

Welcome to AP Calculus AB!

Going into AP calculus, there are certain skills that you have learned over the previous years that we assume you retain. If you do not have these skills, you will find that you will consistently get problems incorrect next year, even though you understand the calculus concepts. It is frustrating for students when they struggle with the algebra. We have a summer assignment that you will find on pages 3-11 that is intended to help you brush up and possibly relearn these topics. **There will be a test on the 2nd day of school on these topics.**

We assume that you have basic skills in algebra. These include being able to solve equations, graph functions, work with algebraic expressions, and basic factoring. These are skills that are used continually in AP Calculus.

Realize also that certain concepts are interrelated. Domain, for example, may require you to be expert at working with inequalities. Solving quadratic equations may involve techniques used in solving fractional equations. The summer work includes review on the following topics:

- Analyzing functions: increasing, decreasing, max, min, domain, range, end behavior, asymptotes, inverses, compositions, even, odd, and graphing
- Simplifying and solving polynomial, rational, radical, trigonometric, exponential & logarithmic equations & inequalities
- Evaluating trig, inverse trig, piecewise, exponential, and logarithmic expressions
- Equations of lines

This work is due the first day back in school in the fall. You need to get off to a good start so print out the problems and spend some quality time on this packet this summer. Staple the pages and be sure your name appears on the first page. Work needs to be shown when needed. Also do not rely on the calculator. Half of your AP exam next year is taken without the calculator. So paper and pencil techniques only.

It is a mistake to decide to do this now. Let it go until mid-summer. We want these techniques to be relatively fresh in your mind in the fall. Also, do not wait to do them at the very last minute. Be sure to allow yourself enough time to review and do a good job. For example, if you start on July 5 and work/learn 3 pages a week, you will be finished by the end of July. That gives you a week to catch up if you get behind or a week to relax if you stayed on schedule.

When you get a chance, check out these very useful websites:

Free Calculus Cliffs Notes

<http://www.cliffsnotes.com/WileyCDA/CliffsReviewTopic/Calculus.topicArticleId-39909.html>

An interactive Calculus page with great notes and examples <http://www.intmath.com/>

This site has neat flashcards of Calculus Facts and Calculus Common Mistakes

<http://mathmistakes.info/>

Great place to find Calculus definitions, theorems, and examples

http://www.mathwords.com/index_calculus.htm

If you have questions about any of these problems or techniques used in solving them, email Dr. Hadaway at Nelda_Hadaway@gwinnett.k12.ga.us. If you email questions, you will be invited to a face-to-face review session in late July. Check Mrs. Ginny Hanley's teacher webpage for information about online review sessions in July. Have a good summer and see you in the fall.

Section I: Analyzing Functions

A. Increasing/Decreasing

1. Determine the interval(s) over which $f(x)$ is:

a. Increasing _____

b. Decreasing _____

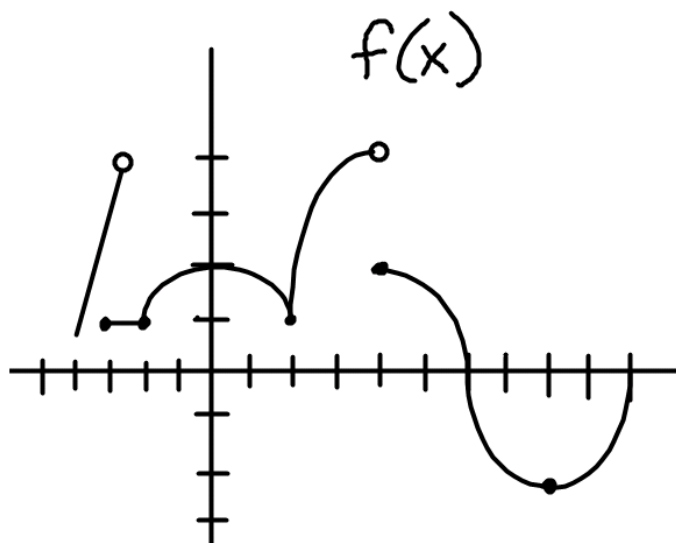
c. Constant _____

d. Linear _____

e. Concave Up _____

f. What are the zeros of f ? _____

g. For what values of x is $f(x)$ discontinuous? _____



B. Compositions

1. Let $f(x) = 3x^2$ and $g(x) = \frac{x-9}{x+1}$, find the following:

a. $f(g(x))$

b. $g(f(x))$

c. $f^{-1}(x)$

d. Domain, Range, and Zeros of $f(x)$

e. Domain, Range, and Zeros of $g(x)$

Find f^{-1} and verify that $(f \circ f^{-1})(x) = (f^{-1} \circ f)(x) = x$.

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

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

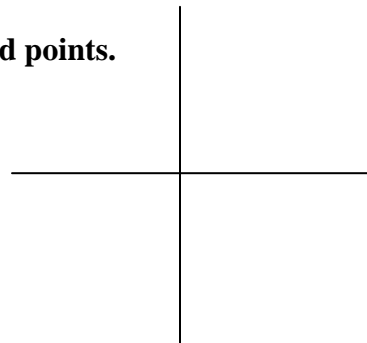
C. Piecewise Functions: Graph then evaluate the function at the indicated points.

