

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Differentiate.

1)  $y = 9x(4x^2 - 3x)$  1) \_\_\_\_\_  
 A)  $72x^2 - 54x$  B)  $72x^2 - 27x$  C)  $108x^2 - 27x$  D)  $108x^2 - 54x$

2)  $y = (1 - 8x^2)(6x^2 - 192)$  2) \_\_\_\_\_  
 A)  $-192x^4 + 3084x^2$  B)  $48x^3 + 1542x$   
 C)  $-192x^3 + 3084$  D)  $-192x^3 + 3084x$

3)  $f(x) = (6x - 2)(2x + 1)$  3) \_\_\_\_\_  
 A)  $24x - 10$  B)  $24x + 1$  C)  $12x + 2$  D)  $24x + 2$

4)  $f(x) = (5x^3 + 6)(5x^7 - 4)$  4) \_\_\_\_\_  
 A)  $20x^9 + 210x^6 - 60x$  B)  $250x^9 + 210x^6 - 60x^2$   
 C)  $250x^9 + 210x^6 - 60x$  D)  $20x^9 + 210x^6 - 60x^2$

5)  $f(x) = (5x - 4)(2x^3 - x^2 + 1)$  5) \_\_\_\_\_  
 A)  $40x^3 - 39x^2 + 8x + 5$  B)  $30x^3 + 39x^2 - 13x + 5$   
 C)  $40x^3 - 13x^2 + 39x + 5$  D)  $10x^3 + 13x^2 - 39x + 5$

6)  $f(x) = (6x + 4)^2$  6) \_\_\_\_\_  
 A)  $36x + 24$  B)  $12x + 8$  C)  $36x + 16$  D)  $72x + 48$

7)  $f(x) = (4x - 1)(\sqrt{x} + 4)$  7) \_\_\_\_\_  
 A)  $2\sqrt{x} - \frac{1}{2\sqrt{x}} + 16$  B)  $2\sqrt{x} + \frac{1}{2\sqrt{x}} + 16$   
 C)  $6\sqrt{x} - \frac{1}{2\sqrt{x}} + 16$  D)  $6\sqrt{x} + \frac{1}{2\sqrt{x}} + 16$

8)  $F(r) = r^2(r - 1)(r + 1)^{-1}$  8) \_\_\_\_\_  
 A)  $2r(r^2 + r - 1)$  B)  $\frac{-2r}{(r + 1)^2}$   
 C)  $(2r^3 + 2r^2 - 2r)(r + 1)^{-2}$  D)  $4r^3 - 2r$

9)  $y = x^2 + 4x(x^{3/2})$

9) \_\_\_\_\_

A)  $(x^2 + 4x)\left(\frac{3}{2x^{1/2}}\right) + (x^{3/2})(2x + 4)$

B)  $6x(x^{1/2}) + 4x^{3/2}$

C)  $2x + 10x^{3/2}$

D)  $\frac{x^{3/2}(2x + 4) - (x^2 + 4x)\left(\frac{3}{2x^{1/2}}\right)}{(x^{3/2})x^2}$

10)  $g(x) = (x^3 + 1)(3x^2 - 1)$

10) \_\_\_\_\_

A)  $-3x^4 + 3x^2 + 6x$

B)  $-3x^4 - 3x^2 + 6x$

C)  $3x^4 - 3x^2 - 6x$

D)  $15x^4 - 3x^2 + 6x$

11)  $f(x) = (-3x^7 - x^4)(2x^2 - 5x + 3)$

11) \_\_\_\_\_

A)  $-84x^7 - 105x^6 + 16x^4 + 20x^3$

B)  $-84x^7 + 105x^6 - 16x^4 + 20x^3$

C)  $30x^8 - 90x^7 + 63x^6 + 4x^5 - 15x^4 + 12x^3$

D)  $-54x^8 + 120x^7 - 63x^6 - 12x^5 + 25x^4 - 12x^3$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

12)  $f(x) = (x^5 - 8x^2 + 5)(x^3 + \sqrt{x} - 1)$  at  $x = 1$   
Enter just an integer.

12) \_\_\_\_\_

13)  $f(x) = (x^2 + 1)^3(x^3 - 1)^2$  at  $x = -1$   
Enter just an integer.

13) \_\_\_\_\_

14)  $f(x) = (x^2 + x)(3x^2 + 4x - 1)$  at  $x = 1$   
Enter just an integer.

14) \_\_\_\_\_

15)  $f(x) = (4x^2 + 4)(2x^2 + 2x)$  at  $x = 1$   
Enter just an integer.

15) \_\_\_\_\_

16)  $f(x) = (x^3 - 2)^3(x^3 + 2)^4$  at  $x = -1$   
Enter just an integer.

16) \_\_\_\_\_

17)  $f(x) = (2x + 1)(3x - 2)^2$  at  $x = 1$   
Enter just an integer.

17) \_\_\_\_\_

18)  $f(x) = x^5 \cdot \frac{x - 1}{x + 1}$  at  $x = 1$

18) \_\_\_\_\_

Enter just a reduced fraction.

- 19) Find the slope of the tangent line to  $f(x) = 4(x^3 + 1)(2x^2 + 2x + 1)^4$  at  $(-1, f(-1))$ .  
Enter just an integer.

19) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Write an equation of the tangent line to the graph of  $y = f(x)$  at the point on the graph where  $x$  has the indicated value.

20)  $f(x) = (4x^2 - 5x - 2)(-2x - 3)$ ,  $x = 0$

20) \_\_\_\_\_

A)  $y = \frac{1}{19}x - 6$

B)  $y = 19x - 6$

C)  $y = 19x + 6$

D)  $y = \frac{1}{19}x + 6$

Find  $\frac{d^2y}{dx^2}$ .

21)  $y = (x^2 + 1)^7$

21) \_\_\_\_\_

A)  $(182x^2 + 14)(x^2 + 1)^5$

B)  $(168x^2 + 14)(x^2 + 1)^6$

C)  $(182x - 14)(x^2 + 1)^5$

D)  $(168x^2 - 14)(x^2 + 1)^5$

A function  $h(x)$  is defined in terms of a differentiable  $f(x)$ . Find an expression for  $h'(x)$ .

22)  $h(x) = (2x^2 + 3x + 9)f(x)$

22) \_\_\_\_\_

A)  $(2x^2 + 3x + 9)f'(x)$

B)  $(4x + 3)f(x) + (2x^2 + 3x + 9)f'(x)$

C)  $(4x + 3)f'(x)$

D)  $(2x^2 + 3x + 9)f(x) + (4x + 3)f'(x)$

Compute the derivative.

- 23) If  $f(x)$  and  $g(x)$  are differentiable functions such that  $f(1) = 3$ ,  $f'(1) = -6$ ,  $g(1) = 7$ ,  $g'(1) = -3$ , compute the following derivative: 23) \_\_\_\_\_

$$\left. \frac{d}{dx} [f(x)g(x)] \right|_{x=1}$$

A) 33

B) 51

C) -39

D) -51

- 24) If  $f(x)$  and  $g(x)$  are differentiable functions such that  $f(2) = 6$ ,  $f'(2) = 2$ ,  $g(2) = -1$ ,  $g'(2) = -5$ , compute the following derivative: 24) \_\_\_\_\_

$$\left. \frac{d}{dx} [f(x)g(x)] \right|_{x=2}$$

A) -28

B) 32

C) -32

D) 17

Differentiate.

