AP CALCULUS AB Summer Packet

Welcome to AP Calculus AB! We are looking forward to a great year ahead with you!

This set of problems is suggested practice to help refresh key skills for AP Calculus AB. Proficiency in these topics will support your success in AP Calculus AB. The best way to use this packet is to do the work independently and for accuracy. Focus on understanding, not speed! If you need help, you can access your previous notes from Precalculus AC or use helpful sites like Khan Academy. You may find it helpful to work with a friend. If this works for you, great! However, please keep in mind those topics that you needed help on so that you can get additional practice when the year begins. You can also get help from your teacher or the ILC once school begins. The answers are provided for you to check your solutions.

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We are all looking forward to a great year together getting to know you and exploring Calculus together.

Have a great summer! Your AP Calculus AB Teachers



Evaluating Functions Example: Given $f(x) = (x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$, evaluate f(f(0). ($(x^2 + 4, 0 \le x \le 3)$,

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



(scan or select the QR code for a tutorial)

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

2.) If
$$f(x) = \begin{cases} -x, & x < 0 \\ x^2 - 1, & 0 \le x < 2, \text{ find:} \\ \sqrt{x + 2} - 2, & x \ge 2 \end{cases}$$

a.) $f(0) - f(2)$
b.) $\sqrt{5 - f(-4)}$
c.) $f(f(3))$

Topic B: 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 to check your work but be sure you can graph these independently.













16. $y = \ln x$

			_		
		-			
		-			

SlopeLinear Equations Forms $m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$ Slope-intercept: y = mx + b $m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$ Point-slope: $y - y_1 = m(x - x_1)$ Example Question:
Write the equation of the line in point-slope form, passing through the points (4, -3) and (-6, -2) $M = \frac{-2 - (-3)}{-y - 4} = \frac{1}{-10}$ $y + 2 = -\frac{1}{10} (x + b)$ 0R $y + 3 = -\frac{1}{10} (x - f)$

1.) Write the equation of the line in point-slope form given m = -7 and the point (-3,-7).

2.) Write the equation of the line in point-slope form, passing through the given points.

a.) (-3, 6), (-1, 2)	b.) $\left(-2, \frac{2}{3}\right), \left(\frac{1}{2}, 1\right)$
(,,,,),, (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(2, 3), (2, 1)



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

1.)
$$x^2 - 9x + 20$$
 2.) $12x^2 - 5x = 2$ 3.) $81x^2 + 72x + 16 = 0$

Topic E: Asymptotes



For each function, determine 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.)
$$y = \frac{x}{x^2 - 25}$$
 5.) $y = \frac{x^2 - 5}{2x^2 - 12}$ 6.) $y = \frac{10x + 20}{x^3 - 2x^2 - 4x + 8}$



Example $3_{12} \times 2^2 H^2 \times 2^2 H^2$	Exponent Rules For $a \neq 0, b \neq 0$		
Simplify $\frac{x^3y^2}{x^3} = \frac{x^3y^2}{x^3} = \frac{x^3y^2}{x^3} = \frac{x^3y^2}{x^3}$	Product Rule	$a^x \times a^y = a^{x+y}$	
	Quotient Rule	$a^x \div a^y = a^{x-y}$	
	Power Rule	$\left(a^{x}\right)^{y}=a^{xy}$	
	Power of a Product Rule	$(ab)^x = a^x b^x$	
	Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$	
	Zero Exponent	$a^{0} = 1$	
	Negative Exponent	$a^{-x} = \frac{1}{a^x}$	
(scan or select the QR code for a tutorial)	Fractional Exponent	$a^{\frac{x}{y}} = \sqrt[y]{a^x}$	

Simplify the following.

1.) $-12^2 x^{-5}$

2.)
$$(-12x^5)^{-2}$$

3.) $(4x^{-1})^{-1}$

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

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

7.) $(121x^8)^{\frac{1}{2}}$



Eliminate the complex fractions:





Simplify the following (no radical in the denominator) 3.) $\frac{4}{1-\sqrt{3}}$

4.)
$$\frac{5}{\sqrt{x+2}-5}$$

Topic I: Rational Equations



1.) Combine the following fractions:

a.)
$$\frac{2}{3} - \frac{1}{x}$$
 b.) $\frac{1}{x-3} + \frac{1}{x+3}$ c.) $\frac{2x-1}{x-1} - \frac{3x}{2x+1}$



(scan or select the QR code for a tutorial)

Simplify the following:

1.) $\log_2 \frac{1}{4}$	2.) log ₈ 4	3.) $\ln \frac{1}{\sqrt[3]{e^2}}$

4.) $5^{\log_5 40}$	5.) $e^{\ln 12}$	6.) 36 ^{ln (1)}
,	,	,

Topic K: Unit Circle



Evaluate each of the following

a)
$$\sin \frac{3\pi}{4} =$$

b) $\cos \frac{7\pi}{6} =$

c) tan 0 =

 $d \cot \frac{5\pi}{3} =$

e) $\sec \frac{\pi}{3}$

f) $\csc \frac{5\pi}{6}$

 $g)\sin\frac{\pi}{2} =$

 $h)\cos\frac{5\pi}{3} =$

i) sin $2\pi =$

j) $\sin \frac{4\pi}{3} =$

k) $\cot \frac{-\pi}{4} =$

84 PLUS CE QUICK REFERENCE SHEET



Topic L: Using the TI-84+

Use your TI-84 to find the zeros of each of the following functions. Make sure each equation is set equal to zero first.

1.) $3x^3 - x - 5 = 0$ 2.) $2x^2 - 1 = 2^x$

Use your TI-84 to find the solution (intersection) of the given system of equations.

3.)
$$\begin{cases} f(x) = x^4 - 6.5x^2 + 6x + 2\\ g(x) = 1 + x + e^{x^2 - 2x} \end{cases}$$

Use your TI-84 to find both a relative maximum and a relative minimum point of the given function.

4.) $h(x) = 2x^5 - 3x^4 + x - 4$

Solutions

Topic A		
1a. 32	1b. $\frac{\sqrt{15}}{2}$	1c. $2 - x - \frac{h}{2}$
2a3	2b. 1	$2c. 8 - 4\sqrt{5}$

Topic B

Please use desmos.com to check if your graphs are accurate

Topic C

1. y + 7 = -7(x + 3)2b. $y - \frac{2}{3} = \frac{2}{15}(x + 2)$ or $y - 1 = \frac{2}{15}(x - \frac{1}{2})$ 2a. y - 6 = -2(x + 3) or y - 2 = -2(x + 1)

Topic D

1. (x-4)(x-5) 2. (3x-2)(4x+1) 3. $(9x+4)^2$

Topic E

1. Vertical Asymptote: x = -5, Horizontal Asymptote: y = 1

- 2. Vertical Asymptote: x = 0, Horizontal Asymptote: y = 0
- 3. Point of Discontinuity: (-8, 2)
- 4. Vertical Asymptote: x = -5, x = 5, Horizontal Asymptote: y = 0
- 5. Vertical Asymptote: $x = \pm \sqrt{6}$, Horizontal Asymptote: $y = \frac{1}{2}$

6. Vertical Asymptote: x = 2, Horizontal Asymptote: y = 0, Point of Discontinuity: $\left(-2, \frac{10}{16}\right)$

Topic F

1. $\frac{-144}{x^5}$	2. $\frac{1}{144x^{10}}$	3. $\frac{x}{4}$	4. $\frac{y^6}{125x^9}$	5. $11x^4$	
Topic G 1. $\frac{-15}{16}$	2. $\frac{x^2-1}{x^2+1}$				
Topic H 1. $\frac{4+4\sqrt{3}}{-2}$	2. $\frac{-5\sqrt{x+2}-25}{-x+23}$				
Topic I 1. $\frac{2x-3}{3x}$	$2. \frac{2x}{(x-3)(x+3)}$	$3. \frac{-x^2 + 3x - 1}{(x - 1)(2x + 1)}$	5		
Topic J 12	$2.\frac{2}{3}$	$3.\frac{-2}{3}$	4. 40	5.12	6. 1
Topic K a. $\frac{\sqrt{2}}{2}$ b. $\frac{-\sqrt{3}}{2}$	c. 0 d. $\frac{-\sqrt{3}}{3}$ e. 2	f. 2 g. 1	h. $\frac{1}{2}$ i. 0	j. $\frac{-\sqrt{3}}{2}$	k1

Topic L

1. (1.279, 0)2. (-0.878,0), (1.323, 0), (6.285,0)3. (0, 2), (1.032, 2.401), (2,4)4. Relative Minimum: (1.130, -4.076) and Relative Maximum: (0.606, -3.658)

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Evaluating Functions Example: Given $f(x) = \begin{pmatrix} -x + 2, x < 0 \\ x^2 + 4, 0 \le x \le 3 \\ 7, x > 3 \end{pmatrix}$, evaluate f(f(0). (f(0)) Start with function on the inside $0 \le 0 < 3$, use $f(0) = 0^2 + 1 = 4$ Since 4 > 3Use third function f(f(0)) = 1

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

2.)



