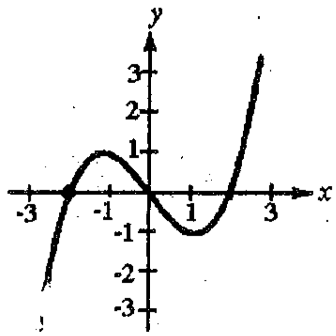
CHAPTER II REVIEW
Multiple Choice

NAME ______________________________

1. Determine whether the slope at the indicated point is positive, negative, or zero.
   (a) Negative
   (b) Positive
   (c) No slope
   (d) Zero
   (e) None of these



2. If $f(2) = 3$ and $f'(2) = -1$, find an equation of the tangent line when $x = 2$.
   (a) $y - 3 = 2(x + 1)$
   (b) $y - 2 = 3(x + 1)$
   (c) $y - 3 = -1(x - 2)$
   (d) $y + 1 = 2(x - 2)$
   (e) None of these

3. Find $f'(x)$: $f(x) = 4x^4 - 5x^3 + 2x - 3$.
   (a) $4x^3 - 5x^2 + 2$
   (b) $16x^3 - 15x^2 + 2$
   (c) $16x^3 - 15x^2 + 2x - 3$
   (d) $4x^4 - 5x^3 + 2x$
   (e) None of these

4. Find $f'(x)$: $f(x) = \frac{x^2 - 3x}{x^2}$.

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

(b) $\frac{2x - 3}{2x}$

(c) $1 - \frac{3}{x}$

(d) $\frac{3}{x^2}$

(e) None of these

5. Find the derivative of x^{-8}.

(a) $-\frac{8}{x^9}$

(b) $\frac{1}{x^9}$

(c) $-\frac{8}{x^7}$

(d) -8

(e) None of these

6. Let $g(x) = 9f(x)$ and let $f'(-6) = -6$. Find $g'(-6)$.

(a) -54

(b) 0

(c) -6

(d) 9

(e) None of these

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

(a) $\frac{3}{2}$

(b) -2

(c) $\frac{z^2 - 2}{2z^2}$

(d) $\frac{-1}{z^2}$

(e) None of these

8. 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, 3)
   (b) (0, -2)
   (c) (1, 0), (0, -2)
   (d) (2, 2)
   (e) None of these

9. 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

10. Find $\frac{dy}{dx}$: $y = 4 \sin x - 5 \cos x + x$.
   (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

11. Differentiate: $f(x) = x^2 + 2 \tan x$.
   (a) $2x + 2 \tan x$
   (b) $2x + \sec^2 x$
   (c) $2 + \sec^2 x$
   (d) $2x + 2 \sec^2 x$
   (e) None of these

12. Find $\frac{d^2y}{dx^2}$ for $y = \frac{x+3}{x-1}$.
(a) 0
(b) $\frac{-8}{(x-1)^3}$
(c) $\frac{-4}{(x-1)^3}$
(d) $\frac{8}{(x-1)^3}$
(e) None of these

13. Let $f(7) = 0$, $f'(7) = 14$, $g(7) = 1$ and $g'(7) = \frac{1}{7}$. Find $h'(7)$ if $h(x) = f(x)/g(x)$.
(a) 98
(b) -14
(c) -2
(d) 14
(e) None of these

14. If $f''(x) = 3x^2 + 6x + 4$, find $f^{(4)}(x)$.
(a) 0
(b) 6
(c) $2x + 6$
(d) $6x + 6$
(e) None of these

15. Find $\frac{dy}{dx}$ for $y = x^3\sqrt{x+1}$.
(a) $\frac{3x^2}{2\sqrt{x+1}}$
(b) $\frac{x^2(7x+6)}{2\sqrt{x+1}}$
(c) $3x^2\sqrt{x+1}$
(d) $\frac{7x^3 + x^2}{2\sqrt{x+1}}$
(e) None of these

16. Find the derivative of $f(x) = -8(1 - x)^2 + 7(1 - x) + 2$.
    (a) $-16x + 16$
    (b) $16(1 - x) - 7$
    (c) $9(1 - x)$
    (d) $-16(1 - x) - 7$
    (e) None of these

17. 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

18. 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

19. 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

20. Find $f''(x)$ if $f(x) = \sin x^2$.
   (a) $2(\cos x^2 - 2x^2 \sin x^2)$
   (b) $-4x \sin x^2$
   (c) $2x \cos x^2$
   (d) $2(\cos x^2 - x \sin x^2)$
   (e) None of these

