HW 4 Date: ________ Name________________________________

Use Scantron 882E to transfer the answers.

**Find the relative extrema of the function, if they exist.**

1) $f(x) = x^2 - 12x + 39$ 1) ________

A) Relative minimum at (6, 3)
B) Relative maximum at (3, 6)
C) Relative maximum at (6, 3)
D) Relative minimum at (3, 6)

2) $f(x) = 4x^2 + 24x + 35$ 2) ________

A) Relative minimum at (1, 3)
B) Relative minimum at (−3, −1)
C) Relative maximum at (3, 1)
D) Relative minimum at (−1, −3)

3) $s(x) = -x^2 - 4x + 77$ 3) ________

A) Relative maximum at (−4, 77)
B) Relative maximum at (−2, 81)
C) Relative minimum at (4, 77)
D) Relative maximum at (2, 81)

4) $f(x) = -7x^2 - 2x - 8$ 4) ________

A) Relative minimum at $\left(\frac{1}{7}, \frac{55}{7}\right)$
B) Relative maximum at $\left(-7, -\frac{55}{7}\right)$
C) Relative maximum at $\left(\frac{1}{7}, \frac{55}{7}\right)$
D) Relative maximum at $\left(-\frac{1}{7}, -\frac{55}{7}\right)$

5) $f(x) = 0.2x^2 - 2.1x + 5.5$ 5) ________

A) Relative minimum at (5.25, −0.0125)
B) Relative minimum at (5.25, 0)
C) Relative maximum at (5.25, −0.0125)
D) Relative minimum at (−5.25, 22.0375)

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

A) Relative minimum at (0, 1); relative maximum at (2, −3)
B) Relative maximum at (−2, −19); relative maximum at (0, 1)
C) Relative maximum at (0, 1); relative minimum at (2, −3)
D) Relative maximum at (2, −3)

7) $y = x^3 - 3x^2 + 5x - 6$ 7) ________

A) Relative maximum at (−1, 2)
B) Relative minimum at (1, 2)
C) Relative maximum at (2, 2)
D) No relative extrema exist

8) $f(x) = x^3 - 12x + 1$ 8) ________

A) Relative maximum at (−2, 17); relative minimum at (2, −15)
B) Relative maximum at (5, 66); relative minimum at (−3, 10)
C) Relative maximum at (5, 66); relative minimum at (2, −15)
D) Relative minimum at (−2, 17); relative maximum at (2, −15)

9) $f(x) = 9x^3 + 5$ 9) ________

A) Relative minimum at (0, 5)
B) Relative maximum at (0, 9)
C) Relative maximum at (0, 5)
D) No relative extrema exist

10) $f(x) = \frac{2}{3}x^3 + \frac{1}{2}x^2 - 21x + 2$ 10) ________

A) Relative maximum at $\left(-\frac{7}{2}, \frac{1273}{24}\right)$; relative minimum at $\left(\frac{7}{2}, -\frac{883}{24}\right)$

B) Relative maximum at $\left(-3, \frac{103}{2}\right)$; relative minimum at $\left(\frac{7}{2}, -\frac{883}{24}\right)$

C) Relative maximum at $\left(3, -\frac{77}{2}\right)$

D) Relative maximum at $\left(-\frac{7}{2}, \frac{1273}{24}\right)$; relative minimum at $\left(3, -\frac{77}{2}\right)$

11) $f(x) = 3x^4 + 16x^3 + 24x^2 + 32$ 11) ________

A) Relative maximum at (−2, 48), relative minimum at (0, 32)
B) Relative minimum at (−2, 48), relative maximum at (0, 32)
C) Relative minimum at (0, 32)
D) Relative minimum at (−2, 48)

12) $f(x) = x^4 - 2x^2 - 8$ 12) ________

A) Relative maximum at (0, −8); relative minimum at (1, −9)
B) Relative maximum at (1, −9); relative minimum at (−1, −9)
C) Relative minimum at (0, −8); relative maxima at (1, −9), (−1, 7)
D) Relative maximum at (0, −8); relative minima at (1, −9), (−1, −9)

13) $f(x) = x^3 - 3x^4$ 13) ________

A) Relative maximum at $\left(\frac{1}{4}, \frac{1}{256}\right)$; relative minimum at (0, 0)

B) Relative maximum at (0,0); relative minima at $\left(-\frac{1}{4}, -\frac{5}{256}\right)$ and $\left(\frac{1}{4}, \frac{1}{256}\right)$

C) Relative maximum at $\left(\frac{1}{4}, \frac{1}{256}\right)$

D) Relative minimum at $\left(-\frac{1}{4}, -\frac{5}{256}\right)$; relative maximum at (0, 0)

14) $f(x) = \frac{x^2 + 1}{x^2}$ 14) ________

A) Relative minimum at (0, 1)
B) Relative maximum at (0, 1)
C) Relative maximum at (−1, 2); relative minimum at (1, 2)
D) No relative extrema exist

15) $f(x) = \frac{8}{x^2 - 1}$ 15) ________

A) Relative maximum at (0, 8)
B) Relative maximum at (0, −8)
C) Relative minimum at (0, −8)
D) No relative extrema exist

16) $f(x) = \dfrac{-4}{x^2 + 1}$ 16) ________

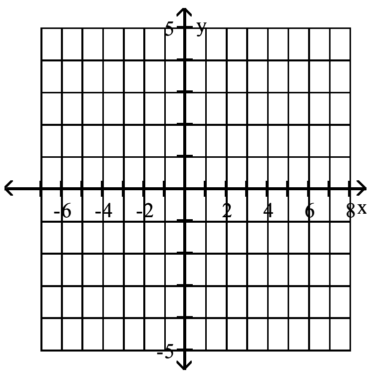
A) No relative extrema exist
B) Relative maximum at (0, −4)
C) Relative maximum at (0, 4)
D) Relative minimum at (0, −4)

17) $f(x) = \dfrac{4x}{x^2 + 1}$ 17) ________

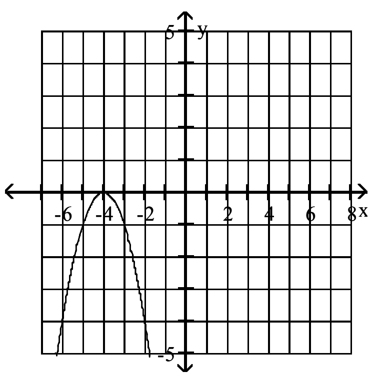
A) Relative minimum at $\left(-1, -2\right)$; relative maximum at $\left(1, 2\right)$
B) Relative maximum at $\left(-1, -2\right)$; relative minimum at $\left(1, 2\right)$
C) Relative maximum at (0, 0)
D) Relative minimum at $\left(-1, -2\right)$; relative maximum at (0, 0)

**Graph the function by first finding the relative extrema.**

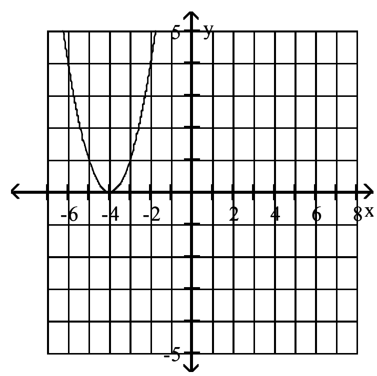
18) $f(x) = x^2 - 8x + 16$ 18) ________



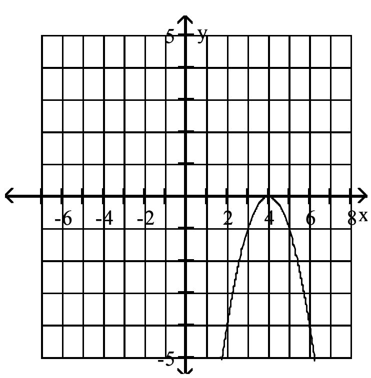

A)



