Summer Assignment for AP Calculus AB **Name** ________________________________

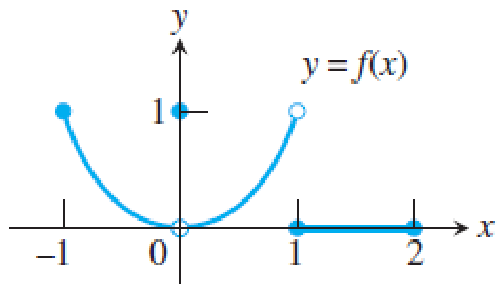
This assignment is a review of Pre-calculus and Algebraic concepts that you need to be familiar with in order to make a smooth transition into AP Calculus AB. It will be **due** when you return to school on **August 6, 2018** - NO EXCEPTIONS. I would suggest that you complete this during the last few weeks of summer so that it is fresh in your mind. A test over this material will be given on Thursday, August 9th. I look forward to meeting you in class this fall and a great school year! I hope you have a great summer!

- Coach Crawford

- For help on Precalculus concepts: http://www.khanacademy.org/ Scroll down on the home page to see many topics of interest.

I. Analyzing Functions

Use the figure at the right to answer the problems below:



1. Use interval notation to determine the interval on which the function, $f(x)$, is

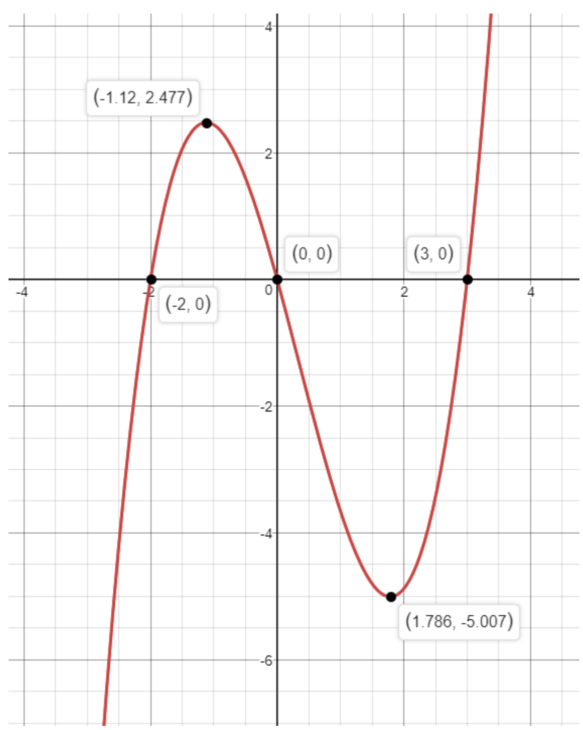
Increasing: ______________ Decreasing:____________

Constant: _______________ Concave Up:_____________ Concave Down: ____________

2. The zeros of the function are $x =$ ____________

3. For what values of x are $f(x)$ discontinuous? $x =$ _________

4. Find the following information about the given graph. Be careful when to use x-values and y-values!



a. Domain ___________
b. Range _____________
c. Intervals of increase________________
d. Intervals of decrease _______________
e. Relative (local) maximum _____________
f. Relative (local) minimum _____________
g. Absolute maximum ________________
h. Absolute minimum ________________
i. x-intercepts ______________________
j. y-intercept _______________________
k. Even, odd, or neither _______________
l. Ending behavior: ________________

Summer Assignment for AP Calculus AB **Name** ________________________________

5. Let $f(x)=3x^2$ and $g(x)=\dfrac{x-9}{x+1}, x\neq -1,$ find the following. State **domain restrictions** when necessary.

a. $f\left(g\left(x\right)\right)=$ ______________ b. $g\left(f\left(x\right)\right)=$ ____________ c. $f^{-1}\left(x\right)=$ __________

d. Domain, range and zeros of $f(x)$ e. Domain, range and zeros of $g(x)$

Find $f^{-1}(x)$ then verify that it is the inverse by doing $\left(f\circ f^{-1}\right)\left(x\right)=x$ and $\left(f^{-1}\circ f\right)\left(x\right)=x$. Your work for the compositions SHOULD NOT BE INDENTICAL!

