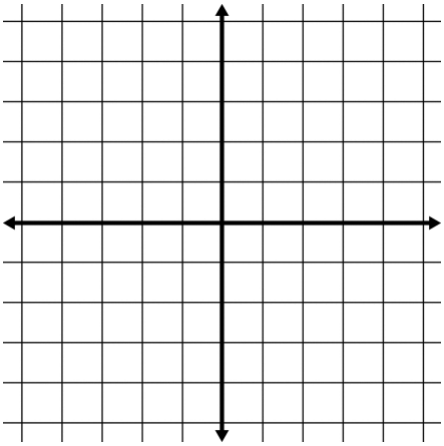
13. $y = \sec x$



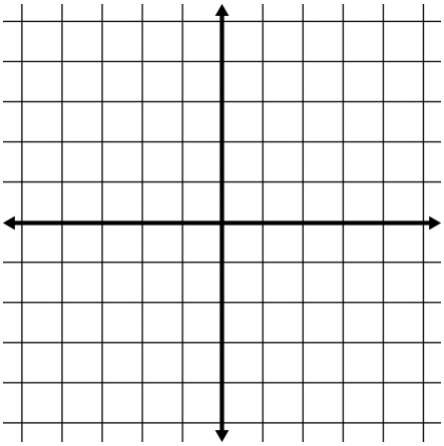
14. $y = \csc x$



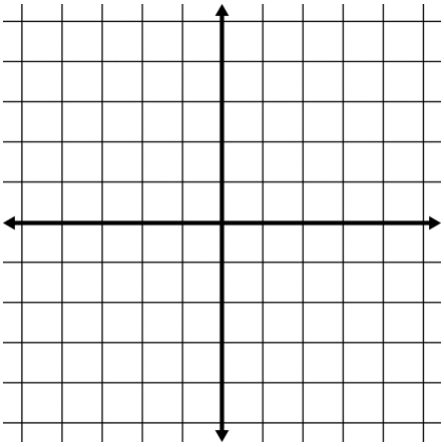
15. $y = e^x$



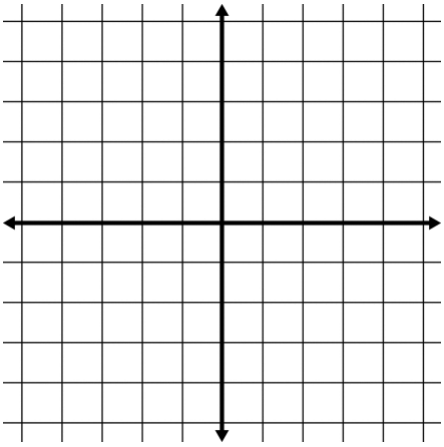
16. $y = \ln x$



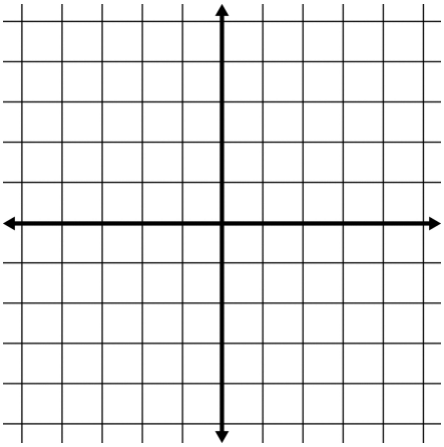
17. $y = \dfrac{1}{x}$



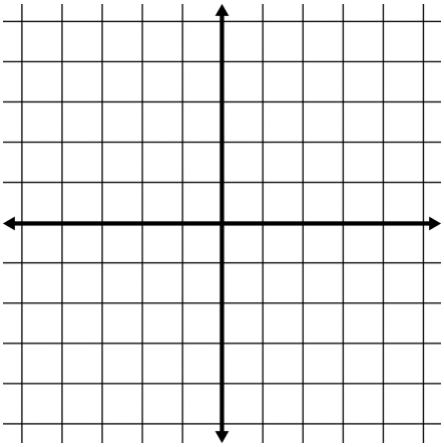
18. $y = \lfloor x \rfloor$ (Hint: This is called the greatest integer or "floor" function.)



