

# Santiago AP Calculus AB/BC Summer Assignment 2021

AB: complete problems 1 – 64, BC: complete problems 1 – 73











AP Calculus is a rigorous college level math course. It will be necessary to do some preparatory work this summer to maintain your math skills. The problems in this packet will help you to focus on some of the mathematical concepts and content you will need to use in solving calculus problems next school year. These problems deal with topics that you've studied in Pre-Calculus and perhaps other classes.

This Summer assignment will be due the first day of the new school year. The assignment will be counted as a grade. Please show all your work directly on this packet. There may, however, be problems where you need more space for work. Neatly work out these problems on separate sheets of paper, indicating the problem number that corresponds to your work. Staple all work to this packet when turning in.

At this level of math, doing math homework is more than just getting the problems done. The problems should be a learning experience. Make an effort to understand the underlying concept(s) that each problem is presenting. Strive to understand the solution to a problem beyond the mere memorization of steps. Doing so will make you a stronger math student in the long run.

It is strongly recommended that you do a few problems each day throughout the summer. Do not leave the entire assignment for the night before school starts. If you are having trouble, the video links below may be helpful. If you're still stuck, you may contact Mr. Kropko at [skropko@cnusd.k12.ca.us](mailto:skropko@cnusd.k12.ca.us), Ms. Moya at [amoya@cnusd.k12.ca.us](mailto:amoya@cnusd.k12.ca.us), or Ms. Wightman at [jessica.wightman@cnusd.k12.ca.us](mailto:jessica.wightman@cnusd.k12.ca.us) and request assistance. Best of luck with the assignment! I look forward to seeing you in August!

**These QR codes (if they are still working) will link to videos that may assist you with selected problems.**

3. 	20. 	22. 	29-34. 
35-40. 	42-45. 	47. 	49. 
50. 	51, 52. 	53. 	56. 
57-62. 	65,66. 	67. 	68-70. 

**These URLs will link to videos and other items that may assist you with selected problems.**

Note, links may become nonoperational.

3	<a href="https://youtu.be/mia78ZtgMao">https://youtu.be/mia78ZtgMao</a>
20	<a href="https://youtu.be/Z72WqNEULEg">https://youtu.be/Z72WqNEULEg</a>
22	<a href="https://youtu.be/BxD6ZFbu01c?t=5m23s">https://youtu.be/BxD6ZFbu01c?t=5m23s</a>
29-34	<a href="https://www.youtube.com/watch?v=NO4H4YROdqk">https://www.youtube.com/watch?v=NO4H4YROdqk</a>
35-40	<a href="https://youtu.be/xPPj-opOYu4?t=4m40s">https://youtu.be/xPPj-opOYu4?t=4m40s</a>
42-45	<a href="http://goo.gl/K8ZShd">http://goo.gl/K8ZShd</a>
47	<a href="https://youtu.be/VUsJj9fprdo">https://youtu.be/VUsJj9fprdo</a>
49	<a href="https://youtu.be/_qX1LOYpR8o">https://youtu.be/_qX1LOYpR8o</a>
50	<a href="https://www.desmos.com/calculator/ankhzzeogq">https://www.desmos.com/calculator/ankhzzeogq</a>
51,52	<a href="https://youtu.be/t6n-ShpFFjo">https://youtu.be/t6n-ShpFFjo</a>
53	<a href="https://youtu.be/idQNhwpFfZY">https://youtu.be/idQNhwpFfZY</a>
54	<a href="https://www.desmos.com/calculator/ybwh9awr7r">https://www.desmos.com/calculator/ybwh9awr7r</a>
56	<a href="https://youtu.be/JGFSEj-oxq4">https://youtu.be/JGFSEj-oxq4</a>
57-62	<a href="https://youtu.be/ObEucyZX464">https://youtu.be/ObEucyZX464</a>
65,66	<a href="https://youtu.be/m02ErGU15MU">https://youtu.be/m02ErGU15MU</a>
67	<a href="https://youtu.be/tsnHL1Lb5MU">https://youtu.be/tsnHL1Lb5MU</a>
68-70	<a href="https://youtu.be/yYxzq_O18Mg">https://youtu.be/yYxzq_O18Mg</a>
67 (ans)	<a href="https://www.desmos.com/calculator/udcar5z92f">https://www.desmos.com/calculator/udcar5z92f</a>
71	<a href="https://youtu.be/BzKpDDveFTU">https://youtu.be/BzKpDDveFTU</a>