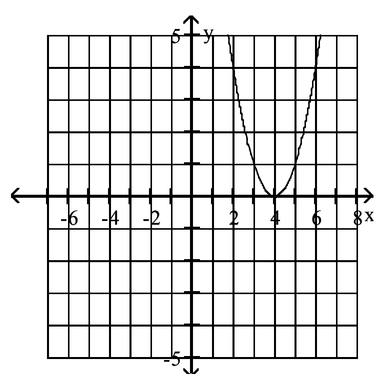

B)




C)

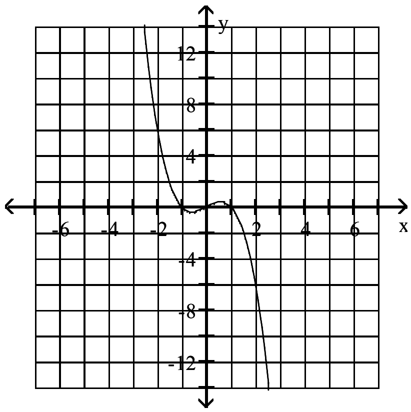



D)

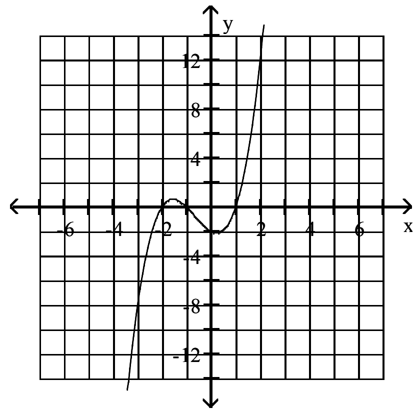


19) $f(x) = x^3 + 2x^2 - x - 2$ 19) ________

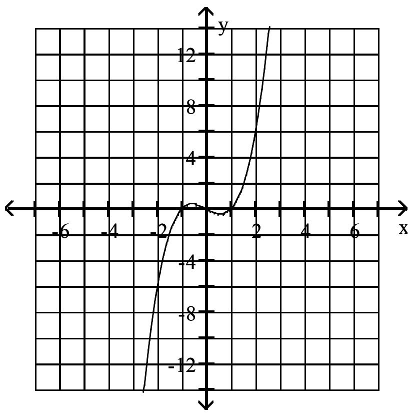
A)



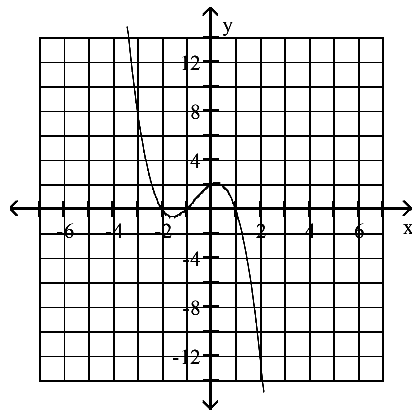

B)




C)




D)

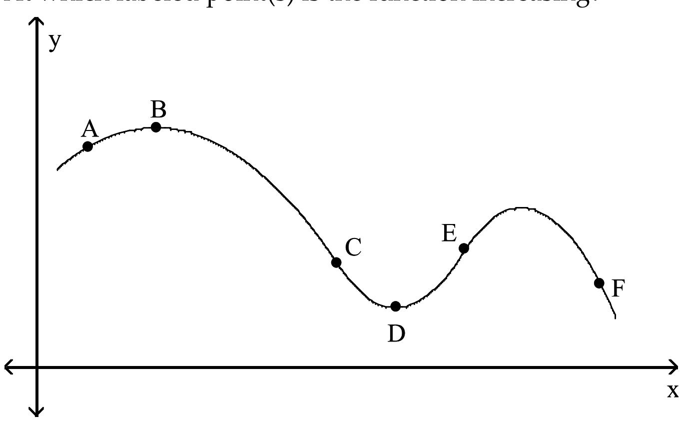



**Solve the problem.**

20) A firm estimates that it will sell N units of a product after spending x dollars on advertising, where 20) ________
$N(x) = -x^2 + 200x - 12, \quad 0 \le x \le 200,$
and x is in thousands of dollars. Find the relative extrema of the function.

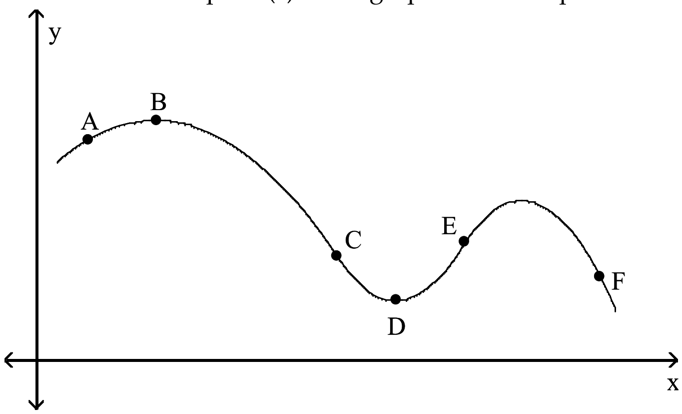
A) relative minimum at (100, 9988)
B) relative minimum at (100, 29,988)
C) relative maximum at (100, 29,988)
D) relative maximum at (100, 9988)

21) At which labeled point(s) is the function increasing? 21) ________




A) C, F
B) E
C) A, E
D) A

22) At which labeled point(s) is the graph concave up? 22) _______

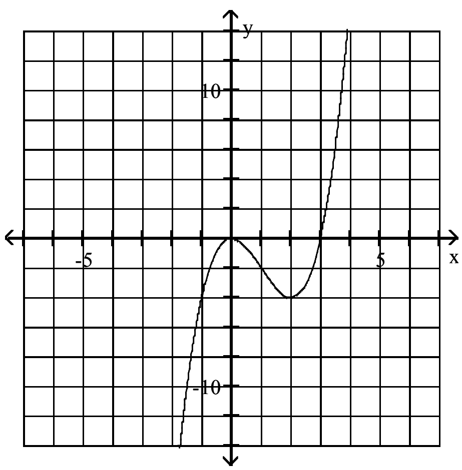



A) C, D, E B) C, E C) C, D D) D

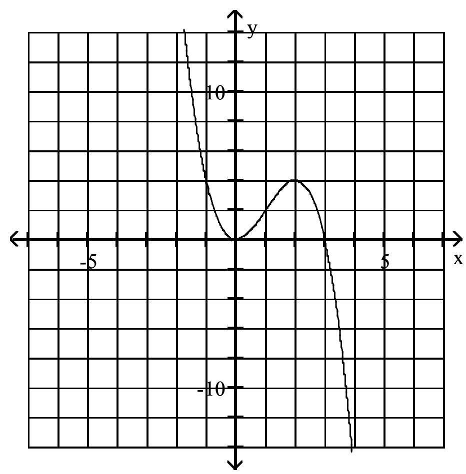
**Graph the function by first finding the relative extrema.**

23) $f(x) = x^3 - 3x^2$ 23) _______

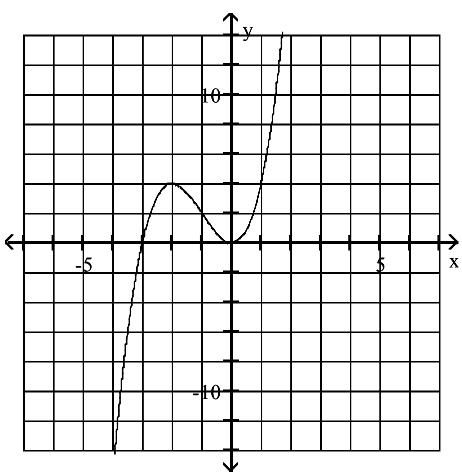
A)