25)  $y = \frac{x}{8x - 5}$

25) \_\_\_\_\_

A)  $-\frac{5}{(8x - 5)^2}$

B)  $-\frac{5x}{(8x - 5)^2}$

C)  $\frac{16x - 5}{(8x - 5)^2}$

D)  $-\frac{5}{8x - 5}$

26)  $y = \frac{9x - 4}{6x^2 + 1}$  26) \_\_\_\_\_

A)  $\frac{54x^3 - 108x^2 + 57x}{(6x^2 + 1)^2}$

B)  $\frac{-54x^2 + 48x + 9}{(6x^2 + 1)^2}$

C)  $\frac{162x^2 - 48x + 9}{(6x^2 + 1)^2}$

D)  $\frac{-54x^2 + 39x + 13}{(6x^2 + 1)^2}$

27)  $y = \frac{7x + 7}{4x - 1}$  27) \_\_\_\_\_

A)  $\frac{21}{4x - 1}$

B)  $-\frac{35}{(4x - 1)^2}$

C)  $-\frac{35x}{(4x - 1)^2}$

D)  $\frac{56x + 21}{(4x - 1)^2}$

28)  $q(t) = \frac{3t}{t^2 - 7t - 6}$  28) \_\_\_\_\_

A)  $\frac{-3(t^2 - 7t + 6)}{(t^2 - 7t - 6)^2}$

B)  $\frac{-3t^2}{(t^2 - 7t - 6)^2}$

C)  $\frac{-3(t^2 + 6)}{(t^2 - 7t - 6)^2}$

D)  $\frac{3}{2t - 7}$

29)  $f(x) = \frac{x + 2}{x - 2}$  29) \_\_\_\_\_

A)  $\frac{2}{x - 2}$

B)  $\frac{-4}{(x - 2)^2}$

C)  $\frac{-2}{(x - 2)^2}$

D)  $\frac{-4}{(x + 2)^2}$

30)  $y = \frac{\sqrt{x} + 5}{\sqrt{x} - 5}$  30) \_\_\_\_\_

A)  $-\frac{5}{\sqrt{x}(\sqrt{x} - 5)^2}$

B)  $-\frac{5\sqrt{x}}{(\sqrt{x} - 5)^2}$

C)  $\frac{5}{2\sqrt{x}(\sqrt{x} - 5)^2}$

D)  $-\frac{\sqrt{x} + 5}{(\sqrt{x} - 5)^2}$

31)  $f(t) = \frac{t^3}{\sqrt{t} - 5}$  31) \_\_\_\_\_

A)  $\frac{5t^3 - 30t^2}{2(\sqrt{t} - 5)^2}$

B)  $\frac{5t^{5/2} - 30t^2}{2(\sqrt{t} - 5)^2}$

C)  $\frac{5t^3 - 30t^2}{2\sqrt{t}(\sqrt{t} - 5)^2}$

D)  $\frac{t^{5/2} - 15t^2}{2(\sqrt{t} - 5)^2}$

32)  $h(r) = \frac{r^2 + 8r - 5}{3r + 8}$  32) \_\_\_\_\_

A)  $\frac{3r^2 + 16r + 79}{3r + 8}$

B)  $\frac{3r^2 + 16r + 79}{(3r + 8)^2}$

C)  $\frac{2r + 8}{3}$

D)  $\frac{3r^2 + 18r + 79}{(3r + 8)^2}$

33)  $y = \frac{x+1}{x^2-1}$  33) \_\_\_\_\_

A)  $\frac{x^3+x^2-x-1}{(x^2-1)^2}$  B)  $\frac{1}{2x}$  C)  $-\frac{1}{(x-1)^2}$  D) none of these

34)  $f(x) = \frac{2x-7}{3x-2}$  34) \_\_\_\_\_

A)  $-\frac{17}{(2x-7)^2}$  B)  $\frac{17}{(3x-2)^2}$  C)  $\frac{17}{(2x-7)^2}$  D)  $-\frac{17}{(3x-2)^2}$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

35)  $f(x) = \frac{x^2}{x^3-5x+2}$  at  $x = -1$  35) \_\_\_\_\_

Enter a reduced fraction only.

36)  $f(x) = \frac{x^2}{x+1}$  at  $x = 2$  36) \_\_\_\_\_

Enter just a reduced fraction.

37)  $f(x) = \frac{6x-7}{x^2+5}$  at  $x = -1$  37) \_\_\_\_\_

Enter just a reduced fraction.

38) Find the slope of the tangent line to  $f(x) = \frac{x}{x^2+1}$  at  $(2, f(2))$ . 38) \_\_\_\_\_

Enter just a reduced fraction.

39) Find the slope of the tangent line to  $f(x) = \frac{1}{x^2+1}$  at  $(-1, f(-1))$ . 39) \_\_\_\_\_

Enter a reduced fraction.

40) Find the slope of the tangent line to  $f(x) = \frac{x^2-1}{x+2}$  at  $(-1, f(-1))$ . 40) \_\_\_\_\_

Enter just an integer.

41) Find the slope of the tangent line to  $f(x) = \frac{x^6+4x^3+1}{x^3+1}$  at  $(1, f(1))$ . 41) \_\_\_\_\_

Enter just a reduced fraction of form  $\frac{a}{b}$ .

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

42) Find the equation of the tangent line to the graph of the function  $f(x) = \frac{x-3}{3x-5}$  at  $x = 1$ . 42) \_\_\_\_\_

A)  $y = -3x + 4$

B)  $y = 3x - 2$

C)  $y = x$

D)  $y = \frac{3}{2}x - \frac{1}{2}$

43) Find the values of  $x$  where the tangent line is horizontal for the graph of  $f(x) = \frac{4x^2}{x+2}$ . 43) \_\_\_\_\_

A)  $x = -2, x = 0, x = -4$

B)  $x = 0, x = -2$

C)  $x = 0, x = -4$

D)  $x = -2$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

44) Find all  $x$ -coordinates of points  $(x, y)$  on the graph of  $Q(x) = \frac{x^3}{(x+2)^5}$  where the tangent line is horizontal. Enter your answer as just a, or a, b where these are integers and  $a < b$ . 44) \_\_\_\_\_

line is horizontal. Enter your answer as just a, or a, b where these are integers and  $a < b$ .

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Write an equation of the tangent line to the graph of  $y = f(x)$  at the point on the graph where  $x$  has the indicated value.

45)  $f(x) = \frac{-8x^2 - 8}{4x - 2}$ ,  $x = 0$  45) \_\_\_\_\_

A)  $y = -8x + 4$

B)  $y = 8x - 4$

C)  $y = -8x - 4$

D)  $y = 8x + 4$

Find the second derivative of the function.

