



**AP Calculus BC
Summer Assignment
School Year 2019-2020**

Objective of the summer assignment:

- i. To build on students' readiness in foundational skills and knowledge
- ii. To review prerequisites topics for the course

Resources/Materials necessary for the summer assignment:

Prior knowledge, old math notes

Estimated length of time to complete: 4 hours

Grade: graded for accuracy not to exceed 10% of the first quarter grade

Due Date: handed in by the third class period

Date of assessment: n/a

Questions? Contact: Julia Varanavage javaranavage@fcps.edu

Summer Packet

Rising

AP Calculus BC

Students

Dear Calculus BC Student,

I am excited that you have decided to take the challenge of the AP Calculus BC curriculum. Now that your current year has ended, it is now time to think about next year. Although Calculus BC can be fun and exciting, it can also be challenging. To help prepare you for the upcoming school year I am requiring all prospective Calculus BC students to complete a summer packet, which is attached, and should be able to be completed within ten hours. Each of these topics should be a review, but all are critical to your success in Calculus BC. Please remember to keep in mind that the entire summer packet will be collected during the first days of school. It is graded for accuracy and will count approximately 10% of your first quarter grade. I hope that you will work on this assignment a little at a time over the summer break, not in one long session or before the end of this school year. You should feel free to collaborate with others, not copy from others. Should you have any questions, please feel free to contact me at the e-mail address below. Have a safe and wonderful summer. I look forward to seeing you in class next year, ready to learn.

Ms. Varanavage

javaranavage@fcps.edu

P.S. Don't forget - Math is FUN!!!

Name _____

Date _____

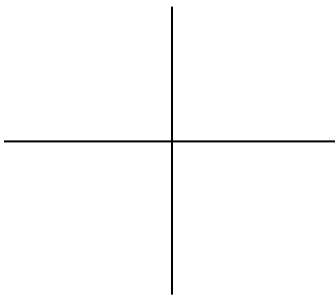
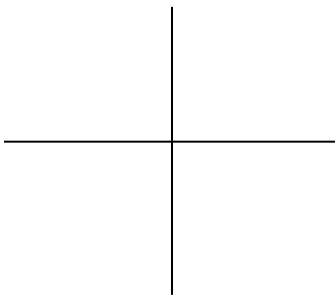
For each function named:

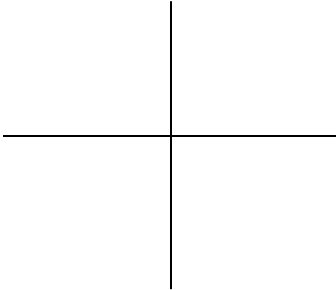
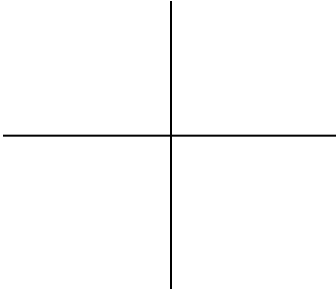
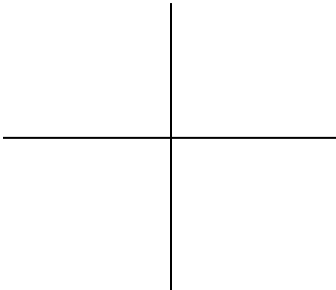
1. give the parent equation (an equation that doesn't have any translations)
2. graph the function

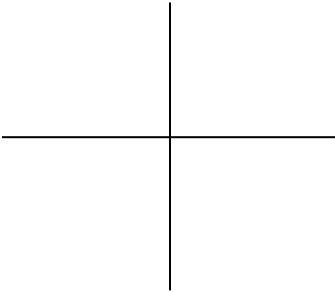
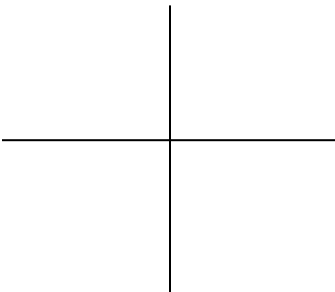
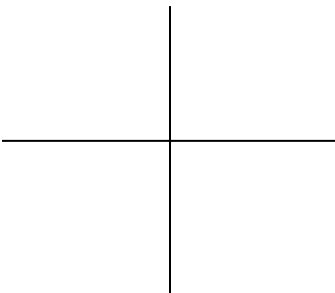
For all non polar functions:

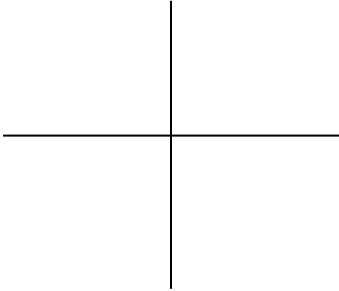
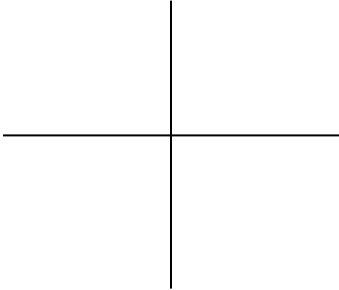
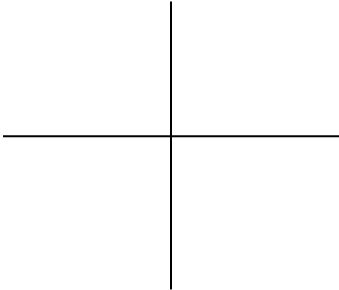
3. state the domain and range
4. state any and all types of symmetry, if none exist then so state
5. state whether the function is even, odd or neither
6. list any asymptotes, if none exist then so state