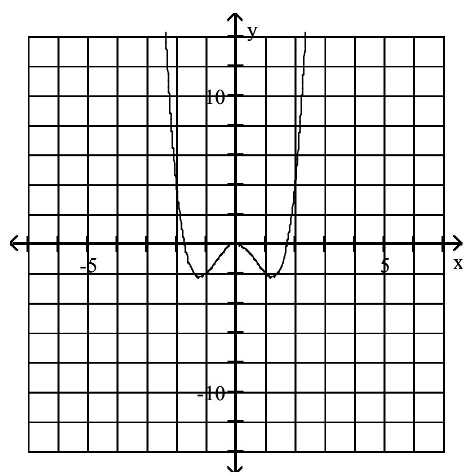

B)




C)




D)



**Solve the problem.**

24) Assume that the temperature of a person during an illness is given by $T(t) = -0.1t^2 + 1.4t + 98.6, \quad 0 \le t \le 14,$ where T = the temperature (°F) at time t, in days. Find the relative extrema of the function. 24) ________

A) relative minimum at (7, 102.5)
B) relative minimum at (7, 103.5)
C) relative maximum at (7, 103.5)
D) relative maximum at (7, 104.5)

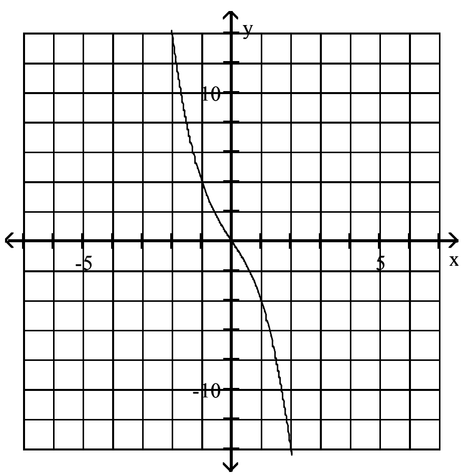
25) The Olympic flame at the 1992 Summer Olympics was lit by a flaming arrow. As the arrow moved d feet horizontally from the archer, assume that its height h, in feet, was approximated by the function $h = -0.002d^2 + 0.7d + 6.5.$ Find the relative maximum of the function. 25) ________

A) relative maximum at (175, 61.25)
B) relative maximum at (175, 67.75)
C) relative maximum at (350, 129)
D) relative maximum at (0, 6.5)

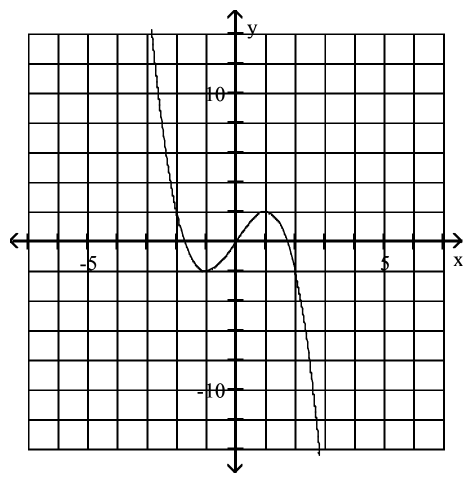
**Graph the function by first finding the relative extrema.**

26) $f(x) = x^3 + 3x$ 26) ________

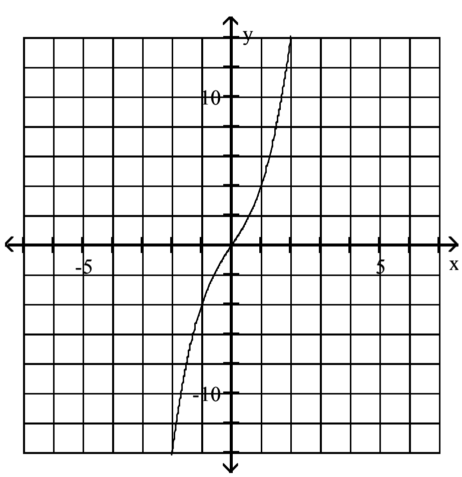
A)



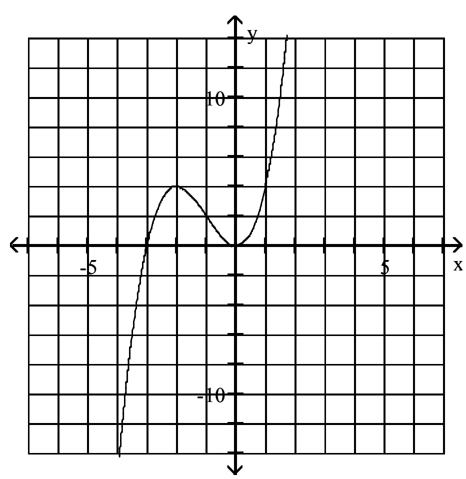

B)




C)

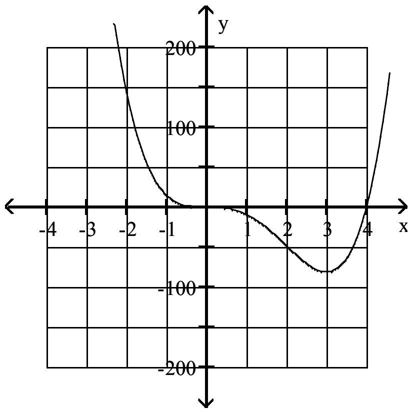



D)

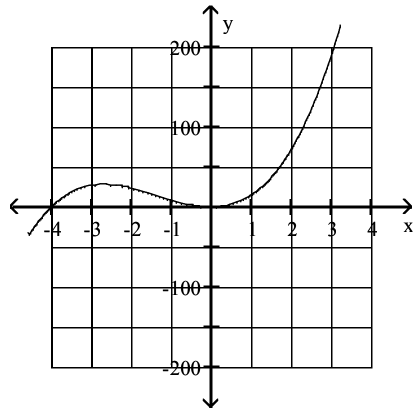


27) $g(x) = 3x^4 - 12x^3$ 27) _______

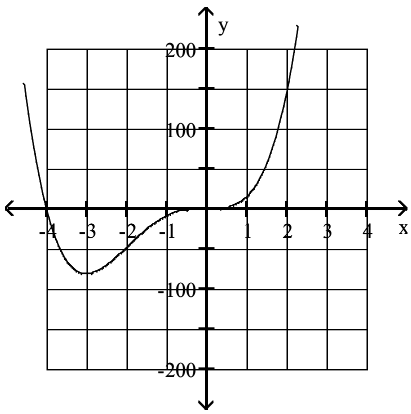
A)



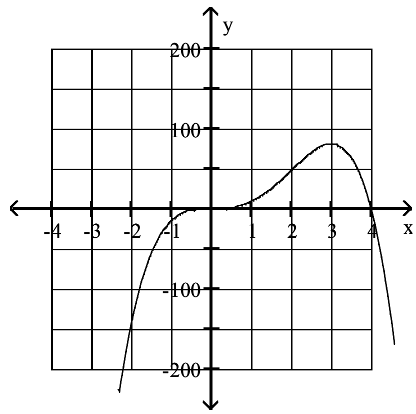

B)