46)  $y = \frac{x^4 + 1}{x^2}$  46) \_\_\_\_\_

A)  $1 + \frac{6}{x^4}$

B)  $2 + \frac{6}{x^4}$

C)  $2x - \frac{2}{x^3}$

D)  $2 - \frac{6}{x^4}$

A function  $h(x)$  is defined in terms of a differentiable  $f(x)$ . Find an expression for  $h'(x)$ .

47)  $h(x) = \frac{3x^2 + 4x - 5}{f(x)}$  47) \_\_\_\_\_

A)  $\frac{f'(x)(6x + 4) - f(x)(3x^2 + 4x - 5)}{[f(x)]^2}$

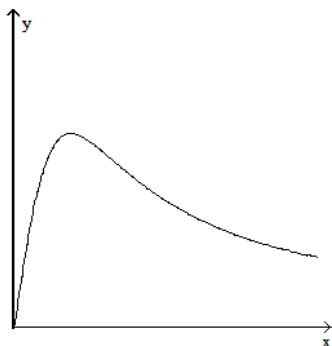
B)  $\frac{f'(x)(6x + 4) - f(x)(3x^2 + 4x - 5)}{f(x)}$

C)  $\frac{f(x)(6x + 4) - f'(x)(3x^2 + 4x - 5)}{(3x^2 + 4x - 5)^2}$

D)  $\frac{f(x)(6x + 4) - f'(x)(3x^2 + 4x - 5)}{[f(x)]^2}$

Find the maximum.

- 48) The graph below shows  $y = \frac{5x}{9 + x^2}$  for  $x \geq 0$ . Find the coordinates of the maximum point. 48) \_\_\_\_\_



- A)  $\left(3, \frac{5}{6}\right)$       B)  $\left(9, \frac{5}{3}\right)$       C)  $(9, 5)$       D)  $\left(3, \frac{5}{3}\right)$

Compute the derivative.

- 49) If  $f(x)$  and  $g(x)$  are differentiable functions such that  $f(1) = 3$ ,  $f'(1) = -5$ ,  $g(1) = 6$ ,  $g'(1) = -2$ , compute the following derivative: 49) \_\_\_\_\_

$$\frac{d}{dx} \left[ \frac{f(x)}{g(x)} \right] \bigg|_{x=1}$$

- A) - 4      B) - 6      C) - 1      D)  $-\frac{2}{3}$

- 50) If  $f(x)$  and  $g(x)$  are differentiable functions such that  $f(2) = 8$ ,  $f'(2) = 2$ ,  $g(2) = -1$ ,  $g'(2) = -5$ , compute the following derivative: 50) \_\_\_\_\_

$$\frac{d}{dx} \left[ \frac{f(x)}{g(x)} \right] \bigg|_{x=2}$$

- A) - 38      B) 38      C)  $\frac{38}{25}$       D) - 42

- 51) One hour after  $x$  milligrams of a particular drug are given to a person, the change in body 51) \_\_\_\_\_

temperature  $T(x)$ , in degrees Celsius, is given approximately by:  $T(x) = \frac{5x^2}{9} \left( 1 - \frac{x}{9} \right) - \frac{160}{9}$ ,  $0 \leq x \leq 6$ .

Find the sensitivity,  $T'(x)$ , of the body to a dosage of three milligrams.

- A)  $-\frac{10}{27}$  degree per milligram      B)  $-\frac{10}{9}$  degrees per milligram  
C)  $\frac{5}{3}$  degrees per milligram      D)  $-\frac{5}{3}$  degrees per milligram

- 52) A publishing company has published a new magazine for young adults. The monthly sales  $S$  (in thousands) is given by  $S(t) = \frac{800t}{t+2}$ , where  $t$  is the number of months since the first issue was published. Find  $S(3)$  and  $S'(3)$  and interpret the results. 52) \_\_\_\_\_
- A) At three months, the monthly sales are \$2,400,000 and increasing at 800,000 magazines per month.
- B) At three months, the monthly sales are \$480,000 and decreasing at 64,000 magazines per month.
- C) At three months, the monthly sales are \$2, 400,000 and increasing at 64,000 magazines per month.
- D) At three months, the monthly sales are \$480,000 and increasing at 64,000 magazines per month.

Solve the problem.

- 53) The total cost to produce  $x$  units of perfume is  $C(x) = (3x + 5)(9x + 2)$ . Find the marginal average cost function. 53) \_\_\_\_\_

A)  $27 - \frac{10}{x^2}$

B)  $27x + 51 + \frac{10}{x}$

C)  $54 - \frac{51}{x}$

D)  $54x + 51$

- 54) The total profit from selling  $x$  units of cookbooks is  $P(x) = (7x - 9)(9x - 4)$ . Find the marginal average profit function. 54) \_\_\_\_\_

A)  $63x - 36$

B)  $63x - 109$

C)  $63 - \frac{109}{x^2}$

D)  $63 - \frac{36}{x^2}$

- 55) The demand function for a certain product is given by: 55) \_\_\_\_\_

$$D(p) = \frac{4p + 300}{5p + 15}.$$

Find the marginal demand  $D'(p)$ .

A)  $D'(p) = \frac{1440}{(5p + 15)^2}$

B)  $D'(p) = \frac{-1440}{(5p + 15)^2}$

C)  $D'(p) = \frac{-1440}{5p + 15}$

D)  $D'(p) = \frac{1560 + 40p}{(5p + 15)^2}$

- 56) A rectangular steel plate expands as it is heated. Find the rate of change of area with respect to temperature  $T$  when the width is 1.7 cm and the length is 2.9 cm if  $dl/dt = 1.3 \times 10^{-5} \text{ cm}/^\circ\text{C}$  and  $dw/dt = 8.8 \times 10^{-6} \text{ cm}/^\circ\text{C}$ . 56) \_\_\_\_\_

A)  $4.9 \times 10^{-5} \text{ cm}^2/^\circ\text{C}$

B)  $2.2 \times 10^{-5} \text{ cm}^2/^\circ\text{C}$

C)  $1.1 \times 10^{-5} \text{ cm}^2/^\circ\text{C}$

D)  $4.8 \times 10^{-5} \text{ cm}^2/^\circ\text{C}$



57) The total revenue for the sale of  $x$  items is given by:

57) \_\_\_\_\_

$$R(x) = \frac{190\sqrt{x}}{3 + x^{3/2}}.$$

Find the marginal revenue  $R'(x)$ .

A)  $R'(x) = \frac{95(3x^{-1/2} - 2x)}{3 + x^{3/2}}$

B)  $R'(x) = \frac{95(3x^{1/2} - 2x)}{(3 + x^{3/2})^2}$

C)  $R'(x) = \frac{95(3x^{-1/2} + 4x)}{(3 + x^{3/2})^2}$

D)  $R'(x) = \frac{95(3x^{-1/2} - 2x)}{(3 + x^{3/2})^2}$

58) Murrel's formula for calculating the total amount of rest, in minutes, required after performing a particular type of work activity for 30 minutes is given by the formula  $R(w) = \frac{30(w - 4)}{w - 1.5}$ , where  $w$  is the work expended in kilocalories per min. A bicyclist expends 5 kcal/min as she cycles home from work. Find  $R'(w)$  for the cyclist; that is, find  $R'(5)$ .