6. $f(x)=2x+3$

7. $f(x)=x^3-1$

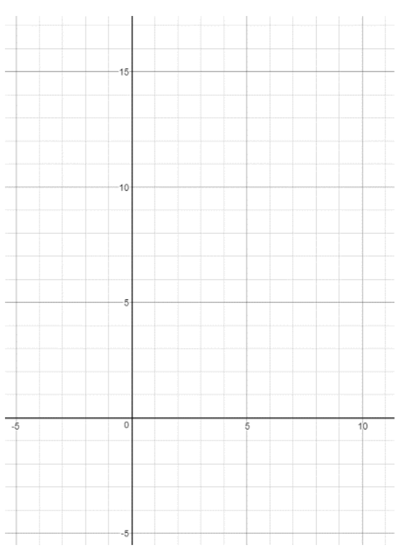
Graph the piece-wise function, then evaluate the function at the values indicated.

8. $f(x)=\begin{cases}3x+2, & x>3\\ -x+4, & x\leq 3\end{cases}$

$(a)\, f\left(2\right)=$ _____

$(b)\, f\left(3\right)=$ _____

$(c)\, f\left(5\right)=$ _____



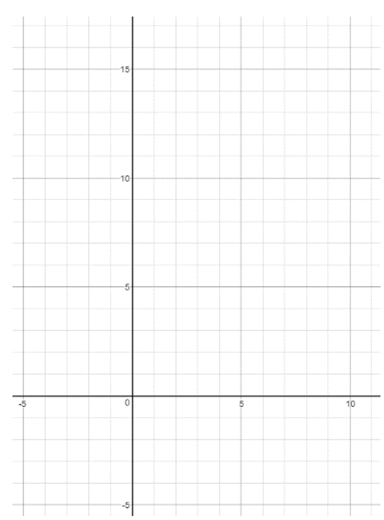
9. $f\left(x\right)=\begin{cases}x^2-1, & x<-2\\ 4, & -2\leq x\leq 1\\ 3x+1, & 1<x\leq 3\\ x^2-1, & x>3\end{cases}$

$(a)\, f\left(5\right)=$ _____

$(b)\, f\left(-3\right)=$ _____

$(c)\, f\left(2\right)=$ _____

$(d)\, f\left(0\right)=$ _____



Summary Assignment for AP Calculus AB **Name** ________________________________

Determine which functions are odd, even or neither. Be able to explain both graphically and algebraically.

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

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

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

13. $f(x) = \frac{1}{x} + x$

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

15. $f(x) = \sin x + x$

Find the domain of each function. Recall: The denominator of a rational function can never = 0 and any radical with an even index can't have a negative radicand.

16. $f(x) = \frac{3x-2}{4x+1}$

17. $g(x) = \frac{x^2-4}{2x+4}$

18. $h(x) = \frac{x^2-5x-6}{x^2-3x-18}$

19. $j(x) = \frac{2^{2-x}}{x}$

20. $k(x) = \sqrt{x-3} + \sqrt{x+3}$

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

Asymptotes: State the equation for the vertical and horizontal asymptotes for the following functions. Find the coordinates of any holes the function has.

22. $f(x) = \frac{x}{x-3}$

23. $g(x) = \frac{x+4}{x^2-1}$

24. $f(x) = \frac{x^2-9}{x^3-3x^2-18x}$

II. Simplifying and Solving Equations and Inequalities

Simplify the following:

25. $\dfrac{x}{\sqrt{x+5} - \sqrt{5}}$

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

27. $x^4 + 11x^2 - 80$

28. $e^x(2x+1)^3 + e^{2x}(2x+1)^2$

29. $x^3 - xy^2 + x^2y - y^3$

Solve each of the following for x.