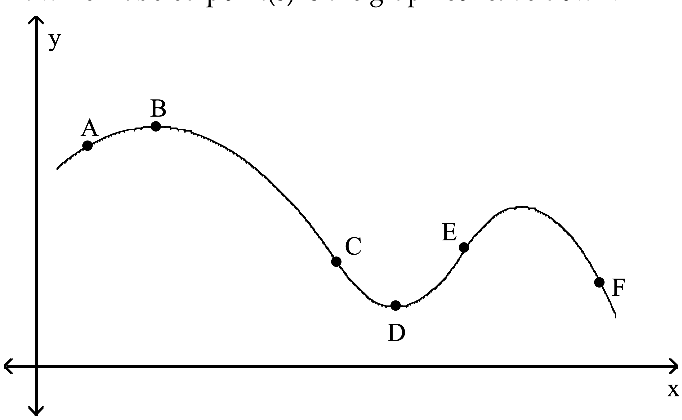

C)




D)

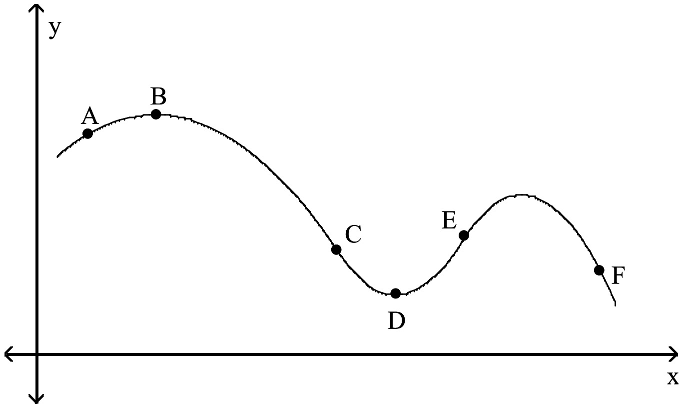



28) At which labeled point(s) is the graph concave down? 28) _______




A) B B) A, B, F C) A, B D) A, F

29) Which labeled point has the most positive slope? 29) _______

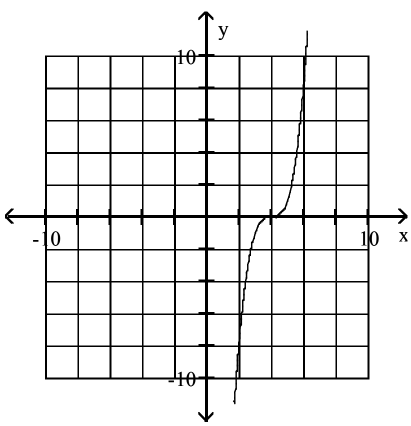



A) E B) A C) F D) B

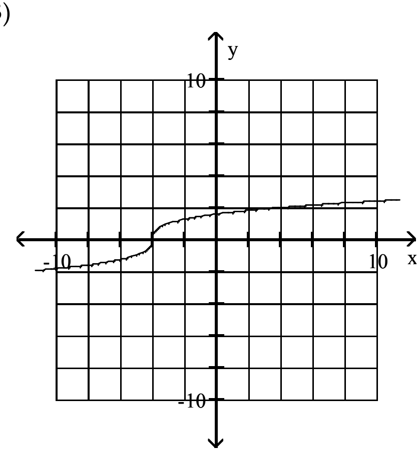
**Graph the function by first finding the relative extrema.**

30) $f(x) = \sqrt[3]{x + 4}$ 30) _______

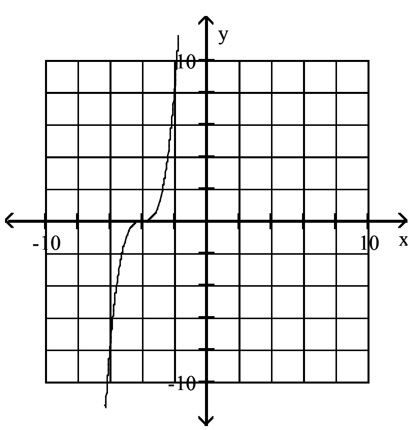
A)



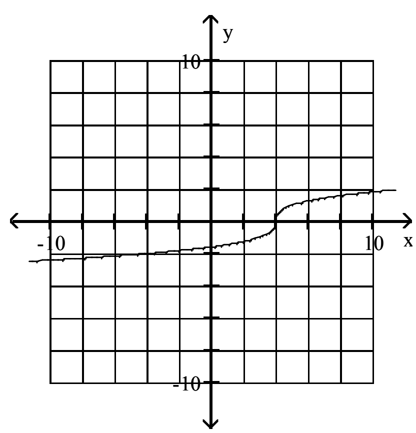
B)



C)



D)



31) $f(x) = \frac{4}{x^2 + 1}$ 31) ________

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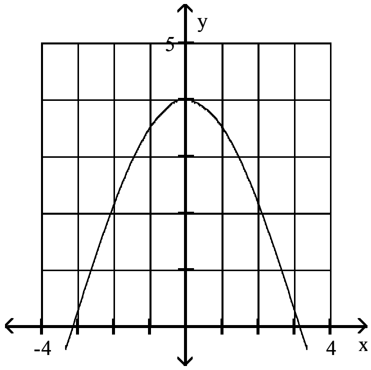
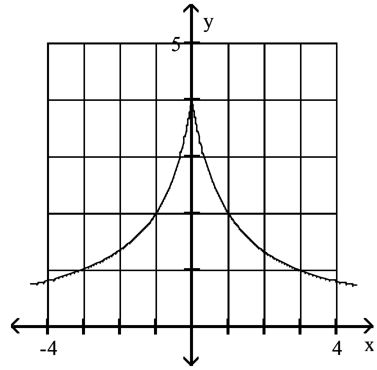
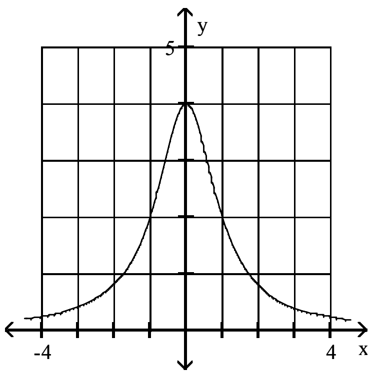
A)



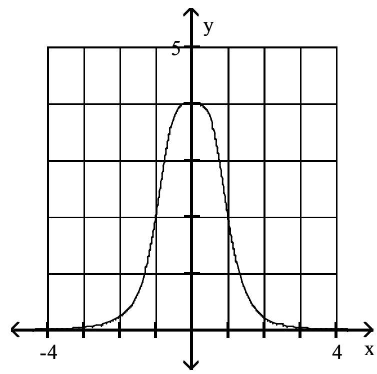

B)




C)

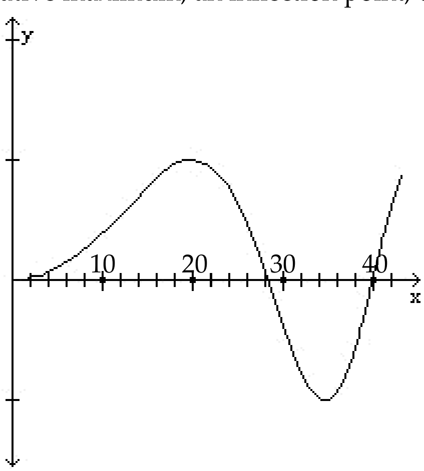



D)




**Solve the problem.**

32) The following graph represents $f'(x)$. At $x = 20$, does the graph of $f(x)$ have a relative minimum, a relative maximum, an inflection point, or none of these? 32) ________




A) inflection point

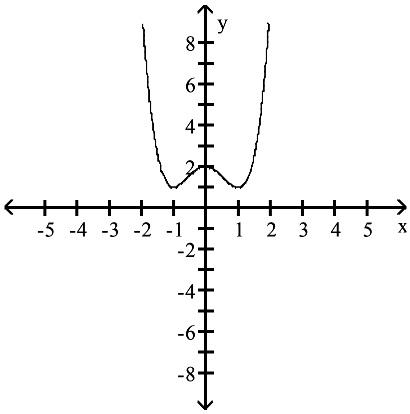
B) none of these

C) relative minimum

D) relative maximum

**Suppose that the function with the given graph is not $f(x)$, but $f'(x)$. Find the open intervals where the function is concave upward or concave downward, and find the location of any inflection points.**