58) \_\_\_\_\_

A) 6.12 min<sup>2</sup>/kcal      B) 4.9 min<sup>2</sup>/kcal      C) 8.57 min<sup>2</sup>/kcal      D) 7.35 min<sup>2</sup>/kcal

59) The population  $P$ , in thousands, of a small city is given by:

59) \_\_\_\_\_

$$P(t) = \frac{600t}{2t^2 + 3}.$$

where  $t$  = the time, in months. Find the growth rate.

A)  $P'(t) = \frac{600(3 - 2t^2)}{(2t^2 + 3)^2}$

B)  $P'(t) = \frac{600(2t^2 - 3)}{(2t^2 + 3)^2}$

C)  $P'(t) = \frac{600(3 + 6t^2)}{(2t^2 + 3)^2}$

D)  $P'(t) = \frac{600(3 - 2t^2)}{2t^2 + 3}$

Compute  $f(g(x))$  for the given  $f(x)$  and  $g(x)$ .

60)  $f(x) = \frac{5}{x - 7}$  and  $g(x) = \frac{8}{5x}$

60) \_\_\_\_\_

A)  $\frac{25x}{8 - 35x}$

B)  $\frac{25x}{8 + 35x}$

C)  $\frac{8x - 56}{25x}$

D)  $\frac{5x}{8 - 35x}$

61)  $f(x) = 4x^2$  and  $g(x) = \frac{7}{x}$

61) \_\_\_\_\_

A)  $\frac{4x^2}{49}$

B)  $\frac{7}{4x^2}$

C)  $\frac{196}{x^2}$

D)  $\frac{4x^2}{7}$

62)  $f(x) = \sqrt[5]{x - 3}$  and  $g(x) = x^5 + 3$

62) \_\_\_\_\_

A)  $x^5$

B)  $-x$

C)  $x$

D)  $1$

63) The following function may be viewed as a composite function  $f(g(x))$ . Find  $f(x)$  and  $g(x)$ .

63) \_\_\_\_\_

$$(3x^2 - 2x + 1)^6$$

A)  $f(x) = x^6$

$g(x) = 3x^2 - 2x + 1$

C)  $f(x) = x$

$g(x) = 3x^2 - 2x + 1$

B)  $f(x) = x^6$

$g(x) = (3x^2 - 2x + 1)^6$

D)  $f(x) = 3x^2 - 2x + 1$

$g(x) = x^6$

64) The following function may be viewed as a composite function  $f(g(x))$ . Find  $f(x)$  and  $g(x)$ .

64) \_\_\_\_\_

$$\frac{1}{x^2 + 2x - 3}$$

A)  $f(x) = x^2 + 2x - 3$

$g(x) = \frac{1}{x}$

C)  $f(x) = \frac{1}{x}$

$g(x) = x^2 + 2x - 3$

B)  $f(x) = \frac{1}{x}$

$g(x) = \frac{1}{x^2 + 2x - 3}$

D)  $f(x) = x$

$g(x) = x^2 + 2x - 3$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

65) Let  $f(x) = \frac{x^2 - x}{x}$ ,  $g(x) = \frac{1}{\sqrt{x}}$ . Compute  $f(g(x))$  at  $x = 4$ .

65) \_\_\_\_\_

Enter just a reduced fraction.

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Express the given function  $H$  as a composition of two functions  $f(x)$  and  $g(x)$  such that  $H(x) = f(g(x))$ .

66)  $H(x) = \frac{1}{x^2 - 4}$

66) \_\_\_\_\_

A)  $f(x) = \frac{1}{x^2}$ ,  $g(x) = x - 4$

B)  $f(x) = \frac{1}{4}$ ,  $g(x) = x^2 - 4$

C)  $f(x) = \frac{1}{x^2}$ ,  $g(x) = -\frac{1}{4}$

D)  $f(x) = \frac{1}{x}$ ,  $g(x) = x^2 - 4$

67)  $H(x) = \frac{8}{x^2} + 7$

67) \_\_\_\_\_

A)  $f(x) = x + 7$ ,  $g(x) = \frac{8}{x^2}$

B)  $f(x) = \frac{1}{x}$ ,  $g(x) = \frac{8}{x} + 7$

C)  $f(x) = x$ ,  $g(x) = \frac{8}{x} + 7$

D)  $f(x) = \frac{8}{x^2}$ ,  $g(x) = 7$

68)  $H(x) = \frac{9}{\sqrt{10x+9}}$

68) \_\_\_\_\_

A)  $f(x) = \sqrt{10x+9}$ ,  $g(x) = 9$

B)  $f(x) = 9$ ,  $g(x) = \sqrt{10x+9}$

C)  $f(x) = \frac{9}{x}$ ,  $g(x) = 10x+9$

D)  $f(x) = \frac{9}{\sqrt{x}}$ ,  $g(x) = 10x+9$

69)  $H(x) = (8x-11)^6$

69) \_\_\_\_\_

A)  $f(x) = 8x-11$ ,  $g(x) = x^6$

B)  $f(x) = (8x)^6$ ,  $g(x) = -11$

C)  $f(x) = 8x^6$ ,  $g(x) = x-11$

D)  $f(x) = x^6$ ,  $g(x) = 8x-11$

Provide an appropriate response.

70) If  $f(x)$  and  $g(x)$  are differentiable functions, find  $g(x)$  given that  $f'(x) = \frac{1}{x^2}$  and

70) \_\_\_\_\_

$\frac{d}{dx}f(g(x)) = \frac{6x}{(3x^2-1)^2}$

A)  $g(x) = (3x^2-1)^2$

B)  $g(x) = \frac{1}{3x^2-1}$

C)  $g(x) = \frac{6x}{3x^2-1}$

D)  $g(x) = 3x^2-1$

71) If  $f(x)$  and  $g(x)$  are differentiable functions such that  $f(2) = -5$ ,  $f'(2) = 6$ ,  $f'(5) = -4$ ,  $g(2) = 5$ ,  $g'(2) = 2$ , and  $g'(5) = 0$ , find  $\frac{d}{dx}f(g(x))|_{x=2}$ .

71) \_\_\_\_\_

A) 30

B) 12

C) -60

D) -8

72) If  $f(x) = \frac{1}{x^3+x^2}$ , find  $f'(x)$ .

72) \_\_\_\_\_

A)  $-\frac{3x+2}{x^3(x+1)^2}$

B)  $-\frac{2x+1}{x^2(x+1)^2}$

C)  $\frac{1}{x^3+x^2}$

D)  $\frac{1}{(x^3+x^2)^2}$

73) If  $y = (\sqrt[3]{x}+1)^5$ , find  $\frac{dy}{dx}$ .

