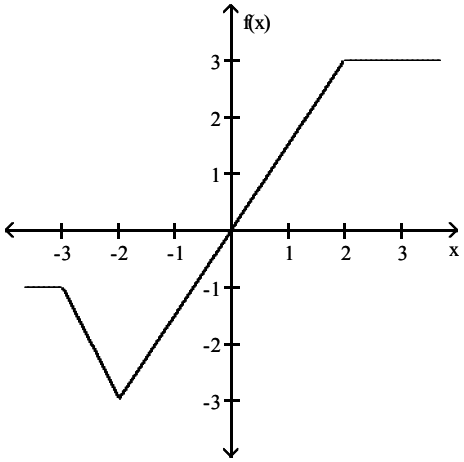
MAC 2233 –– Lial
Chapter 5
Practice for the Test

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

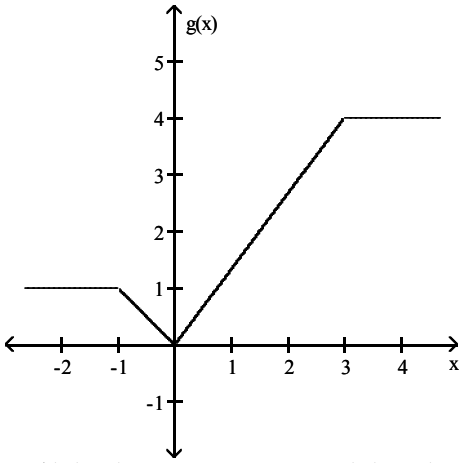
Identify the open intervals where the function is changing as requested.

1) Increasing 1) _____



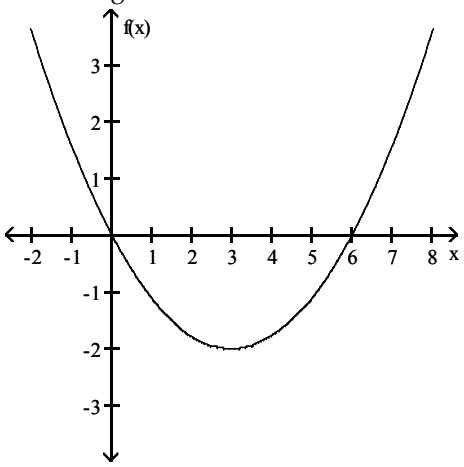
A) (–3, ∞) B) (–2, 2) C) (–3, 3) D) (–2, ∞)

2) Increasing 2) _____



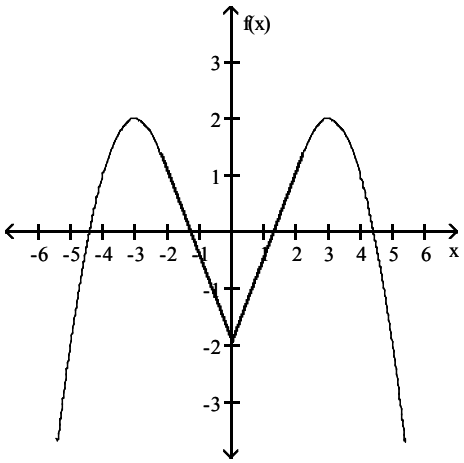
A) (0, 3) B) (–1, 0) C) (–∞, 0) D) (–∞, –1)

3) Increasing 3) _____



A) (3, ∞) B) (–2, 0) C) (–2, ∞) D) (3, 6)

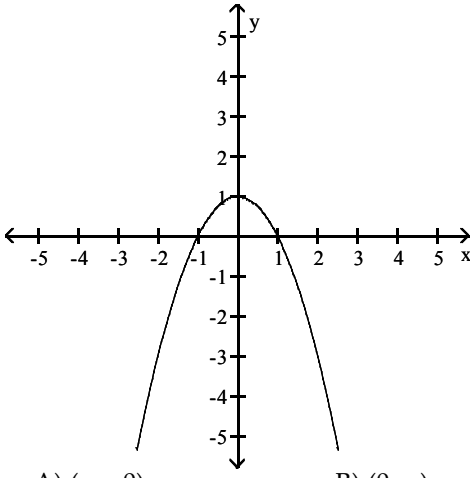
4) Decreasing 4) _____



A) (–3, 0) B) (–3, 0), (3, ∞) C) (–∞, –3), (0, 3) D) (–3, 3)