33) 33) _______




A) Concave upward on $(-1, 0)$ and $(1, \infty)$; concave downward on $(-\infty, -1)$ and $(0, 1)$; inflection points at $-2$, 0, and 2

B) Concave upward on $(-\infty, -1)$ and $(0, 1)$; concave downward on $(-1, 0)$ and $(1, \infty;)$; inflection points at $-1$, 0, and 1

C) Concave upward on $(-\infty, 0)$; concave downward on $(0, \infty)$; inflection point at 0

D) Concave upward on $(-1, 0)$ and $(1, \infty)$; concave downward on $(-\infty, -1)$ and $(0, 1)$; inflection points at $-1$, 0, and 1

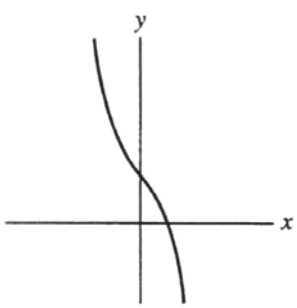
34) Which of the following graphs could represent a function with the following properties? 34) _______

I. $f(x) > 0$, for $x < 0$

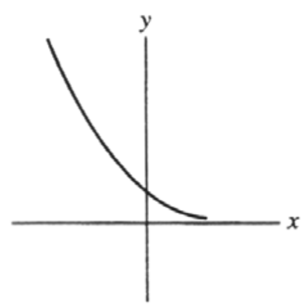
II. $f'(x) \le 0$, for all $x$

III. $f'(0) = 0$

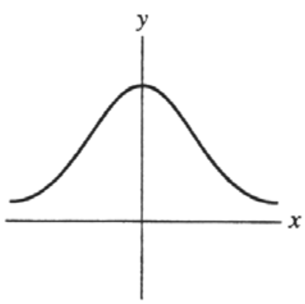
A)




B)




C)



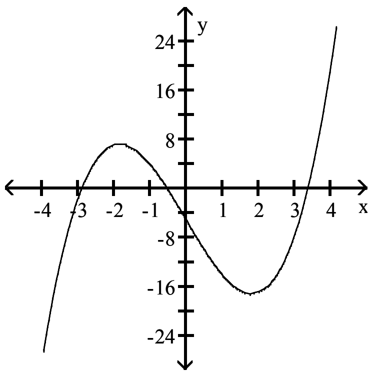

D) none of these

**Solve the problem.**

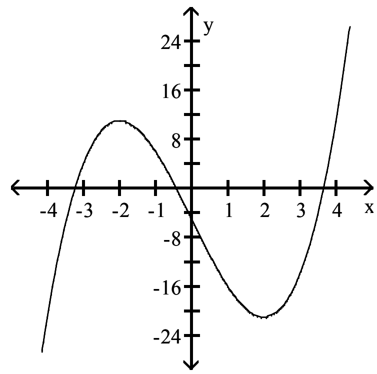
35) Using the following properties of a twice−differentiable function $y = f(x)$, select a possible graph of f. 35) _______

| x | y | Derivatives |
|---|---|---|
| $x < 2$ | | $y' > 0,\quad y'' < 0$ |
| $-2$ | 11 | $y' = 0,\quad y'' < 0$ |
| $-2 < x < 0$ | | $y' < 0,\quad y'' < 0$ |
| 0 | $-5$ | $y' < 0,\quad y'' = 0$ |
| $0 < x < 2$ | | $y' < 0,\quad y'' > 0$ |
| 2 | $-21$ | $y' = 0,\quad y'' > 0$ |
| $x > 2$ | | $y' > 0,\quad y'' > 0$ |

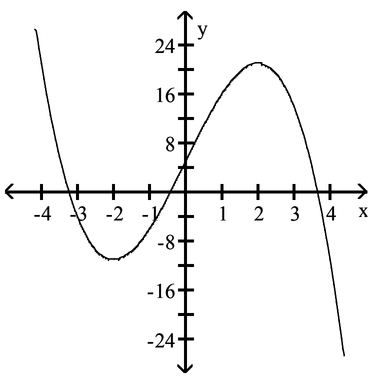
A)



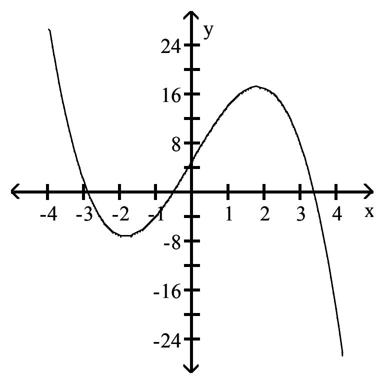

B)




C)



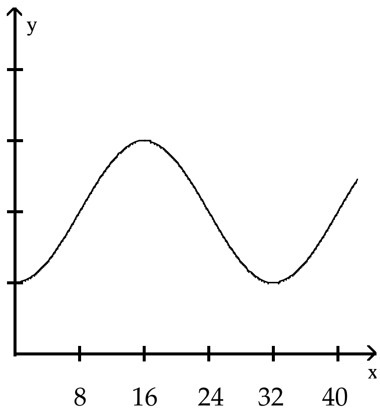

D)



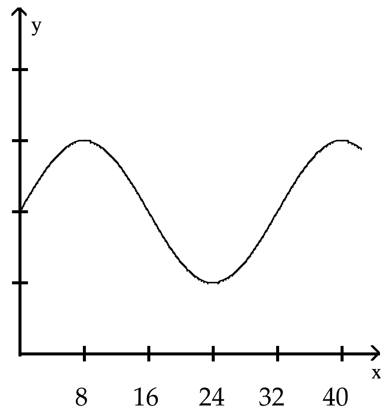
**Choose the graph of a function having the given properties.**

36) Relative minimum points at x = 8 and x = 40; relative maximum point at x = 24; inflection points at x = 16 and x = 32. 36) _______

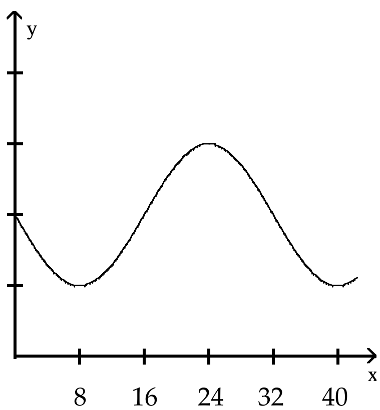
A)



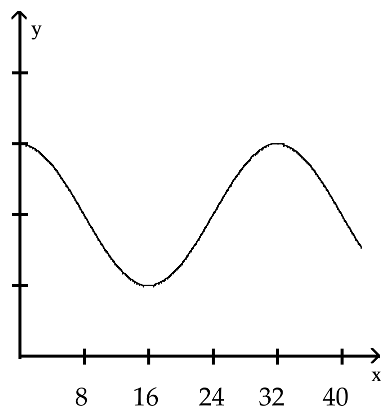

B)




C)

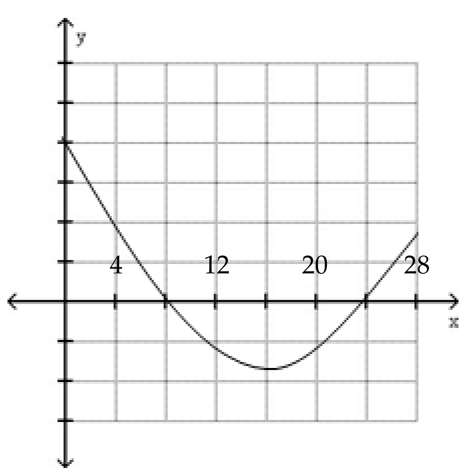



D)