73) \_\_\_\_\_

A)  $5(\sqrt[3]{x}+1)^4 \sqrt[3]{x}$

B)  $5(\sqrt[3]{x}+1)^4$

C)  $\frac{5}{3}(\sqrt[3]{x}+1)^4 x^{-2/3}$

D)  $\frac{1}{3}(\sqrt[3]{x}+1)^4 x^{-2/3}$

E) none of these

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

74) Differentiate:  $f(x) = ((x^5 + 2)^3 + 1)^4$  at  $x = -1$ . 74) \_\_\_\_\_  
Enter just an integer.

75) Use the chain rule to compute the derivative of  $\frac{(3x + 1)^3}{(3x + 1)^3 + 1}$  at  $x = -1$ . 75) \_\_\_\_\_  
Enter just a reduced fraction.

76) Use the chain rule to find the derivative of  $\sqrt{6x^3 - 2x}$  at  $x = 1$ . 76) \_\_\_\_\_  
Enter just an integer.

77) The radius,  $r$ , of a sphere is increasing. For what value of  $r$  is  $\frac{dV}{dt}$  equal to  $64\pi$  times the rate of increase of  $r$ . Enter just an integer. 77) \_\_\_\_\_

78) Find the equation of the line tangent to the graph of  $y = x(x - 5)^4$  at the point  $(3, 48)$ . 78) \_\_\_\_\_  
Enter your answer in standard point-slope form.

79) Find the slope of the tangent line to the graph of  $y = \frac{x}{\sqrt{8 - x^2}}$  at the point  $(2, 1)$ . 79) \_\_\_\_\_  
Enter just an integer.

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

80) Let  $f(x) = x^3$ . Using the chain rule, find an expression for the derivative of  $[f(g(x))]$ . 80) \_\_\_\_\_  
A)  $3x^2 g'(x)^3$   
B)  $3[g(x)]^2$   
C)  $3[g(x)]^2 g'(x)$   
D)  $g'(x)^3$   
E) none of these

81) Let  $g(x) = \sqrt{x}$ . Using the chain rule, find an expression for the derivative of  $[g(f(x))]$ . 81) \_\_\_\_\_  
A)  $\frac{1}{2\sqrt{x}} f'(\sqrt{x})$   
B)  $\sqrt{x} f'(x) + \frac{1}{2}x^{-1/2} f(x)$   
C)  $\sqrt{x} f(\sqrt{x})$   
D)  $\frac{1}{2\sqrt{f(x)}} f'(x)$   
E) none of these

82) If  $f(x) = x^2 - 9$  and  $g(x) = x^2 - 16$ , find  $\frac{d}{dx} g(f(x))$ . 82) \_\_\_\_\_

A)  $(x^2 - 9)^2 - 16$

B)  $4x^3 - 36x$

C)  $4x^3 - 50x^2$

D)  $((x^2 - 9)^2 - 16)(2x)$

83) If  $f(x) = \frac{3}{x} + x^3$  and  $g(x) = 1 - x^2$ , find  $\frac{d}{dx} f(g(x))$ . 83) \_\_\_\_\_

A)  $\frac{6x}{x^2} - 6x^2$

B)  $\frac{6x}{(1 - x^2)^2} - 6x(1 - x^2)^2$

C)  $\left[ -\frac{6}{x} - 2x^3 \right] \left[ -\frac{3}{x^2} + 3x^2 \right]$

D)  $-\frac{3}{(1 - x^2)^2} + 3(1 - x^2)^2$

84) If  $f(x) = x(x - 1)^5$  and  $g(x) = x^2$ , find  $\frac{d}{dx} f(g(x))$ . 84) \_\_\_\_\_

A)  $2x(x^2 - 1)^5 + 10x^2(x^2 - 1)^4$

B)  $2x(x^2 - 1)^5 + 10x^3(x^2 - 1)^4$

C)  $2x(x^2 - 1)^5 + 10x^3(x^2 - 1)$

D)  $(x^2 - 1)^5 + 5x^2(x^2 - 1)^4$

85) If  $y = \sqrt{u}$  and  $u = x^3 - 5x^2 + 1$ , find  $\frac{dy}{dx}$ . 85) \_\_\_\_\_

A)  $\sqrt{3x^2 - 10x} (x^3 - 5x^2 + 1)$

B)  $\frac{3x^2 - 10x}{2\sqrt{x^3 - 5x^2 + 1}}$

C)  $\sqrt{x^3 - 5x^2 + 1}$

D)  $\sqrt{3x^2 - 10x}$

86) If  $y = 3u + 2$  and  $u = \frac{t}{t + 1}$ , find  $\frac{dy}{dt}$ . 86) \_\_\_\_\_

A)  $\frac{1}{(3u + 2)^2}$

B)  $\frac{3}{(t + 1)^2}$

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

D)  $\frac{1}{9}$

87) If  $y = u + 1 - 8^{1/3}$  and  $u = \frac{t}{6} + 1$ , find  $\frac{dy}{dt}$ . 87) \_\_\_\_\_

A)  $-\frac{1}{6t^2} \cdot 8^{-2/3}$

B)  $-\frac{t^2}{6}$

C)  $-2 \cdot 8^{-2/3}$

D)  $\frac{1}{6}$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

88) Compute  $\frac{dy}{dx}$  using the chain rule where  $y = u^2$  and  $u = 3x + 4$ . 88) \_\_\_\_\_

Enter your answer as just a polynomial in x in standard form (no label).

89) Compute  $\frac{dy}{dx}$  using the chain rule where  $y = 4u^2 + 8u + 4$  and  $u = 3x + 1$ .

89) \_\_\_\_\_

Enter your answer as just a polynomial in x in standard form (no label).

90) Compute  $\frac{dy}{dx}$  using the chain rule where  $y = \frac{u^2}{u^2 + 1}$  and  $u = \sqrt{2x + 4}$  at  $x = 1$ .

90) \_\_\_\_\_

Enter just a reduced fraction.

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Differentiate.