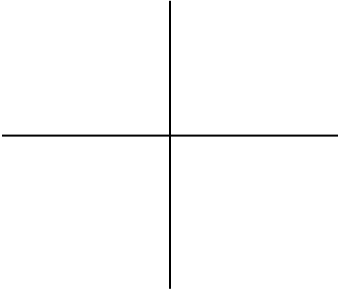
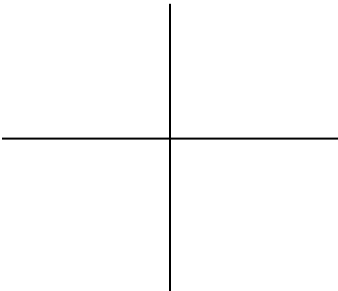
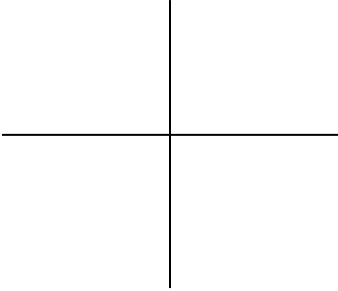
For polar function – state the requested information.

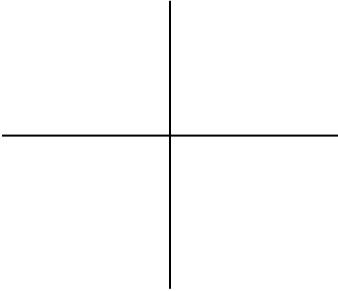
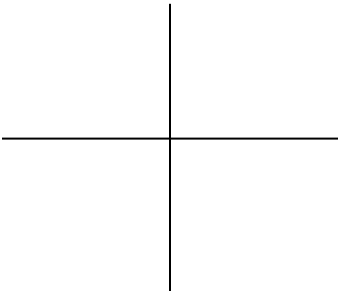
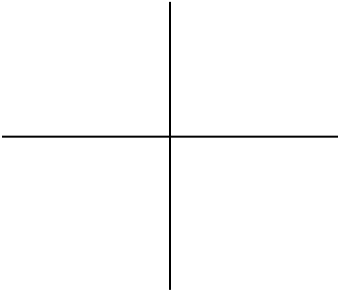
Name	Equation	Graph	
Constant			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Linear			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____

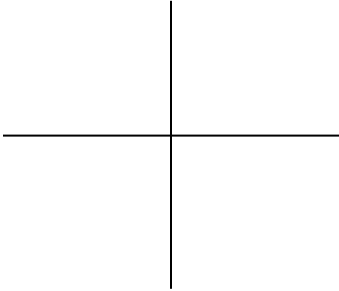
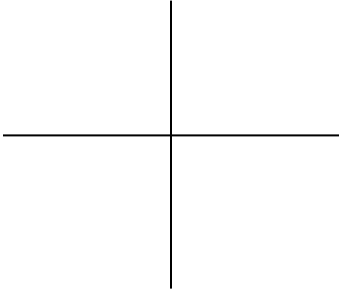
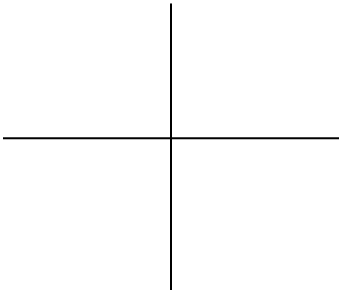
Name	Equation	Graph	
Quadratic			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Cubic			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Absolute Value			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____

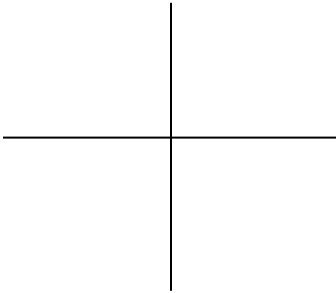
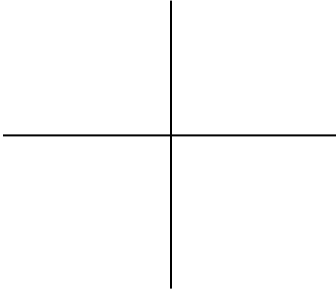
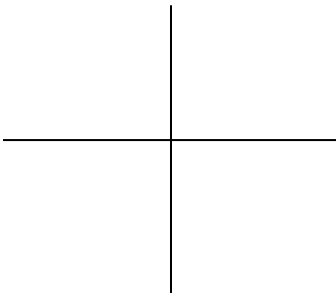
Name	Equation	Graph	
<p>Greatest Integer</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Square Root</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Cube Root</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>

