To: All students enrolled in AP Calculus AB/BC for 2023-2024
From: AP Calculus teacher, Mr. Collins

An Introduction to Calculus:

In some ways, Calculus involves taking what you already know a step further.
You know how to find the slope of a line, right? You probably don't know how to find the slope of a curve because it's constantly *changing* – but Calculus helps us do that.
'Traditional' math tells us how to find the slope of a line, and Calculus tells us how to find the slope of a curve. 'Traditional' math tells us how to find the length of a rope pulled taut, but Calculus tells us how to find the length of a curved rope. 'Traditional' math tells us how to find the area of a flat, rectangular roof, but Calculus tells us how to find the area of a curved dome-shaped roof. Get the idea?
How does Calculus manage to pull this off? Imagine a curve like this:

If you were to zoom in a few times, each part of the curve would kind of look like a line, wouldn't it? And if "a few times" wasn't enough, you could zoom in more. And more. And more. In fact, you could zoom in nearly an infinite number of times until the curve became enough like a line that you could treat it that way. "What makes calculus such a fantastic achievement is that it actually zooms in *infinitely*. In fact, everything you do in calculus involves infinity in one way or another, because if something is constantly changing, it's changing infinitely often from each infinitesimal moment to the next."
(excerpt taken from http://media.wiley.com/product_data/excerpt/84/07645249/0764524984.pdf)

This process – doing something an infinite number of times until the problem becomes figure-out-able – is the foundation of Calculus. The process is called a "limit" and it's what we'll be talking about in our first month of Calculus together.

Next year, we will be using the following resource (**Version #1 - Calculus (flippedmath.com)**).
You have two options to obtain the materials used in AP Calculus.

You can print each Unit yourself as we go through the curriculum, or you can purchase the workbook that has all of the note-taking guides and practice sheets all together, bound in a very nice book. This book will be a very great tool to use in future math courses as well.

We have a discount they are giving us to purchase the book. Please either purchase the book OR print Unit 1 (62 pages) and bring it with you on the first day of school.
AP Calculus AB has 8 units (382 total pages). AP Calculus BC has 10 Units (563 total pages).

FOLLOW THE CORRECT LINK! The AB book is $31- $3 discount + shipping.
The BC book is $39 - $3 discount + shipping.
There is a separate AP Calculus AB book and AP Calculus BC book. If you know you will take AP Calculus BC now or in the future, you may purchase the BC book now and use it in AB. If you already have the AB book, and are now in BC, you may want to print the additional topics instead of purchasing a new book, but that is your choice.

Calc AB workbook: https://www.flippedmath.com/store/p54/AP_Calculus_AB_Workbook.html#/
coupon code: **Steinbrenner25AB**

Calc BC workbook: https://www.flippedmath.com/store/p66/AP_Calculus_BC_Workbook.html#/
coupon code: **Steinbrenner25BC**

AP Calculus Summer Assignment

The following is the Summer Assignment for students who are taking AP Calculus at Steinbrenner HS for the 2023-2024 school year. If you took AP Calculus AB last year, this is a new assignment, and ***DOES*** need to be completed by August 10th, 2023.

Step 1: Follow this link: Summer Packet - Calculus (flippedmath.com)
Step 2: Complete the Calculus Summer Packet ***for your own review***. This will help in the packet below.
Step 3: Check your answers to the review with the posted solutions from the same website above.

Step 4: Print this Summer Packet (pages 3-20, front and back).
Complete it. SHOW ALL WORK in the packet.
This is different than the problems in Steps 1-3 above. This is due in class Tuesday, August 10, 2023.
NO EXCEPTIONS! Work together if needed, use resources, ***solve EVERY problem***!
DO NOT LEAVE ANY BLANK! You are about to be Calculus students!

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

The Summer Packet grade will be entered in the Homework Category in Q1 as 150 points.

Bring THIS PACKET and your workbook or Unit 1 (see above) to class on the first day!