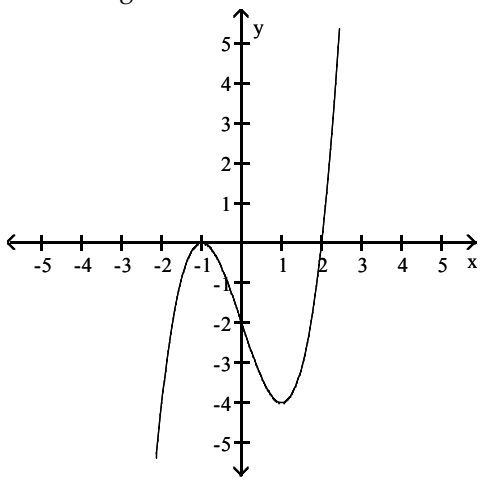
Suppose that the function with the given graph is not f(x), but f′(x). Find the open intervals where f(x) is increasing or decreasing as indicated.

5) Decreasing 5) _____



A) (–∞, 0) B) (0, ∞) C) (–∞, –1), (1, ∞) D) (–1, 1)

6) Decreasing 6) _____



A) $(-\infty, 2)$ B) $(-1, 2)$ C) $(-\infty, -1), (-1, 2)$ D) $(-\infty, 2)$

Find all the critical numbers of the function.

7) $y = 2.5 - 3.9x + 1.2x^2$ 7) _____

A) $\frac{7}{12}$ B) $-\frac{25}{24}$ C) $\frac{13}{8}$ D) $\frac{25}{39}$

8) $f(x) = 2x^3 + 3x^2 - 36x + 8$ 8) _____

A) -2 B) 6 C) $-3, 2$ D) $3, -2$

9) $f(x) = (x + 2)^{1/5}$ 9) _____

A) $\frac{2}{5}$ B) 2 C) -2 D) 10

10) $y = x^{1/5} - x^{6/5}$ 10) _____

A) $\frac{1}{5}$ B) $0, \frac{1}{6}$ C) $-\frac{1}{5}, 0$ D) $\frac{1}{6}$

Find the open interval(s) where the function is changing as requested.

11) Increasing; $y = 7x - 5$ 11) _____

A) $(-\infty, 7)$ B) $(-5, \infty)$ C) $(-\infty, \infty)$ D) $(-5, 7)$

12) Increasing; $f(x) = x^2 - 2x + 1$ 12) _____

A) $(-\infty, 0)$ B) $(-\infty, 1)$ C) $(0, \infty)$ D) $(1, \infty)$

13) Decreasing; $f(x) = x^3 - 4x$ 13) _____

A) $\left(-\infty, -\frac{2\sqrt{3}}{3}\right)$ B) $\left(\frac{2\sqrt{3}}{3}, \infty\right)$ C) $(-\infty, \infty)$ D) $\left(-\frac{2\sqrt{3}}{3}, \frac{2\sqrt{3}}{3}\right)$

14) Increasing; $f(x) = \frac{1}{x^2 + 1}$ 14) _____

A) $(-\infty, 1)$ B) $(1, \infty)$ C) $(-\infty, 0)$ D) $(0, \infty)$

15) Increasing; $y = \sqrt{x^2 + 9}$ 15) _____

A) $(0, \infty)$ B) $(-\infty, 0)$ C) $(-1, \infty)$ D) none

Solve the problem.