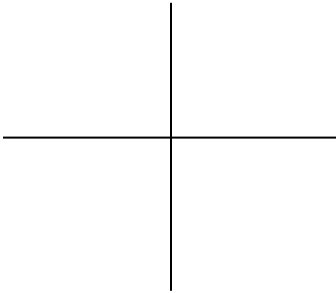
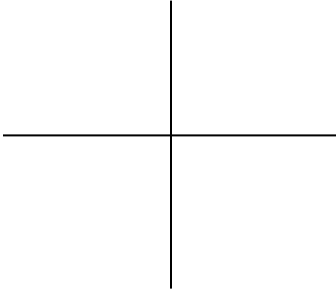
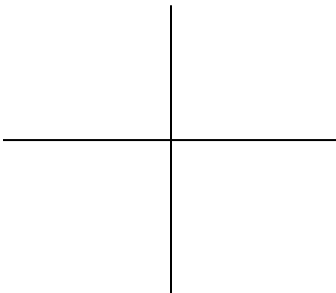
Name	Equation	Graph	
<p>Reciprocal</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Squared Reciprocal</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Rational Function constant function divided by a difference of squares function</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>

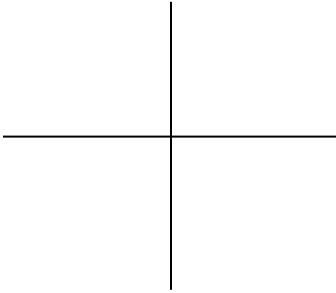
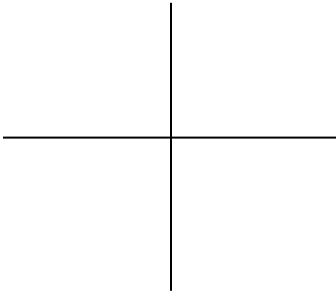
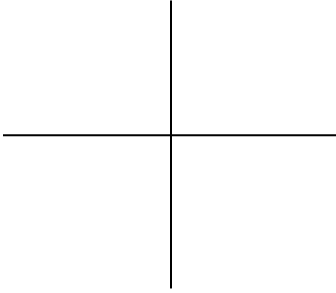
Name	Equation	Graph	
<p>Rational Function linear function divided by a difference of squares function</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Rational Function constant function divided by a sum of squares function</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Rational Function constant function divided by a difference of cubes function</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>

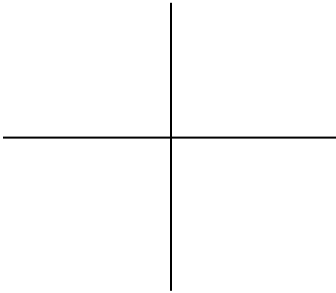
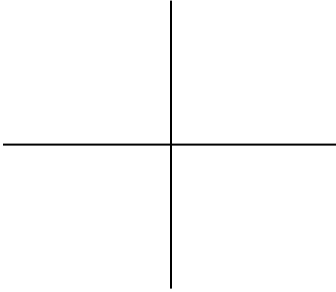
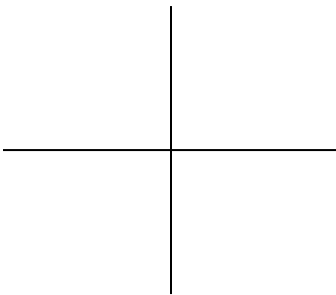
Name	Equation	Graph	
<p>Rational Function constant function divided by a sum of cubes function</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Exponential</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Natural Exponential</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>

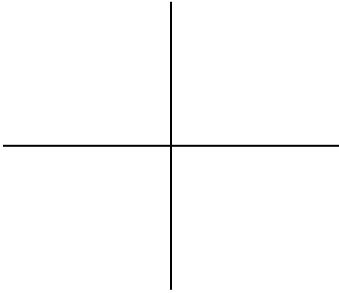
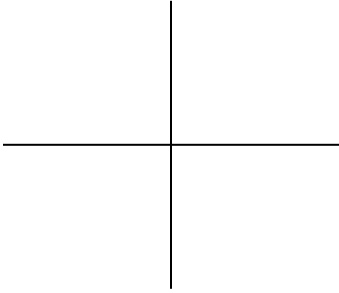
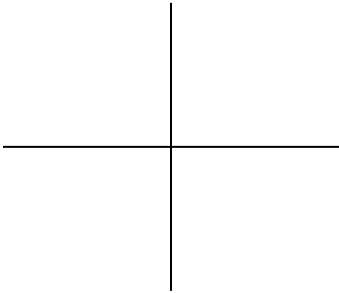
Name	Equation	Graph	
Logarithmic			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Natural Logarithmic			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Sine			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____

