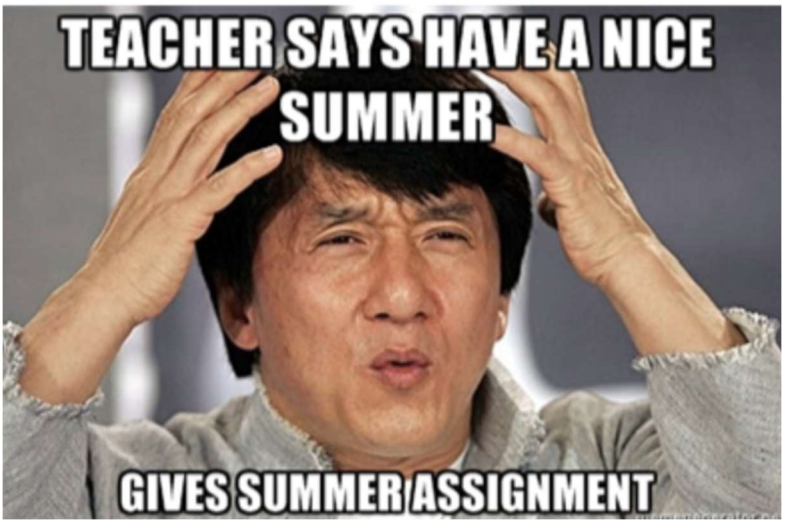
AP Calculus 2026-2027 Summer Assignment



Directions: This assignment is to be completed on separate paper. It must be completed neatly and legibly with the final answer circled or highlighted. All graphs need to be completed on graph paper. This can either be purchased, or you can go to www.printfreegraphpaper.com. If the work is not completed neatly, you will not receive credit for that problem.

If you have any questions regarding the assignment, please email Mrs. Rodriguez at mrodriguez@somersschools.org

AP Calculus students (both AB and BC) should expect an assessment on this content the first week of school.

Students taking Calculus DE: Completing this packet is OPTIONAL

Students taking AP Calculus AB: You are required to complete questions 1 thru 64 (Topics 1 thru 11). Questions 65 – 72 (Topics 12 and 13) are optional.

Students taking AP Calculus BC: Be prepared to turn in this ENTIRE assignment on September 2, 2026. This is the day of the test on the information from this assignment!

Topic #1: Piecewise Functions

Part 1: For each of the following evaluate the piecewise function at the given values.

1) Given the following piecewise function:

$$f(x)=\begin{cases} x+3 & \text{if } x\le 0 \\ 3 & \text{if } 0<x<2 \\ 2x-1 & \text{if } x>2 \end{cases}$$

Evaluate:

a) f(-1) b) f(0) c) f(1) d) f(2) e) f(4)

2) Given the following piecewise function:

$$g(x)=\begin{cases} \sqrt{x+1} & \text{if } x\ge -1 \\ |x+1| & \text{if } x<-1 \end{cases}$$

Evaluate:

a) g(-3) b) g(-2) c) g(-1) d) g(0) e) g(3)

3) Given the following piecewise function:

$$f(x)=\begin{cases} x+2 & -3\le x\le 1 \\ -2x+6 & 1<x\le 5 \end{cases}$$

Evaluate:

a) f(-3) b) f(1) c) f(5)

Part 2:

For each of the following piecewise functions, create a table of values and graph each function. Determine whether each function is continuous or not. Justify your responses. Be sure to do this neatly **ON GRAPH PAPER!**

4)

$$f(x)=\begin{cases} 3x+1 & \text{if } x<1 \\ 2x & \text{if } x\ge 1 \end{cases}$$

5)

$$f(x) = \begin{cases} 3x+1 & \text{if } x < 1 \\ 2x & \text{if } 1 \le x < 2 \\ -x & \text{if } x \ge 2 \end{cases}$$

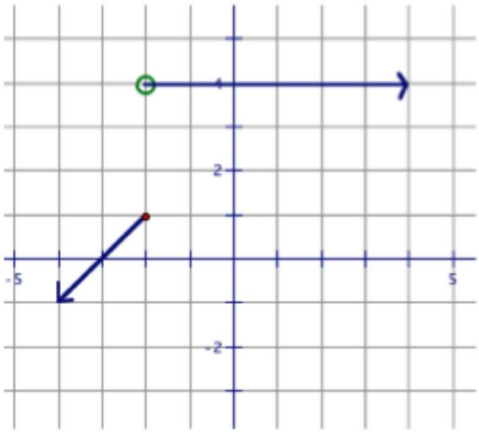
6) Hint: There should be a line and point that is filled in somewhere not on the line for this problem!

