**Test Form A** **Name** _____ **Date** ____

**Chapter 2** **Class** _____ **Section** __

1. If $f(x) = 2x^2 + 4$, which of the following will calculate the derivative of $f(x)$?

(a) $\dfrac{[2(x + \Delta x)^2 + 4] - (2x^2 + 4)}{\Delta x}$

(b) $\lim\limits_{\Delta x \to 0} \dfrac{(2x^2 + 4 + \Delta x) - (2x^2 + 4)}{\Delta x}$

(c) $\lim\limits_{\Delta x \to 0} \dfrac{[2(x + \Delta x)^2 + 4] - (2x^2 + 4)}{\Delta x}$

(d) $\dfrac{(2x^2 + 4 + \Delta x) - (2x^2 + 4)}{\Delta x}$

(e) None of these

2. Differentiate: $y = \dfrac{1 + \cos x}{1 - \cos x}$.

(a) $-1$ (b) $-2 \csc x$ (c) $2 \csc x$

(d) $\dfrac{-2 \sin x}{(1 - \cos x)^2}$ (e) None of these

3. Find $dy/dx$ for $y = x^3\sqrt{x + 1}$.

(a) $\dfrac{3x^2}{2\sqrt{x + 1}}$ (b) $\dfrac{x^2(7x + 6)}{2\sqrt{x + 1}}$ (c) $3x^2\sqrt{x + 1}$

(d) $\dfrac{7x^3 + x^2}{2\sqrt{x + 1}}$ (e) None of these

4. Find $f'(x)$ for $f(x) = (2x^2 + 5)^7$.

(a) $7(4x)^6$ (b) $(4x)^7$ (c) $28x(2x^2 + 5)^6$

(d) $7(2x^2 + 5)^6$ (e) None of these

5. Find $\dfrac{d^2y}{dx^2}$ for $y = \dfrac{x + 3}{x - 1}$.

(a) 0 (b) $\dfrac{-8}{(x - 1)^3}$ (c) $\dfrac{-4}{(x - 1)^3}$

(d) $\dfrac{8}{(x - 1)^3}$ (e) None of these

6. The position equation for the movement of a particle is given by $s = (t^2 - 1)^3$ when $s$ is measured in feet and $t$ is measured in seconds. Find the acceleration at two seconds.

(a) 342 units/sec$^2$ (b) 18 units/sec$^2$ (c) 288 units/sec$^2$

(d) 90 units/sec$^2$ (e) None of these

7. Find $\dfrac{dy}{dx}$ if $y^2 - 3xy + x^2 = 7$.

(a) $\dfrac{2x + y}{3x - 2y}$ (b) $\dfrac{3y - 2x}{2y - 3x}$ (c) $\dfrac{2x}{3 - 2y}$

(d) $\dfrac{2x}{y}$ (e) None of these

8. Find $y'$ if $y = \sin(x + y)$.

(a) 0 (b) $\dfrac{\cos(x + y)}{1 - \cos(x + y)}$ (c) $\cos(x + y)$

(d) 1 (e) None of these

9. Differentiate: $y = \sec^2 x + \tan^2 x$.

(a) 0 (b) $\tan x + \sec^4 x$ (c) $\sec^2 x(\sec^2 x + \tan^2 x)$

(d) $4 \sec^2 x \tan x$ (e) None of these

10. Find the derivative: $s(t) = \csc \dfrac{t}{2}$.

(a) $-\csc \dfrac{t}{2} \cot \dfrac{t}{2}$ (b) $-\dfrac{1}{2}\cot^2 \dfrac{t}{2}$ (c) $\dfrac{1}{2}\csc \dfrac{t}{2} \cot \dfrac{t}{2}$