91)  $f(x) = (3x + 4)^2$

A)  $3(3x + 4)$

B)  $6(3x + 4)$

C)  $2(3x + 4)$

D)  $6(3x + 4)^2$

91) \_\_\_\_\_

92)  $f(x) = (8x + 5)^4$

A)  $8(8x + 5)^3$

B)  $4(8x + 5)^3$

C)  $32(8x + 5)^4$

D)  $32(8x + 5)^3$

92) \_\_\_\_\_

93)  $f(x) = (2x^2 - 7)^4$

A)  $16x(2x^2 - 7)^3$

B)  $4(2x^2 - 7)^3$

C)  $16(2x^2 - 7)^3$

D)  $(16x - 7)(2x^2 - 7)^3$

93) \_\_\_\_\_

94)  $f(x) = \sqrt{1 - 16x}$

A)  $-\frac{8}{\sqrt{1 - 16x}}$

B)  $-\frac{16}{\sqrt{1 - 16x}}$

C)  $-\frac{8x}{\sqrt{1 - 16x}}$

D)  $\frac{1}{2\sqrt{1 - 16x}}$

94) \_\_\_\_\_

95)  $f(x) = \frac{1}{3x^2 - 3}$

A)  $-\frac{6x - 3}{(3x^2 - 3)^2}$

B)  $-\frac{6x}{(3x^2 - 3)^2}$

C)  $-\frac{1}{(3x^2 - 3)^2}$

D)  $-\frac{6x}{3x^2 - 3}$

95) \_\_\_\_\_

96)  $f(x) = \frac{1}{\sqrt{4x + 7}}$

A)  $-\frac{2}{(4x + 7)^{3/2}}$

B)  $-\frac{2}{(4x + 7)^{1/2}}$

C)  $-\frac{1}{2(4x + 7)^{3/2}}$

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

96) \_\_\_\_\_

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

A)  $\frac{11 - 3x^2}{2\sqrt{11x - x^3}}$

B)  $\frac{1}{2\sqrt{11 - 3x^2}}$

C)  $\frac{-3x^2}{\sqrt{11x - x^3}}$

D)  $\frac{1}{2\sqrt{11x - x^3}}$

97) \_\_\_\_\_

98)  $f(x) = \frac{1}{(4x^2 + 5x + 3)^3}$  98) \_\_\_\_\_

A)  $-\frac{3(8x + 5)}{(4x^2 + 5x + 3)^4}$  B)  $-\frac{3(8x + 5)}{(4x^2 + 5x + 3)^3}$

C)  $\frac{(8x + 5)}{(4x^2 + 5x + 3)^4}$  D)  $-\frac{3}{(4x^2 + 5x + 3)^4}$

99)  $f(x) = 5x(3x + 4)^2$  99) \_\_\_\_\_

A)  $5(3x + 4)^1(9x + 4)$  B)  $5(3x + 4)^1$

C)  $5(3x + 4)^2(5x + 4)$  D)  $5(9x + 4)^1$

100)  $f(x) = \left(\frac{2x + 3}{x - 2}\right)^4$  100) \_\_\_\_\_

A)  $\left(\frac{-28}{(x - 2)^2}\right)^3$  B)  $\frac{7(2x + 3)^3}{(x - 2)^5}$  C)  $\frac{-28(2x + 3)^3}{(x - 2)^5}$  D)  $\left(\frac{2x + 3}{x - 2}\right)^3$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

101) The cost of manufacturing  $x$  units is  $C$  dollars, where  $C = 4x + 6\sqrt{x} + 5$ . Weekly production at  $t$  weeks from the present is estimated to be  $x = 2800 + 100t$  units when  $t = 8$ . 101) \_\_\_\_\_

Find the time rate of change of cost,  $\frac{dC}{dt}$ . Enter just an integer.

102) When a manufacturer produces and sells  $x$  units per week, its weekly profit is  $P$  dollars, where  $P = 100(2000 + 120x - x^2)$ . Production level  $t$  weeks from the present will be  $x = \frac{t}{2} - 16$ . Find the rate of change in profit with respect to  $x$ . Enter your answer as a polynomial in  $x$  in standard form (not labeled). 102) \_\_\_\_\_

103) Suppose that the cost of manufacturing  $x$  units of a product is  $C(x) = 6x - 2\sqrt{x} + 1$  dollars and that the production level  $t$  weeks from the present is  $x = 4t^2$ . Find the rate of change in cost with respect to time. Enter your answer as a polynomial in  $t$  in standard form (not labeled). 103) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Solve the problem.

104) If \$8000 is invested at interest rate  $i$ , compounded quarterly, it will grow in 4 years to an amount 104) \_\_\_\_\_

$A$ , in dollars, given by  $A = 8000\left(1 + \frac{i}{4}\right)^{16}$ . Find the rate of change,  $\frac{dA}{di}$ .

A)  $\frac{dA}{di} = 128,000\left(1 + \frac{i}{4}\right)^{15}$

B)  $\frac{dA}{di} = 32,000\left(1 + \frac{i}{4}\right)^{15}$

C)  $\frac{dA}{di} = 32,000\left(1 + \frac{i}{4}\right)^{16}$

D)  $\frac{dA}{di} = 128,000\left(1 + \frac{i}{4}\right)^{16}$

105) The formula  $E = 1000(100 - T) + 580(100 - T)^2$  is used to approximate the elevation (in meters) above sea level at which water boils at a temperature of  $T$  (in degrees Celsius). Find the rate of change of  $E$  with respect to  $T$  for a temperature of  $99^\circ\text{C}$ . 105) \_\_\_\_\_

A)  $-1160 \text{ m}/^\circ\text{C}$

B)  $-2160 \text{ m}/^\circ\text{C}$

C)  $2160 \text{ m}/^\circ\text{C}$

D)  $-59,580 \text{ m}/^\circ\text{C}$

106) The concentration of a certain drug in the bloodstream  $t$  minutes after swallowing a pill containing the drug can be approximated using the equation  $C(t) = \frac{1}{3}(3t + 1)^{-1/2}$ , where  $C(t)$  is the concentration in arbitrary units and  $t$  is in minutes. Find the rate of change of concentration with respect to time at  $t = 16$  minutes. 106) \_\_\_\_\_

A)  $-\frac{1}{2058} \text{ units/min}$

B)  $-\frac{1}{686} \text{ units/min}$

C)  $-\frac{1}{21} \text{ units/min}$

D)  $-\frac{1}{14} \text{ units/min}$

Find  $dy/dx$  by implicit differentiation.

107)  $7y^2 - 5x^2 = 1$  107) \_\_\_\_\_

A)  $\frac{5x}{7}$

B)  $\frac{10x + 1}{14y}$

C)  $\frac{5x^2}{14y}$

D)  $\frac{5x}{7y}$

108)  $\frac{1}{3}x^3 - 3y^2 = 7$  108) \_\_\_\_\_

A)  $\frac{x^2}{6y}$

B)  $\frac{6y}{x^2}$

C)  $\frac{6y}{x^2 + 7}$

D)  $\frac{x^2}{3y}$

109)  $2y - x + xy = 6$  109) \_\_\_\_\_

A)  $\frac{y+1}{x+2}$

B)  $\frac{1-y}{x+2}$

C)  $-\frac{1-y}{x+2}$

D)  $-\frac{1+y}{x+2}$

110)  $y^2 - xy + x^2 = 8$  110) \_\_\_\_\_

A)  $\frac{2x-y}{x+2y}$

B)  $\frac{2x+y}{x+2y}$

C)  $\frac{2x+y}{x-2y}$

D)  $\frac{2x-y}{x-2y}$



111)  $y^2 - x^2 = 6$  111) \_\_\_\_\_  
 A)  $\frac{y}{x}$  B)  $\frac{x}{y}$  C)  $-\frac{y}{x}$  D)  $-\frac{x}{y}$

112)  $-5xy + 2y - 8 = 0$  112) \_\_\_\_\_  
 A)  $\frac{5y}{-5x + 2}$  B)  $\frac{5(x + y)}{2}$  C)  $\frac{5y(x + 1)}{2}$  D)  $\frac{5y}{-5xy + 2}$

113)  $y^3 + 12xy + 4x^3 - 5x = 0$  113) \_\_\_\_\_  
 A)  $\frac{5 - 12y - 12x^2}{3y^2 + 12x}$  B)  $\frac{5 - 12y - 12x^2}{3y^2 - 12x}$   
 C)  $\frac{5 + 12y - 12x^2}{3y^2 - 12x}$  D)  $\frac{5 + 12y - 12x^2}{3y^2 + 12x}$

114)  $12x^3 - x^2y^3 = 7$  114) \_\_\_\_\_  
 A)  $\frac{36x^2 - 2xy^2}{xy^2}$  B)  $\frac{36x^2 - 2xy^3}{3xy^2}$  C)  $\frac{36x^2 - 2xy^3}{3x^2y^2}$  D)  $\frac{36x^2 - 2xy^2}{3x^2y^2}$

Differentiate implicitly to find the slope of the curve at the given point.