$$f(x) = \begin{cases} x+3, & x \neq 3 \\ 7, & x = 3 \end{cases}.$$

7)

$$f(x) = \begin{cases} x+5 & x < -2 \\ x^2+2x+3 & x \ge -2 \end{cases}$$

8) Given the following piecewise function, write the function that gives you the graph. (Hint: extend the lines to determine the equations of each "piece" of the piecewise function. Don't forget to include the domain in your equation)



Function: _____

9) True or false: the following piecewise function is equivalent to f(x) = 2x + 1. Justify your answer.

$$f(x) = \begin{cases} 2x+1 & \text{if } x > 2 \\ 2x+1 & \text{if } x < 2 \end{cases}$$

Topic #2: Absolute Value Equations as Piecewise Functions

Directions: Write each of the following absolute value equations as a piecewise function and graph each absolute value equation. The graphs should be completed on graph paper.

10) $f(x) = |2x + 6|$

11) $g(x) = -|2x - 6|$

12) $h(x) = |x^2 - 4|$

13) $f(x) = |x^2 - 3x|$

14) $p(x) = |2x^2 + 5x - 3|$

Topic #3: Factoring Polynomials

Part 1: Factor each of the following polynomials. Be sure to make sure you have factored each as far as you can. Check each answer by foiling your answer back together.

15) $x^2 + 4x - 12$

16) $x^3 + 4x^2 - 12x$

17) $3x^2 + 16x - 12$

18) $4x^2 - 9$

19) $9 - 25x^2$

20) $x^4 - 16$

21) $x^3 - 2x^2 + 6x - 12$

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

23) $x^2(2x - 1) - 4(2x - 1)^2$

Topic #4: Radicals and Exponents

Simplify each of the following using only positive exponents.

24) $-3x^{-3}$

25) $-5(\frac{3}{2})(4-9x)^{-\frac{1}{2}}(-9)$

26) $2(\frac{2}{2-x})(\frac{-2}{(2-x)^2})$

27) $-4\left(\frac{2x-1}{2x+1}\right)^{-3}\left[\frac{2(2x+1)-2(2x-1)}{(2x+1)^2}\right]$

28) $\frac{\frac{1}{2}(2x-5)^{-\frac{3}{2}}}{\frac{3}{2}}$

Topic #5: Logarithmic and Exponential Equations
This is a longer topic than the others because you need more work on this topic than any of the others! You need to complete this section fully!!

For the following problem, evaluate each logarithm.
29) DO NOT USE A CALCULATOR FOR THE FOLLOWING!

a) $\log_2 4$ b) $\log_2 32$ c) $\log_2 64$ d) $\log_2 2^{10}$

e) $\log_5 0.2$ f) $\log_5 \frac{1}{125}$ g) $\log_5 \sqrt[3]{5}$ h) $\log_5 1$

i) $\log_6 36$ k) $\log_{36} 6$ l) $\log_6 6\sqrt{6}$ m) $\log_6 \sqrt[3]{\frac{1}{6}}$

o) $\log 10^8$ p) $\log_2 2^8$ q) $\log_5 5^8$ r) $\ln e^8$

30) Evaluate each of the following. DO NOT USE A CALCULATOR!

a) $e^{\ln 5}$

b) $\ln\sqrt{\frac{1}{e^3}}$

c) $e^{7\ln 10}$

d) $10^{\log 3+\log 5}$

e) $\log\sqrt[3]{10^5}$

f) $e^{1+2\ln x}$

31) Solve for x without a calculator. You may leave answers in terms of e if necessary (eg. e^3)

a) $\log_2 x = 2$

b) $\ln x = 2$

c) $\log(x^2 - 1) = 2$

d) $\log_6(\log_2 x) = 1$

e) $\ln(x - 2) = 1$

32) Use the properties of logarithms to rewrite each logarithm.