1. Find an equation for the line that contains the points (2, -3) and (6, 9).
2. Find the value of  $y$  for which the line through A and B has the slope  $-\frac{2}{3}$ : A(-2, 3), B(4,  $y$ )
3. Find an equation for the line that contains the point (5, 1) and is perpendicular to the line  $6x - 3y = 2$ .
4. Find an equation for the line that contains the point (-10, 5) and has an undefined slope.

**For questions 5-10, let  $f(x) = \sqrt{x-3}$  and  $g(x) = x^2 - 2x + 5$ . Evaluate the following:**

5.  $(f+g)(4)$
6.  $g(x+h)$
7.  $f^{-1}(x)$
8.  $(g \circ f)(x)$
9.  $\frac{1}{f(x)}$
10.  $(f \circ g)(x)$

**For problems 11-19, simplify or evaluate the expression. Don't use a calculator.**

11.  $\frac{\sqrt{x}}{x}$
12.  $e^{\ln 3}$
13.  $\ln 1$
14.  $\ln e^7$
15.  $\log_{\frac{1}{2}} 8$
16.  $e^{3 \ln x}$
17.  $\frac{4xy^{-2}}{12x^{\frac{-1}{3}}y^{-5}}$
18.  $27^{\frac{2}{3}}$
19.  $\frac{3x(x+1) - 2(2x+1)}{(x-1)^2}$

20. Rewrite  $\frac{1}{2}\ln(x-3) + \ln(x+2) - 6\ln x$  as a single logarithmic expression.

21. Solve for  $t$ :  $(1.045)^t = 2$

22. Solve for  $x$ :  $\log_5 x + \log_5(x-4) = 1$

23. Solve for  $x$ :  $27^{2x} = 9^{x-3}$

24. Solve for  $x$ :  $\ln(3x)^2 = 16$

25. Evaluate  $\log_2 5$  to the nearest thousandth.

26. Solve:  $x^3 + 3x^2 - 5x - 15 = 0$

27. Solve:  $x^4 - 9x^2 + 8 = 0$

28. Rewrite and simplify the expression so there are no variables in the denominator:  $\frac{9x^3 + x - 6}{\sqrt[3]{x^2}}$

**Evaluate the expressions without a calculator:**

29.  $\cos(120^\circ)$

30.  $\sin\left(\frac{7\pi}{6}\right)$

31.  $\csc\left(\frac{\pi}{3}\right)$

32.  $\sec\left(-\frac{\pi}{4}\right)$

33.  $\tan\left(\frac{\pi}{2}\right)$

34.  $\sin\left(\frac{3\pi}{2}\right)$

35.  $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

36.  $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

37.  $\arctan(1)$

38.  $\tan^{-1}(-\sqrt{3})$

39.  $\arccos(0)$

40.  $\arcsin\left(-\frac{1}{2}\right)$

41. Evaluate  $f\left(\frac{\pi}{2}\right) - f(2\pi)$  if  $f(x) = x + \sin x$  (express as a single fraction)

42. List the three Pythagorean Trigonometric Identities:

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43. List the double angle formulas.

$$\sin(2x) =$$

$$\cos(2x) =$$

$$\cos(2x) =$$

$$\cos(2x) =$$

44. List the sum/difference formulas.

$$\sin(\alpha + \beta) =$$

$$\cos(\alpha + \beta) =$$

$$\sin(\alpha - \beta) =$$

$$\cos(\alpha - \beta) =$$

45. List the power reducing formulas.

$$\sin^2 \theta =$$

$$\cos^2 \theta =$$

46. Simplify the trigonometric expression:  $\sin x \cos x (\cot x + \tan x)$

47. Verify the trigonometric identity:  $\frac{\sin \theta}{1 + \cos \theta} + \frac{1 + \cos \theta}{\sin \theta} = 2 \csc \theta$

