Name:_____
School:_____

Calculus Individual 2018

St. Paul's Tournament

1. $\lim_{k \to -\infty} \dfrac{\sin(k)}{k}$

2. $\lim_{h \to 0} \dfrac{1 - e^h}{h}$

3. $\lim_{w \to \infty} \dfrac{9w^4 + 13w - 1300}{1297w - 15w^4}$

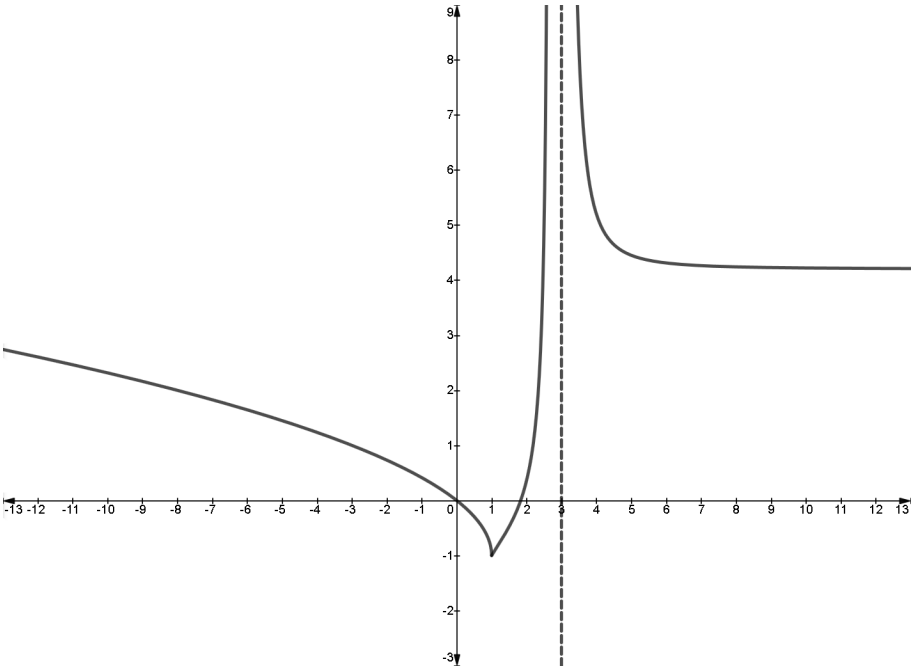
4. $\lim_{x \to -6} \dfrac{x^3 + 216}{x^2 - 2x - 24}$

5. $\lim_{x \to 11} \dfrac{|11 - x|}{11 - x}$

6. Find the intervals on which the following function is continuous: $A(x) = \dfrac{\sqrt{x+1}}{x-4}$

7. Find the equation (in slope-intercept form) of the tangent line to the curve $C(x) = \sqrt{11 - x}$ at $x = 2$.

8. Locate where the derivative does not exist:



9. Find the derivative of the following function: $\beta(x) = \ln(\frac{7x}{x+4})$

10. List the interval(s) where the following function is concave down: $d(x) = x^3 - 6x^2 + 16$

11. Compute the expression: $\dfrac{d}{dx}\displaystyle\int_3^{2x} \cos(t)dt$

12. Compute the expression: $\displaystyle\int x\sqrt[9]{2-x^2}dx$

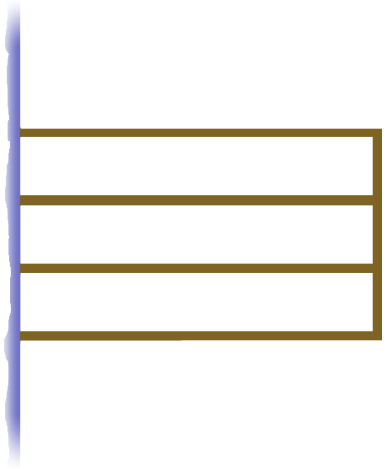
13. Compute the expression: $\displaystyle\sum_{k=1}^{24}(7+5k)$

14. Compute the area of the region bounded by the x-axis and the function $g(x) = \sin(x)$ on the interval $[-\pi, \pi]$.

15. Compute the average value of $A(x) = x^3 - 2x + 1$ on $[-2, 2]$

16. A ball thrown upward from the top of a building has a height of $h = 128 + 32t - 16t^2$ feet after t seconds.
    a.) At what time does the ball turn around?
    b.) How long does it take the ball to reach the ground?
    c.) What is the ball's velocity at the moment of impact?

17. A farmer plans to enclose a rectangular pasture adjacent to a river.
    The pasture must contain 900 square meters to provide enough grass for the herd.
    He wishes to divide it into 3 equal rectangular portions (as shown below).
    No fencing is needed along the river.
    What dimensions will require the least amount of fencing?



Answers

1. 0
2. -1
3. $-\frac{3}{5}$
4. 0
5. DNE
6. $[-1, 4) \cup (4, \infty)$
7. $y = -\frac{1}{6}x + \frac{10}{3}$
8. $x = 1, 3$
9. $\frac{4}{x^2+4x}$
10. $(-\infty, 2)$
11. $2\cos(2x)$
12. $-\frac{9(2-x^2)^{10/9}}{20} + c$
13. 1668
14. 4
15. 1
16. 1 second; 4 seconds; -96 feet per second
17. 60 by 15