Name_____

Calculate the instantaneous velocity for the given value of t of an object moving with rectilinear motion according to the given function relating s (in feet) and t (in seconds).

1) $s = 5t + 12;\ t = 4$ 1) _____

Objective: (3.1) Calculate Instantaneous Velocity

Find the derivative.

2) $w = z^6 - e$ 2) _____

Objective: (3.2) Find Derivative of Exponential

3) $y = \frac{1}{x^{2.4}} - \frac{\pi}{\sqrt{x}}$ 3) _____

Objective: (3.2) Find Derivative of Exponential

4) $y = \sqrt[7]{x^2} + x^e$ 4) _____

Objective: (3.2) Find Derivative of Exponential

5) $s = \frac{5e^t}{2e^t + 1}$ 5) _____

Objective: (3.2) Find Derivative of Exponential

Find y ′.

6) $y = \left(\frac{1}{x^2} + 6\right)\left(x^2 - \frac{1}{x^2} + 6\right)$ 6) _____

Objective: (3.2) Find Derivative of Product

7) $y = \left(\frac{1}{x} + 4\right)\left(x - \frac{1}{x} + 4\right)$ 7) _____

Objective: (3.2) Find Derivative of Product

Find the derivative of the function.

8) $y = \dfrac{x^2 - 3x + 2}{x^7 - 2}$ 8) _____

Objective: (3.2) Find Derivative of Quotient

9) $f(t) = (4 - t)(4 + t^3)^{-1}$ 9) _____

Objective: (3.2) Find Derivative of Quotient

10) $g(x) = \dfrac{x^2 + 5}{x^2 + 6x}$ 10) _____

Objective: (3.2) Find Derivative of Quotient

Find the second derivative.

11) $s = \dfrac{13t^3}{3} + 13$ 11) _____

Objective: (3.2) Find Second Derivative of Polynomial

12) $r = \dfrac{3}{s^3} - \dfrac{5}{s}$ 12) _____

Objective: (3.2) Find Second Derivative of Polynomial

13) $y = \dfrac{1}{11x^2} + \dfrac{1}{9x}$ 13) _____

Objective: (3.2) Find Second Derivative of Polynomial

14) $y = 6x^2 + 7x + 5x^{-3}$ 14) _____

Objective: (3.2) Find Second Derivative of Polynomial

15) $y = 2x^2 + 8x - 9$ 15) _____

Objective: (3.2) Find Second Derivative of Polynomial

Find $D_x y$.

16) $y = x^7$ 16) _____

Objective: (3.3) Find Derivative Using Power/Sum/Difference Rules

17) $y = 5x^2 + 6x + 8$ 17) _____

Objective: (3.3) Find Derivative Using Power/Sum/Difference Rules

18) $y = -7x^7$ 18) _____

Objective: (3.3) Find Derivative Using Power/Sum/Difference Rules

19) $y = x^7 + e^7$ 19) _____

Objective: (3.3) Find Derivative Using Power/Sum/Difference Rules

20) $y = \frac{1}{2}x^{10} - \frac{1}{5}x^5$ 20) _____

Objective: (3.3) Find Derivative Using Power/Sum/Difference Rules

21) $y = (x^2 - 4x + 2)(5x^3 - x^2 + 4)$ 21) _____

Objective: (3.3) Find Derivative of Product

22) $y = (6x - 5)(3x + 1)$ 22) _____

Objective: (3.3) Find Derivative of Product

23) $y = \frac{x^2}{3 - 5x}$ 23) _____

Objective: (3.3) Find Derivative of Quotient

24) $y = \frac{2x^2 + x - 1}{x^3 - 4x^2}$ 24) _____

Objective: (3.3) Find Derivative of Quotient

25) $y = \frac{\pi}{5x^2 - 4}$ 25) _____

Objective: (3.3) Find Derivative of Quotient

26) $y = \frac{x - 8}{x + 8}$ 26) _____

Objective: (3.3) Find Derivative of Quotient

27) $y = \frac{x}{3x - 5}$ 27) _____

Objective: (3.3) Find Derivative of Quotient

28) $y = \frac{\pi}{2x^2 - 6}$ 28) _____

Objective: (3.3) Find Derivative of Quotient

Find the equation of the tangent line to the equation at the point where x has the given value.