**Solve the problem.**

37) The following graph shows $f'(x)$. On what interval is $f(x)$ decreasing? 37) _______




A) $0 < x < 8$　　B) $8 < x < 24$　　C) $0 < x < 16$　　D) $16 < x < 28$

38) Find the x coordinates of all relative extreme points of $f(x) = \frac{2}{3}x^3 - 7x^2 + 24x - 72$ 38) ________

A) $x = 3, 4$
B) $x = 0, 3, 4$
C) $x = -4, -3, 0$
D) $x = -4, -3$
E) $x = 2, 6$

39) Find the x coordinates of all relative extreme points of $f(x) = \frac{1}{4}x^4 + \frac{2}{3}x^3 - \frac{3}{2}x^2 + 4$ 39) ________

A) $x = 0$ B) $x = -3, 0, 1$ C) $x = -3, 1$ D) $x = -1, 0, 3$ E) $x = -1, 3$

40) Find the x coordinates of all relative extreme points of $f(x) = \frac{1}{2}x^4 - \frac{2}{3}x^3 - 6x^2 - 100$ 40) ________

A) $x = -3, 0, 2$ B) $x = -2, 3$ C) $x = -3, 2$ D) $x = 0$ E) $x = -2, 0, 3$

41) Find the x coordinates of all relative extreme points of $f(x) = \frac{2}{3}x^3 - 7x^2 + 24x - 72$ 41) ________

A) $x = 3, 4$
B) $x = 2, 6$
C) $x = -4, -3$
D) $x = -4, -3, 0$
E) $x = 0, 3, 4$

42) Find the relative extreme points for $f(x) = x^3 + 6x^2 - 15x$. 42) ________
A) (5, f(5)) is a relative extreme minimum point, (−1, f(−1)) a relative extreme maximum
B) (5, f(5)) is a relative extreme maximum point, (−1, f(−1)) a relative extreme minimum
C) (0, f(0)) is a relative extreme minimum point
D) (−5, f(−5)) is a relative extreme minimum point, (1, f(1)) a relative extreme maximum
E) (−5, f(−5)) is a relative extreme maximum point, (1, f(1)) a relative extreme minimum

43) Find the relative minimum point(s) of $f(x) = \frac{x^4}{4} - x^3 - 5x^2 - 10$. 43) ________

A) (0, f(0))
B) (−2, f(−2)) and (0, f(0))
C) (−2, f(−2)) and (5, f(5))
D) (2, f(2)) and (−5, f(−5))
E) none of these

**Find the relative extrema of the function, if they exist.**

44) $f(x) = x^2 - 14x + 51$ 44) ________
A) Relative maximum at (2, 7) B) Relative maximum at (7, 2)
C) Relative minimum at (7, 2) D) Relative minimum at (2, 7)

45) $f(x) = x^3 - 12x + 3$ 45) ________
A) Relative maximum at (5, 68); relative minimum at (2, −13)
B) Relative maximum at (5, 68); relative minimum at (−3, 12)
C) Relative maximum at (−2, 19); relative minimum at (2, −13)
D) Relative minimum at (−2, 19); relative maximum at (2, −13)

**Find the points of inflection.**

46) $f(x) = 4x^3 + 2x + 3$ 46) _______

A) (3, 0) B) (0, 3) C) (0, 2) D) (2, 0)

47) $f(x) = 7x - x^3$ 47) _______

A) (1, 7) B) (0, 0), (1, 7)
C) (0, 0) D) No points of inflection exist

48) $f(x) = \frac{4}{3}x^3 - 12x^2 + 10x + 46$ 48) _______

A) (3, 0) B) (0, 4) C) (3, −26) D) (3, 4)

49) Find the interval(s) where f is concave up for $f(x) = 4x^4 - 3x^3 + 5x - 10$. 49) _______

A) $\left(-\infty, \frac{3}{8}\right)$
B) $\left(\frac{3}{8}, \infty\right)$
C) $(-\infty, 0) \cup \left(\frac{3}{8}, \infty\right)$
D) $\left(0, \frac{3}{8}\right)$
E) $(-\infty, \infty)$

50) Find the interval(s) where f is concave down for $f(x) = -4x^4 + 3x^3 - 5x + 10$. 50) _______

A) $\left(0, \frac{3}{8}\right)$
B) $\left(-\infty, \frac{3}{8}\right)$
C) $(-\infty, 0) \cup \left(\frac{3}{8}, \infty\right)$
D) $(-\infty, 0) \cup (3, \infty)$
E) $(-\infty, 0)$

51) Which of the following is (are) true of $f(x) = 5 + 3x^2 - x^3$? 51) _______

(I) (1, 7) is a point of inflection
(II) f(2) is a relative maximum point
(III) f has a relative minimum point at x = 0
(IV) f is increasing on $(2, \infty)$

A) II, III, and IV
B) II and III
C) I, II, and III
D) all of these
E) none of these

52) Which of the following is (are) true of $f(x) = x^3 - 3x^2 + 3x$? 52) _______

(I) f increasing on $(1, \infty)$

(II) (1, 1) is a relative extreme point

(III) (1, 1) is an inflection point

(IV) f is concave up on $(-\infty, 1)$

A) II, III, and IV

B) I, II, and III

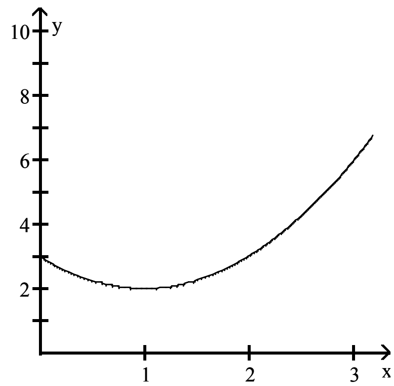
C) I, II, and IV

D) I and III

E) all of these

**Find the absolute maximum and absolute minimum values of the function, if they exist, over the indicated interval, and indicate the x–values at which they occur.**

53) $f(x) = x^2 - 2x + 3$; [0, 3] 53) _______



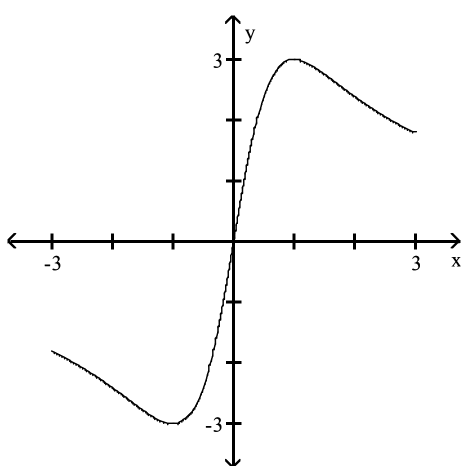

A) Absolute maximum = 3 at x = 0; absolute minimum = 4 at x = 3

B) Absolute maximum = 6 at x = 3; absolute minimum = 4 at x = 0

C) Absolute maximum = 6 at x = 3; absolute minimum = 2 at x = 1

D) Absolute maximum = 3 at x = 0; absolute minimum = 2 at x = 1

54) $f(x) = \dfrac{6x}{x^2 + 1}$; [–3, 3] 54) _______




A) Absolute maximum = 3 at x = 1; absolute minimum = 0 at x = 0

B) Absolute maximum = 1.8 at x = 1; absolute minimum = –1.8 at x = –1

C) Absolute maximum = 1.8 at x = –1; absolute minimum = 0 at x = 0

D) Absolute maximum = 3 at x = 1; absolute minimum = –3 at x = –1

**Find the absolute maximum and absolute minimum values of the function, if they exist, over the indicated interval. When no interval is specified, use the real line $(-\infty, \infty)$.**