Topics A-G Correctness Score ____ / 57 **Topics H-Q Correctness Score ____ / 51**

Topics A-G Completeness Score ____ / 21 **Topics H-Q Completeness Score ____ / 21**

Name_____ **Student Number**_____

Topic A: Functions

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

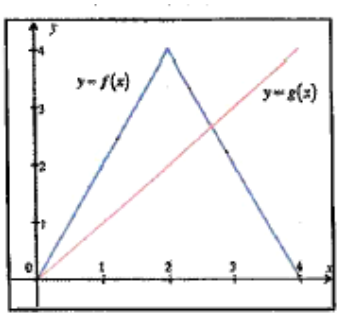
a.) $f(4)-f(-4)$ b.) $\sqrt{f\left(\frac{3}{2}\right)}$ c.) $\frac{f(x+h)-f(x)}{2h}$

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, 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:

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

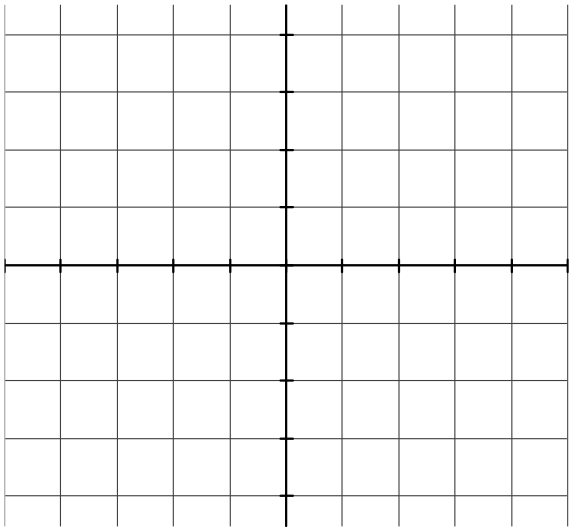
7.) $y=\log(x-10)$

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

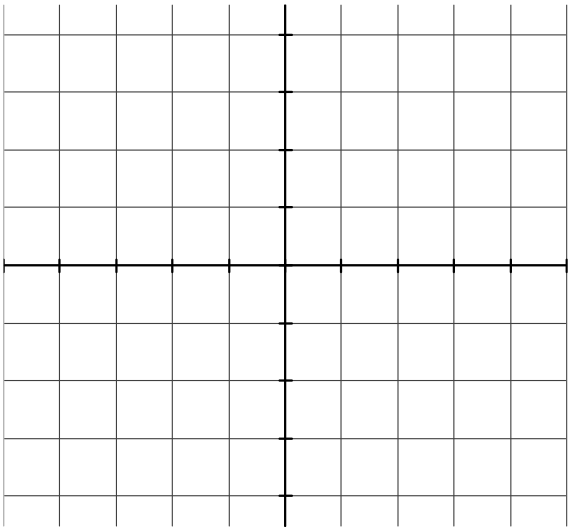
Topic C: Graphs of Common Functions

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 calculator 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.