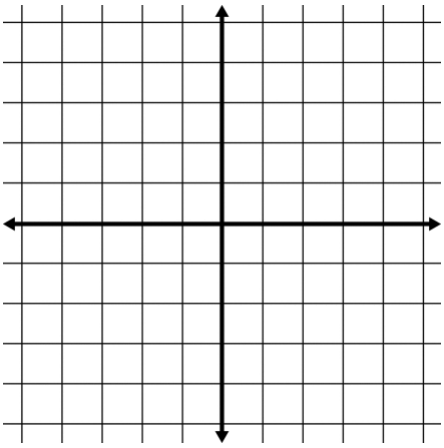
19. $y = \dfrac{1}{x^2}$



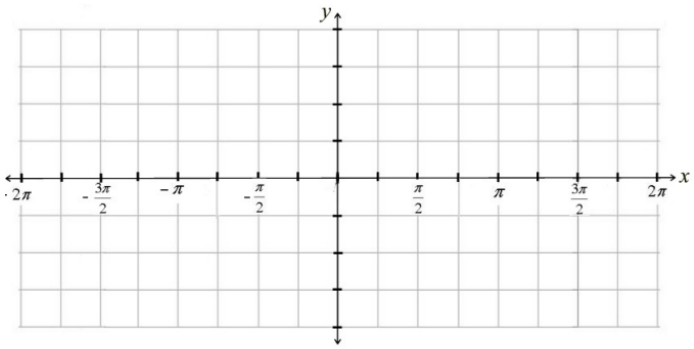
20. $y = 2^x$



21. $y = \sqrt{4 - x^2}$



22. $y = \dfrac{\sin x}{x}$ (Hint: There should be a "hole" on your curve.)



Topic D: Even/Odd Functions and Symmetry

Show work to determine if the relation is even, odd, or neither. You may first want to research how to determine evenness and oddness. **You must show your work to receive credit.**

1.) $f(x) = 7$

2.) $f(x) = 2x^2 - 4x$

3.) $f(x) = -3x^3 - 2x$

4.) $f(x) = \sqrt{x+1}$

5.) $f(x) = \sqrt{x^2+1}$

6.) $f(x) = |8x|$

Show work to determine if the graphs of these equations are symmetric to the *x*-axis, *y*-axis, or the origin. You should see the connection between these problems and those in the above section. **You must show your work to receive credit.**

7.) $4x = 1$

8.) $y^2 = 2x^4 + 6$

9.) $3x^2 = 4y^3$

10.) $x = |y|$

11.) $|x| = |y|$

12.) $|x| = y^2 + 2y + 1$

Topic E: Function Transformations

If $f(x) = x^2 - 1$, describe in words what the following would do to the graph of $f(x)$:

1.) $f(x) - 4$

2.) $f(x-4)$

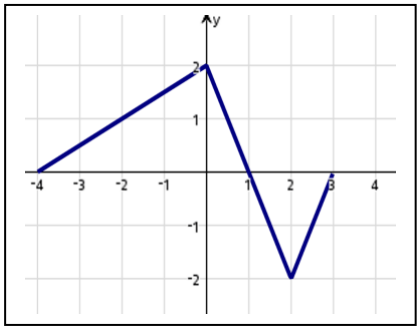
3.) $-f(x+2)$

4.) $5f(x)+3$

5.) $f(2x)$

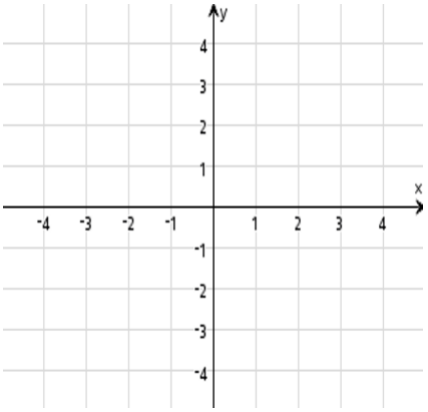
6.) $|f(x)|$

Here is a graph of $y = f(x)$:

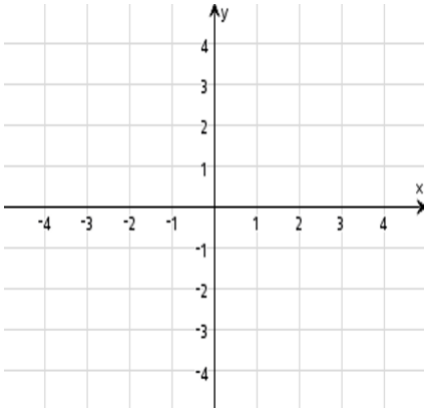


Given the graph of $f(x)$ above, sketch the following graphs.

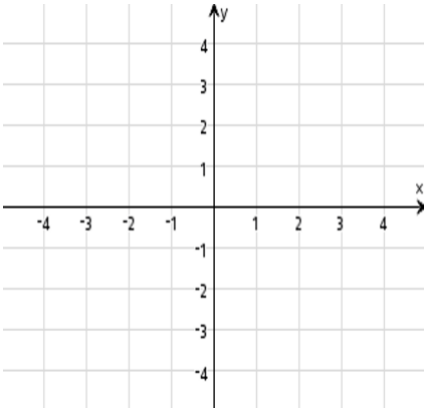
7.) $y = 2f(x)$



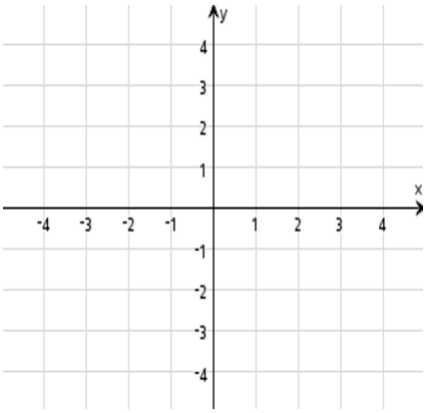
8.) $y = -f(x)$



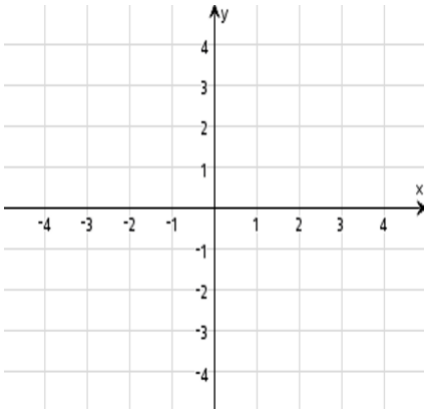
9.) $y = f(x-1)$



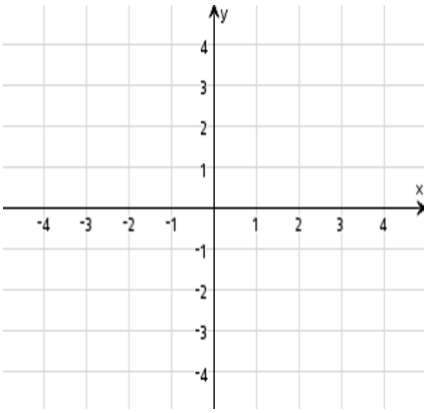
10.) $y = f(x)+2$



11.) $y = |f(x)|$



12.) $y = f(|x|)$



Topic F: Special Factorization

Factor completely.

Hint: For Problems 1 through 3, research "Sum/Difference of Cubes."
For Problems 5, 7, and 8, research "Factor by Grouping."

1.) x^3+8

2.) x^3-8

3.) $27x^3-125y^3$

4.) x^4+11x^2-80

5.) $ac+cd-ab-bd$

6.) $2x^2+50y^2-20xy$

7.) $x^2+12x+36-9y^2$

8.) $x^3-xy^2+x^2y-y^3$

9.) $(x-3)^2(2x+1)^3+(x-3)^3(2x+1)^2$
(Hint: Look for common binomial factors.