(d) $\dfrac{1}{2}\cot^2 \dfrac{t}{2}$ (e) None of these

11. Find an equation for the tangent line to the graph of $f(x) = 2x^2 - 2x + 3$ at the point where $x = 1$.

(a) $y = 2x - 2$ (b) $y = 4x^2 - 6x + 5$ (c) $y = 2x + 1$

(d) $y = 4x^2 - 6x + 2$ (e) None of these

12. Find all points on the graph of $f(x) = -x^3 + 3x^2 - 2$ at which there is a horizontal tangent line.

(a) $(0, -2), (2, 2)$ (b) $(0, -2)$ (c) $(1, 0), (0, -2)$

(d) $(2, 2)$ (e) None of these

13. Find the instantaneous rate of change of $w$ with respect to $z$ if $w = \dfrac{7}{3z^2}$.

(a) $\dfrac{7}{6z}$ (b) $\dfrac{14}{3}z$ (c) $-\dfrac{14}{3z}$

(d) $-\dfrac{14}{3z^3}$ (e) None of these

14. Suppose the position equation for a moving object is given by $s(t) = 3t^2 + 2t + 5$ where $s$ is measured in meters and $t$ is measured in seconds. Find the velocity of the object when $t = 2$.

(a) 13 m/sec (b) 14 m/sec (c) 10 m/sec

(d) 6 m/sec (e) None of these

15. A point moves along the curve $y = 2x^2 + 1$ in such a way that the $y$ value is decreasing at the rate of 2 units per second. At what rate is $x$ changing when $x = \frac{3}{2}$?

(a) increasing $\frac{1}{3}$ unit/sec (b) decreasing $\frac{1}{3}$ unit/sec (c) decreasing [illegible]/sec

(d) increasing $\frac{7}{2}$ unit/sec (e) None of these

**Test Form B** Name _____ Date _____

**Chapter 2** Class _____ Section _____

1. If $f(x) = -x^2 + x$, which of the following will calculate the derivative of $f(x)$?

(a) $\lim_{\Delta x \to 0} \dfrac{(-x^2 + x + \Delta x) - (-x^2 + x)}{\Delta x}$

(b) $\lim_{\Delta x \to 0} \dfrac{[-(x + \Delta x)^2 + (x + \Delta x)] - (-x^2 + x)}{\Delta x}$

