Name______________________________

Solve the problem. Round your answer, if appropriate.

1) As the zoom lens in a camera moves in and out, the size of the rectangular image changes. Assume that the current image is $8 \text{ cm} \times 7 \text{ cm}$. Find the rate at which the area of the image is changing ($\frac{dA}{df}$) if the length of the image is changing at 0.8 cm/s and the width of the image is changing at 0.1 cm/s.

Objective: (3.8) Solve Apps: Related Rates I

2) A ladder is slipping down a vertical wall. If the ladder is 13 ft long and the top of it is slipping at the constant rate of 5 ft/s, how fast is the bottom of the ladder moving along the ground when the bottom is 5 ft from the wall?

Objective: (3.8) Solve Apps: Related Rates I

3) A man flies a kite at a height of 50 m. The wind carries the kite horizontally away from him at a rate of 9 m/sec. How fast is the distance between the man and the kite changing when the kite is 130 m away from him?

Objective: (3.8) Solve Apps: Related Rates I

Find the indicated derivative. Assume that $x$ is restricted so that $\ln$ is defined.

4) $\frac{d}{dx} \ln 8x$

Objective: (3.9) Find Derivative Containing Natural Log

5) $\frac{d}{dx} \ln \sqrt{3x + 5}$

Objective: (3.9) Find Derivative Containing Natural Log

6) $\frac{dy}{dx}$ if $y = \ln (x + 2)^3$

Objective: (3.9) Find Derivative Containing Natural Log

7) $\frac{dy}{dx}$ if $y = \ln (5x^3 - x^2)$

Objective: (3.9) Find Derivative Containing Natural Log
8) \( \frac{dy}{dx} \) if \( y = x^{14} \ln x \)

Objective: (3.9) Find Derivative Containing Natural Log

9) \( f \left( \frac{7\pi}{4} \right) \) if \( f(x) = -\ln(\cos x) \)

Objective: (3.9) Find Derivative Containing Natural Log

Find \( D_{xy} \).

10) \( y = e^{(3 - 4x)} \)

Objective: (3.9) Find Derivative of Exponential Function

11) \( y = e^{\sqrt{x + 8}} \)

Objective: (3.9) Find Derivative of Exponential Function

12) \( y = e^{9\ln x} \)

Objective: (3.9) Find Derivative of Exponential Function

13) \( y = \frac{1}{e^{x^9}} \)

Objective: (3.9) Find Derivative of Exponential Function

Find \( \frac{dy}{dx} \).

14) \( y = 3^x \)

Objective: (3.9) Find Derivative of Logarithmic/Exponential Function I

15) \( y = (x^2 + 2x)^{\pi} \)

Objective: (3.9) Find Derivative of Logarithmic/Exponential Function I
16) $y = \pi x^2 + 7x$

Objective: (3.9) Find Derivative of Logarithmic\Exponential Function I

17) $y = (\cos x)^\sqrt{7}$

Objective: (3.9) Find Derivative of Logarithmic\Exponential Function I

18) $y = 6\cos x$

Objective: (3.9) Find Derivative of Logarithmic\Exponential Function I

Find $\frac{dy}{dx}$ by using logarithmic differentiation.

19) $y = \frac{\sqrt{6x + 3}}{6x^3}$

Objective: (3.9) Use Logarithmic Differentiation

20) $y = \frac{(x + 5)(x + 2)}{(x - 5)(x - 2)}$

Objective: (3.9) Use Logarithmic Differentiation

Find $D_x y$.

21) $y = \cosh x^4$

Objective: (3.10) Find Derivative of Hyperbolic Function I

22) $y = 3 \sinh 7x$

Objective: (3.10) Find Derivative of Hyperbolic Function I

23) $y = \ln (\sinh 4x)$

Objective: (3.10) Find Derivative of Hyperbolic Function I

24) $y = \sinh 7x \coth x$

Objective: (3.10) Find Derivative of Hyperbolic Function II
Find \( \frac{dy}{dx} \).

25) \( y = \cos^{-1}(5x^2 - 2) \)
   Objective: (3.10) Find Derivative Involving Inverse Trig Function

26) \( y = \sin^{-1}\left(\frac{10x + 11}{5}\right) \)
   Objective: (3.10) Find Derivative Involving Inverse Trig Function

27) \( y = \tan^{-1}\sqrt{3x} \)
   Objective: (3.10) Find Derivative Involving Inverse Trig Function

28) \( y = 4x^3 \sin^{-1}x \)
   Objective: (3.10) Find Derivative Involving Inverse Trig Function

Find \( dy \).

29) \( y = 6x^2 + 9x + 4 \)
   Objective: (3.11) Find Differential

30) \( y = \csc(6x^2 - 1) \)
   Objective: (3.11) Find Differential

Find \( \Delta y \) for the given values of \( x_1 \) and \( x_2 \).

31) \( y = x^3 + 2x; \quad x = 2, \Delta x = 0.01 \)
   Objective: (3.11) Find Value of Differential

Use differentials to calculate the given number.

32) \( \sqrt[3]{3.57} \)
   Give your answer as a decimal. Round to 4 decimal places if necessary.
   Objective: (3.11) Use Differential to Approximate Value
Find the linearization $L(x)$ of $f(x)$ at $x = a$.

33) $f(x) = \frac{1}{4x - 3}$, $a = 0$

Objective: (3.11) Find Linear Approximation
Answer Key
Testname: 13FALL_MATH3A_CH3_3.6_3.11_PROBS

1) 6.4 cm\(^2\)/sec
2) 12.0 ft/s
3) 8.4 m/sec
4) \( \frac{1}{x} \)
5) \( \frac{3}{2(3x + 5)} \)
6) \( \frac{3}{x + 2} \)
7) \( \frac{15x - 2}{5x^2 - x} \)
8) \( 14x^{13} \ln x + x^{13} \)
9) -1
10) -4e\(^{3 - 4x}\)
11) \( \frac{\sqrt{x} + 8}{2\sqrt{x} + 8} \)
12) 9x\(^8\)
13) \( -\frac{9x^8}{e^x^9} \)
14) 3x ln 3
15) \( \pi(x^2 + 2x)^{\pi - 1}(2x + 2) \)
16) \( (\pi x^2 + 7x) \ln \pi (2x + 7) \)
17) \( -\sqrt{7}(\cos x)\sqrt{7 - 1}\sin x \)
18) \( -6\cos x \ln 6 \sin x \)
19) \( \frac{-(5x + 3)}{2x^4(6x + 3)^{1/2}} \)
20) \( \frac{-14x^2 + 140}{(x - 5)^2(x - 2)^2} \)
21) 4x\(^3\) sinh \( x^4 \)
22) 21 sinh \( 6x \) cosh \( x \)
23) 4 coth \( 4x \)
24) 7 cosh \( 7x \) coth \( x \) - sinh \( 7x \) csch \( 2x \)
25) \( \frac{-10x}{\sqrt{1 - (5x^2 - 2)^2}} \)
26) \( \frac{10}{\sqrt{25 - (10x + 11)^2}} \)
27) \( \frac{3}{2(1 + 3x)^{3/2}} \)
28) \( \frac{4x^3}{\sqrt{1 - x^2}} + 12x^2 \sin^{-1} x \)
29) \( (12x + 9) \) dx

30) \( -12x \csc(6x^2 - 1) \cot(6x^2 - 1) \) dx
31) 0.14
32) 1.8925
33) \( L(x) = -\frac{4}{9}x - \frac{1}{3} \)