

## 4.1 Exp and Log Derivatives

Calculus

Name: \_\_\_\_\_

CA #1

Find the derivative of each function.

1.  $f(x) = e^{5x^2}$

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3.  $f(x) = e^{\sin(x^2)}$

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5.  $f(x) = \ln(x^3 - 2)$

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7.  $f(x) = \log_2(x^3)$

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9.  $f(x) = \ln(\sec x + \csc x)$

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11.  $f(x) = 3^{\sqrt{x}}$

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13.  $f(x) = \ln(5^x)$

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15. If  $f(x) = e^{3x^4}$ , what is the equation of the tangent line at  $x = 0$ .

16. At what coordinate point(s) is the tangent line of  $f(x) = e^{x^2}$  parallel to  $y = -8$ .

17.  $f(x) = e^{\sin x}$  on the interval  $0 < x < \pi$ . On this interval, when will the average rate of change equal the instantaneous rate of change. [This is applying the Mean Value Theorem]

18. Find the values of  $x$  where the tangent line to the graph of  $y = \ln(x)$  is parallel to  $5x + 3y = 9$

Answers to 4.1 CA #1

1. $10xe^{5x^2}$		3. $2x \cos(x^2) e^{\sin(x^2)}$		5. $\frac{3x^2}{x^3-2}$	
7. $\frac{3}{x \ln 2}$		9. $\frac{\sec x \tan x - \csc x \cot x}{\sec x + \csc x}$		11. $\frac{\ln(3)3^{\sqrt{x}}}{2\sqrt{x}}$	
13. $\ln 5$	14. $\frac{5 \cos(\ln(x^5))}{x}$	15. $y = 1$	16. $(0,1)$	17. $x = \frac{\pi}{2}$	18. $x = -\frac{3}{5}$

## 4.2 Inverse Derivatives

Calculus

Name: \_\_\_\_\_

**CA #1**

Find the following.

1.  $\frac{d}{dx} \sin^{-1}(8x)$

3.  $\frac{d}{dx} \cot^{-1}(2x)$

5.  $\frac{d}{dx} \tan^{-1}(6x^3)$

7.  $\frac{d}{dx} \csc^{-1}(x^3)$

9. Anti-derivative of  $f'(x) = \frac{20x^4}{1+16x^{10}}$

11. Anti-derivative of  $f'(x) = \frac{3}{\sqrt{1-9x^2}}$

13.  $\frac{d}{dx} \cos^{-1}(7x^3)$

**INVERSE FUNCTIONS:**

15. If  $f(x) = 4\sqrt{x}$  and  $f^{-1}(20) = 25$ , find the derivative of  $f^{-1}(x)$  at  $x = 20$

16. If  $f(x) = \cos(x)$  and  $f^{-1}\left(\frac{\sqrt{2}}{2}\right) = \frac{\pi}{4}$ , find the derivative of  $f^{-1}(x)$  at  $x = \frac{\sqrt{2}}{2}$

17. If  $f(x) = 3x + 10$  find  $\frac{d}{dx}[f^{-1}(x)]$  at  $x = -2$ .

18. If  $f(x) = \frac{x^3}{27}$  find  $\frac{d}{dx}[f^{-1}(x)]$  at  $x = 1$ .

Answers to 4.2 CA #1

1. $\frac{8}{\sqrt{1-64x^2}}$		3. $-\frac{2}{4x^2+1}$		5. $\frac{18x^2}{36x^6+1}$		7. $-\frac{3}{ x \sqrt{x^6-1}}$
	9. $\tan^{-1}(4x^5) + C$			11. $\sin^{-1}(3x) + C$		
13. $\frac{21x^2}{\sqrt{1-49x^6}}$		15. $\frac{5}{2}$	16. $-\sqrt{2}$	17. $\frac{1}{3}$	18. 1	

### 4.3 L'Hôpital's Rule

Calculus

Name: \_\_\_\_\_

**CA #1**

**Find the following. Use L'Hôpital's when possible.**

1. $\lim_{x \rightarrow 2} \frac{x-2}{x^2-7x+10}$	2. $\lim_{x \rightarrow 0} \frac{3x^2}{e^x-1-x}$	3. $\lim_{x \rightarrow 3} \frac{x^2-2x+1}{x-3}$
4. $\lim_{x \rightarrow 0} \frac{x^2}{1-\cos(3x)}$	5. $\lim_{x \rightarrow 4} \frac{x^2+6x-40}{4-x}$	6. $\frac{d}{dx} \frac{3x-2}{5x+1}$
7. $\lim_{x \rightarrow 6} \frac{7-\sqrt{55-x}}{x-6}$	8. $\lim_{x \rightarrow 0} \frac{x+1}{x^2-5x+3}$	9. $\lim_{x \rightarrow 0} \frac{2e^x-2-2x}{1-\cos x}$
10. $\frac{d}{dx} \frac{e^x}{\tan(3x)}$	11. $\lim_{x \rightarrow 1} \frac{5 \ln x^2}{x^2-1}$	12. $\lim_{x \rightarrow 0} \frac{1-\cos(4x)}{\cos(3x)-1}$

Answers to 4.3 CA #1

1. $-\frac{1}{3}$	2. 6	3. Does not exist	4. $\frac{2}{9}$	5. -14	6. $\frac{13}{(5x+1)^2}$
7. $\frac{1}{14}$	8. $\frac{1}{3}$	9. 2	10. $e^x \cot 3x - 3e^x \csc^2 3x$	11. 5	12. $-\frac{16}{9}$