115)  $y^3 + yx^2 + x^2 - 3y^2 = 0$ ;  $(-1, 1)$  115) \_\_\_\_\_  
 A)  $\frac{3}{2}$  B)  $-\frac{1}{2}$  C)  $-2$  D)  $-1$

116)  $x^2 + y^2 = 1$ ;  $(4, 7)$  116) \_\_\_\_\_  
 A)  $\frac{5}{7}$  B)  $-\frac{4}{7}$  C)  $-\frac{7}{4}$  D)  $\frac{4}{7}$

117)  $x^3 - y^3 = 5$ ;  $(3, 5)$  117) \_\_\_\_\_  
 A)  $-\frac{9}{25}$  B)  $\frac{9}{5}$  C)  $-\frac{25}{9}$  D)  $\frac{9}{25}$

118)  $y^6 + x^3 = y^2 + 12x$ ;  $(0, 1)$  118) \_\_\_\_\_  
 A)  $2$  B)  $\frac{3}{2}$  C)  $-3$  D)  $3$

119)  $x^5y^5 = 32$ ;  $(2, 1)$  119) \_\_\_\_\_  
 A)  $2$  B)  $-\frac{1}{4}$  C)  $16$  D)  $-\frac{1}{2}$

120) Suppose that  $x$  and  $y$  are related by the equation  $x^3 + (2y + 1)^2 = y^2$ . Use implicit differentiation to determine  $\frac{dy}{dx}$ . 120) \_\_\_\_\_

A)  $\frac{dy}{dx} = 3x^2 + 2(y + 1)$

B)  $\frac{dy}{dx} = \frac{-3x^2}{6y + 1}$

C)  $\frac{dy}{dx} = \frac{3x^2 + 4(2y + 1)}{2y}$

D)  $\frac{dy}{dx} = \frac{-3x^2}{2(3y + 2)}$

121) Suppose that  $x$  and  $y$  are related by the equation  $\frac{x^2}{4} + \frac{y^3}{2} = 4$ . Use implicit differentiation to determine  $\frac{dy}{dx}$ . 121) \_\_\_\_\_

A)  $\frac{dy}{dx} = -\frac{x}{3y^2}, y \neq 0$

B)  $\frac{dy}{dx} = \frac{2y^2}{x}$

C)  $\frac{dy}{dx} = \frac{1}{3y^2}, y \neq 0$

D)  $\frac{dy}{dx} = -\frac{2x}{y^3}$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

122) Use implicit differentiation to determine  $\frac{dy}{dx}$  where  $x^2 + y^2 = 4$ . Is  $\frac{dy}{dx} = \frac{x}{y}$  correct? 122) \_\_\_\_\_  
Enter "yes" or "no".

123) Use implicit differentiation to determine  $\frac{dy}{dx}$  where  $4x^3 + 4xy + y = 8$ . Is  $\frac{dy}{dx} = \frac{-12x^2 - 4y}{4x + 1}$  correct? 123) \_\_\_\_\_  
Enter "yes" or "no".

124) Use implicit differentiation to determine  $\frac{dy}{dx}$  where  $x^3 + y^3 = 2xy$ . Is  $\frac{dy}{dx} = \frac{2y - 3x^2}{3y^2 - 2x}$  correct? 124) \_\_\_\_\_  
Enter "yes" or "no".

125) Use implicit differentiation to determine  $\frac{dy}{dx}$  where  $x^2y^3 + x = y$ . Is  $\frac{dy}{dx} = \frac{2xy^3 + 1}{-3x^2y^2 + 1}$  correct? 125) \_\_\_\_\_  
Enter "yes" or "no".

- 126) Use implicit differentiation to determine  $\frac{dy}{dx}$  where  $xy + 10 = x^2$ . Is  $\frac{dy}{dx} = \frac{2x - y}{x}$  correct?  
Enter "yes" or "no". 126) \_\_\_\_\_
- 127) Use implicit differentiation to determine the slope of the graph of  $\sqrt{x+y} = x$  at (2, 2).  
Enter just an integer. 127) \_\_\_\_\_
- 128) Use implicit differentiation to determine the slope of the graph of  $x^{1/2} + y^{1/2} = 4$  at (1, 9).  
Enter just an integer. 128) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 129) Assume  $4x^3 + 2xy - y^3 = \frac{1}{2}$ . What is the slope of the graph at the point  $\left(\frac{1}{2}, -1\right)$ ? 129) \_\_\_\_\_  
 A) 1 B) 8 C)  $\frac{8}{5}$  D)  $-\frac{1}{2}$
- 130) Assume  $\frac{4}{x} + \sqrt{y} = x$ . What is the slope of the graph at the point (-1, 9)? 130) \_\_\_\_\_  
 A)  $3\sqrt{3}$  B) 18 C)  $4 + \sqrt{3}$  D) 30
- 131) Suppose that  $15x^{1/3}y^{-2/3} = 50$ , where x and y are both differentiable functions of t. Find  $\frac{dy}{dt}$ . 131) \_\_\_\_\_  
 A)  $\frac{25y^{1/3}}{2x^{2/3}}$  B)  $-\frac{y}{x} \frac{dx}{dt}$  C)  $\frac{10}{x^{2/3}y^{5/3}} \frac{dx}{dt}$  D)  $\frac{y}{2x} \frac{dx}{dt}$
- 132) Suppose  $2x^3 - 3p^4 = 6$ , where x and p are differentiable functions of t. Find  $\frac{dp}{dt}$ . 132) \_\_\_\_\_  
 A)  $\frac{x^2}{2p^3} \frac{dx}{dt}$  B)  $6x^2 - 12p^3 \frac{dp}{dt}$  C)  $\frac{6 - 6x^2}{12p^3} \frac{dx}{dt}$  D)  $6x^2 \frac{dx}{dt} - 12p^3$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

- 133) Find the equation of the tangent line to the graph of  $x^2 + y^2 = 1$  at the point  $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ . 133) \_\_\_\_\_  
 Is  $y = -\frac{1}{\sqrt{3}}x + \frac{2\sqrt{3}}{3}$  correct?  
 Enter "yes" or "no".