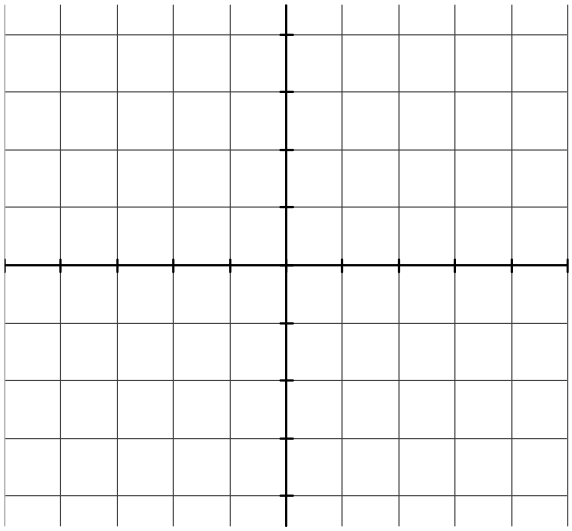
1. $y = x$



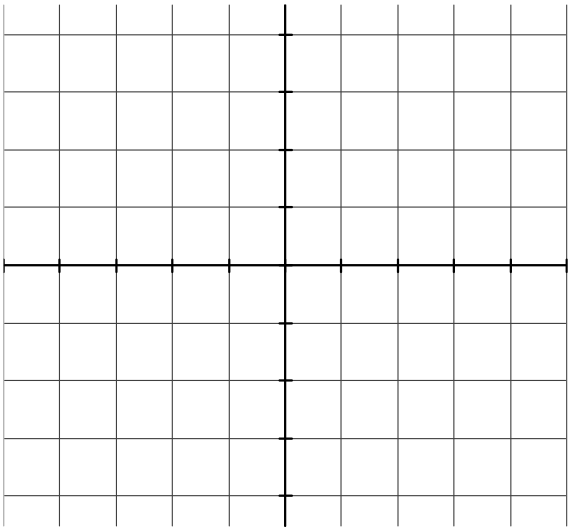
2. $y = x^2$



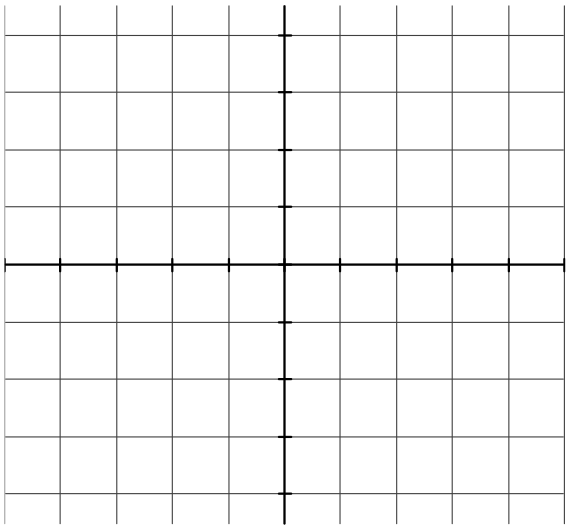
3. $y = x^3$



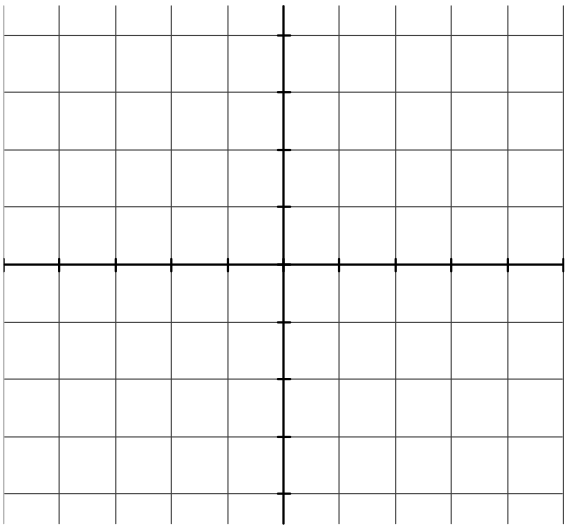
4. $y = \sqrt{x}$



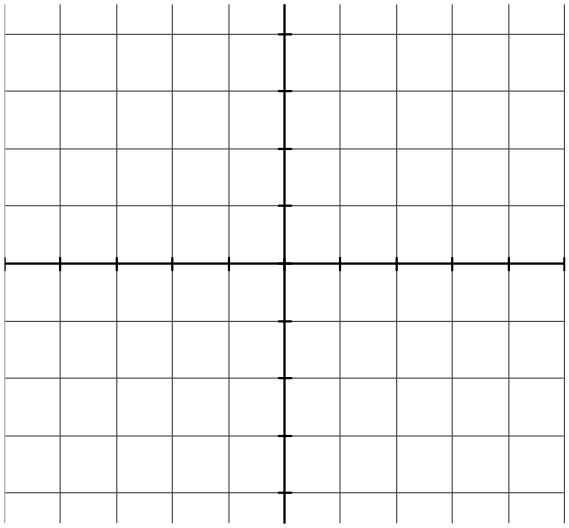
5. $y = |x|$



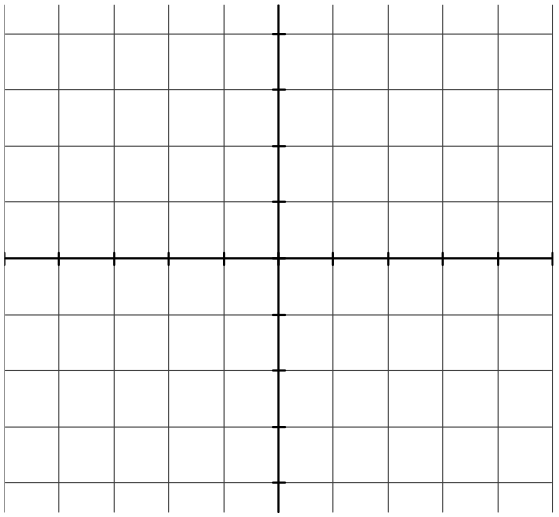
6. $y = \dfrac{|x|}{x}$



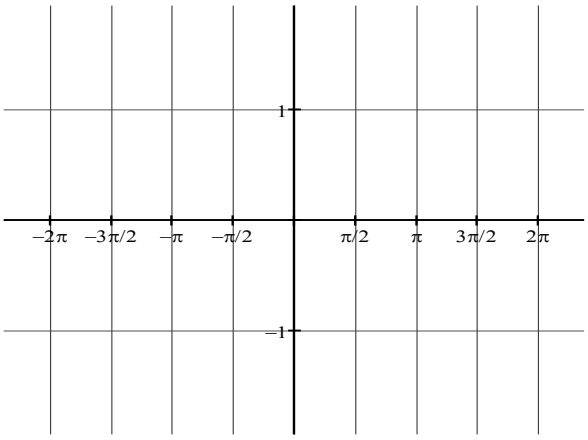
7. $y = x^{1/3}$



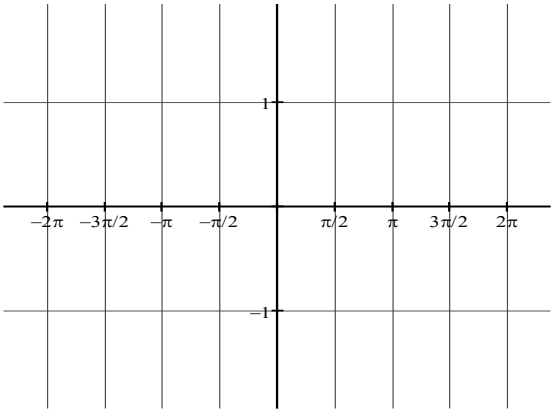