16) Suppose the total cost C(x) to manufacture a quantity x of insecticide (in hundreds of liters) is given by $C(x) = x^3 - 27x^2 + 240x + 800$. Where is C(x) decreasing? 16) _____

A) (8, 800) B) (10, 800) C) (8, 10) D) (0, 800)

17) 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 $C(s) = 15s^2 - 6s + 1200$, where s is the processor speed in MHz. Determine the intervals where the cost function C(s) is decreasing. 17) _____

A) (0.2, ∞) B) Nowhere C) Everywhere D) (−∞, 0.2)

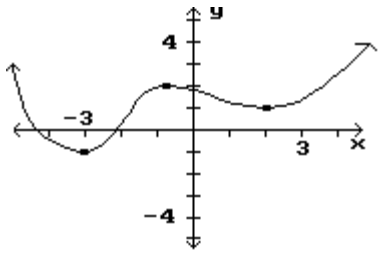
18) A probability function is defined by $f(x) = \frac{1}{\sqrt{6\pi}} e^{-x^2/2}$. Give the intervals where the function is increasing and decreasing. 18) _____

A) increasing:on (−∞, 0); decreasing on (0, ∞) B) decreasing on (−∞, ∞)

C) increasing on (−∞, ∞) D) increasing on (0, ∞); decreasing on (−∞, 0)

Find the location and value of all relative extrema for the function.

19) 19) _____



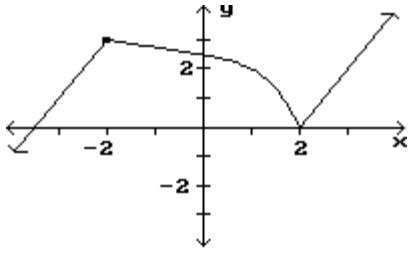
A) Relative minimum of −1 at −3 ; Relative maximum of 2 at −1 ; Relative minimum of 1 at 2.

B) Relative minimum of −3 at −1 ; Relative maximum of −1 at 2 ; Relative minimum of 2 at 1.

C) Relative minimum of 0 at −2 ; Relative maximum of −1 at 2 ; Relative minimum of 2 at 1.

D) Relative minimum of −1 at −3 ; Relative maximum of 2 at −1 ; Relative minimum of 0 at 2.

20) 20) _____



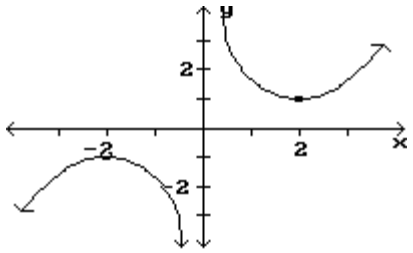
A) None

B) Relative maximum of 3 at −2.

C) Relative minimum of 0 at 2.

D) Relative maximum of 3 at −2 ; Relative minimum of 0 at 2.

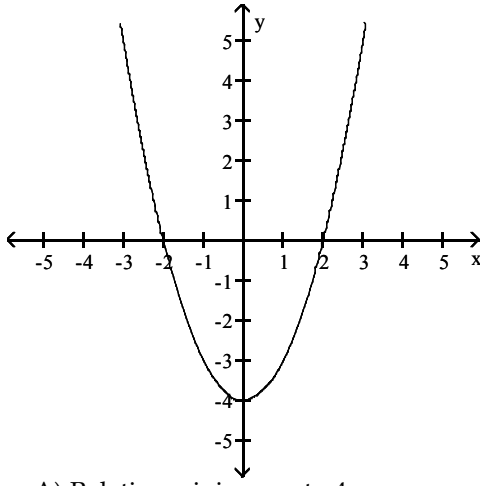
21) 21) _____



A) Relative minimum of –1 at –2.
B) Relative maximum of 2 at 1.
C) Relative minimum of 1 at 2 ; Relative maximum of –1 at –2.
D) None

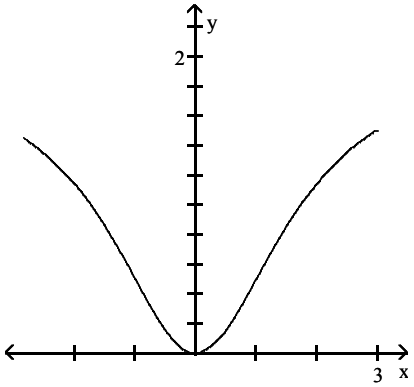
Suppose that the function with the given graph is not f(x), but f′(x). Find the locations of all extrema, and tell whether each extremum is a relative maximum or minimum.