30. $x^2 - 9 = 0$

31. $3x^2 + 7x + 3 = 0$

32. $x^2 - 5x - 24 = 0$

33. $\frac{2x+5}{3x+1} = 0$

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

35. $\ln x = 3$

36. $\ln x = 1$

37. $\ln x = e$

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

Solve the following over the interval $[0, 2\pi)$.

39. $\cos^2 x = \frac{1}{4}$

40. $2\sin^2 x + \sin x = 1$

41. $\sin 2x = 0$

42. $2\sin x \cos x = 0$

43. $-3\cos 4x = 0$

44. $5\sin 3x + 2 = 2$

Rewrite each of the following as indicated.

45. Write $\cos 2\theta = 1 - 2\sin^2\theta$ **in terms of** $\sin\theta$.

46. Write $\cos 2\theta = 2\cos^2\theta - 1$ **in terms of** $\cos\theta$.

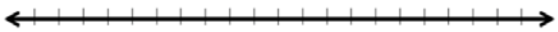
Summer Assignment for AP Calculus AB **Name** ______________________________

Solve inequality and graph the solution on the number line provided.

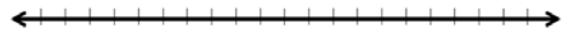
47. $|x-3|>12$

48. $|x-3|\le 4$

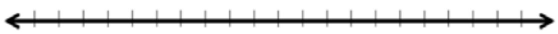
49. $|10x+8|>2$



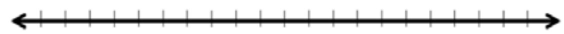
50. $x^2-16<0$



51. $x^2-3x\ge 10$



52. $x^2+6x-16\le 0$



III.Evaluating trigonometric functions. Solve for the principal values only WITHOUT a calculator.

53. $\cos\pi=$ _____ **54.** $\sin\frac{\pi}{6}=$ _____ **55.** $\sec 210^\circ=$ ______ **56.** $\tan 90^\circ=$ _____

57. $\csc\left(-150^\circ\right)=$ ______ **58.** $\csc\frac{3\pi}{2}=$ ______ **59.** $\cos 0=$ _____ **60.** $\cot\frac{5\pi}{2}=$ ______

61. $\sin^{-1}\left(-\frac{1}{2}\right)=$ ______ **62.** $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)=$ _____ **63.** $\tan^{-1}(1)=$ _____

64. $\arcsin\left(\frac{\sqrt{2}}{2}\right)=$ _____ **65.** $\arctan\left(-\sqrt{3}\right)=$ _____ **66.** $arc\sec\left(\frac{2\sqrt{3}}{3}\right)=$ _____

Solve for ALL solutions without using a calculator.

67. $\sin\theta=-\frac{\sqrt{2}}{2}$ $\theta=$ __________________________

68. $\sin 2\theta=-\frac{\sqrt{2}}{2}$ $\theta=$ __________________________

Summer Assignment for AP Calculus AB   Name ________________________________

IV. Logarithms and Exponentials

Evaluate each logarithm or exponential WITHOUT using a calculator.

69. $\log_2 8 =$ ____ **70.** $\log_4 \frac{1}{64} =$ _____ **71.** $\log 10 =$ ______ **72.** $5^{\log_5 7} =$ ______ **73.** $\ln e =$ ____

74. $\log 1 =$ ____ **75.** $\ln 1 =$ _____ **76.** $\log_5 1 =$ _____ **77.** $16^{\frac{3}{4}} =$ _____ **78.** $32^{-\frac{2}{5}} =$ _____

79. $64^{\frac{2}{3}} =$ ______ **80.** $125^{-\frac{1}{3}} =$ ______ **81.** $27^{\frac{4}{3}} =$ _______ **82.** $\left(\frac{1}{4}\right)^{\frac{3}{2}} =$ _______ **83.** $100^{-\frac{5}{2}} =$ ________

84. What is significant about the answers to 74 – 76? Explain. ________________________________

____

Solve each equation ALGEBRAICALLY.