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(scan or select the QR code for a tutorial)
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a.)
$$f(4) - f(-4) = 32$$

b.) $\sqrt{f(\frac{3}{2})} = \frac{\sqrt{15}}{2}$
c.) $\frac{f(x+h) - f(x)}{2h} = 2 - x - \frac{1}{2}h$
 $f(4) = 4(-4) - (-4)^{3} = -1|b^{-1}|b^{--32}$
 $f(\frac{3}{2}) = 4(\frac{3}{2}) - (\frac{3}{2})^{1}$
 $f(x) = 4(-4) - (-4)^{3} = -1|b^{-1}|b^{--32}$
 $f(\frac{3}{2}) = 4(\frac{3}{2}) - (\frac{3}{2})^{1}$
 $f(x) = 4(-4) - (-4)^{3} = -1|b^{-1}|b^{--32}$
 $f(\frac{3}{2}) = 4(\frac{3}{2}) - (\frac{3}{2})^{1}$
 $f(x) = 4(-4) - (-4)^{3} = -1|b^{-1}|b^{--32}$
 $f(x) = 4(-4) - (-4)^{3} = -1|-2|$
 $f(x) = 4(-4) - (-4)^{3} = -1|-2|$
 $f(x) = 4(-4) - (-4)^{3} = -1|-2|$
 $f(x) = 4(-4) - (-4)^{3} = 4(-4) - (-4)^{3} = 4(-4)^{3} =$

Topic B: 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 to check your work but be sure you can graph these independently.



















SlopeLinear Equations Forms $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$ Slope-intercept: y = mx + b $m = \frac{\text{rise}}{x_2 - x_1}$ Point-slope: $y - y_1 = m(x - x_1)$ Example Question:
Write the equation of the line in point-slope form, passing through the points (4, -3) and (-6, -2) $M = \frac{-2 - (-3)}{-b - 4} = \frac{1}{-10}$ $y + 2 = -\frac{1}{10} (x + b)$ OR $y + 3 = -\frac{1}{10} (x - f)$

1.) Write the equation of the line in point-slope form given m = -7 and the point (-3,-7).

2.) Write the equation of the line in point-slope form, passing through the given points.

a.) (-3, 6), (-1, 2)

$$M = \frac{2 - 6}{-1 - (-3)} = \frac{-4}{2} = -2$$
b.) $\left(-2, \frac{2}{3}\right), \left(\frac{1}{2}, 1\right)$

$$M = \frac{1 - \frac{2}{3}}{\frac{1}{2} - (-2)} = \frac{\frac{1}{3}, \frac{2}{5}}{\frac{5}{2}, \frac{2}{5}} = \frac{2}{15}$$

$$U = -2(x+3)$$

$$U = \frac{2}{3} = \frac{2}{15}(x+2)$$

$$U = \frac{2}{3} = \frac{2}{15}(x+2)$$

$$U = \frac{2}{3} = \frac{2}{15}(x+2)$$

$$U = \frac{2}{15}(x-\frac{1}{2})$$

Topic D: Solving Quadratic Equations



Solve each equation for x over the real number system.

1.)
$$x^{2} - 9x + 20$$

2.) $12x^{2} - 5x = 2$
3.) $81x^{2} + 72x + 16 = 0$
1.) $x^{2} - 9x + 20$
2.) $12x^{2} - 5x = 2$
3.) $81x^{2} + 72x + 16 = 0$
1.) $x^{2} - 4x$
3.) $81x^{2} + 72x + 16 = 0$
1.) $x^{2} - 4x$
4.) $y = 72x$
5.) $y = 7$

Topic E: Asymptotes



For each function, determine the vertical asymptote(s) and horizontal asymptote (if it exists) and the location of any holes.

л	x + 8
VA = X=0 HA = y=0	$y = \frac{2(x+8)}{(x+8)} = 2$ Point of Discontinuity at (-8,2)
5.) $y = \frac{x^2 - 5}{2x^2 - 12}$	6.) $y = \frac{10x + 20}{x^3 - 2x^2 - 4x + 8}$
$2x^{2}-12 \neq 0$ $2x^{2} = 12$ $x^{2} = 6$	$\chi^{3} - 2\chi^{2} - 4\chi + 8 \neq 0$ $\chi^{2}(\chi - 2) - 4(\chi - 2) = 0$
$X = \pm \sqrt{6}$ $VA = X = \sqrt{6}, X = -\sqrt{6}$	$(\chi - 4) (\chi - \lambda) = 0$ $(\chi + 2) (\chi - 2) (\chi - \lambda) = 0$ $\chi = 0$
$HA = y = \frac{1}{2}$	$VA = X = 2$ $VA = U_{2}O$ $VA = V_{2}O$ $VA = V_{2}O$ $VA = V_{2}O$
	VA = X = 0 HA = y = 0 5.) $y = \frac{x^2 - 5}{2x^2 - 12}$ $2x^2 - 12 \neq 0$ $2x^2 = 12$ $x^2 = 6$ $X = \pm \sqrt{6}$ $VA = X = \sqrt{6}, X = -\sqrt{6}$ $HA = y = \frac{1}{2}$