55) $f(x) = 5x^2 - 3x^3$; [0, 3] 55) ________

A) Absolute maximum: $\frac{500}{243}$, absolute minimum: 0

B) No absolute maximum, absolute minimum: −36

C) Absolute maximum: $\frac{500}{243}$, absolute minimum: −36

D) Absolute maximum: $\frac{500}{81}$, absolute minimum: 0

56) $f(x) = x^4 - 4x^3$; [−4, 4] 56) ________

A) Absolute maximum: 256, absolute minimum: − 108
B) Absolute maximum: 512, absolute minimum: − 27
C) Absolute maximum: 0, absolute minimum: − 27
D) Absolute maximum: 512, absolute minimum: 0

57) $f(x) = \frac{1}{3}x^3 - 5x$; [−8, 8] 57) ________

A) Absolute maximum: $\frac{392}{3}$, absolute minimum: −7.45

B) Absolute maximum: 7.45, absolute minimum: $-\frac{392}{3}$

C) Absolute maximum: 7.45, absolute minimum: −7.45

D) Absolute maximum: $\frac{392}{3}$, absolute minimum: $-\frac{392}{3}$

**Find the absolute maximum and absolute minimum values of the function, if they exist, on the indicated interval.**

58) $f(x) = x^3 - 4x^2 - 16x + 3$; [−9, 0] 58) ________

A) Absolute maximum: $\frac{529}{27}$, absolute minimum: 552

B) Absolute maximum: − 906, absolute minimum: $\frac{401}{27}$

C) There are no absolute extrema.

D) Absolute maximum: $\frac{401}{27}$, absolute minimum: − 906

59) $f(x) = x^2 - 6x + 12$; [−1, 5] 59) ________

A) Absolute maximum: 19, absolute minimum: 3
B) Absolute maximum: 3
C) Absolute maximum: 19, absolute minimum: 7
D) Absolute maximum: 7, absolute minimum: 3

60) $f(x) = x^3 - 3x + 5$; [−4, 1] 60) ________

A) Absolute maximum: 3, absolute minimum: 1
B) Absolute minimum: 1
C) Absolute maximum: 7, absolute minimum: −47
D) Absolute maximum: 7

61) $f(x) = -3 - 8x - 4x^2$; [−2, 1]  61) ________

A) Absolute maximum: −3, absolute minimum: −15
B) Absolute maximum: 1; absolute minimum: −15
C) Absolute maximum: 7; absolute minimum: −3
D) Absolute maximum: 7

62) $f(x) = x^4 - 32x^2 + 6$; [−5, 5]  62) ________

A) Absolute maximum: −250
B) Absolute maximum: 6, absolute minimum: −250
C) Absolute maximum: 0, absolute minimum: −250
D) Absolute minimum: 0

63) $f(x) = 2 - x^{2/3}$; [−64, 64]  63) ________

A) Absolute maximum: 2, absolute minimum: −14
B) Absolute maximum: 2
C) There are no absolute extrema.
D) Absolute maximum: 64, absolute minimum: −64

**Solve the problem.**

64) $P(x) = -x^3 + \frac{27}{2}x^2 - 60x + 100$, $x \geq 5$ is an approximation to the total profit (in thousands of dollars) from the sale of x hundred thousand tires. Find the number of tires that must be sold to maximize profit.  64) ________

A) 450,000 B) 500,000 C) 550,000 D) 500,000

65) $S(x) = -x^3 + 6x^2 + 288x + 4000$, $4 \leq x \leq 20$ is an approximation to the number of salmon swimming upstream to spawn, where x represents the water temperature in degrees Celsius. Find the temperature that produces the maximum number of salmon. Round to the nearest tenth, if necessary.  65) ________

A) 4°C B) 20°C C) 8°C D) 12°C

66) The velocity of a particle (in $\frac{ft}{s}$) is given by $v = t^2 - 8t + 5$, where t is the time (in seconds) for which it has traveled. Find the time at which the velocity is at a minimum.  66) ________

A) 4 s B) 5 s C) 2.5 s D) 8 s

67) The price P of a certain computer system decreases immediately after its introduction and then increases. If the price P is estimated by the formula $P = 190t^2 - 1600t + 7000$, where t is the time in months from its introduction, find the time until the minimum price is reached.  67) ________

A) 8.4 months B) 4.2 months C) 16.8 months D) 8 months

68) The cost of a computer system increases with increased processor speeds. The cost C of a system as a function of processor speed is estimated as $C = 8S^2 - 4S + 1000$, where S is the processor speed in MHz. Find the processor speed for which cost is at a minimum.  68) ________

A) 2 MHz B) 5 MHz C) 0.3 MHz D) 0.2 MHz

69) For a dosage of x cubic centimeters (cc) of a certain drug, assume that the resulting blood pressure B is approximated by $B(x) = 0.05x^2 - 0.3x^3$. Find the dosage at which the resulting blood pressure is maximized. Round your answer to the nearest hundredth. 69) _______

A) 0.17 cc B) 0.25 cc C) 0.11 cc D) 0.09 cc

70) Assume that the temperature T of a person during a certain illness is given by $T(t) = -0.1t^2 + 1.1t + 98.6$, $0 \le t \le 12$ where T = the temperature (°F) at time t, in days. Find the maximum value of the temperature and when it occurs. Round your answer to the nearest tenth, if necessary. 70) _______

A) 100.6°F at 5.5 days B) 101.6°F at 3.3 days
C) 100.5°F at 4.4 days D) 101.6°F at 5.5 days

71) The total–revenue and total–cost functions for producing x clocks are $R(x) = 480x - 0.01x^2$ and $C(x) = 200x + 100{,}000$, where $0 \le x \le 25{,}000$. What is the maximum annual profit? 71) _______

A) $1,860,000 B) $1,960,000 C) $2,160,000 D) $2,060,000

72) A carpenter is building a rectangular room with a fixed perimeter of 240 ft. What are the dimensions of the largest room that can be built? What is its area? 72) _______

A) 60 ft by 60 ft; 3600 $ft^2$ B) 24 ft by 216ft; 5184 $ft^2$
C) 120 ft by 120 ft; 14,400 $ft^2$ D) 60 ft by 180 ft; 10,800 $ft^2$

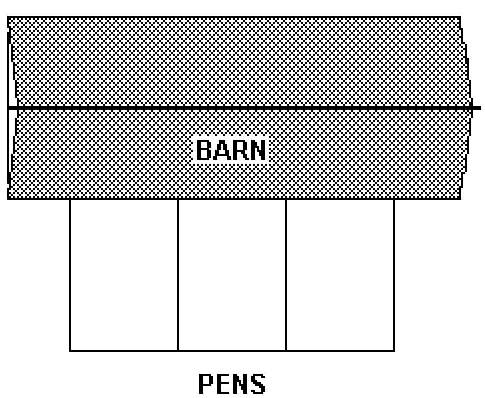
73) Find the dimensions that produce the maximum floor area for a one–story house that is rectangular in shape and has a perimeter of 175 ft. Round to the nearest hundredth, if necessary. 73) _______

A) 43.75 ft x 43.75 ft B) 14.58 ft x 43.75 ft
C) 87.5 ft x 87.5 ft D) 43.75 ft x 175 ft

74) An architect needs to design a rectangular room with an area of 77 $ft^2$. What dimensions should he use in order to minimize the perimeter? Round to the nearest hundredth, if necessary. 74) _______

A) 8.77 ft x 8.77 ft B) 15.4 ft x 77 ft
C) 8.77 ft x 19.25 ft D) 19.25 ft x 19.25 ft

75) A farmer decides to make three identical pens with 144 feet of fence. The pens will be next to each other sharing a fence and will be up against a barn. The barn side needs no fence. 75) _______




What dimensions for the total enclosure (rectangle including all pens) will make the area as large as possible?