21. Find $\frac{dy}{dx}$ if $y^2 - 3xy + x^2 = 7$.
   (a) $\frac{2x + y}{3x - 2y}$
   (b) $\frac{3y - 2x}{2y - 3x}$
   (c) $\frac{2x}{3 - 2y}$
   (d) $\frac{2x}{y}$
   (e) None of these

22. Find $\frac{dy}{dx}$ if $y = \sin(x + y)$.
   (a) 0
   (b) $\frac{\cos(x + y)}{1 - \cos(x + y)}$
   (c) $\cos(x + y)$
   (d) 1
   (e) None of these

23. Find an equation of the tangent line to the graph of $x^2 + 2y^2 = 3$ at the point (1, 1).
   (a) $y - 1 = -\frac{x}{zy}(x - 1)$
   (b) $y + 1 = -\frac{1}{2}(x + 1)$
   (c) $y - 1 = \frac{1}{2}(x - 1)$
   (d) $x + 2y = 3$
   (e) None of these

24. Find $\frac{dy}{dx}$, then evaluate the derivative at the point (0, 2): $x^2 - 2xy = y^2 - 4$.
(a) -1
(b) 3
(c) 1
(d) $\frac{1}{2}$
(e) None of these

25. 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 128π 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

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

27. As a balloon in the shape of a sphere is being blown up, the radius is increasing $\frac{1}{\pi}$ inches per second. At what rate is the volume increasing when the radius is 1 inch?

(a) 4π in.^{3}/sec
(b) 3 in.^{3}/sec
(c) 4 in.^{3}/sec
(d) 3π in.^{3}/sec
(e) None of these

28. Two boats leave the same port at the same time with one boat traveling north at 15 knots per hour and the other boat traveling west at 12 knots per hour. How fast is the distance between the two boats changing after 2 hours?

(a) 19.2 knots/hr
(b) 26.8 knots/hr
(c) 17.7 knots/hr
(d) 38.4 knots/hr
(e) None of these

29. The radius of a circle is increasing at the rate of 2 feet per minute. Find the rate at which the area is increasing when the radius is 7 feet.

(a) 28 ft^2/min
(b) 49π ft^2/min
(c) 14π ft^2/min
(d) 28π ft^2/min
(e) None of these

Open-Ended Questions

30. Use the definition of a derivative to calculate the derivative of $f(x) = x^2 + x$.

31. Find the slope of the tangent line to the graph of $f(x) = -x + 3$ when $x = 2$.

32. Consider $f(x) = \sqrt{x}$.

a. Use the definition of the derivative to calculate the derivate of f.
b. Find the slope of the tangent line to the graph of f at the point $(4, 2)$.
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.

33. Find the average rate of change of y with respect to x on the interval $[2, 3]$, where $y = x^3 + 2$.

34. 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?

35. 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.

36. Differentiate: $y = \dfrac{2x}{(1 - 3x^2)^2}$.

37. Find $f'(\theta)$: $f(\theta) = \theta \cot \theta$.

38. Find y'' for $y = \frac{\csc x}{2}$.

39. Find the derivative: $f(t) = \frac{t}{1 - \cos t}$.

40. Find the derivative of $y = \sqrt[3]{x^2 + x}$.

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

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

43. Find $\frac{dy}{dx}$ for the equation $x^3 - 2x^2 y + 3xy^2 = 38$.

44. Find $\frac{d^2 y}{dx^2}$ in terms of x and y: $y^3 - xy = 5$.

45. Find an equation of the line tangent to the curve $2x^2 - y^2 = 1$ at the point (5, 7).

46. 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?

47. The formula for the volume of a tank is $V = 2\pi r^3$ where r is the radius of the tank. If the radius is increasing at the rate of $\frac{3}{2}$ feet per minute, find the rate at which the volume is increasing when the radius is 3 feet.

48. Assume x and y are both differentiable functions of t. Find $\frac{dx}{dt}$ given $y = -1$ and $\frac{dy}{dt} = 12$: $2x^3 + y^2 = 3$.

49. A metal cube contracts when it is cooled. If the edge of the cube is decreasing at a rate 0.2 cm/hr, how fast is the volume changing when the edge is 60 centimeters.