Eliminate the complex fractions:





$$=\frac{\chi^{2}-1}{\chi^{2}+1}$$



Simplify the following (no radical in the denominator) $3.)\frac{4}{1-\sqrt{3}}$

$$\frac{4}{1-\sqrt{3}} \cdot \frac{1+\sqrt{3}}{1+\sqrt{3}} = \frac{4+4\sqrt{3}}{1-3} = \frac{4+4\sqrt{3}}{-2}$$

4.)
$$\frac{5}{\sqrt{x+2}-5}$$

***** (mjngak : $-\sqrt{x+2} - 5$
 $\frac{5}{\sqrt{x+2}-5}$. $(-\sqrt{x+2} - 5)$
 $\sqrt{x+2} - 5$. $(-\sqrt{x+2} - 5)$
 $= \frac{-5\sqrt{x+2}-25}{-(x+2)+25} = \frac{-5\sqrt{x+2}-25}{-x+23}$



1.) Combine the following fractions:

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

b.) $\frac{1}{x-3} + \frac{1}{x+3}$
c.) $\frac{2x-1}{x-1} - \frac{3x}{2x+1}$
d common denominator: $(x-3)(x+3)$
 $\frac{2}{3} \cdot \frac{x}{x} - \frac{1}{x} \cdot \frac{3}{3}$
 $\frac{2x}{3} \cdot \frac{x}{x} - \frac{1}{x} \cdot \frac{3}{3}$
 $\frac{2x}{3x} - \frac{3}{3x}$
 $= \frac{2x^{3}}{3x}$
 $= \frac{2x^{3}}{3x}$
b.) $\frac{1}{x-3} + \frac{1}{x+3}$
d common denominator: $(x-3)(x+3)$
 $\frac{1}{x-3} \cdot \frac{(x+3)}{(x+3)(x+3)} + \frac{1}{x+3} \cdot \frac{(x-3)}{(x-3)}$
 $\frac{(x+3)}{(x+3)(x+3)} + \frac{(x-3)}{(x+3)(x-3)}$
 $= \frac{2x}{(x-3)(x+3)}$
 $\frac{2x^{2}-1}{(x-1)(2x+1)} - \frac{3x^{2}}{2x+1} \cdot \frac{(x-1)}{(x-1)}$
 $\frac{2x^{2}-1}{(x-1)(2x+1)} - \frac{3x^{2}-3x}{(x-1)(2x+1)}$
 $= \frac{-x^{2}+3x-1}{(x-1)(2x+1)}$



Simplify the following:



Topic K: Unit Circle



Evaluate each of the following

a)
$$\sin\frac{3\pi}{4} = \sqrt{2}$$

$$b)\cos\frac{7\pi}{6} = -\frac{\sqrt{3}}{2}$$

c) $\tan 0 = 0$

- $d = \frac{5\pi}{3} = \frac{1}{-\sqrt{3}} = \frac{1}{3}$
- e) $\sec \frac{\pi}{3} = \frac{1}{\frac{1}{2}} = 2$
- f) $\csc \frac{5\pi}{6} = \frac{1}{\frac{1}{2}} = 2$
- $g)\sin\frac{\pi}{2}=1$
- $h)\cos\frac{5\pi}{3} = \frac{1}{2}$

i) sin $2\pi = 0$

j)
$$\sin \frac{4\pi}{3} = -\frac{\sqrt{3}}{2}$$

k) $\cot \frac{-\pi}{4} = \frac{1}{-1} = -1$

Topic L: Using the TI-84+

Use your TI-84 to find the zeros of each of the following functions. Make sure each equation is set equal to zero first.

1.)
$$3x^{3} - x - 5 = 0$$

(|.279,0)
2.) $2x^{2} - 1 = 2^{x}$
 $2x^{2} - |-2^{x} = 0$
(-.878,0)
(|.323,0)
(y.285,0)

Use your TI-84 to find the solution (intersection) of the given system of equations.

3.)
$$\begin{cases} f(x) = x^{4} - 6.5x^{2} + 6x + 2\\ g(x) = 1 + x + e^{x^{2} - 2x} \end{cases}$$
$$(0, 2) \notin (1.032, 2.401) \notin (2, 4)$$

Use your TI-84 to find both a relative maximum and a relative minimum point of the given function.

4.)
$$h(x) = 2x^5 - 3x^4 + x - 4$$