Name:_____
School:_____
Compliments of Mr. Vu

Calculus AB Individual 2019

Catholic High Tournament

1. Find $\lim_{x\to 0}\left(\dfrac{e^x - e^{2x}}{1-e^x}\right)$

2. Find a if $\lim_{x\to\infty}\left(\dfrac{ax^2-4x+3}{2x^2+5x+2}\right) = 6$

3. If $f(x) = x\ln x$, find $f''(e)$

4. Suppose $F(x) = f(x^2+1)$ and $f'(5) = 3$, find $F'(2)$

5. Find the coordinates of the points on $y = x^3 - 3x^2$ where the tangent line is horizontal

6. Find $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$ if $y = \log_5 x$

7. A function has derivative $f'(x) = x(x-3)^2(x+1)^4$. What is the total number of local extreme points on $f(x)$?

8. Find a and b such that $p(1) = 0$ and $p'(1) = 4$ for $p(x) = x^2 + ax + b$

9. Find the slope of the tangent to $x^2y^2 = 9$ at $(-1, 3)$

10. Let $f(x)$ and $g(x)$ have values given in the table below.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	3	-1	-5	2

If $j(x) = \dfrac{f(x)}{5x}$, find $j'(2)$

11. If $y = x - \dfrac{2}{3x^3}$, find $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$

12. The length of a rectangle is decreasing at 2 cm/sec, and the width is increasing at 2 cm/sec. How fast is the area changing when the length is 12 cm and the width is 5 cm? (include units)

13. Find the coordinates of the relative maximum point for $f(x) = x^3 + 3x^2 + 4$

14. If $u = \ln\sqrt{v^2 + 2v - 1}$, find and simplify $\dfrac{\mathrm{d}u}{\mathrm{d}v}$

15. If R is variable and r is constant, find $\dfrac{\mathrm{d}}{\mathrm{d}R}(r^2R^3)$.

Answers

1. 1
2. $a = 12$
3. $\frac{1}{e}$
4. $F'(2) = 12$
5. $(0, 0)$ and $(2, -4)$
6. $\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} = -\frac{1}{x^2 \ln 5}$
7. 1
8. $a = 2, b = -3$
9. slope $= 3$
10. $j'(2) = -\frac{1}{4}$
11. $\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} = -\frac{8}{x^5}$
12. $\frac{\mathrm{d}A}{\mathrm{d}t} = 14 \text{ cm}^2/\text{sec}$
13. $(-2, 8)$
14. $\frac{v+1}{v^2+2v-1}$
15. $3r^2R^2$