a) $\log 8 + \log 5 - \log 4$

b) $\log_2 48 - \frac{1}{3}\log_2 27$

c) $\frac{1}{2}\ln 5 + 3\ln 2$

d) $4\log M + \frac{1}{2}\log N$

e) $\frac{1}{2}(\log_b M + \log_b N - \log_b P)$

f) $5(\log_b A + \log_b B) - 2\log_b C$

g) $\log 4 - \log 3 + \log\pi + 3\log r$

h) $\ln 10 - \ln 5 - \frac{1}{3}\ln 8$

33) Identify the domain and range of a logarithmic function (for example: f(x) = ln(x))

34) Identify the domain and range of an exponential function (for example: $y = e^x$)

35) Solve for y in each equation (hint: use the properties of logarithms to get a single logarithm on each side of the equal sign and then set the expressions you are taking the log of equal to one another)

a) $\ln y - \ln x = 2\ln 7$

b) $\ln y = 2\ln x - \ln 4$

c) $\log y + \frac{1}{2}\log x = \log 3$

d) $\ln y = \frac{1}{3}(\ln 4 + \ln x)$

Topic #6: Evaluating Functions

Given a function, evaluate the function at the given value.

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

a) f(2) b) f(2a) c)f(x+h)

37) $f(x) = 3x - 6$

a) f(3) b) f(2a – 3) c) f(x+h)

d)f(x+h) – f(x) (*Evaluate each separately, then subtract)

38) $f(x) = 2x^2 - 3x$

a) f(2) b) f(3g) c) f(x + h) d) f(x + h) – f(x)

Topic #7: Compositions of Functions

Given the following functions, evaluate each composition.

f(x) = sin(x) g(x) = x^2 k(x) = x + 1 p(x) = 2x

39) a) f(g(x)) b) f(k(x)) c) k(p(x))

d) g(k(x)) e) g(k(p(x))) f) f(p(g(x)))

40) Write each of the following as two functions (decompose the following functions.

a) f(x) = $(x + 1)^2$ b) f(x) = sin(x^3) c) f(x) = $\sin^2 x$

d) f(x) = 2(x – 1)

Topic #8: Trigonometry

41) Evaluate each of the following without the use of a calculator.

a) $\sin\left(\frac{\pi}{6}\right)$ b) $\cos(\pi)$ c) $\tan\left(\frac{\pi}{3}\right)$

d) $\sec\left(\frac{5\pi}{6}\right)$ e) $\csc(\pi)$ f) $\cos\left(\frac{\pi}{2}\right)$

Solve the following equations on the interval $[0,2\pi)$ without the use of a calculator:

42) $2\cos^2\theta - \cos\theta - 1 = 0$

43) $\sin^2\theta - 1 = 0$

44) $2\cos\theta + \sqrt{2} = 0$

45) $\sec\theta - 2 = 0$

46) $2\sin\theta - \sqrt{3} = 0$

Topic #9: Writing equations of lines.

47) Given the following point and slope, write the equation of a line. (-2,3) with slope of -4

48) Write the equation of a line that goes through the points (0, 2) and (-4, -2)

49) Write the equation of a line that is parallel to the line y = -2x + 3 through the point (5, 4)

50) Write the equation of a line that is normal (perpendicular) to the line y = -2x + 3 through the point (5, 4).

Topic #10: Domain and Range

Find the domain of each of the following functions.

51) $y = \dfrac{2x-3}{3x+4}$

52) $y = \sqrt{3x-9}$

53) $y = \sqrt{x-3} + \sqrt{x+3}$

54) $y = \dfrac{\sqrt{2x+9}}{2x-9}$

55) $y = \log(2x-12)$

56) $y = \dfrac{5}{\sqrt{\sin x}}$

Topic #11: Rational Equations/Expressions and Functions

Simplify each expression:

57) $\dfrac{\frac{3}{x} - \frac{4}{y}}{\frac{4}{x} - \frac{3}{y}}$

58) $\dfrac{\frac{x^2 - y^2}{xy}}{\frac{x+y}{y}}$

59) $\dfrac{\frac{4}{x-5} + \frac{2}{x+2}}{\frac{2x}{x^2-3x-10} + 3}$

For questions 60 thru 64, idenitify:

a) Vertical asymptotes
b) Holes
c) Horizontal Asymptotes
d) X-intercepts
e) Y-intercepts

If there are none, write NONE for that answer.

