Name:_____
School:_____

Calculus AB Individual 2018

Catholic High Tournament

1. Find $\lim_{x \to \pi/2} \left(\frac{\cos^2(x)}{1 - \sin x} \right)$

2. Find $\lim_{x \to 2} \left(\frac{e^x - e^2}{x - 2} \right)$

3. Find the equation of the line tangent to $y = \ln x$ when $x = e$ (answer in slope intercept form)

4. Find the coordinates of all points on $y = x^3 - x$ that have tangent lines parallel to $y = 2x$

5. If $j(x) = \frac{f(x)}{x}$ and $f(x)$ has values given in the table below, find $j'(3)$

x	$f(x)$	$f'(x)$
3	2	-2

6. Find the value of the derivative for $x = \tan y$ at $(1, \frac{\pi}{4})$

7. Find the slope of the normal to $x^3 + 2xy = 5$ at $(1, 2)$

8. If $y = \ln(5x)$, find $y'''(3)$

9. The tangent line to $f(x)$ at $(2, 7)$ also passes through $(4, -9)$.
   Find $f(2) + f'(2)$

10. If $f(x) = x - 2\sin x$ on $[0, 2\pi]$, give the x coordinate of the relative maximum point.

11. On what open interval(s) is $f(x) = x^3 - 6x^2 + 15$ decreasing?

12. Find the maximum value of $f(\theta) = \theta + \cos\theta$ on $[0, \pi]$

13. If the position of a particle moving along a horizontal number line is given by $x = 2t^3 + 3t^2 - 36t + 40$ (x in cm, t in seconds), find the acceleration (in cm/sec^2) when the velocity is 0.

14. The area of a rectangle is increasing at 14 cm^2/sec and the length of the rectangle is decreasing at 2 cm/sec. How fast is the width changing when the length is 12 cm and the area is 60 cm^2? (include units)

15. Find c for which $y = x^2 + c$ is tangent to the line $y = x$.

Answers

1. 2
2. e^2
3. $y = \frac{1}{e}x$
4. $(1, 0), (-1, 0)$
5. $-\frac{8}{9}$
6. $\frac{1}{2}$
7. $\frac{2}{7}$
8. $\frac{2}{27}$
9. -1
10. $\frac{5\pi}{3}$
11. $(0, 4)$
12. $\pi - 1$
13. 30 cm/sec^2
14. 2 cm/sec
15. $c = \frac{1}{4}$