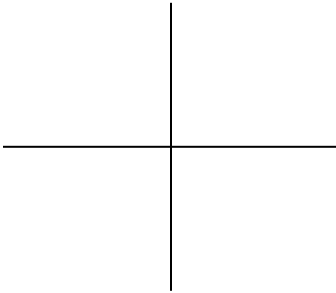
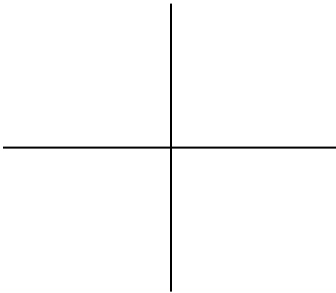
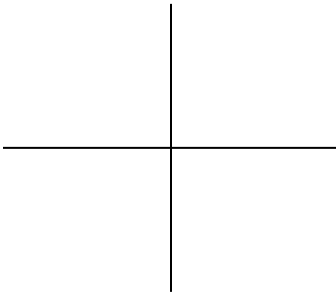
Name	Equation	Graph	
Cosine			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Tangent			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Secant			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____

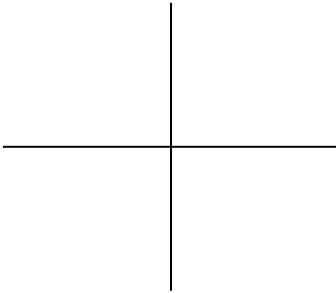
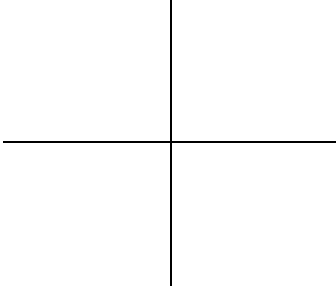
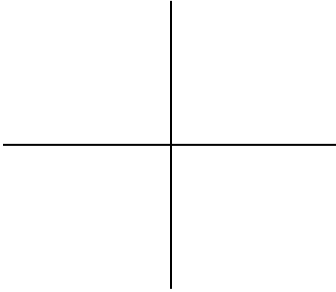
Name	Equation	Graph	
Cosecant			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Cotangent			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Arcsine			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____

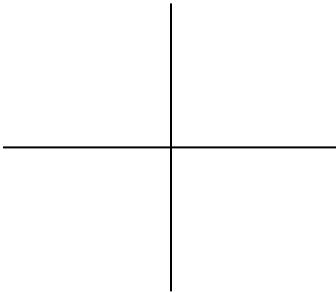
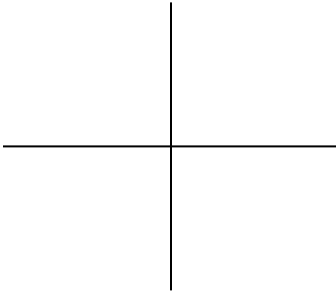
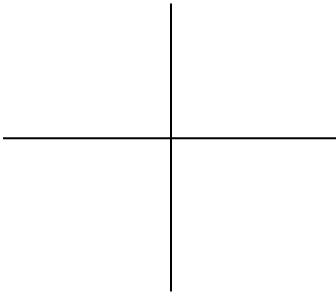
Name	Equation	Graph	
Arccosine			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Arctangent			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Piece-wise containing at least: constant linear 1 asymptote 1 hole a break in the domain over 3 units			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____

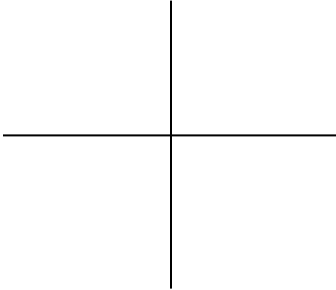
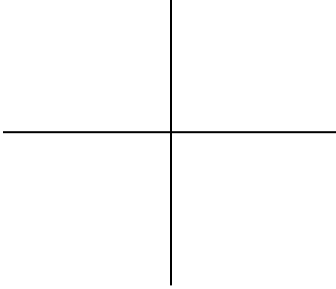
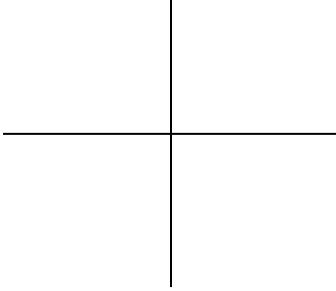
Name	Equation	Graph	
Circle			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Semi-circle			Domain _____ Range _____ Symmetry _____ Even/Odd _____ Asymptotes _____ _____
Polar Cosine Circle			Domain for one complete graph _____ Symmetry _____

Name	Equation	Graph	
Polar Sine Circle			Domain for one complete graph _____ Symmetry _____
Polar Cosine Rose			Domain for one complete graph _____ Symmetry _____ Number of petals for even multiple of theta _____ Number of petals for even multiple of theta _____
Polar Sine Rose			Domain for one complete graph _____ Symmetry _____ Number of petals for even multiple of theta _____ Number of petals for even multiple of theta _____

Name	Equation	Graph	
Polar Cosine Lemniscate			Domain for one complete graph _____ Symmetry _____
Polar Sine Lemniscate			Domain for one complete graph _____ Symmetry _____
Polar Cosine Cardioid			Domain for one complete graph _____ Symmetry _____