29) $y = \frac{4x^2 - 6}{3x - 2}$; $x = 0$ 29) _____

Objective: (3.3) Find Equation of Tangent Line at a Point

Solve the problem.

30) Find all points of the graph of $y = 8x^2 + 8x$ whose tangent lines are parallel to the line $y - 24x = 0$. 30) _____

Objective: (3.3) Find Points at Which Tangent Line Has Given Slope

31) At what points on the graph of $y = 2x^3 - 3x^2 - 20x$ is the slope of the tangent line -8? 31) _____

Objective: (3.3) Find Points at Which Tangent Line Has Given Slope

32) For a motorcycle traveling at speed v (in mph) when the brakes are applied, the distance d (in feet) required to stop the motorcycle may be approximated by the formula $d = 0.050\ v^2 + v$. Find the instantaneous rate of change of distance with respect to velocity when the speed is 48 mph. 32) _____

Objective: (3.3) Solve Apps: Derivative Rules

33) The energy loss E (in joules/kilogram) due to friction when water flows through a pipe is given by $E = 0.020(L/D)v^2$. In the formula, L is the pipe length (in m), D is the pipe diameter (in m), and v is the water velocity (in m/s). Find a formula for the instantaneous rate of change of energy with respect to velocity. 33) _____

Objective: (3.3) Solve Apps: Derivative Rules

34) A cubic salt crystal expands by accumulation on all sides. As it expands outward find the rate of change of its volume with respect to the length of an edge when the edge is 0.210 mm. 34) _____

Objective: (3.3) Solve Apps: Derivative Rules

Find $D_x y$.

35) $y = \frac{9}{x} + 6 \sec x$ 35) _____

Objective: (3.4) Find Derivative of Trigonometric Function

36) $y = x^5 \cos x - 10x \sin x - 10 \cos x$ 36) _____

Objective: (3.4) Find Derivative of Trigonometric Function

Solve the problem.

37) Find the tangent to $y = \cos x$ at $x = \frac{\pi}{2}$. 37) _____

Objective: (3.4) Solve Apps: Tangent Lines

Evaluate the indicated derivative.

38) $f'(2)$ if $f(x) = (6 - x^3)^{-1}$ 38) _____

Objective: (3.5) Evaluate Derivative at a Point Using Chain Rule

39) $f'(1/2)$ if $f(x) = \cos(\pi x) \sin(\pi x)$ 39) _____

Objective: (3.5) Evaluate Derivative at a Point Using Chain Rule

Suppose that the functions f and g and their derivatives with respect to x have the following values at the given values of x. Find the derivative with respect to x of the given combination at the given value of x.

40) 40) _____

x	f(x)	g(x)	f'(x)	g'(x)
3	1	16	6	3
4	3	3	2	–6

f(g(x)), x = 4

Objective: (3.5) Find Derivative Given Numerical Values

41) 41) _____

x	f(x)	g(x)	f'(x)	g'(x)
3	1	9	6	7
4	–3	3	2	–4

$1/f^2(x)$, x = 4

Objective: (3.5) Find Derivative Given Numerical Values

Find $D_x y$.

42) $y = \sin\left(\frac{7\pi x}{2}\right) - \cos\left(\frac{7\pi x}{2}\right)$ 42) _____

Objective: (3.5) Find Derivative Using Chain Rule I

43) $y = \cos^3(\pi x - 12)$ 43) _____

Objective: (3.5) Find Derivative Using Chain Rule I

44) $y = (3x^2 - 7)^3$ 44) _____

Objective: (3.5) Find Derivative Using Chain Rule I

45) $y = \frac{1}{5}(7x + 11)^3$ 45) _____

Objective: (3.5) Find Derivative Using Chain Rule I

46) $y = 4x(3x + 5)^3$ 46) _____

Objective: (3.5) Find Derivative Using Chain Rule II

47) $y = \sqrt[3]{\frac{7z + 8}{-9z + 7}}$ 47) _____

Objective: (3.5) Find Derivative Using Chain Rule II

Find an equation for the line tangent to the given curve at the indicated point.