85. $\log\left(x^2 - 3x\right) = 1$ $x =$ ________

86. $\ln\left(x+4\right) = 0$ $x =$ ________

87. $5^{3x+1} = 625$ $x =$ ________

88. $3^{2x-1} = 30$ $x =$ ______

V.Lines

Find the equation of the line going through each set of points.

Use the Point-Slope Formula: $y - y_1 = m\left(x - x_1\right)$ **Recall:** $m = \frac{y_2 - y_1}{x_2 - x_1}$

89. $(2,3),(5,6)$ **90.** $(12,1),(5,0)$ **91.** $(-3,7),(-3,14)$ **92.** $(5,5),(8,5)$

Write the equation of a line that fits the required directions:

93. The equation of a line parallel to #82 going through (1,1). ______________________

94. The equation of a line perpendicular to #82 going through (3,5). ______________________

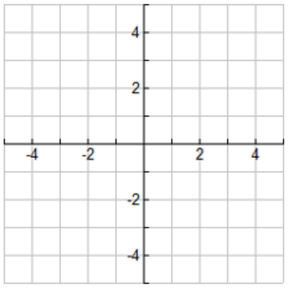
95. The equation of a line parallel to #83 going through (2,4). ____________________

96. The equation of a line perpendicular to #84 going through the point (-5,2). _________________

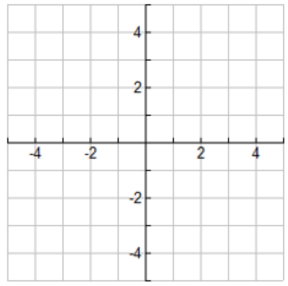
Summer Assignment for AP Calculus AB Name ________________________________

VI.PARENT FUNCTIONS

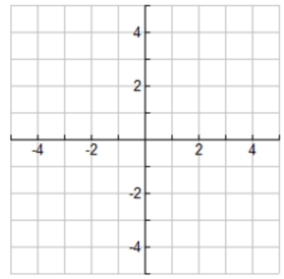
97. Graph each of the parent functions and be familiar with them enough to graph them later WITHOUT the use of a calculator.