22) 22) _____



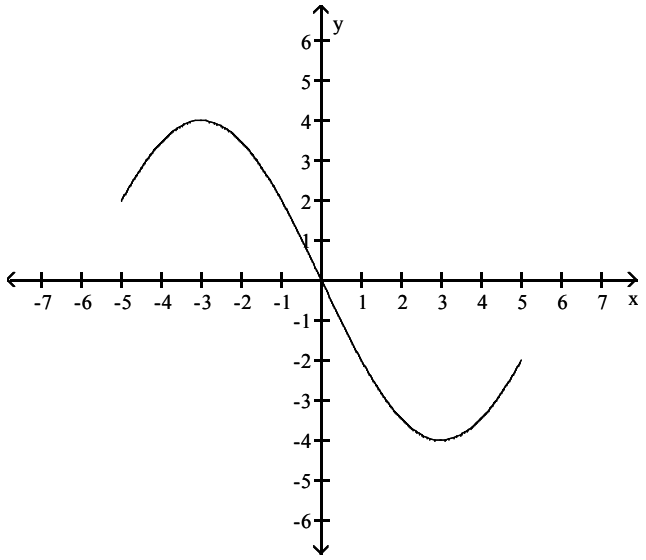
A) Relative minimum at –4
B) Relative maxima at –2 and 2
C) Relative maximum at –2; relative minimum at 2
D) Relative minimum at –2; relative maximum at 2

23) 23) _____



A) Relative minimum at 0
B) No relative extrema
C) Relative maxima at –3 and 3
D) Relative maximum at 0

24) 24) _____



A) Relative minimum at 0
B) Relative maximum at –3; relative minimum at 3
C) Relative maximum at 0
D) No relative extrema

Find the x–value of all points where the function has relative extrema. Find the value(s) of any relative extrema.

25) $f(x) = x^2 + 2x - 3$ 25) _____

A) Relative minimum of –4 at –1.
B) Relative minimum of 0 at –2.
C) Relative maximum of –4 at –1.
D) Relative minimum of –2 at 0.

26) $f(x) = x^3 - 3x^2 + 1$ 26) _____

A) Relative maximum of 1 at 0; Relative minimum of –3 at 2.
B) No relative extrema.
C) Relative maximum of 1 at 0.
D) Relative maximum of 0 at 1; Relative minimum of –3 at –2.

27) $f(x) = 3x^4 + 16x^3 + 24x^2 + 32$ 27) _____

A) Relative maximum of 48 at –2; Relative minimum of 32 at 0.
B) No relative extrema.
C) Relative minimum of 32 at 0.
D) Relative minimum of 30 at –1.

28) $f(x) = \dfrac{1}{x^2 - 1}$ 28) _____

A) Relative maximum of 0 at 1.
B) Relative minimum of –1 at 0.
C) No relative extrema.
D) Relative maximum of –1 at 0.

29) $f(x) = x^{4/3} - x^{2/3}$ 29) _____

A) Relative minimum of of $-\frac{1}{4}$ at $\frac{\sqrt{2}}{4}$

B) Relative maximum of 0 at 0; Relative maximum of $-\frac{1}{4}$ at $-\frac{\sqrt{2}}{4}$

C) Relative maximum of 0 at 0; Relative minimum of $-\frac{1}{4}$ at $\frac{\sqrt{2}}{4}$ and $-\frac{\sqrt{2}}{4}$

D) No relative extrema.