- 134) Find the equation of the line tangent to the graph of  $x^2y^3 = 1$  at the point (1, 1). 134) \_\_\_\_\_  
Enter your answer in slope-intercept form.
- 135) Find the equation of the line tangent to the graph of  $x^2(y - 1)^3 = 8$  at the point (1, 3). 135) \_\_\_\_\_  
Enter your answer in slope-intercept form.
- 136) Determine the rate of change of  $\sqrt{2x + 4}$  with respect to  $x$  at  $x = 1$ . 136) \_\_\_\_\_  
Enter just a reduced quotient of form  $\frac{a}{b}$ .
- 137) The radius of a spherical balloon increases at a rate of 1 mm/sec. How fast is the surface area increasing when the radius is 10mm? (Note: The surface area  $S$  of a sphere of radius  $r$  is  $S = 4\pi r^2$ .) Enter just a real number (no approximations, no units or words). 137) \_\_\_\_\_
- 138) Mr. Smith is 6 ft tall and walks at a constant rate of 2 ft/sec toward a street light that is 10 ft above the ground. At what rate is the length of his shadow changing when he is 6 ft from the base of the pole that supports the light? Enter just an integer (no units). 138) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

Solve the problem.

- 139) Given the revenue and cost functions  $R(x) = 36x - 0.5x^2$  and  $C(x) = 4x + 10$ , where  $x$  is the daily production, find the rate of change of profit with respect to time when  $x = 10$  units and  $\frac{dx}{dt} = 7$  units per day. 139) \_\_\_\_\_  
A) \$217/day      B) \$154/day      C) \$182/day      D) \$214/day
- 140) A product sells by word of mouth. The company that produces the product has noticed that revenue from sales is given by  $R(x) = 3\sqrt{x}$ , where  $x$  is the number of units produced and sold. If the revenue keeps changing at a rate of \$400 per month, how fast is the rate of sales changing when 100 units have been made and sold? (Round to the nearest dollar per month.) 140) \_\_\_\_\_  
A) \$1333/month      B) \$24,000/month      C) \$2667/month      D) \$27/month
- 141) Water is discharged from a pipeline at a velocity  $v$  given by  $v = 1484p^{(1/2)}$ , where  $p$  is the pressure (in psi). If the water pressure is changing at a rate of 0.159 psi/second, find the acceleration ( $dv/dt$ ) of the water when  $p = 49$  psi. 141) \_\_\_\_\_  
A) 106 ft/sec<sup>2</sup>      B) 825.85 ft/sec<sup>2</sup>      C) 51.94 ft/sec<sup>2</sup>      D) 16.85 ft/sec<sup>2</sup>
- 142) A piece of land is shaped like a right triangle. Two people start at the right angle at the same time, and walk at the same speed along different legs of the triangle while spraying the land. If the area covered is changing at 3 m<sup>2</sup>/sec, how fast are the people moving when they are 2 m from the right angle? (Round approximations to two decimal places.) 142) \_\_\_\_\_  
A) 0.75 m/sec      B) 3.00 m/sec      C) 1.33 m/sec      D) 1.50 m/sec

- 143) A metal cube dissolves in acid such that an edge of the cube decreases by 0.57 mm/min. How fast is the volume of the cube changing when the edge is 9.7 mm? 143) \_\_\_\_\_
- A)  $-54 \text{ mm}^3/\text{min}$  B)  $-495 \text{ mm}^3/\text{min}$   
 C)  $-520 \text{ mm}^3/\text{min}$  D)  $-161 \text{ mm}^3/\text{min}$
- 144) Electrical systems are governed by Ohm's law, which states the 144) \_\_\_\_\_  
 $V = IR$ , where  $V$  = voltage,  $I$  = current, and  $R$  = resistance. If the current in an electrical system is decreasing at a rate of 8 A/s while the voltage remains constant at 14 V, at what rate is the resistance increasing when the current is 60 A?
- A)  $\frac{28}{15} \text{ ohms/s}$  B)  $\frac{7}{225} \text{ ohms/s}$  C)  $\frac{15}{28} \text{ ohms/s}$  D)  $\frac{224}{15} \text{ ohms/s}$
- 145) A ladder is slipping down a vertical wall. If the ladder is 17 ft long and the top of it is slipping at the constant rate of 2 ft/s, how fast is the bottom of the ladder moving along the ground when the bottom is 8 ft from the wall? 145) \_\_\_\_\_
- A) 0.25 ft/s B) 1.9 ft/s C) 4.3 ft/s D) 3.8 ft/s

Answer Key

Testname: UNTITLED3

- 1) D
- 2) D
- 3) D
- 4) B
- 5) A
- 6) D
- 7) C
- 8) C
- 9) C
- 10) D
- 11) D
- 12) -18
- 13) -192
- 14) 38
- 15) 80
- 16) -243
- 17) 20
- 18)  $\frac{1}{2}$
- 19) 12
- 20) C
- 21) A
- 22) B
- 23) D
- 24) C
- 25) A
- 26) B
- 27) B
- 28) C
- 29) B
- 30) A
- 31) B
- 32) B
- 33) C
- 34) B
- 35)  $-\frac{5}{18}$
- 36)  $\frac{8}{9}$
- 37)  $\frac{5}{18}$
- 38)  $-\frac{3}{25}$

Answer Key

Testname: UNTITLED3

39)  $\frac{1}{2}$

40) -2

41)  $\frac{9}{2}$

42) C

43) C

44) 0, 3

45) D

46) B

47) D

48) A

49) D

50) B

51) C

52) D

53) A

54) D

55) B

56) D

57) D

58) A

59) A

60) A

61) C

62) C

63) A

64) C

65)  $-\frac{1}{2}$

66) D

67) A

68) D

69) D

70) D

71) D

72) A

73) C

74) 480

75)  $\frac{36}{49}$

76) 4

77) 4

Answer Key

Testname: UNTITLED3

78)  $y - 48 = -80(x - 3)$

79) 1

80) C

81) D

82) B

83) B

84) B

85) B

86) B

87) D

88)  $18x + 24$

89)  $72x + 48$

90)  $\frac{2}{49}$

91) B

92) D

93) A

94) A

95) B

96) A

97) A

98) A

99) A

100) C

101) 405

102)  $-200x + 12,000$

103)  $48t - 4$

104) B

105) B

106) B

107) D

108) A

109) B

110) D

111) B

112) A

113) A

114) C

115) C

116) B

117) D

118) D

119) D



Answer Key

Testname: UNTITLED3

120) D

121) A

122) no

123) yes

124) yes

125) yes

126) yes

127) 4

128) -3

129) A

130) D

131) D

132) A

133) yes

134)  $y = -\frac{2}{3}x + \frac{5}{3}$

135)  $y = -\frac{4}{3}x + \frac{13}{3}$

136)  $\frac{1}{\sqrt{6}}$

137)  $80\pi$

138) 3

139) B

140) C

141) D

142) D

143) D

144) B

145) D