8. $y = x^{2/3}$



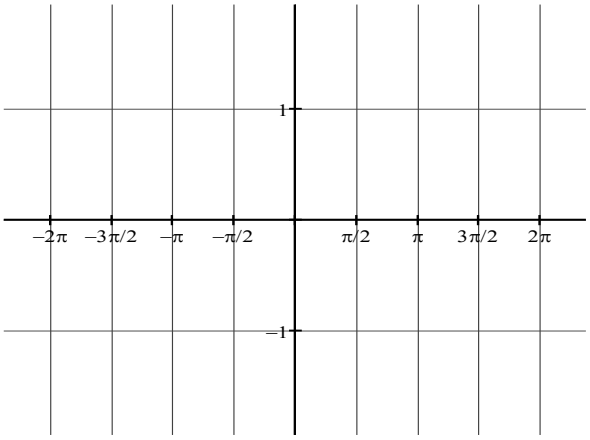
9. $y = \sin x$



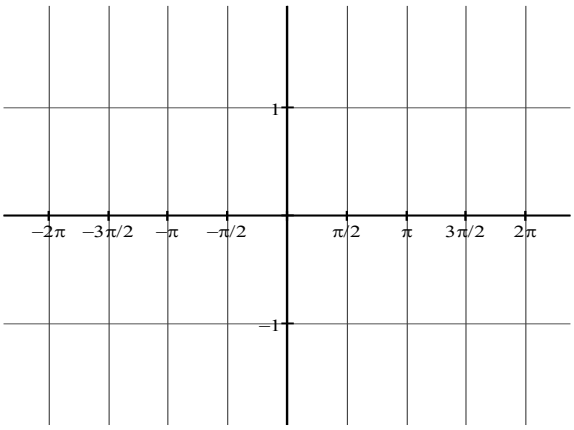
10. $y = \cos x$



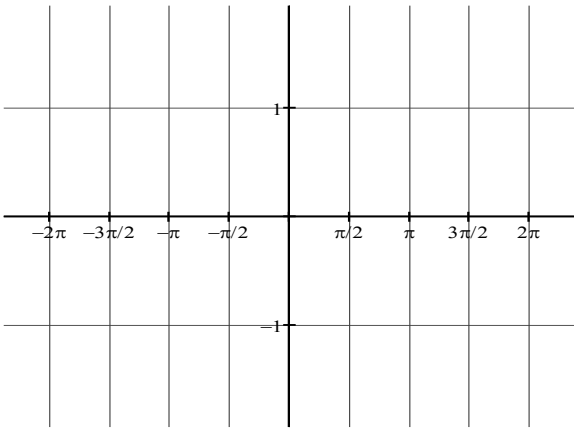
11. $y = \tan x$



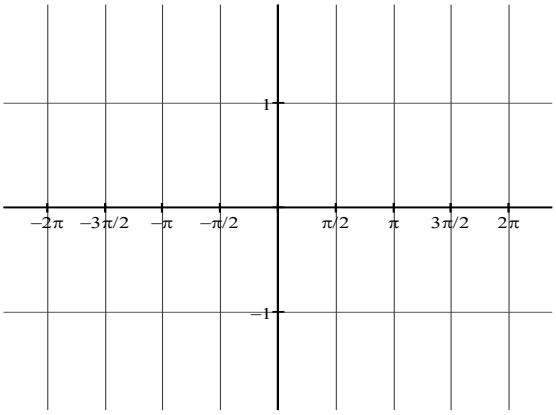
12. $y = \cot x$



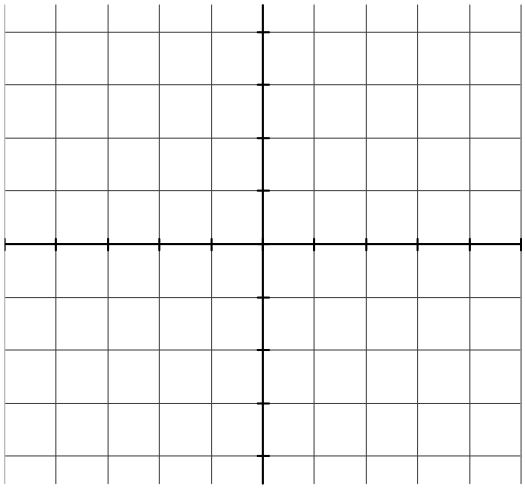
13. $y = \sec x$



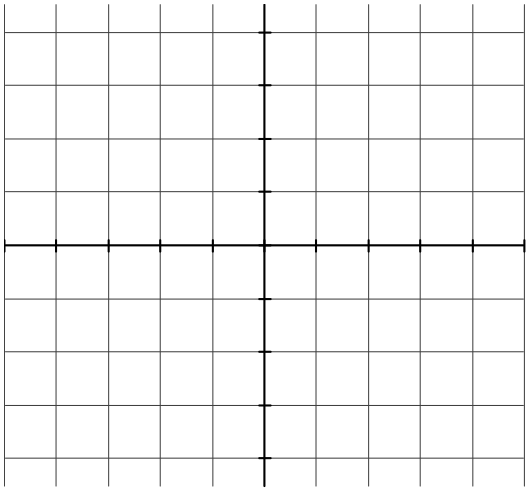
14. $y = \csc x$



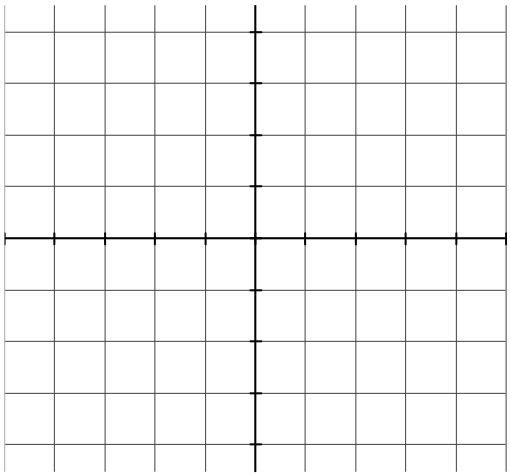
15. $y = e^x$



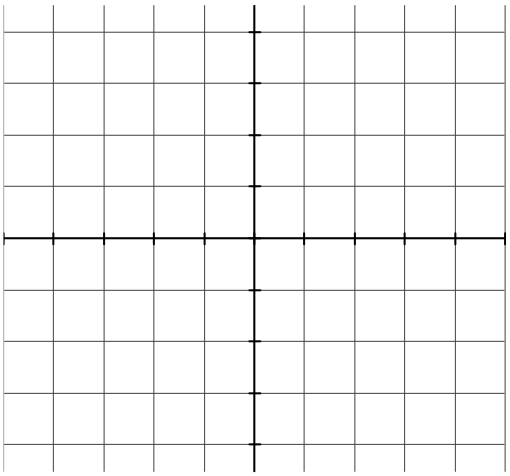