A) 36 ft by 36 ft B) 18 ft by 72 ft C) 18 ft by 18 ft D) 24 ft by 120 ft

76) A company wishes to manufacture a box with a volume of 40 cubic feet that is open on top and is twice as long as it is wide. Find the width of the box that can be produced using the minimum amount of material. Round to the nearest tenth, if necessary. 76) _______

A) 3.6 ft B) 7.2 ft C) 3.2 ft D) 6.4 ft

77) From a thin piece of cardboard 10 in. by 10 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? Round to the nearest tenth, if necessary. 77) _______

A) 3.3 in. by 3.3 in. by 3.3 in.; 37 $in.^3$ B) 6.7 in. by 6.7 in. by 3.3 in.; 148.1 $in.^3$
C) 6.7 in. by 6.7 in. by 1.7 in.; 74.1 $in.^3$ D) 5 in. by 5 in. by 2.5 in.; 62.5 $in.^3$

78) Find the number of units that must be produced and sold in order to yield the maximum profit, given the following equations for revenue and cost: 78) _______

$R(x) = 40x - 0.5x^2$
$C(x) = 7x + 3.$

A) 36 units B) 47 units C) 33 units D) 34 units

79) Find the maximum profit given the following revenue and cost functions: 79) _______

$R(x) = 108x - x^2$

$C(x) = \frac{1}{3}x^3 - 6x^2 + 84x + 37$

where x is in thousands of units and R(x) and C(x) are in thousands of dollars.

A) 469 thousand dollars B) 251 thousand dollars
C) 395 thousand dollars D) 683 thousand dollars

80) An appliance company determines that in order to sell x dishwashers, the price per dishwasher must be 80) _______

$p = 600 - 0.3x.$

It also determines that the total cost of producing x dishwashers is given by

$C(x) = 5000 + 0.3x^2.$

How many dishwashers must the company produce and sell in order to maximize profit?

A) 530 B) 500 C) 450 D) 1000

81) A company is constructing an open-top, square-based, rectangular metal tank that will have a volume of 53 $ft^3$. What dimensions yield the minimum surface area? Round to the nearest tenth, if necessary. 81) _______

A) 5.4 ft by 5.4 ft. by 1.8 ft B) 10.3 ft by 10.3 ft. by 0.5 ft
C) 4.7 ft by 4.7 ft. by 2.4 ft D) 3.8 ft by 3.8 ft. by 3.8 ft

82) If the price charged for a bolt is p cents, then x thousand bolts will be sold in a certain hardware store, where $p = 100 - \frac{x}{26}$. How many bolts must be sold to maximize revenue? 82) _______

A) 1300 bolts B) 2600 thousand bolts
C) 1300 thousand bolts D) 2600 bolts

83) A company estimates that the daily revenue (in dollars) from the sale of x cookies is given by $R(x) = 1540 + 0.02x + 0.0003x^2$.
Currently, the company sells 630 cookies per day. Use marginal revenue to estimate the increase in revenue if the company increases sales by one cookie per day. 83) _______

A) \$0.65 B) \$65.00 C) \$39.80 D) \$0.40

84) A grocery store estimates that the weekly profit (in dollars) from the production and sale of x cases of soup is given by
$P(x) = -5500 + 9.1x - 0.0015x^2$
and currently 1300 cases are produced and sold per week. Use the marginal profit to estimate the increase in profit if the store produces and sells one additional case of soup per week. 84) _______

A) \$7.15 B) \$3795.00 C) \$5.20 D) \$5.52

85) A company estimates that the daily cost (in dollars) of producing x chocolate bars is given by $C(x) = 1410 + 0.04x + 0.0002x^2$.
Currently, the company produces 690 chocolate bars per day. Use marginal cost to estimate the increase in the daily cost if one additional chocolate bar is produced per day. 85) _______

A) \$31.60 B) \$0.73 C) \$73.00 D) \$0.32

86) The weekly profit, in dollars, from the production and sale of x bicycles is given by
$P(x) = 90.00x - 0.005x^2$
Currently, the company produces and sells 900 bicycles per week. Use the marginal profit to estimate the change in profit if the company produces and sells one more bicycle per week. 86) _______

A) 81.00 dollars B) 10.00 dollars C) 90.00 dollars D) 99.00 dollars

87) The total cost, in dollars, to produce x DVD players is $C(x) = 90 + 7x - x^2 + 6x^3$. Find the marginal cost when x = 5. 87) _______

A) \$537 B) \$760 C) \$447 D) \$850

88) The profit, in dollars, from the sale of x compact disc players is $P(x) = x^3 - 5x^2 + 11x + 8$. Find the marginal profit when x = 4 . 88) _______

A) \$20 B) \$28 C) \$27 D) \$19

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

89) $y^3 + yx^2 + x^2 - 3y^2 = 0$; (−1, 1) 89) _______

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

90) $x^2 + y^2 = 1$; (3, 8) 90) _______

A) $-\frac{3}{8}$ B) $-\frac{8}{3}$ C) $\frac{7}{8}$ D) $\frac{3}{8}$

91) $x^3 - y^3 = 5$; (3, 5) 91) _______

A) $\frac{9}{25}$ B) $-\frac{9}{25}$ C) $-\frac{25}{9}$ D) $\frac{9}{5}$

92) $y^5 + x^3 = y^2 + 12x$; (0, 1) 92) ________

A) $\frac{12}{7}$ B) $\frac{12}{5}$ C) $-\frac{7}{2}$ D) 4

**Calculate dy/dt using the given information.**

93) $x^3 + y^3 = 9$; $dx/dt = -3$, $x = 1$, $y = 2$ 93) ________

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

94) $x^{4/3} + y^{4/3} = 2$; $dx/dt = 6$, $x = 1$, $y = 1$ 94) ________

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

**Solve the problem.**

95) Water is falling on a surface, wetting a circular area that is expanding at a rate of 9 $mm^2$/sec. How fast is the radius of the wetted area expanding when the radius is 195 mm? (Round approximations to four decimal places.) 95) ________

A) 0.0147 mm/sec B) 0.0073 mm/sec
C) 0.0462 mm/sec D) 136.1356 mm/sec

96) A spherical balloon is inflated with helium at a rate of 140π $ft^3$/min. How fast is the balloon's radius increasing when the radius is 7 ft? 96) ________

A) 2.50 ft/min B) 2.14 ft/min C) 0.71 ft/min D) 0.10 ft/min

97) A man flies a kite at a height of 120 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? 97) ________

A) 3.5 m/sec B) 4.1 m/sec C) 120.3 m/sec D) 9 m/sec

98) A rectangular swimming pool 15 m by 12 m is being filled at the rate of 0.9 $m^3$/min. How fast is the height h of the water rising? 98) ________

A) 0.0050 m/min B) 0.97 m/min C) 0.30 m/min D) 162 m/min

99) 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 4 ft/s, how fast is the bottom of the ladder moving along the ground when the bottom is 5 ft from the wall? 99) ________

A) 2.4 ft/s B) 10.4 ft/s C) 9.6 ft/s D) 0.80 ft/s

100) The volume of a sphere is increasing at a rate of 4 $cm^3$/sec. Find the rate of change of its surface area when its volume is $\frac{256\pi}{3}$ $cm^3$. (Do not round your answer.) 100) ______

A) $\frac{4}{3}$ $cm^2$/sec B) 8π $cm^2$/sec C) $\frac{64}{3}$ $cm^2$/sec D) 2 $cm^2$/sec