48. Verify the trigonometric identity:  $(\sin x + \cos x)^2 = 1 + \sin(2x)$

49. Find the solutions to the equation  $2 \sin^2 \theta = 1 - \sin \theta$  for  $0 \leq \theta < 2\pi$ .

50. Find the domain for  $f(x) = \sqrt{x^2 - 5x - 14}$

51. Algebraically determine all the points of intersection for  $y = x^2 + 3x - 4$  and  $y = 5x + 11$

52. Algebraically determine all the points of intersection for  $y^2 = 2x + 6$  and  $y = x - 1$

53. Use a graphing calculator to approximate all of the function's real zeros. Round your results to 3 decimal places.  $f(x) = 3x^6 - 5x^5 - 4x^3 + x^2 + x + 1$

54. Use a graphing calculator to approximate all points of intersection of the graphs of the two functions.  $f(x) = 3\sqrt{\ln(x+100) + x}$  and  $g(x) = e^{0.6x} + \sin^2(0.5x) + 1$ . Round your results to 3 decimal places.

55. In terms of transformations (shifts/stretch/reflections), describe how the following would affect the graph of  $f(x)$ .

a)  $f(x) - 4$

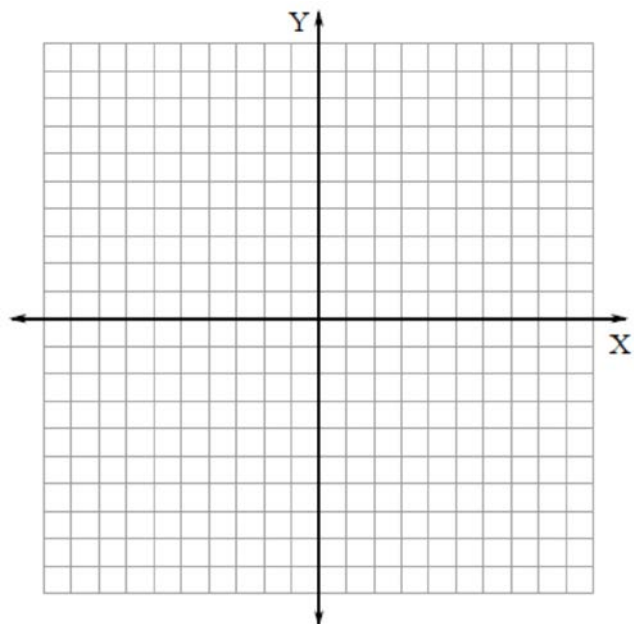
b)  $f(x - 4)$

c)  $-f(x + 2)$

d)  $5f(3x) + 1$

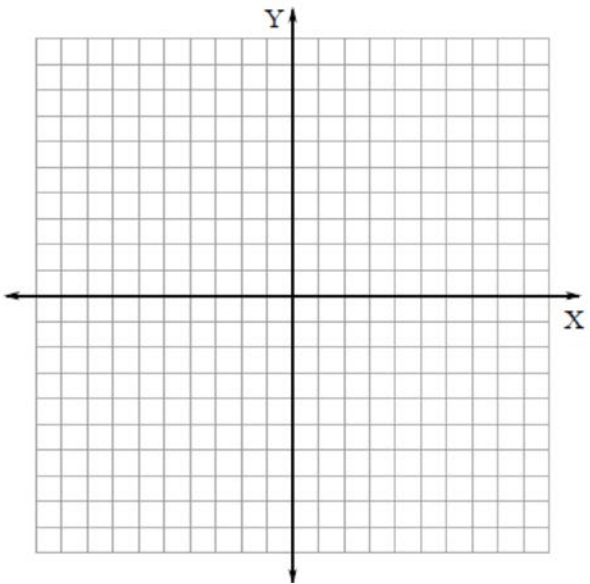
56. For the rational function below, state the zeros (if none exist, write none). Graph and state all vertical asymptotes, horizontal asymptotes, and/or holes if any exist. Also sketch the function's graph.