60) $y = \frac{2x}{x+1}$

61) $y = \frac{x-4}{x^2-16}$

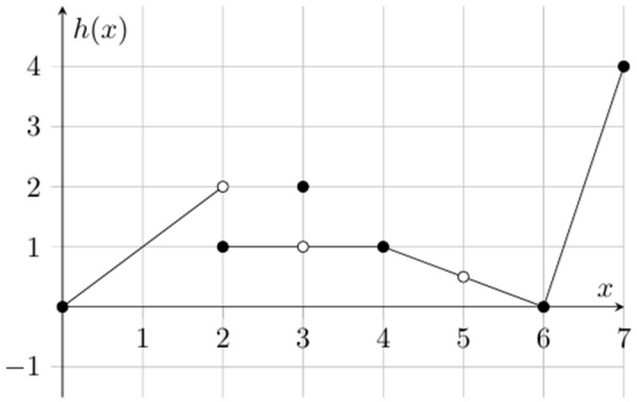
62) $y = \frac{(x+4)(x-3)}{(x-3)}$

63) $y = \frac{(x-3)}{x^2}$

64) $y = \frac{x(x+1)}{x^2-x-2}$

Topic #12: Limits

Use the graph to answer the following limit questions



65)

a) $\lim_{x\to 2^-} h(x) =$ b) $\lim_{x\to 2^+} h(x) =$ c) $\lim_{x\to 2} h(x) =$ d) $\lim_{x\to 3} h(x) =$

e) $\lim_{x\to 4} h(x) =$ f) $\lim_{x\to 5^-} h(x) =$ g) $\lim_{x\to 6} h(x) =$

Evaluate each of the following limits algebraically

66) $\lim_{x\to 3} \frac{x^2+x-12}{x-3} =$

67) $\lim_{x\to 3} \frac{\sqrt{x+1}-2}{x-3} =$

68) $\lim_{x\to 3} f(x)$ where $f(x) = \begin{cases} \frac{x^2-9}{x-3} & x \neq 3 \\ 2 & x = 3 \end{cases}$

69) Hint: you need to write the absolute value as a piecewise function to write this overall function as a piecewise function to determine the limit.

$$\lim_{x\to 2} \frac{|x-2|}{x-2}$$

70) $\lim_{x \to -1} f(x)$

$$f(x) = \begin{cases} x^2 - 5 & \text{for} \quad x < -1 \\ -7 - 3x & \text{for} \quad x \geq -1 \end{cases}$$

71) $\lim_{x \to -1} \dfrac{x^2 + 8x}{x^2 + x}$

72) $\lim_{x \to 8} \dfrac{x - 8}{\frac{1}{2} - \frac{2}{x-4}}$

73) $\lim_{x \to 14} \dfrac{\sqrt{x - 10} - 2}{-4x + 56}$

Evaluate each of the following limits as x approaches infinity.

74) $\lim_{x \to \infty} \dfrac{x + 4 + 3x^3 + 12x^2}{14 - 6x + 21x^3 - 9x^4}$

75) $\lim_{x \to \infty} \dfrac{21x^2 - 58x + 21}{54 - 33x - 10x^2}$

76) $\lim_{x \to \infty} \dfrac{\sqrt{x^6 + 4x}}{5x + x^3}$

77) $\lim_{x \to -\infty} \dfrac{\sqrt{4x^2 - 9}}{1 + 4x}$

78) $\lim_{x \to \infty} \dfrac{x^{12} + 3 \log_4 x}{x^{12}}$

79) $\lim_{x \to \infty} \dfrac{x^{62} - 5x^{97}}{-5e^x}$

Topic #13: Continuity

Determine whether each of the following functions are continuous. If not, explain what part of the definition of continuity is not met.

74) Is $f(x)$ continuous at $x = -5$

$$f(x) = \begin{cases} 18 - x^2, & x \leq -5 \\ 8 + 3x, & x > -5 \end{cases}$$

75) Is $f(x)$ continuous at $x = 2$

$$f(x) = \begin{cases} 13 + 2x^2, & x \geq 2 \\ 18 + 2x, & x < 2 \end{cases}$$

76) Find the value of k that makes the following piecewise function continuous.

$$f(x) = \begin{cases} k^2 - 24x, & x > 2 \\ kx, & x \leq 2 \end{cases}$$