Topic G: Linear Functions

1.) Find the equation of the line in point-slope form, with the given slope, passing through the given point.

a.) $m=-7,\ (-3,-7)$ b.) $m=-\frac{1}{2},\ (2,-8)$ c.) $m=\frac{2}{3},\ \left(-6,\frac{1}{3}\right)$

2.) Find the equation of the line in point-slope form, passing through the given points.

a.) $(-3,6),\ (-1,2)$ b.) $(-7,1),\ (3,-4)$ c.) $\left(-2,\frac{2}{3}\right),\ \left(\frac{1}{2},1\right)$

3.) Find the equations of the lines through the given point that are a.) parallel and b.) normal to the given line.

a.) $(5,-3),\ x+y=4$ b.) $(-6,2),\ 5x+2y=7$ c.) $(-3,-4),\ y=-2$

4.) Find the equation of the line in general form, containing the point $(4,-2)$ and parallel to the line containing the points $(-1,4)$ and $(2,3)$.

5.) Find k if the lines $3x-5y=9$ and $2x+ky=11$ are **a.)** parallel and **b.)** perpendicular.

Topic H: Solving Quadratic and Polynomial Equations

Solve each equation for *x* over the real number system. **<u>You must show your work to receive credit</u>.**

1.) $x^2 + 7x - 18 = 0$

2.) $x^2 + x + \frac{1}{4} = 0$

3.) $2x^2 - 72 = 0$

4.) $12x^2 - 5x = 2$

5.) $20x^2 - 56x + 15 = 0$

6.) $81x^2 + 72x + 16 = 0$

7.) $x + \frac{1}{x} = \frac{17}{4}$

8.) $x^3 - 5x^2 + 5x - 25 = 0$

9.) $2x^4 - 15x^3 + 18x^2 = 0$

10.) If $y = x^2 + kx - k$, for what values of *k* will the quadratic have two real solutions? **<u>You must show your work to receive credit</u>.**

Topic I: Asymptotes

For each function, find the equations of both the vertical asymptote(s) and horizontal asymptote (if it exists) and the location of any holes.

1.) $y = \frac{x-1}{x+5}$

2.) $y = \frac{8}{x^2}$

3.) $y = \frac{2x+16}{x+8}$

4.) $y = \frac{2x^2+6x}{x^2+5x+6}$

5.) $y = \frac{x}{x^2-25}$

6.) $y = \frac{x^2-5}{2x^2-12}$

7.) $y = \frac{x^3}{x^2+4}$

8.) $y = \frac{x^3+4x}{x^3-2x^2+4x-8}$

9.) $y = \frac{10x+20}{x^3-2x^2-4x+8}$

10.) $y = \frac{1}{x} - \frac{x}{x+2}$ (Hint: Express with a common denominator)

Topic J: Negative and Fractional Exponents

Simplify and write with positive exponents.

1.) $-12^{2}x^{-5}$

2.) $\left(-12x^{5}\right)^{-2}$

3.) $\left(4x^{-1}\right)^{-1}$

4.) $\left(\dfrac{-4}{x^{4}}\right)^{-3}$

5.) $\left(\dfrac{5x^{3}}{y^{2}}\right)^{-3}$

6.) $\left(x^{3}-1\right)^{-2}$

7.) $\left(121x^{8}\right)^{1/2}$

8.) $\left(8x^{2}\right)^{-4/3}$

9.) $\left(-32x^{-5}\right)^{-3/5}$

10.) $\dfrac{1}{4}\left(16x^{2}\right)^{-3/4}\left(32x\right)$

11.) $\dfrac{\left(x^{2}-1\right)^{-1/2}}{\left(x^{2}+1\right)^{1/2}}$

12.) $\left(x^{-2}+2^{-2}\right)^{-1}$

Topic K: Complex Fractions

Eliminate the complex fractions. Be sure to show all the steps involved in the simplification.
You must show your work to receive credit.