Name	Equation	Graph	
Polar Sine Cardiod			Domain for one complete graph _____ Symmetry _____
Polar Cosine "lima bean" a > b			Domain for one complete graph _____ Symmetry _____
Polar Sine "lima bean" a > b			Domain for one complete graph _____ Symmetry _____

Name	Equation	Graph	
Polar Cosine "loopy" $a < b$			Domain for one complete graph _____ Symmetry _____
Polar Sine "loopy" $a < b$			Domain for one complete graph _____ Symmetry _____
Parametric with a limited domain			Domain of t _____ Range of x _____ Range of y _____

Name	Equation	Graph	
<p>Special Rational (absolute value of x divided by x)</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Special Sine (sin x divided by x)</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>
<p>Special Cosine (difference of 1 minus cos x divided by x)</p>			<p>Domain _____</p> <p>Range _____</p> <p>Symmetry _____</p> <p>Even/Odd _____</p> <p>Asymptotes _____</p> <p>_____</p>

Topic 1: Fractional and Negative Exponents

Simplify using only positive exponents.

1. $-3x^{-3}$

2. $-5\left(\frac{3}{2}\right)(4-9x)^{-\frac{1}{2}}(-9)$

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

4. $(16x^2y)^{\frac{3}{4}}$

5. $-\frac{x^{-\frac{1}{2}}}{2}\sin\sqrt{x}$

6. $\frac{\sqrt{4x-16}}{\sqrt{(x-4)^2}}$

7. $-4\left(\frac{2x-1}{2x+1}\right)^{-3}\left[\frac{2(2x+1)-2(2x-1)}{(2x+1)^2}\right]$

8. $\frac{\frac{1}{2}(2x+5)^{-\frac{3}{2}}}{\frac{3}{2}}$

9. $\left(\frac{1}{x^{-2}} + \frac{4}{x^{-1}y^{-1}} + \frac{1}{y^{-2}}\right)^{-\frac{1}{2}}$

Topic 2: Domain and Discontinuity

Find the domain of the following functions and describe the discontinuity, if any, as removable or non-removable.

$$1. y = \frac{3x-2}{4x+1}$$

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

$$3. y = \frac{x^2-5x-6}{x^2-3x-18}$$

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

$$5. y = \sqrt{x-3} - \sqrt{x+3}$$

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

$$7. y = \frac{x^2+8x+12}{\sqrt[4]{x+5}}$$

$$8. y = \sqrt{x^2-5x-14}$$

$$9. y = \frac{\sqrt[3]{x-6}}{\sqrt{x^2-x-30}}$$

$$10. y = \log(2x-12)$$

$$11. y = \sqrt{\tan x}$$

$$12. y = \frac{x}{\cos x}$$

Topic 3: Solving Inequalities

Write the following absolute value equations as piecewise equations.

1. $y = |x^2 - 1|$

2. $y = |x^2 + x - 12|$

3. $y = |x^2 + 4x + 4|$

Solve the following by factoring and making appropriate sign charts.

4. $x^2 - 16 > 0$

5. $x^2 + 6x - 16 > 0$

6. $x^2 - 3x \geq 10$

7. $2x^2 + 4x \leq 3$

8. $x^3 + 4x^2 - x \geq 4$

9. $x^2 - 9 > 0$

Topic 4: Special Factorization

Factor completely.

1. $x^3 + 8$

2. $x^3 - 64$

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. $(x-3)^2(2x+1)^3 + (x-3)^3(2x+1)^2$

Topic 5: Function Transformation

If $f(x) = x^2 - 1$, describe in words, using correct mathematical terminology, what the following would do to the graph of $f(x)$.

1. $f(x) - 4$

2. $f(x - 4)$

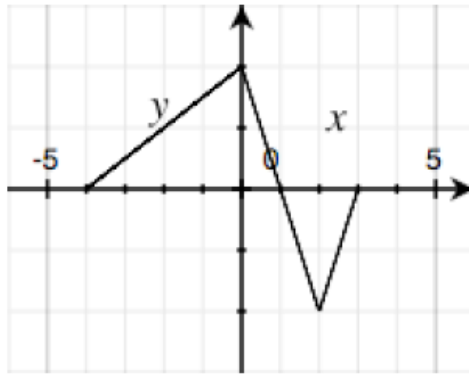
3. $-f(x + 2)$

4. $5f(x) + 3$

5. $f(2x)$

6. $|f(x)|$

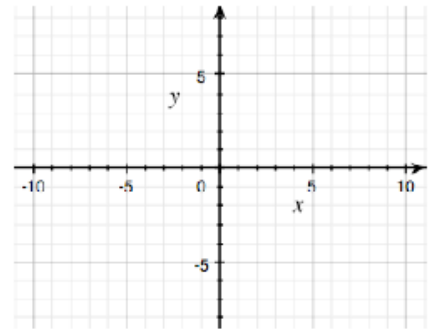
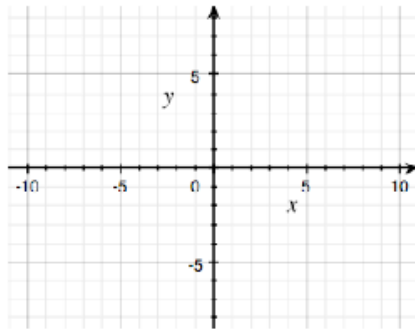
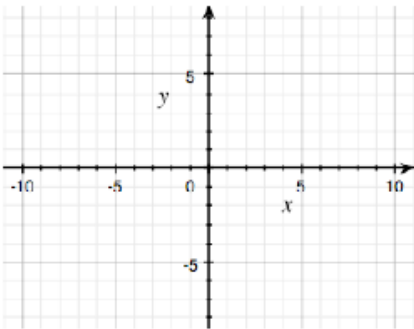
Using the following graph of $y = f(x)$, sketch the following graphs.