16. $y = \ln x$



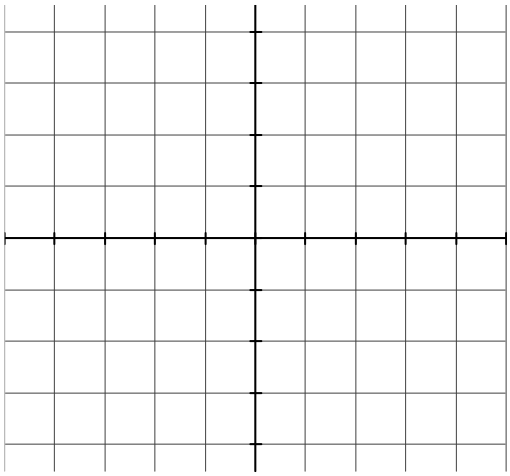
17. $y = \frac{1}{x}$



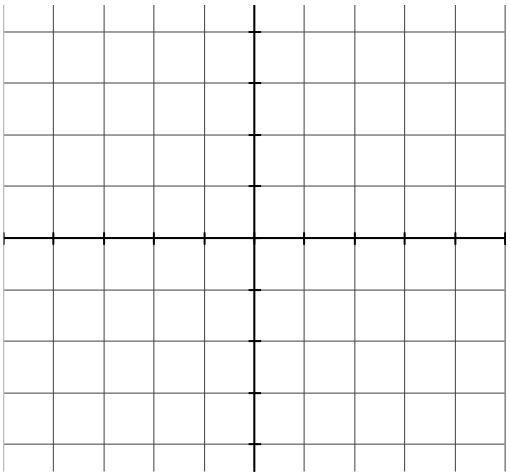
18. $y = x$



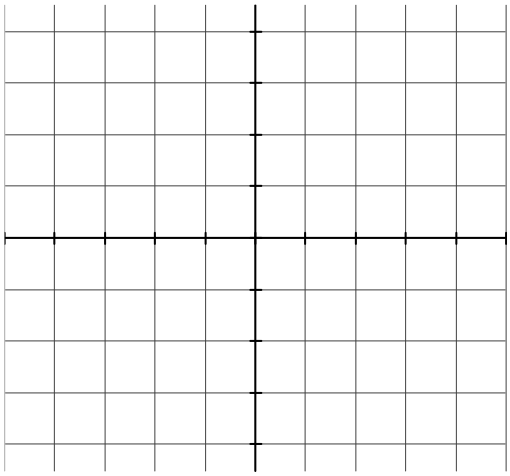
19. $y = \frac{1}{x^2}$



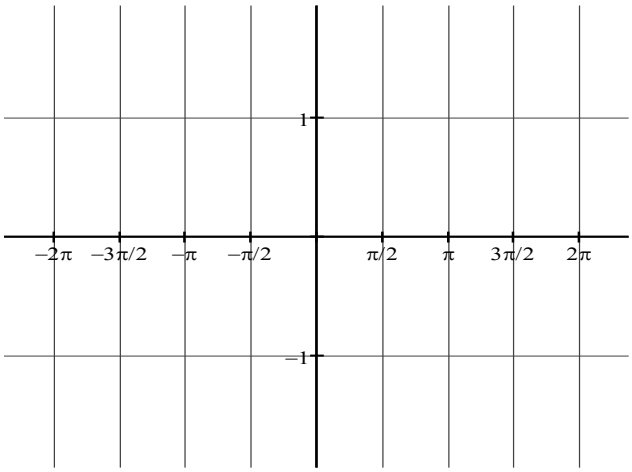
20. $y = 2^x$



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



22. $y = \frac{\sin x}{x}$



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.) $f(x-4)$

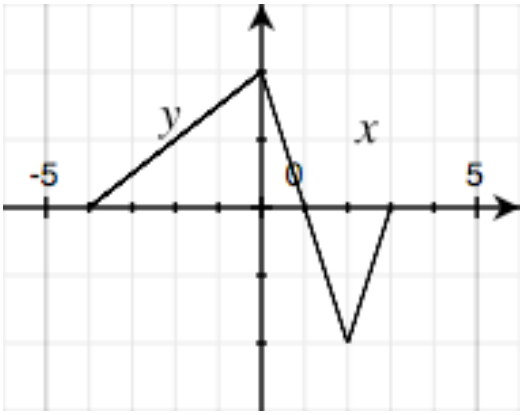