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



For problems 57-62, graph each function on the coordinate planes provided. Give each function's domain and range.

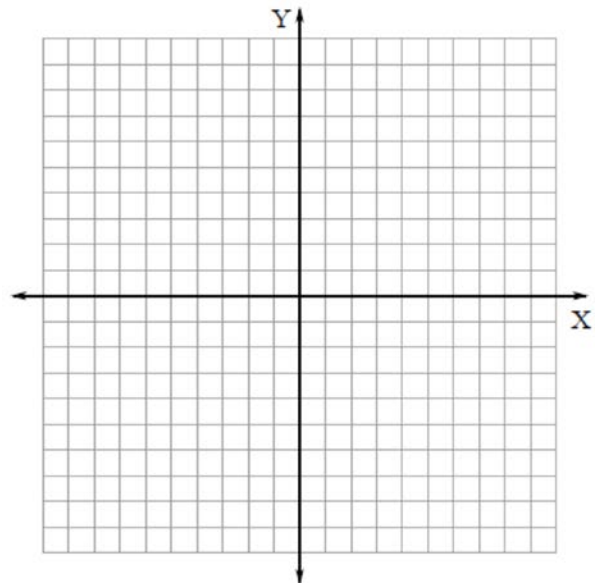
57.  $y = -e^x$



Domain:

Range:

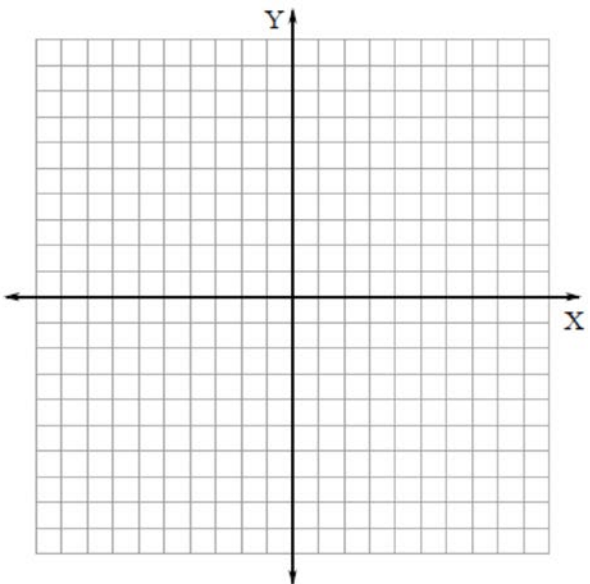
58.  $y = |x+3| - 2$



Domain:

Range:

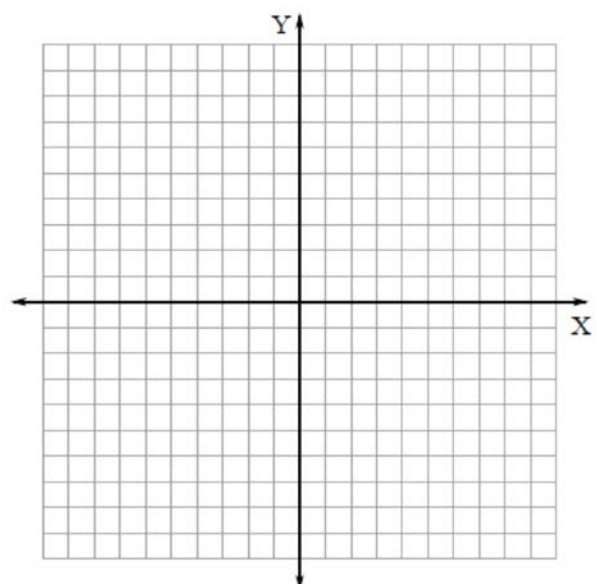
59.  $y = 3 + 2\sin x$



Domain:

Range:

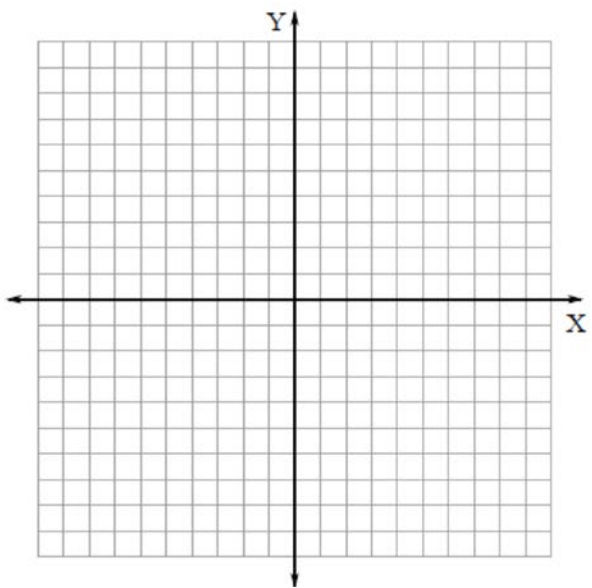
60.  $y = 1 + \sqrt{x+2}$



Domain:

Range:

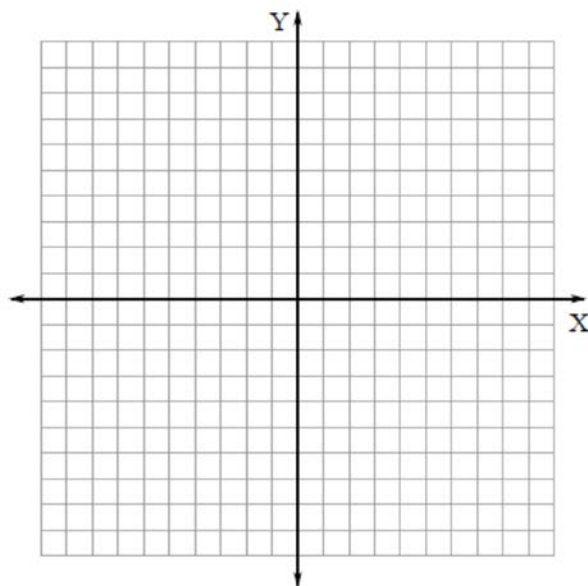
61.  $f(x) = \begin{cases} -6, & x \leq 2 \\ 3, & x > 2 \end{cases}$



Domain:

Range:

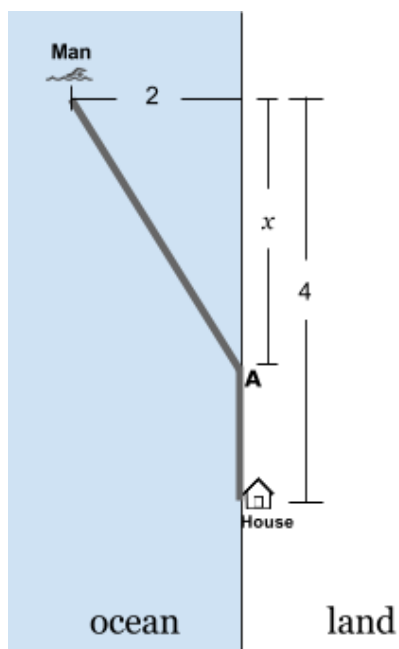
62.  $f(x) = \begin{cases} 2x, & (-\infty, -1) \\ 2x^2, & [-1, 2] \\ -x+3, & (2, \infty) \end{cases}$