1.) $\dfrac{\frac{5}{8}}{-\frac{2}{3}}$

2.) $\dfrac{4-\frac{2}{9}}{3+\frac{4}{3}}$

3.) $\dfrac{2+\frac{7}{2}+\frac{3}{5}}{5-\frac{3}{4}}$

4.) $\dfrac{x-\frac{1}{x}}{x+\frac{1}{x}}$

5.) $\dfrac{1+x^{-1}}{1-x^{-2}}$

6.) $\dfrac{x^{-1}+y^{-1}}{x+y}$

7.) $\dfrac{x^{-2}+x^{-1}+1}{x^{-2}-x}$

8.) $\dfrac{\frac{1}{3}(3x-4)^{-3/4}}{-\frac{3}{4}}$

9.) $\dfrac{2x(2x-1)^{1/2}-2x^2(2x-1)^{-1/2}}{(2x-1)}$

Topic L: Inverses

Find the inverse of each of the following functions and use a graphing utility (TI-Nspire or Desmos) to show graphically that its inverse is a function.

1.) $2x-6y=1$

2.) $y=ax+b$

3.) $y=9-x^2,\ x\geq 0$

4.) $y=\sqrt{1-x^3}$

5.) $y=\dfrac{9}{x}$

6.) $y=\dfrac{2x+1}{3-2x}$

Find the inverse of each of the following functions and show that $f\left(f^{-1}(x)\right)=x$

7.) $f(x)=\dfrac{1}{2}x-\dfrac{4}{5}$

8.) $f(x)=x^2-4$

9.) $f(x)=\dfrac{x^2}{x^2+1}$

10.) Without finding the inverse, find the domain and range of the inverse to $f(x)=\dfrac{\sqrt{x+1}}{x^2}$

Topic M: Adding Fractions and Solving Rational Equations

You must show all your work to receive credit for these problems.

1.) Combine the following fractions.

a.) $\frac{2}{3}-\frac{1}{x}$

b.) $\frac{1}{x-3}+\frac{1}{x+3}$

c.) $\frac{5}{2x}-\frac{5}{3x+15}$

d.) $\frac{2x-1}{x-1}-\frac{3x}{2x+1}$

2.) Solve the equation for x.

a.) $\frac{2}{3}-\frac{1}{x}=\frac{5}{6}$

b.) $\frac{1}{x-3}+\frac{1}{x+3}=\frac{10}{x^2-9}$

c.) $\frac{5}{2x}-\frac{5}{3(x+5)}=\frac{5}{x}$

d.) $\frac{2x-1}{x-1}-\frac{3x}{2x+1}=\frac{x^2+11}{2x^2-x-1}$

Topic N: Absolute Value Equations

Solve the following equations. If you need help, seek out solutions to similar problems to refamiliarize yourself with the process. **You must show all work to receive credit.**

1.) $4|x+8| = 20$

2.) $|1-7x| = 13$

3.) $|8+2x| + 2x = 40$

4.) $|4x-5| + 5x + 2 = 0$

5.) $|x^2 - 2x - 1| = 7$

6.) $|12 - x| = x^2 - 12x$

Topic O: Solving Inequalities

Solve the following inequalities. **Be sure to show all your work to receive full credit.**

1.) $5(x-3) \le 8(x+5)$

2.) $4 - \frac{5x}{3} > -\left(2x + \frac{1}{2}\right)$

3.) $\frac{3}{4} > x + 1 > \frac{1}{2}$

4.) $x + 7 \ge |5 - 3x|$

5.) $(x+2)^2 < 25$

6.) $x^3 < 4x^2$

7.) $\frac{5}{x-6} \ge \frac{1}{x+2}$

8.) Find the domain of: $\sqrt{\frac{x^2 - x - 6}{x - 4}}$

Topic P: Exponential Functions and Logarithms

Simplify the following:

1.) $\log_2 \frac{1}{4}$

2.) $\log_8 4$

3.) $\ln \frac{1}{\sqrt[3]{e^2}}$

4.) $5^{\log_5 40}$

5.) $e^{\ln 12}$

6.) $\log_{12} 2 + \log_{12} 9 + \log_{12} 8$

7.) $\log_2 \frac{2}{3} + \log_2 \frac{3}{32}$

8.) $\log_{\frac{1}{3}} \frac{4}{3} - \log_{\frac{1}{3}} 12$

9.) $\log_3 \left(\sqrt{3}\right)^5$

Solve the following. **<u>You must show all work to receive credit</u>.**

10.) $\log_5 (3x-8) = 2$

11.) $\log_9 \left(x^2 - x + 3\right) = \frac{1}{2}$

12.) $\log(x-3) + \log 5 = 2$

13.) $\log_2 (x-1) + \log_2 (x+3) = 5$

14.) $\log_5 (x+3) - \log_5 x = 2$

15.) $\ln x^3 - \ln x^2 = \frac{1}{2}$

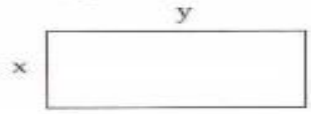
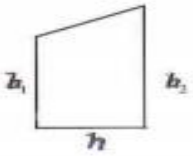
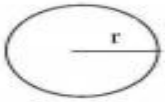
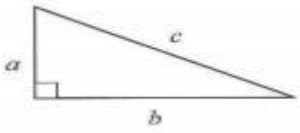
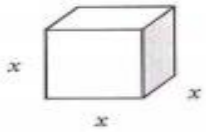
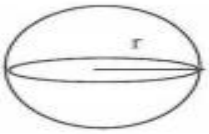
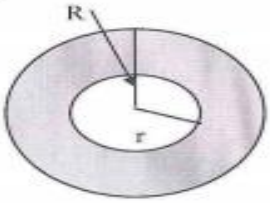
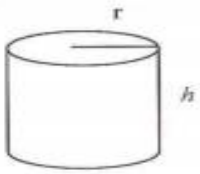
16.) $3^{x-2} = 18$

17.) $e^{3x+1} = 10$

18.) $8^x = 5^{2x-1}$

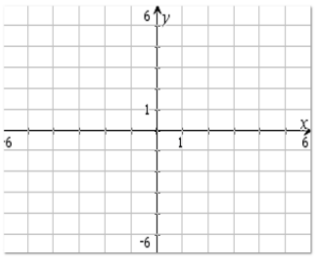
Topic Q: Geometry

1.) You will use each of the following formulas in AP Calculus AB. Complete each of the following.

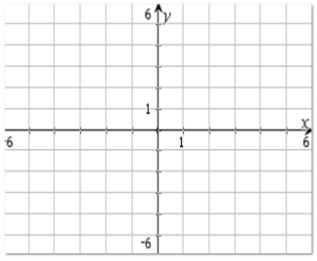
Square  Perimeter = _____ Area = _____	Rectangle  Perimeter = _____ Area = _____	Trapezoid  Area = _____
Circle  Circumference = _____ Area = _____	Triangle  Pythagorean Theorem (only good for right triangles) = _____ Area (of any triangle) = _____	Cube  Volume = _____ Surface Area = _____
Sphere  Volume = _____	"Washer"  Area of the shaded region = _____	Cylinder  Volume = _____

Find the area between the x-axis and $f(x)$ from $x = 0$ to $x = 5$. Sketch the region to verify.

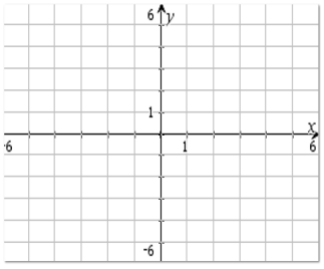
2.) $f(x) = 4$



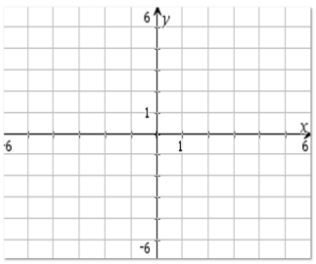
3.) $f(x) = x$



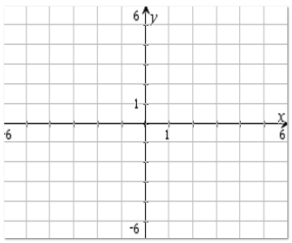
4.) $f(x) = x + 3$



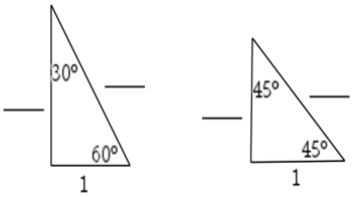
5.) $f(x) = \sqrt{9 - x^2}$



6.) $f(x) = \begin{cases} x+1, & x \le 2 \\ 5-x, & x > 2 \end{cases}$



7.) Fill in the four blanks.