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

a. $f(2)$

b. $f(3)$

c. $f(5)$



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

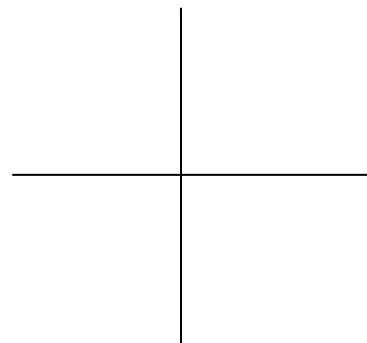
a. $f(-3)$

b. $f(-2)$

c. $f(2)$

d. $f(5)$

e. $f(3)$



D. Even/Odd Functions

Show work to determine if the relation is even, odd, or neither.

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

E. Domains of Functions: Find the Domain of each.

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

F. Asymptotes

Find the equation of both Horizontal and Vertical Asymptotes for the following functions. Find the coordinates of any holes.

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

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

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

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

Section II. Simplifying and Solving Equations and Inequalities

A. Simplify the following expressions

1. $\frac{x}{\sqrt{x+5}-\sqrt{5}}$

2. $\frac{\sqrt{2x+3}-\sqrt{3}}{x}$

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

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

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

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

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

B. Solving Equations- Solve the following for x :

1. $x^2 - 9 = 0$

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

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

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

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

6. $\ln x = 3$

7. $\ln x = 1$

8. $\ln x = e$

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

10. $2\sin^2 x + \sin x = 1$

11. $2\sin x \cos x = 0$

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

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

$$15. \frac{60}{x} - \frac{60}{x-5} = \frac{2}{x}$$

$$16. \frac{2x+3}{x-1} = \frac{10}{x^2-1} + \frac{2x-3}{x+1}$$

C. Solving Inequalities: Solve and graph the solution

1. $|x-3| > 12$

2. $|x-3| \leq 4$

3. $|10x+8| > 2$

4. $x^2 - 16 < 0$

5. $x^2 + 6x - 16 \leq 0$

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

Section III: Evaluation Functions

A. Evaluate Trig Functions without a calculator:

1. $\cos \pi$

2. $\sin \frac{\pi}{6}$

3. $\sec 210^\circ$

4. $\tan 90^\circ$

5. $\csc (-150)$

6. $\csc \frac{3\pi}{2}$

7. $\cos 0$

8. $\sin^{-1} \frac{-1}{2}$

9. $\cos^{-1} \frac{-\sqrt{3}}{2}$

10. $\tan^{-1} 1$

11. $\arcsin 0$

12. $\tan^{-1} -\sqrt{3}$

13. $\sin \frac{2\pi}{3}$

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

15. $\arctan 0$

B. Evaluate Logarithms and Exponentials without a calculator

1. $\log_4 64$

2. $\log_3 \frac{1}{9}$

3. $\log 10$

4. $\ln e$

5. $\ln 1$

6. $\ln e^3$

7. $3^{\log_3 7}$

8. $4^{\log_4 \sin x}$

Section IV: Lines

$$y - y_1 = m(x - x_1)$$

A. Find the equation of the line using point-slope form :

1. (2, 3), (5, 6)

2. (12, 1), (5, 0)

3. (5, 5), (8, 5)

4. (-3, 7), (-3, 14)

5. (-11, -12), (-15, -4)

B. Using the above, write the equation of the lines that are parallel and perpendicular through the point (1, 1).

6. Parallel to # 1

Perpendicular to # 1

7. Parallel to # 2

Perpendicular to # 2

8. Parallel to # 3

Perpendicular to # 3

9. Parallel to # 4

Perpendicular to # 4

10. Parallel to # 5

Perpendicular to # 5

Memorize the following Trig Identities:

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

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

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

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

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

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

$$\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

Graph each of the following Parent Functions:

$$1. f(x) = x$$

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

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

$$4. f(x) = |x|$$

$$5. f(x) = \sqrt{x}$$

$$6. f(x) = \frac{1}{x}$$

$$7. f(x) = \frac{1}{x^2}$$

$$8. f(x) = e^x$$

$$9. f(x) = \ln x$$

$$10. f(x) = \tan x$$

$$11. f(x) = \sin x$$

$$12. f(x) = \cos x$$

$$13. f(x) = \tan^{-1} x$$

$$14. f(x) = x^{\frac{2}{3}}$$

$$15. f(x) = \frac{1}{1+x^2}$$

$$16. f(x) = \lceil x \rceil$$

$$17. f(x) = \sqrt{1-x^2}$$

$$18. f(x) = \frac{|x|}{x}$$

Exponential and Logarithm Rules

$$\ln e = 1$$

$$\ln 1 = 0$$

$$\ln 0 = \text{undefined}$$

$$\log_a a = 1$$

$$\log_a 1 = 0$$

$$\log_a 0 = \text{undefined}$$

$$\log a + \log b = \log ab$$

$$\log a - \log b = \log \frac{a}{b}$$

$$\log a^b = b \log a$$

$$a^{\log_a x} = x$$

$$e^{\ln x} = x$$

$$\log_a a^x = x$$

$$\ln e^x = x$$