(c) $\dfrac{[-(x + \Delta x)^2 + (x + \Delta x)] - (-x^2 + x)}{\Delta x}$

(d) $\dfrac{(-x^2 + x + \Delta x) - (-x^2 + x)}{\Delta x}$

(e) None of these

2. Differentiate: $y = \dfrac{3x}{x^2 + 1}$.

(a) $\dfrac{3}{1 + x^2}$ (b) $\dfrac{3}{2x}$ (c) $\dfrac{3x^2 - 3}{(1 + x^2)^3}$

(d) $\dfrac{3(1 - x^2)}{(1 + x^2)^2}$ (e) None of these

3. Find $dy/dx$ for $y = \sqrt{x}(3x - 1)$.

(a) $\dfrac{9x - 1}{2\sqrt{x}}$ (b) $\dfrac{9}{2}\sqrt{x} - 1$ (c) $3\sqrt{x}$

(d) $\dfrac{3}{2\sqrt{x}}$ (e) None of these

4. Find $f'(x)$ for $f(x) = \sin^3 4x$.

(a) $4\cos^3 4x$ (b) $3\sin^2 4x \cos 4x$ (c) $\cos^3 4x$

(d) $12\sin^2 4x \cos 4x$ (e) None of these

5. Find $\dfrac{d^2y}{dx^2}$ for $y = \dfrac{x + 2}{x - 3}$.

(a) $\dfrac{10}{(x - 3)^3}$ (b) 0 (c) $\dfrac{-10}{(x - 3)^3}$

(d) $\dfrac{2}{(x - 3)^3}$ (e) None of these

6. Find $\dfrac{dy}{dx}$ if $x^2 + y^2 = 2xy$.

(a) $\dfrac{x}{1 - y}$ (b) $\dfrac{y + x}{y - x}$ (c) 1

(d) $-\dfrac{x}{y}$ (e) None of these

7. Find $y'$ if $x = \tan(x + y)$.

(a) $-\sin^2(x + y)$ (b) $\sec^2(x + y)$ (c) $-\tan^2(x + y)$

(d) $\dfrac{1 - \sec^2 x}{\sec^2 y}$ (e) None of these

8. Differentiate: $y = \csc^2\theta + \cot^2\theta$.

(a) $\cot\theta + \csc^4\theta$ (b) 0 (c) $-4\csc^2\theta\cot\theta$

(d) $-\csc^2\theta(\csc^2\theta + \cot^2\theta)$ (e) None of these

9. Find the derivative: $s(t) = \sec\sqrt{t}$.

(a) $\tan^2\sqrt{t}$ (b) $\dfrac{\sec\sqrt{t}\tan\sqrt{t}}{2\sqrt{t}}$ (c) $\sec\dfrac{1}{2\sqrt{t}}\tan\dfrac{1}{2\sqrt{t}}$

(d) $\sec\sqrt{t}\tan\sqrt{t}$ (e) None of these

10. A particle moves along the curve given by $y = \sqrt{t^3 + 1}$. Find the acceleration when $t = 2$ seconds.

(a) 3 units/sec$^2$ (b) $\frac{2}{3}$ units/sec$^2$ (c) $-\frac{1}{108}$ units/sec$^2$

(d) $-\frac{1}{9}$ units/sec$^2$ (e) None of these

11. Find an equation for the tangent line to the graph of $f(x) = -2x^2 + 2x + 3$ at the point where $x = 1$.

(a) $y = -4x + 2$ (b) $2x + y - 1 = 0$ (c) $y = -4x^2 + 2x + 1$

(d) $2x + y = 5$ (e) None of these

12. Find point(s) on the graph of the function $f(x) = x^3 - 2$ where the slope is 3.

(a) $(1, 3), (-1, 3)$ (b) $(1, -1), (-1, -3)$ (c) $(\sqrt[3]{2}, 0)$

(d) $(1, 3)$ (e) None of these

13. Find the instantaneous rate of change of $w$ with respect to $z$ for $w = \dfrac{1}{z} + \dfrac{z}{2}$.

(a) $\dfrac{3}{2}$ (b) $-2$ (c) $\dfrac{z^2 - 2}{2z^2}$

(d) $\dfrac{-1}{z^2}$ (e) None of these

14. Suppose the position equation for a moving object is given by $s(t) = 3t^2 - 2t + 5$ where $s$ is measured in meters and $t$ is measured in seconds. Find the velocity of the object when $t = 2$.

(a) 13 m/sec (b) 6 m/sec (c) 10 m/sec

(d) 14 m/sec (e) None of these

15. A point moves along the curve $y = 2x^2 - 1$ in such a way that the $y$ value is decreasing at the rate of 2 units per second. At what rate is $x$ changing when $x = -\frac{3}{2}$?

(a) decreasing $\frac{7}{2}$ unit/sec (b) increasing $\frac{7}{2}$ unit/sec (c) increasing $\frac{1}{3}$ unit/sec

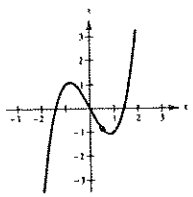
(d) decreasing $\frac{1}{3}$ unit/sec (e) None of these

**Test Form C** Name _____ Date _____

**Chapter 2** Class _____ Section _____

**A graphing calculator/utility is recommended for this test.**

1. Determine whether the slope at the indicated point is positive, negative, or zero.

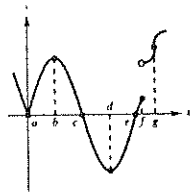


(a) Zero
(b) No slope
(c) Positive
(d) Negative
(e) None of these

2. Find the slope of the graph of $f(x) = x^2 - 2x$ at the point $(a, f(a))$.

(a) 0 (b) $2a - 2$ (c) $f(a)$
(d) $a^2 - 2a$ (e) None of these

3. Use the graph to determine all $x$-values at which the function is not differentiable.



(a) $a$, $b$, $c$, $d$, $e$, $f$, and $g$
(b) $b$ and $d$
(c) $a$ and $f$
(d) $a$, $f$, and $g$
(e) None of these

4. Use a graphing utility to graph $f(x) = \dfrac{3x^2 - 8}{x^2 - 4}$ and its derivative, $f'$, on the same coordinate axes.