Topic R: Basic Right-Angle Trigonometry

(Some ACE AP Calculus students will have to complete this portion of the packet after the school year begins.)

Solve the following.

If point *P* is on the terminal side of θ, find all 6 trigonometric functions of θ. (Answers need not be rationalized.)

1.) $P(-2,4)$

2.) $P\left(\sqrt{5},-2\right)$

3.) If $\cos\theta = -\frac{5}{13}$, in quadrant II, find $\sin\theta$ and $\tan\theta$.

4.) If $\cot\theta = \frac{2\sqrt{10}}{3}$, in quadrant III, find $\sin\theta$ and $\cos\theta$.

5.) State the quadrant in which each of the following is true.

a.) $\sin\theta > 0$ and $\cos\theta < 0$

b.) $\csc\theta < 0$ and $\cot\theta > 0$

c.) $\tan\theta > 0$ and $\sec\theta < 0$

Topic S: Special Angles

(Some ACE AP Calculus students will have to complete this portion of the packet after the school year begins.)

Evaluate each of the following.

1.) $\sin^2 120° + \cos^2 120°$

2.) $2\tan^2 300° + 3\sin^2 150° - \cos^2 180°$

3.) $\cot^2 135° - \sin^2 210° + 5\cos^2 225°$

4.) $\cot(-30°) + 3\tan 600° - \csc(-450°)$

5.) $\left(\cos\frac{2\pi}{3} - \tan\frac{3\pi}{4}\right)^2$

6.) $\left(\sin\frac{11\pi}{6} - \tan\frac{5\pi}{6}\right)\left(\sin\frac{11\pi}{6} + \tan\frac{5\pi}{6}\right)$

Determine whether each of the following statements is true or false.

7.) $\sin\frac{\pi}{6} + \sin\frac{\pi}{3} = \sin\left(\frac{\pi}{6} + \frac{\pi}{3}\right)$

8.) $\frac{\cos\frac{5\pi}{3} + 1}{\tan^2\frac{5\pi}{3}} = \frac{\cos\frac{5\pi}{3}}{\sec\frac{5\pi}{3} - 1}$

9.) $2\left(\frac{3\pi}{2} + \sin\frac{3\pi}{2}\right)\left(1 + \cos\frac{3\pi}{2}\right) > 0$

10.) $\frac{\cos^3\frac{4\pi}{3} + \sin\frac{4\pi}{3}}{\cos^2\frac{4\pi}{3}} > 0$

Topic T: Trigonometric Identities

(Some ACE AP Calculus students will have to complete this portion of the packet after the school year begins.)

Verify the following identities.

1.) $(1+\sin x)(1-\sin x)=\cos^2 x$

2.) $\sec^2 x+3=\tan^2 x+4$

3.) $\dfrac{1-\sec x}{1-\cos x}=-\sec x$

4.) $\dfrac{1}{1+\tan x}+\dfrac{1}{1+\cot x}=1$

5.) $\csc(2x)=\dfrac{\csc x}{2\cos x}$

6.) $\dfrac{\cos(3x)}{\cos x}=1-4\sin^2 x$

Topic U: Solving Trigonometric Equations

(Some ACE AP Calculus students will have to complete this portion of the packet after the school year begins.)