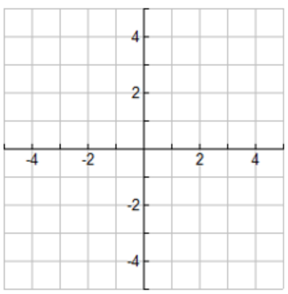
a. $f(x) = x$



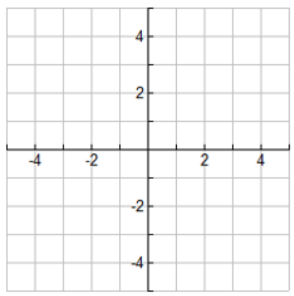
b. $f(x) = x^2$



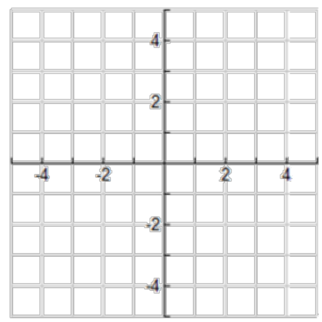
c. $f(x) = x^3$



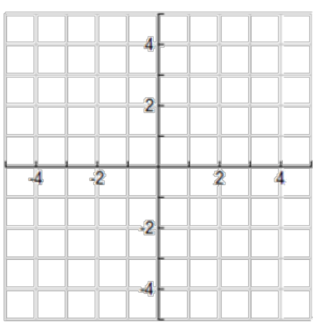
d. $f(x) = e^x$



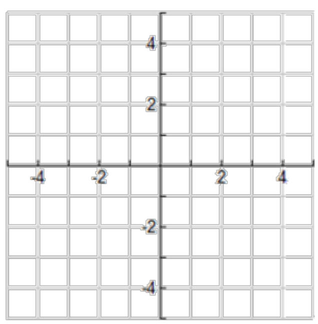
e. $f(x) = \ln x$



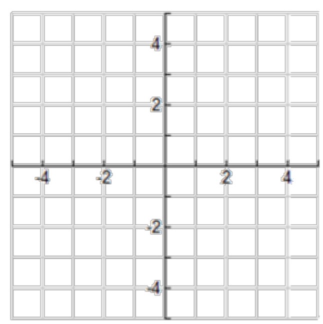
f. $f(x) = \lfloor x \rfloor$



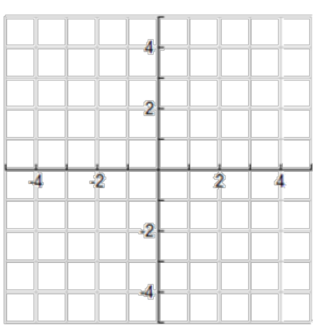
g. $f(x) = x^{\frac{2}{3}}$



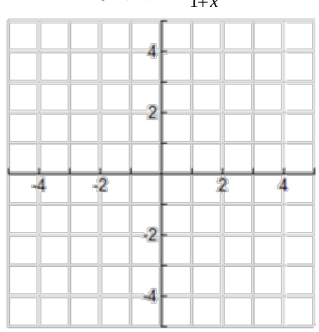
h. $f(x) = \frac{1}{1+x^2}$



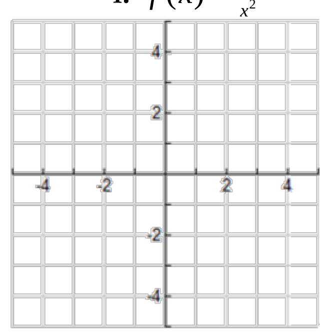
i. $f(x) = \frac{1}{x^2}$



j. $f(x) = \sqrt{1-x^2}$



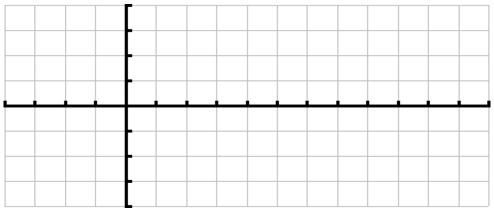
k. $f(x) = \sqrt{9-x^2}$



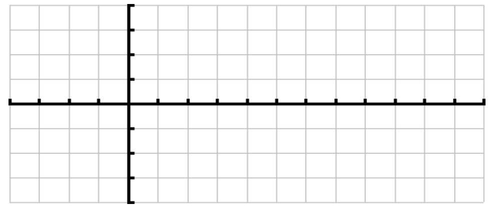
l. $f(x) = \frac{|x|}{x}$

98. Use FIVE (5) points to graph each of the trig functions below. Graph ONE period starting at the y-axis. Label the axes.

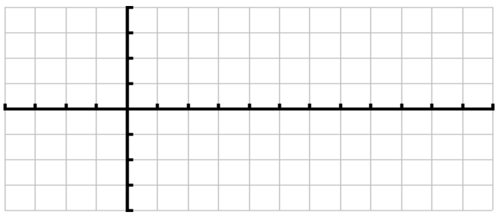
a. $f(x) = \sin x$



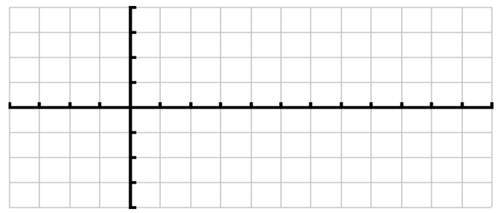
b. $f(x) = \cos x$



c. $f(x) = \tan x$



d. $f(x) = \tan^{-1} x$



VII.FORMULAS and OTHER

You should have the following trig identities MEMORIZED and be able to use them.