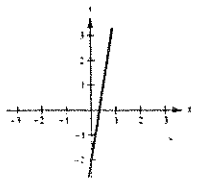
Then use the graph to describe the behavior of $f$ at that value of $x$ where $f'(x) = 0$.

(a) $f(x) = 0$ (b) $f$ increases without bound. (c) $f$ has a horizontal tangent line.
(d) $f$ has no tangent line. (e) None of these

5. Find the value of the derivative of the function $f(t) = \dfrac{t^3 + 2}{t}$ at the point $(-2, 3)$.

(a) $-\dfrac{9}{2}$ (b) $-\dfrac{7}{2}$ (c) 12
(d) $-\dfrac{11}{16}$ (e) None of these

6. The graph at the right represents the graph of the derivative of which of the following functions?



(a) $f(x) = 2x^2 + 1$
(b) $f(x) = 2x - 3$
(c) $f(x) = 3x^2 - 2x - 1$
(d) $f(x) = x^2$
(e) None of these

7. Find $\dfrac{dy}{dx}$: $y = 4 \sin x - 5 \cos x + x$.

(a) $4 \cos x + 5 \sin x + 1$ (b) $-4 \cos x + 5 \sin x + 1$ (c) $4 \cos x - 5 \sin x + 1$
(d) $4 \cos x + 5 \sin x$ (e) None of these

8. The position function for a particular object is $s = -\frac{35}{2}t^2 + 58t + 91$. Which statement is true?

(a) The initial velocity is $-35$ (b) The velocity is a constant
(c) The velocity at time $t = 1$ is 23 (d) The initial position is $-\frac{35}{2}$
(e) None of these

9. Find $\dfrac{dy}{d\theta}$ for $y = \csc \theta - \cot \theta$.

(a) 0 (b) $-\cot^2 \theta + \csc \theta \cot \theta$ (c) $\sec \theta \tan \theta - \sec^2 \theta$
(d) $-\csc \theta \cot \theta + \csc^2 \theta$ (e) None of these

10. Find an equation of the tangent line to the graph of $f(\theta) = \tan \theta$ at the point $\left(\dfrac{\pi}{4}, 1\right)$.

(a) $4x - 4y = \pi - 4$ (b) $4\sqrt{2}x - 4y = \pi - 4$ (c) $4x - 2y = \pi - 2$
(d) $y = x$ (e) None of these

11. Let $f(3) = 0$, $f'(3) = 6$, $g(3) = 1$ and $g'(3) = \dfrac{1}{3}$. Find $h'(3)$ if $h(x) = \dfrac{f(x)}{g(x)}$.

(a) 18 (b) 6 (c) $-6$
(d) $-2$ (e) None of these

12. Find the derivative: $f(x) = \dfrac{1}{\sqrt[3]{3 - x^3}}$.

(a) $\dfrac{-1}{3(3 - x^3)^{4/3}}$ (b) $\dfrac{x^2}{(3 - x^3)^{4/3}}$ (c) $\dfrac{-x^2}{(3 - x^3)^{2/3}}$
(d) $\dfrac{-x^2}{(3 - x^3)^{4/3}}$ (e) None of these

13. Find the derivative: $f(\theta) = \sqrt{\sin 2\theta}$.

(a) $\dfrac{\cos 2\theta}{\sqrt{\sin 2\theta}}$ (b) $\sqrt{\sec 2\theta}$ (c) $\dfrac{\cos 2\theta}{2\sqrt{\sin 2\theta}}$
(d) $\cos \theta$ (e) None of these

14. Determine the slope of the graph of the relation $2x^2 - 3xy + y^3 = -1$ at the point $(2, -3)$.

(a) $-\frac{17}{21}$ (b) $\frac{5}{7}$ (c) $-\frac{1}{3}$
(d) $\frac{4}{3}$ (e) None of these

15. A machine is rolling a metal cylinder under pressure. The radius of the cylinder is decreasing at a constant rate of 0.05 inches per second and the volume $V$ is $128\pi$ cubic inches. At what rate is the length $h$ changing when the radius $r$ is 1.8 inches? [Hint: $V = \pi r^2 h$]