Solve each equation on the interval $[0, 2\pi)$. Do not use a calculator. **<u>You must show all work to receive credit</u>.**

1.) $\sin^2 x = \sin x$

2.) $3\tan^3 x = \tan x$

3.) $\sin^2 x = 3\cos^2 x$

4.) $\cos x + \sin x \tan x = 2$

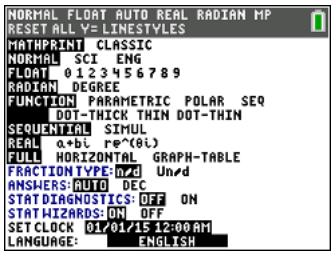
5.) $\sin x = \cos x$

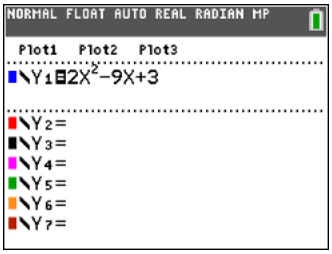
6.) $2\cos^2 x + \sin x - 1 = 0$

Topic V. Graphical Solutions to Equations and Inequalities

You have a TI-84 graphing calculator. So, when are we going to use it? For about 25% of the exam, a calculator is required. So, it is vital you are comfortable using it.

There are several settings of the calculator you should make. First, so you don't get into rounding difficulties, it is suggested you set your calculator to show at least three decimal places (and preferably more). This is standard on the AP Calculus exam, so it's best we start getting used to it. This will ensure that you always see 6 digits across the screen. (There may be times that this can be a problem – i.e. when you have a decimal answer with four or more digits to the left of the decimal. We'll deal with this later.) Also, be sure that your calculator's Angle Setting is in Radian mode throughout the year.

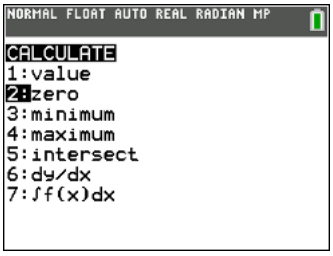




You must know how to graph functions on your TI-84.

How to find zeros (solutions or *x*-intercepts) of a function.

Step 1: Enter the left side of the equation that's already set equal to zero (for example, $2x^2 - 9x + 3 = 0$) into the Y_1= entry line.

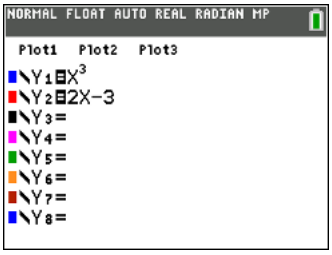


Step 2: Select "2nd TRACE" and then option:2

Step 3: Move the cursor to a position you feel is left of the zero you wish to find, and press Enter. Then move the cursor to the right of the desired zero you wish to find, and press Enter. When it says "Guess?" press Enter. You will notice that the ordered pair for the zero will show up automatically once it falls within the range of your lower and upper bound.

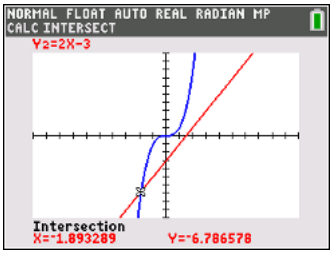
You can find relative Maximum and Minimum values in a similar way.

How to find the intersection of two functions.



Step 1: Enter each side of the equation (for example, $x^3 = 2x - 3$ into the Y_1= and Y_2= entry lines.

Step 2: Select "2nd TRACE" and then option:5



Step 3: Make sure you see the intersection on the screen, if not then adjust the window. When asked "First Curve?"press Enter. Curser will move to the other curve, press Enter. "Guess?", press Enter.

This problem could also be solved by setting the above equation equal to zero and using the procedure for finding a zero instead.

Topic V: Using the TI-84 (Continued)

Use your TI-84 to find the zeros of each of the following functions. Make sure each equation is set equal to zero first.

1.) $3x^3 - x - 5 = 0$

2.) $2x^2 - 1 = 2^x$

3.) $2\ln(x+1) = 5\cos x$ on $[0, 2\pi)$

Use your TI-84 to find the solution (intersection) of the given system of equations.

4.) $\begin{cases} f(x) = x^4 - 6.5x^2 + 6x + 2 \\ g(x) = 1 + x + e^{x^2 - 2x} \end{cases}$

Use your TI-84 to find both a relative maximum and a relative minimum point of the given function.

5.) $h(x) = 2x^5 - 3x^4 + x - 4$