3.) $-f(x+2)$

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

5.) $f(2x)$

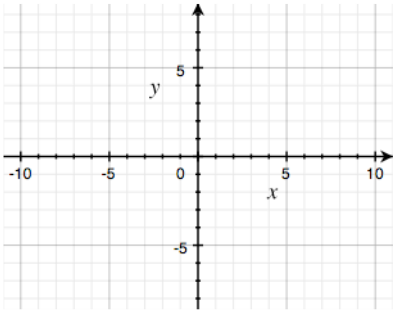
6.) $|f(x)|$

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

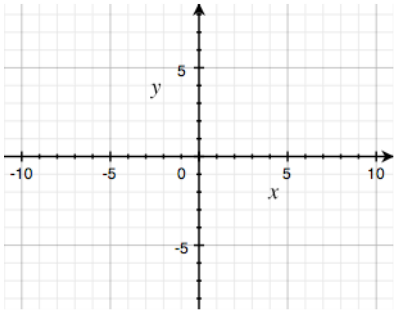


Sketch the following graphs:

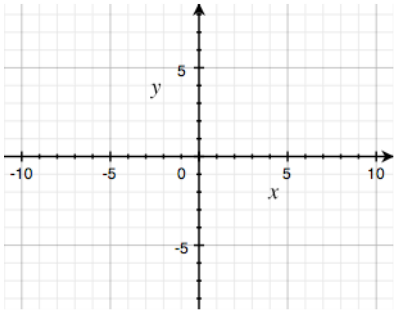
7.) $y = 2f(x)$



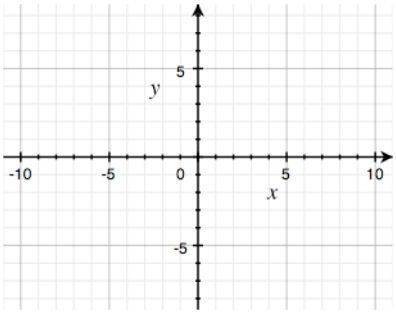
8.) $y = -f(x)$



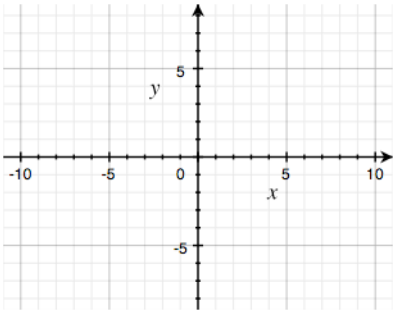
9.) $y = f(x-1)$



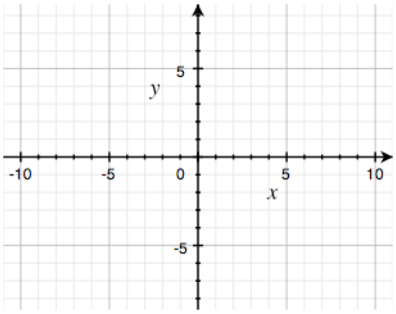
10.) $y = f(x)+2$



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



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



Topic F: Special Factorization

Factor completely.

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

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. (2 answers)

Topic H: Solving Quadratic and Polynomial Equations

Solve each equation for *x* over the real number system.