7. $y = 2f(x)$

8. $y = -f(x)$

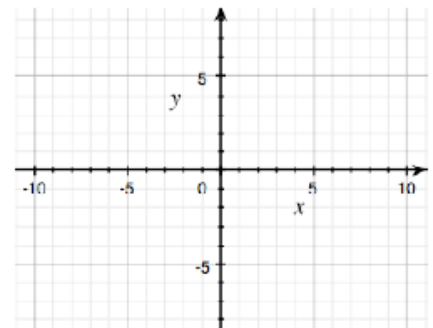
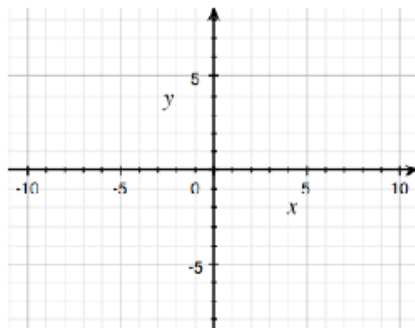
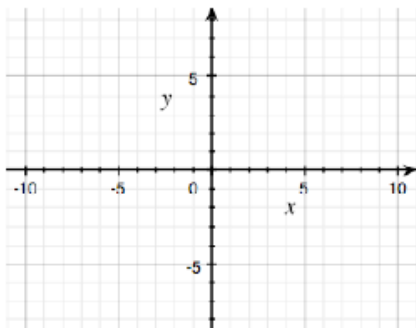
9. $y = f(x - 1)$



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

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

12. $y = f|x|$



Topic 6: Even and Odd Functions

Determine if the relation is even, odd or neither analytically.

1. $f(x) = 2x^2 - 7$

2. $f(x) = -4x^3 - 2x$

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

4. $f(x) = x - \frac{1}{x}$

5. $f(x) = |x| - x^2 + 1$

6. $5x^2 - 6y = 1$

7. $y = e^x - e^{-x}$

8. $3y^3 = 4x^3 + 1$

9. $3x = |y|$

Topic 7: Solving Quadratic Equations

Solve each equation.

1. $7x^2 - 3x = 0$

2. $4x(x-2) - 5x(x-1) = 2$

3. $x^2 + 6x + 4 = 0$

4. $2x^2 - 3x + 3 = 0$

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

6. $x + \frac{1}{x} = \frac{13}{6}$

7. $x^4 - 9x^2 + 8 = 0$

8. $x - 10\sqrt{x} + 9 = 0$

9. $\frac{1}{x^2} - \frac{1}{x} = 6$

Topic 8: Asymptotes

Find the equations for all asymptotes, if any exist, for each function.

1. $y = \frac{x}{x-3}$

2. $y = \frac{x+4}{x^2-1}$

3. $y = \frac{x+4}{x^2+1}$

4. $y = \frac{x^2-2x+1}{x^2-3x-4}$

5. $y = \frac{x^2-9}{x^3+3x^2-18x}$

6. $y = \frac{2x^2+6x}{x^3-3x^2-4x}$

7. $y = \frac{x^2-x-6}{x^3-6x^2+x-6}$

8. $y = \frac{2x^3}{x^3-1}$

9. $y = \frac{\sqrt{x}}{2x^2-10}$

Topic 9: Complex Fractions

Simplify the following.

$$1. \frac{x}{x - \frac{1}{2}}$$

$$2. \frac{\frac{1}{x} + 4}{\frac{1}{x} - 2}$$

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

$$4. \frac{\frac{3}{x} - \frac{4}{y}}{\frac{4}{x} - \frac{3}{y}}$$

$$5. \frac{1 - \frac{2}{3x}}{x - \frac{4}{9x}}$$

$$6. \frac{\frac{x^2 - y^2}{xy}}{\frac{x + y}{y}}$$

$$7. \frac{x^{-3} - x}{x^{-2} - 1}$$

$$8. \frac{\frac{x}{1-x} + \frac{1+x}{x}}{\frac{1-x}{x} + \frac{x}{1+x}}$$

$$9. \frac{\frac{4}{x-5} + \frac{2}{x+2}}{\frac{2x}{x^2 - 3x - 10} + 3}$$

Topic 10: Composition of Functions

If $f(x) = x^2$, $g(x) = 2x - 1$, and $h(x) = \frac{1}{x}$, find the following. For 6-9 state the domain of the resulting function.