(a) $-2.195$ in./sec (b) 39.51 in./sec (c) 2.195 in./sec
(d) $-43.90$ in./sec (e) None of these

**Test Form D** Name _____ Date _____

**Chapter 2** Class _____ Section _____

1. Use the definition of a derivative to calculate the derivative of $f(x) = \frac{1}{x}$.

2. Differentiate: $y = \frac{2x}{1 - 3x^2}$.

3. Find $\frac{dy}{dx}$ for $y = \sqrt{2x + 1}\,(x^3)$.

4. Find $f'(x)$ for $f(x) = \cot^3\sqrt{x}$.

5. Calculate $\frac{d^2y}{dx^2}$ for $y = \frac{1 - x}{2 - x}$.

6. The position equation for the movement of a particle is given by $s = (t^3 + 1)^2$ where $s$ is measured in feet and $t$ is measured in seconds. Find the acceleration of this particle at 1 second.

7. Find $y'$ if $y = \frac{x}{x + y}$.

8. Find $\frac{dy}{dx}$ if $x = \cos y$.

9. Find the derivative: $f(\theta) = \sec \theta^2$.

10. Differentiate: $y = \sin^2 x - \cos^2 x$.

11. Find an equation for the tangent line to the graph of $f(x) = \sqrt{x + 1}$ at the point where $x = 3$.

12. Find the values of $x$ for all points on the graph of $f(x) = x^3 - 2x^2 + 5x - 16$ at which the slope of the tangent line is 4.

13. Find the instantaneous rate of change of $R$ with respect to $x$ if $R = 2x^2 + \frac{1}{x}$.

14. An object is thrown (straight down) from the top of a 220-foot building with an initial velocity of 26 feet per second.
    a. Write the position equation for the movement described.
    b. What is the velocity at 1 second?

15. As a balloon in the shape of a sphere is being blown up, the volume is increasing at the rate of 4 cubic inches per second. At what rate is the radius increasing when the radius is 1 inch?

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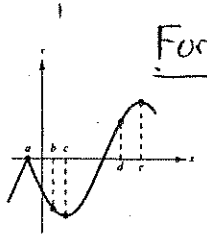
1. At each point indicated on the graph, determine whether the value of the derivative is positive, negative, zero, or the function has no derivative.




Form E

2. Let $f(x) = \frac{4}{x}$.
    a. Use the definition of the derivative to calculate the derivative of $f$.
    b. Find the slope of the tangent line to the graph of $f$ at the point $(-2, -2)$.
    c. Write an equation of the tangent line in part b.
    d. Use a graphing utility to graph $f$ and the tangent line on the same axes. Then sketch the graphs.

3. Find the point(s) on the graph of $y = \frac{1}{x}$ where the graph is parallel to the line $4x + 9y = 3$.

4. A coin is dropped from a height of 750 feet. The height, $s$, (measured in feet), at time, $t$ (measured in seconds), is given by $s = -16t^2 + 750$.
    a. Find the average velocity on the interval $[1, 3]$.
    b. Find the instantaneous velocity when $t = 3$.
    c. How long does it take for the coin to hit the ground?
    d. Find the velocity of the coin when it hits the ground.

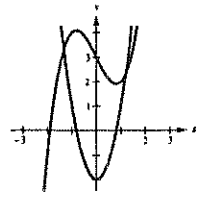
5. The volume of a right circular cone of radius $r$ and height $r$ is given by $V = \frac{\pi}{3}r^3$. How fast is the changing volume with respect to changes in $r$ when the radius is equal to 2 feet?

6. Find the derivative: $f(x) = 5 \sec x \tan x$.

7. Evaluate the derivative for the function $f(t) = \frac{t}{\cos t}$ at the point $\left(\frac{\pi}{3}, \frac{2\pi}{3}\right)$.

8. Let $f(x) = x^5 - 5x$.
    a. Calculate $f'(x)$.
    b. Use a graphing utility to graph $f$ and $f'$ on the same axes. Sketch the graphs.
    c. Use the graph to determine those point(s) where $f$ has a horizontal tangent line.
    d. Give the value of $f'$ at each of the points found in part c.

