Name: _____ AP Calculus AB Summer Packet

Date: _____

Topics:

I. Trigonometry
II. Functions and their transformations
III. Exponentials and Logarithms
IV. Limits
V. Derivatives

This packet is due on the 1st day of school. You will be given a test within a few days.

I can provide links to recordings of my PreCalculus Honors class which you can use to review or learn for the first time the needed material. Email me at fletcher.williams@knoxvillecatholic.com to get them.

Assume all of the problems included are to be completed without a calculator.

I. Trigonometry

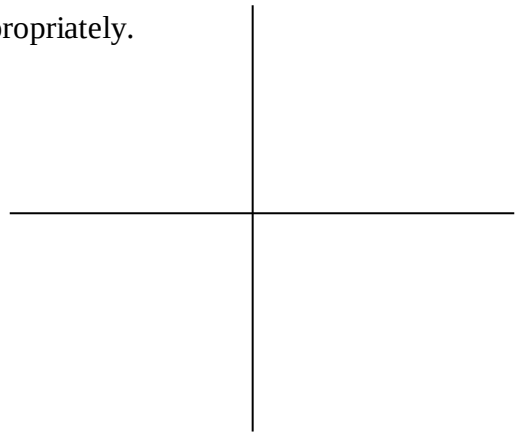
*Know your unit circle well. You should be able to calculate the following (idea: make a Quizlet and share it with others!):

- basic trig ratios, e.g. $\sin 30^\circ, \cos \pi, \sec 0, \tan 480^\circ$...

- basic inverse trig, e.g. $\arcsin(1/2), \cos^{-1} 0, \tan^{-1} 1, \operatorname{arccsc}\left(-\sqrt{2}\right)$... (be careful of restricted ranges!)

1. Be able to graph sinx, cosx, tanx, secx, cscx, cotx.

2. Graph one period of $y = -2\cos\left(\frac{\pi}{4}x + \pi\right) - 1$. Label appropriately.



3. Solve the following equations on the interval $0 \le \theta < 360^\circ, 0 \le x < 2\pi$.
   a. $\cos 2x = \sin x$

b. $\sin 2\theta = 2\sin\theta$

III. Functions and Their Graphs

Be able to graph functions of the form $f(x) = x^n$ and transformations where *n* is:

1) positive integer
2) negative integer
3) rational number

IV. Exponentials and Logarithms

4. Simplify the following:

   a. $5^{\log_5 3}$

   b. $\log_3 27^{\sqrt{2}}$

   c. $\ln \frac{1}{e^3}$

   d. $\log_6 \left(\frac{36}{6^{-10}} \right)$

5. Solve for *x* in terms of natural logs: $e^{2x-1} = 3$

6. Solve for *t* in terms of log base 10: $10^{5t} = 2$

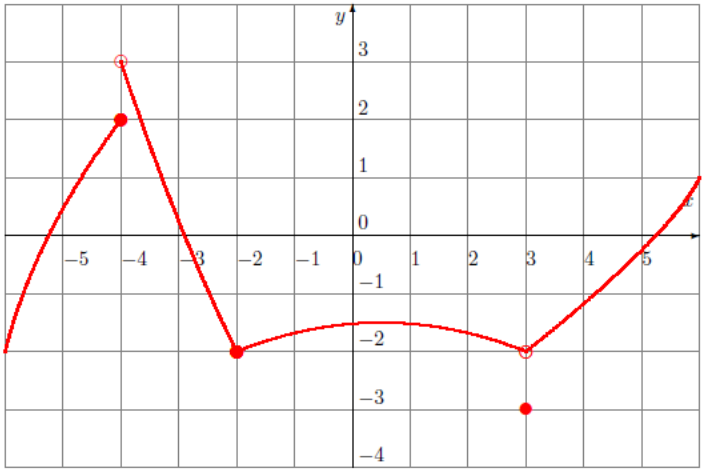
7. Solve for *x* in terms of *e*: $\ln x^2 = 8$

8. Combine the following into a single logarithmic expression: $\frac{1}{3}\log_b x + \log_b y$

VI. Limits

9. Write down the definition of a limit. (That is, what is formally required for the statement $\lim_{x\to a} f(x) = \text{L}$ to be true. Think ε and δ …)

10. Calculate the indicated limits/function values based on the graph:



a) $\lim_{x\to -4^-} f(x)$
b) $\lim_{x\to -4^+} f(x)$
c) $\lim_{x\to -4} f(x)$
d) $\lim_{x\to -2} f(x)$
e) $\lim_{x\to 3} f(x)$
f) $\lim_{x\to -2^-} f(x)$
g) $f(-4)$
h) $f(-2)$
i) $f(3)$

11. Given that $\frac{\sin 3x}{x} \le f(x) \le x^2 + 3$ on the interval [- 5, 5], determine $\lim_{x\to 0} f(x)$ and justify your answer.

VII. Derivatives

Know these derivative rules by heart:
Derivative of a constant, Power Rule, Constant Multiple Rule, Sum Rule, Product Rule, Quotient Rule, sinx, cosx

12. Compute derivatives of the following:

a. $v(t) = t^5 - 4t + \sqrt{t} - 3 - \frac{1}{t^2}$

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

d. $f(x) = \left(2x^2 - 3\right)^4 \left(2x+4\right)^3$

c. $f(x) = \dfrac{\sin x - \cos x}{\sin x + \cos x}$

e. $g(x) = \left(\dfrac{x^2 - 1}{x^2 + 1}\right)^2$

13. Write down the equation of the line tangent to $y = \sqrt[3]{x}$ at x = - 8.