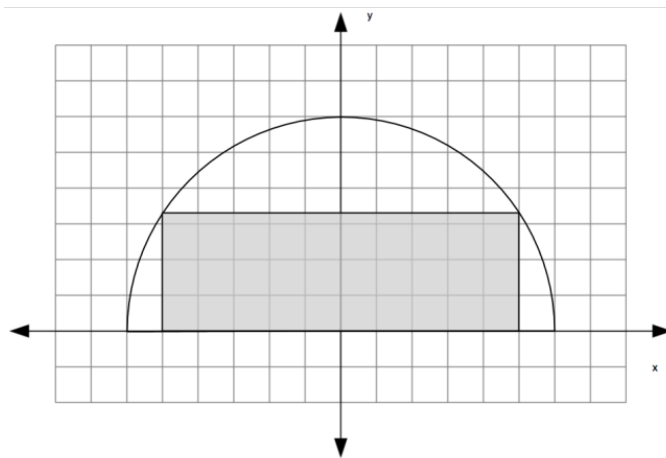
Domain:

Range:

63. A man in the ocean swims to point A and then walks to the house as shown in the diagram. Write a function,  $D(x)$ , that represents the total distance traveled by the man as a function of  $x$ . (Be sure to check your  $D(x)$ . It should yield these values:  $D(0) = 6$  and  $D(4) = \sqrt{20}$ )



64. A semi-circle of radius 6 is centered at the origin as shown. A rectangle has two of its vertices at  $(5, 0)$  and  $(-5, 0)$  and the other two vertices on the semi-circle.



What is the exact area of the rectangle?

What is the equation of the semi-circle?





For problems 68-70, find the sum, if possible, of the infinite geometric series.

68.  $\sum_{n=0}^{\infty} \frac{1}{2} \left(\frac{2}{3}\right)^n$

69.  $\sum_{i=1}^{\infty} \frac{1}{4^{i-1}}$

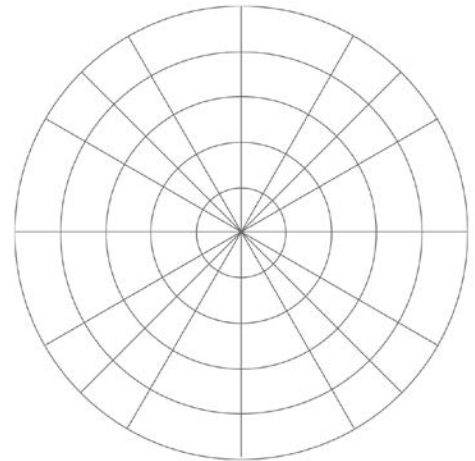
70.  $\sum_{n=1}^{\infty} \left(\frac{5}{4}\right)^n$

71. Graph the polar equation  $r = 1 + 4 \sin \theta$ .

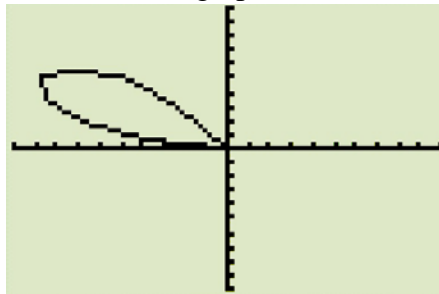


$\theta$	$r$

$\theta$	$r$



72. Use a graphing calculator to graph the polar equation  $r = 10 \sin(3\theta)$ . Be sure your calculator is in *degree* mode and *polar* mode. Choose standard zoom (ZOOM 6). From your **window** menu, adjust  $\theta_{\min}$  and  $\theta_{\max}$  so that your graph looks like the graph below. What value of  $\theta_{\min}$  and  $\theta_{\max}$  did you use?



73. Use a graphing calculator to graph the two polar equations  $r = 7 - 7 \cos(\theta)$  and  $r = 7$ . Be sure your calculator is in *degree* mode and *polar* mode. Choose standard zoom (ZOOM 6). From your **window** menu, adjust  $\theta_{\min}$  and  $\theta_{\max}$  so that your graph looks like the graph below. What value of  $\theta_{\min}$  and  $\theta_{\max}$  did you use?