48) $y = x^3 - 36x + 4$ at $(6, 4)$ 48) _____

Objective: (3.5) Find Equation of Tangent Line

Find $D_x y$.

49) $y = e^{(3 - 4x)}$ 49) _____

Objective: (3.9) Find Derivative of Exponential Function

50) $y = e^{\sqrt{x + 8}}$ 50) _____

Objective: (3.9) Find Derivative of Exponential Function

51) $y = x^6 e^x$ 51) _____

Objective: (3.9) Find Derivative of Exponential Function

52) $y = \frac{1}{e^{x^9}}$ 52) _____

Objective: (3.9) Find Derivative of Exponential Function

53) $e^{16xy} + xy = 5$ 53) _____

[Hint: Use implicit differentiation]

Objective: (3.9) Find Derivative of Exponential Function

1) 5 ft/s

2) $(6 - e)z^5 - e$

3) $-2.4x^{-3.4} + \frac{\pi}{2}x^{-3/2}$

4) $\frac{2}{7x^{5/7}} + ex^{e-1}$

5) $\frac{5e^t}{(2e^t + 1)^2}$

6) $\frac{4}{x^5} + 12x$

7) $\frac{2}{x^3} + 4$

8) $y' = \frac{-5x^8 + 18x^7 - 14x^6 - 4x + 6}{(x^7 - 2)^2}$

9) $f'(t) = \frac{2t^3 - 12t^2 - 4}{(4 + t^3)^2}$

10) $g'(x) = \frac{6x^2 - 10x - 30}{x^2(x + 6)^2}$

11) 26t

12) $\frac{36}{s^5} - \frac{10}{s^3}$

13) $\frac{6}{11x^4} + \frac{2}{9x^3}$

14) $12 + 60x^{-5}$

15) 4

16) $7x^6$

17) $10x + 6$

18) $-49x^6$

19) $7x^6$

20) $5x^9 - x^4$

21) $25x^4 - 84x^3 + 42x^2 + 4x - 16$

22) $36x - 9$

23) $\frac{-5x^2 + 6x}{(3 - 5x)^2}$

24) $\frac{-2x^4 - 2x^3 + 7x^2 - 8x}{(x^3 - 4x^2)^2}$

25) $-\frac{10\pi x}{(5x^2 - 4)^2}$

26) $\frac{16}{(x + 8)^2}$

27) $-\frac{5}{(3x - 5)^2}$

28) $-\frac{4\pi x}{(2x^2 - 6)^2}$

29) $y = \frac{9}{2}x + 3$

30) (1, 16)

31) (−1, 15), (2, −36)

32) 5.8 f/mph

33) dE/dv = 0.040(L/D)v

34) 0.132 mm^3/mm

35) $-\frac{9}{x^2} + 6 \sec x \tan x$

36) $-x^5 \sin x + 5x^4 \cos x - 10x \cos x$

37) $y = -x + \frac{\pi}{2}$

38) 3

39) $-\pi$

40) −36

41) $\frac{4}{27}$

42) $\frac{7\pi}{2}\cos\left(\frac{7\pi x}{2}\right) + \frac{7\pi}{2}\sin\left(\frac{7\pi x}{2}\right)$

43) $-3\pi \cos^2(\pi x - 12)\sin(\pi x - 12)$

44) $18x(3x^2 - 7)^2$

45) $\frac{21}{5}(7x + 11)^2$

46) $4(3x + 5)^2(12x + 5)$

47) $\frac{1}{3}\left(\frac{7z + 8}{-9z + 7}\right)^{-2/3}\left(\frac{121}{(-9z + 7)^2}\right)$

48) $y = 72x - 428$

49) $-4e(3 - 4x)$

50) $\frac{e\sqrt{x + 8}}{2\sqrt{x + 8}}$

51) $x^5e^x(6 + x)$

52) $-\frac{9x^8}{e^{x^9}}$

53) $-\frac{y}{x}$