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

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

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

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

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

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

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

Topic K: Complex Fractions

Eliminate the complex fractions:

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

Topic M: Adding Fractions and Solving Rational Equations

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

Topic N: Absolute Value Equations

Solve the following equations:

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

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

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

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

Topic O: Solving Inequalities

Solve the following inequalities:

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

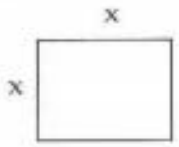
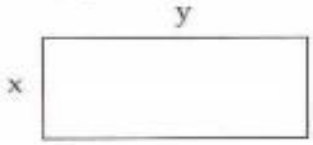
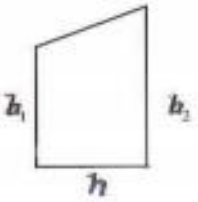
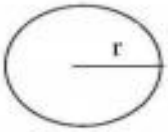
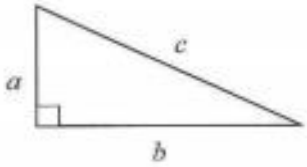
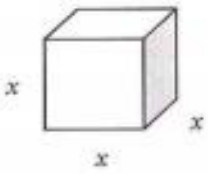
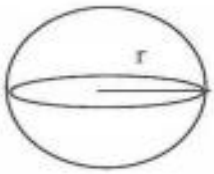
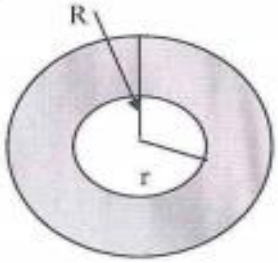
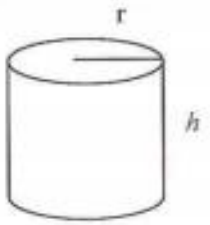
2.) $4-\frac{5x}{3}>-\left(2x+\frac{1}{2}\right)$

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

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

Topic Q: Geometry

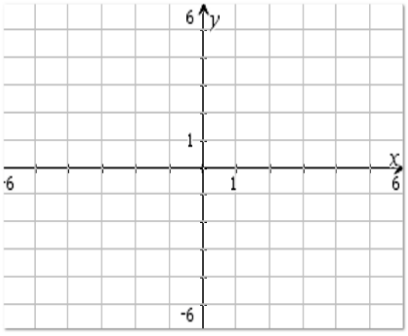
1.) You will use each of the following formulas in AP Calculus AB. Complete each of the following.

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 = _____

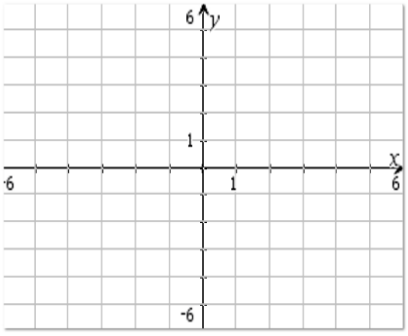
Topic Q: Geometry (continued)

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

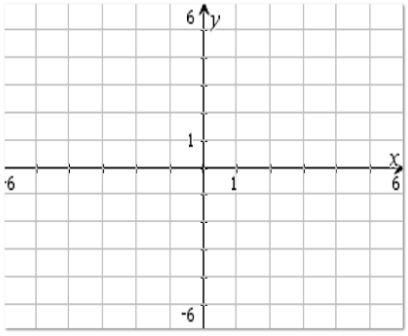
2.) $f(x)=4$



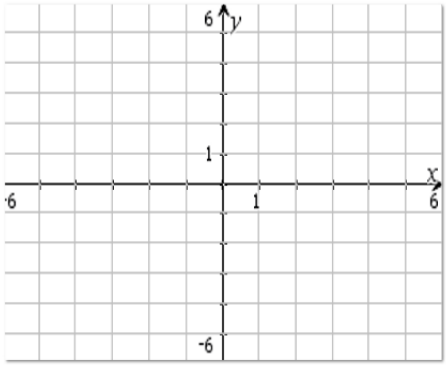
3.) $f(x)=x$



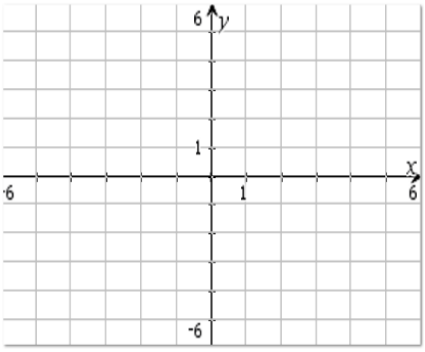
4.) $f(x)=x+3$



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.