1. $f(g(2))$

2. $g(f(2))$

3. $f(h(-1))$

4. $h(f(-1))$

5. $g\left(f\left(h\left(\frac{1}{2}\right)\right)\right)$

6. $f(g(x))$

7. $g(f(x))$

8. $g(g(x))$

9. $g(h(x))$

Topic 11: Solving Rational equations

Solve each equation for x .

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

$$2. x + \frac{6}{x} = 5$$

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

$$4. \frac{x-5}{x+1} = \frac{3}{5}$$

$$5. \frac{60}{x} - \frac{60}{x-5} = \frac{2}{x}$$

$$6. \frac{2}{x+5} + \frac{1}{x-5} = \frac{16}{x^2-25}$$

$$7. \frac{x}{x-2} + \frac{2x}{4-x^2} = \frac{5}{x+2}$$

$$8. \frac{x}{2x-6} - \frac{3}{x^2-6x+9} = \frac{x-2}{3x-9}$$

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

Topic 12: Logarithmic Function

Write each expression as a sum and/or difference without exponents.

1. $\log(u^2 g^5)$

2. $\ln\left(\frac{x(x+2)}{(x+3)^2}\right)$

3. $\log\left(\frac{x}{\sqrt{x-5}(3x+7)}\right)$

Write each expression as a single logarithm.

4. $2\log x^3 + \frac{1}{2}\log(4x-9)$

5. $\frac{1}{3}\log x - 2(\log 3 + \log x)$

6. $\ln(x^2+3x+2) - 2\ln(x+1)$

Solve each equation for x.

7. $\log_3(x-8) = 2$

8. $\ln x + \ln(x+2) = 4$

9. $\log 4x - \log(x-3) = \log 12$

Topic 13: Exponential Function

Solve each of the following for x .

1. $4^{1-2x} = 8^x$

2. $500e^{-x} = 300$

3. $3^x = 14$

4. $6^{x-3} = 3^{4x+1}$

5. $2^{2x} + 2^x - 12 = 0$

6. $e^{2x} + e^x - 2 = 0$

Solve each of the following.

7. Which rate would yield more after 1 year starting with \$500?

5 ½ % compounded quarterly 6 ¼ % compounded monthly 9% compounded annually

8. If a population increased from 300,000 to 450,000 from 2001 to 2004, what will the population be in 2007?

9. The half-life of carbon 14 is 5600 years. A piece of charcoal is found to contain 70% of the carbon 14 that it originally had. When did the tree from which the charcoal came die?

Topic 14: Trig Identities

Establish each trig identity.

1. $\tan \theta \cos \theta = \sin \theta$

2. $\tan \theta (\cot \theta + \tan \theta) = \sec^2 \theta$

3. $1 - \frac{\cos^2 x}{1 + \sin x} = \sin x$

4. $\frac{\sin x}{\sin x - \cos x} = \frac{1}{1 - \cot x}$

5. $\frac{\sec x}{1 - \sin x} = \frac{1 + \sin x}{\cos^3 x}$

6. $(4 \sin x \cos x)(1 - 2 \sin^2 x) = \sin(4x)$

Topic 15: Trig equations

Solve each equation for x on the interval $[0, 2\pi]$.

1. $\sin x = \frac{1}{2}$

2. $\sin^2 - 1 = 0$

3. $\tan x = 2 \sin x$

4. $1 + \sin x = 2 \cos^2 x$

5. $\sin(2x) = \cos x$

6. $\cos(2x) = \cos x$

7. $\sin^2 x = 2 \cos x + 2$

8. $\sin(2x) = \frac{1}{2}$

9. $2 \sin \frac{x}{2} + \sqrt{3} = 0$

Topic 16: Polar

Convert the given polar equation to a rectangular equation.

1. $r = 7$

2. $\theta = \pi$

3. $r \cos \theta = 6$

4. $r = 6 \cos \theta$

5. $r^2 = \tan \theta$

6. $r^2 = \sin 2\theta$

7. $r = \frac{1}{\sin \theta - \cos \theta}$

8. $r = 1 + \cos \theta$

9. $\sec \theta = 2$

Topic 17: Parametric

For problem 1-6:

- a) sketch the curve represented by the parametric equations
- b) find a rectangular equation.

1. $x = 2t$, $y = t + 6$

2. $x = t^2$, $y = t - 2$, $2 \leq t \leq 4$

3. $x = \sqrt{t}$, $y = 1 - t$

4. $x = \frac{1}{t}$, $y = t + 1$

5. $x = 2\sin t$, $y = 2\cos t$, $0 \leq t \leq \pi$

6. $x = \cos t$, $y = \cos 2t$

7. Find parametric equations for the line that has a slope of $\frac{1}{2}$ and passing through the point $(4, -1)$.

8. Find parametric equations for the line that and passing through the point $(6, 7)$ and the point $(7, 8)$.

9. Find parametric equations for the circle $x^2 + y^2 = a^2$.

Topic 18: Limits Algebraically

Find each limit analytically.