9. The graphs of a function $f$ and its derivative $f'$ are given on the same coordinate axes. Label the graphs as $f$ or $f'$ and state the reasons for your choice.



10. Find $f''(x)$: $f(x) = \sqrt{2x^2 + 5}$.

11. Find the point(s) (if any) of horizontal tangent lines: $x^2 + xy + y^2 = 6$.

12. A balloon rises at the rate of 8 feet per second from a point on the ground 60 feet from an observer. Find the rate of change of the angle of elevation when the balloon is 25 feet above the gro

# Answers to CHAPTER 2 Tests

**Test Form A**

| | | | |
|---|---|---|---|
| 1. c | 2. d | 3. b | 4. c |
| 5. d | 6. a | 7. b | 8. b |
| 9. d | 10. e | 11. c | 12. a |
| 13. d | 14. b | 15. b | |

**Test Form B**

| | | | |
|---|---|---|---|
| 1. b | 2. d | 3. a | 4. d |
| 5. a | 6. c | 7. a | 8. c |
| 9. b | 10. b | 11. d | 12. b |
| 13. c | 14. c | 15. c | |

**Test Form C**

| | | | |
|---|---|---|---|
| 1. d | 2. b | 3. d | 4. c |
| 5. a | 6. c | 7. a | 8. c |
| 9. d | 10. c | 11. b | 12. b |
| 13. a | 14. a | 15. c | |

**Test Form D**

1. $-\frac{1}{x^2}$ 2. $\frac{6x^2+2}{(1-3x^2)^2}$ 3. $\frac{x^2(7x+3)}{\sqrt{2x+1}}$

4. $\frac{-3\cot^2\sqrt{x}\left(\csc^2\sqrt{x}\right)}{2\sqrt{x}}$ 5. $\frac{-2}{(2-x)^3}$

6. 42 ft/sec$^2$ 7. $\frac{y}{(x+y)^2+x}$ 8. $-\csc y$

9. $2\theta \sec\theta^2 \tan\theta^2$ 10. $2\sin 2x$

11. $x-4y=-5$ 12. $\frac{1}{3}, 1$ 13. $4x-\frac{1}{x^2}$

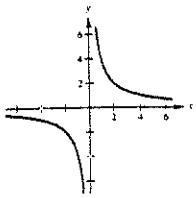
14. a. $s=-16t^2-26t+220$ b. $-58$ ft/sec

15. $\frac{1}{\pi}$ in/sec

**Test Form E**

1. a. no derivative b. negative c. zero
   d. positive e. zero

2. a. $-\frac{4}{x^2}$ b. $-1$ c. $y=-x-4$
   d.



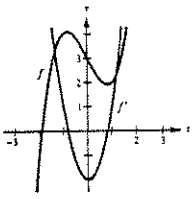
3. $\left(-\frac{1}{2}, -\frac{2}{3}\right)$ and $\left(\frac{1}{2}, \frac{2}{3}\right)$

4. a. $-64$ ft/sec b. $-96$ ft/sec
   c. $\frac{5\sqrt{30}}{4}$ sec $\approx 6.85$ sec
   d. $-40\sqrt{30}$ ft/sec $\approx -219.09$ ft/sec

5. $4\pi$ ft$^2$ 6. 5 sec $x(2\sec^2 x-1)$ 7. $\frac{6+2\sqrt{3}\pi}{3}$

8. a. $5x^4-5$
   c. $(-1, 4)$ and $(1, -4)$
   d. 0

9.



The derivative of $f$ is zero if its tangent line is horizontal.

10. $\frac{10}{(2x^2+5)^{3/2}}$

11. $\left(\sqrt{2}, -2\sqrt{2}\right)$ and $\left(-\sqrt{2}, 2\sqrt{2}\right)$

12. $\frac{96}{845}$ rad/sec

Test

Pg. 150 / 1, 2, 5 → 24, 27 → 29, 31 → 34, 43 → 48,
53 → 66, 68, 71, 86