Tangent and Cotangent Identities

$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$

Reciprocal Identities

$\csc\theta = \dfrac{1}{\sin\theta}$ $\sin\theta = \dfrac{1}{\csc\theta}$

$\sec\theta = \dfrac{1}{\cos\theta}$ $\cos\theta = \dfrac{1}{\sec\theta}$

$\cot\theta = \dfrac{1}{\tan\theta}$ $\tan\theta = \dfrac{1}{\cot\theta}$

Pythagorean Identities

$\sin^2\theta + \cos^2\theta = 1$

$\tan^2\theta + 1 = \sec^2\theta$

$1 + \cot^2\theta = \csc^2\theta$

Even/Odd Formulas

$\sin(-\theta) = -\sin\theta$ $\csc(-\theta) = -\csc\theta$

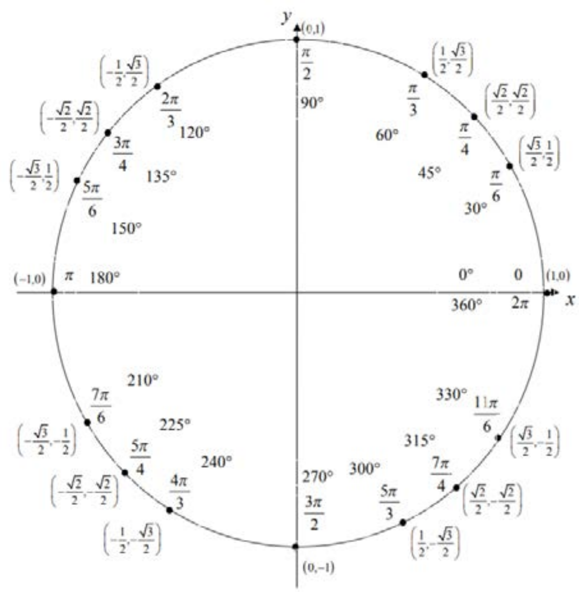
$\cos(-\theta) = \cos\theta$ $\sec(-\theta) = \sec\theta$

$\tan(-\theta) = -\tan\theta$ $\cot(-\theta) = -\cot\theta$

Double Angle Formulas

$\sin(2\theta) = 2\sin\theta\cos\theta$

$$\cos(2\theta) = \cos^2\theta - \sin^2\theta$$
$$= 2\cos^2\theta - 1$$
$$= 1 - 2\sin^2\theta$$



Rule 1: $\log_b(M \cdot N) = \log_b M + \log_b N$

Rule 2: $\log_b\left(\dfrac{M}{N}\right) = \log_b M - \log_b N$

Rule 3: $\log_b\left(M^k\right) = k \cdot \log_b M$

Rule 4: $\log_b(1) = 0$

Rule 5: $\log_b(b) = 1$

Rule 6: $\log_b\left(b^k\right) = k$

Rule 7: $b^{\log_b(k)} = k$

Where : $b > 1$, and M, N and k can be any real numbers but M and N must be positive!

Logarithm Properties

$$\log_a xy = \log_a x + \log_a y$$

$$\log_a \frac{x}{y} = \log_a x - \log_a y$$

$$\log_a x^n = n \log_a x$$

$$\log_a b = \frac{\log_c b}{\log_c a}$$

$$\log_a b = \frac{1}{\log_b a}$$

The following can be derived from the above properties.

$$\log_a 1 = 0$$

$$\log_a a = 1$$

$$\log_a a^r = r$$

$$\log_a \frac{1}{b} = -\log_a b$$

$$\log_{\frac{1}{a}} b = -\log_a b$$

$$\log_a b \log_b c = \log_a c$$

$$\log_{a^m} a^n = \frac{n}{m}, m \neq 0$$