1. $\lim_{x \rightarrow 3} (x^2 + 3x - 7)$

2. $\lim_{x \rightarrow -2} \frac{4 - x^2}{2 + x}$

3. $\lim_{x \rightarrow 1} \frac{\sqrt{x} - 1}{x - 1}$

4. $\lim_{x \rightarrow 0} \frac{\sin^2 x}{x^2}$

5. $\lim_{x \rightarrow 0} \frac{\sec x - 1}{x \sec x}$

6. $\lim_{x \rightarrow \frac{\pi}{6}} \frac{1 - \tan x}{\sin x - \cos x}$

7. $\lim_{x \rightarrow 1} f(x)$ if $f(x) = \begin{cases} \frac{x^2 - x}{x - 1} & x < 1 \\ \sqrt{1 - x} & x \geq 1 \end{cases}$

8. $\lim_{x \rightarrow 3} f(x)$ if $f(x) = \begin{cases} 2(x + 1) & x < 3 \\ x^2 - 1 & x > 3 \end{cases}$

9. If $\lim_{x \rightarrow c} f(x) = \frac{3}{2}$ and $\lim_{x \rightarrow c} g(x) = \frac{1}{2}$, find

a. $\lim_{x \rightarrow c} [4f(x)]$

b. $\lim_{x \rightarrow c} [f(x) + g(x)]$

c. $\lim_{x \rightarrow c} [f(x)g(x)]$

d. $\lim_{x \rightarrow c} \frac{f(x)}{g(x)}$

10. If $\lim_{x \rightarrow c} f(x) = 27$ find

a. $\lim_{x \rightarrow c} \sqrt[3]{f(x)}$

b. $\lim_{x \rightarrow c} \frac{f(x)}{18}$

c. $\lim_{x \rightarrow c} [f(x)]^2$

d. $\lim_{x \rightarrow c} [f(x)]^{2/3}$

Topic 19: Limits at Infinity

Solve each limit without a calculator.

$$1. \lim_{x \rightarrow 2^+} \frac{x-3}{x-2}$$

$$2. \lim_{x \rightarrow 3^-} \frac{x^2}{x^2-9}$$

$$3. \lim_{x \rightarrow 4^+} \frac{x^2}{x^2+16}$$

$$4. \lim_{x \rightarrow -3^-} \frac{x^2+2x-3}{x^2+x-6}$$

$$5. \lim_{x \rightarrow (-1/2)^+} \frac{x^2+x-1}{4x^2-4x-3}$$

$$6. \lim_{x \rightarrow 0^-} \left(1 + \frac{1}{x}\right)$$

$$7. \lim_{x \rightarrow 0^-} \left(x^2 - \frac{1}{x}\right)$$

$$8. \lim_{x \rightarrow 0^+} \frac{2}{\sin x}$$

$$9. \lim_{x \rightarrow (\pi/2)^+} \frac{-2}{\cos x}$$

$$10. \lim_{x \rightarrow 1^+} \frac{x^2+x+1}{x^3-1}$$

$$11. \lim_{x \rightarrow 1^+} \frac{x^3-1}{x^2+x+1}$$

$$12. \lim_{x \rightarrow -1^-} \frac{x+1}{x^4-1}$$

$$13. \lim_{x \rightarrow \infty} \left(5 - \frac{1}{x^2}\right)$$

$$14. \lim_{x \rightarrow \infty} \left(\frac{2x-1}{x+1}\right)$$

$$15. \lim_{x \rightarrow \infty} \left(\frac{2x+5}{3x^2+1}\right)$$

$$16. \lim_{x \rightarrow -\infty} \left(\frac{5x^2}{x+3}\right)$$

$$17. \lim_{x \rightarrow \infty} \left(\frac{3x-2}{\sqrt{4x^2+1}}\right)$$

$$18. \lim_{x \rightarrow -\infty} \left(\frac{3x-2}{\sqrt{4x^2+1}}\right)$$

Topic 20: Applications

1. Consider a ten-story building with a single elevator. From the point of view of a person on the sixth floor, sketch a graph indicating the height of the elevator as a function of time as it travels from the ground floor to the third floor, then to the eighth floor and finally back to the ground floor.

2. Draw a graph which accurately represents the temperature of the contents of a cup left overnight in a room. Assume the room is at 70°F and the cup is originally filled with water slightly above the freezing point.

3. The table below defines three functions for $0 \leq x \leq 8$. Identify which of the functions are linear, exponential or neither and explain why.

x	y_1	y_2	y_3
0	4.25	4.25	4.25
2	6.80	5.11	3.39
4	10.88	5.97	2.53
6	17.408	9.552	1.67
8	27.8528	15.2832	0.81

4. A spherical cell takes in nutrients through its cell wall at a rate proportional to the area of the cell wall. The rate at which the cell uses nutrients is proportional to its volume.

a. Write an expression for the rate at which nutrients enter the cell as a function of its radius, r .

b. Write an expression for the rate at which the cell uses nutrients as a function of its radius, r .

c. Sketch a graph showing the rate at which nutrients enter the cell against the radius r as well as a graph for the rate at which the cell uses nutrients on the same axes.