2019 CATHOLIC HIGH SCHOOL CALCULUS A INDIVIDUAL

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

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

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 $\frac{d^2y}{dx^2}$ 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 $\dfrac{d^2y}{dx^2}$

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 $\dfrac{du}{dv}$

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