30) $f(x)= (\ln x)^2$, $x > 0$ 30) _____

A) (–1, –1) relative maximum
B) (1, 0), relative minimum
C) (1, –1), relative maximum
D) (–1, 0), relative minimum

31) $f(x) = x + \ln |x|$ 31) _____

A) (–1, –1) relative maximum
B) (1, 0), relative minimum
C) (1, –1), relative maximum
D) (–1, 0), relative minimum

32) $f(x) = (\ln 3x)^2$, $x > 0$ 32) _____

A) (–2, 0), relative minimum
B) (1, 0), relative minimum
C) (3e, 0), relative minimum
D) $\left(\frac{1}{3}, 0\right)$, relative minimum

33) $f(x) = xe^{4x}$ 33) _____

A) $\left(\frac{1}{4}, -\frac{1}{4e}\right)$, relative maximum
B) $\left(-\frac{1}{4}, -\frac{1}{4e}\right)$, relative minimum
C) $\left(-\frac{1}{4}, -\frac{e}{4}\right)$, relative maximum
D) $\left(\frac{1}{4}, \frac{e}{4}\right)$, relative minimum

34) $f(x) = \frac{x^9}{5\ln x}$ 34) _____

A) Relative maximum of 0 at 0; relative minimum of $\frac{9}{5}e$ at $e^{1/9}$

B) Relative minimum of $\frac{9}{5}e$ at $e^{1/9}$

C) Relative minimum of 0 at 0

D) Relative minimum of $-\frac{9}{5}e^{-1}$ at $e^{-1/9}$

Solve the problem.

35) The annual revenue and cost functions for a manufacturer of grandfather clocks are approximately $R(x) = 480x - 0.03x^2$ and $C(x) = 200x + 100{,}000$, where x denotes the number of clocks made. What is the maximum annual profit? 35) _____

A) $853,333 B) $753,333 C) $553,333 D) $653,333

36) Find the number of units, x, that produces the maximum profit P, if $C(x) = 25 + 56x$ and $p = 100 - 2x$. 36) _____

A) 44 units B) 224 units C) 11 units D) 56 units

37) Find the price p per unit that produces the maximum profit P if $C(x) = 30 + 48x$ and $p = 92 - 2x$. 37) _____

A) \$70 B) \$66 C) \$44 D) \$48

38) Suppose a certain drug is administered to a patient, with the percent of concentration in the bloodstream t hr later given by $K(t) = \frac{6t}{t^2 + 1}$. On what time interval is the concentration of the drug increasing? 38) _____

A) (0, 6) B) (1, ∞) C) (6, ∞) D) (0, 1)

Find f"(x) for the function.

39) $f(x) = 4x^2 + 3x - 8$ 39) _____

A) 0 B) 4 C) 8 D) $8x + 3$

40) $f(x) = 2x^{3/2} - 6x^{1/2}$ 40) _____

A) $3x^{1/2} - 3x^{-1/2}$ B) $3x^{-1/2} + 3x^{-3/2}$

C) $1.5x^{1/2} + 1.5x^{-1/2}$ D) $1.5x^{-1/2} + 1.5x^{-3/2}$

41) $f(x) = x^2 + \sqrt{x}$ 41) _____

A) $\frac{8x^{3/2} - 1}{4x^{3/2}}$ B) $\frac{2x^{3/2} + 1}{x^{3/2}}$ C) $\frac{2x^{3/2} - 1}{x^{3/2}}$ D) $\frac{8x^{3/2} + 1}{4x^{3/2}}$

Find the requested value of the second derivative of the function.

42) $f(x) = x^4 + 4x^3 - 4x + 7$; Find $f''(6)$. 42) _____

A) 571 B) −575 C) 580 D) 576

Find f"(x) for the function.

43) $f(x) = 9e^{-x^2}$ 43) _____

A) $36x^2 e^{-x^2} - 18e^{-x^2}$ B) $36x^2 e^{-x^2} + 9e^{-x^2}$

C) $18x^2 e^{-x^2}$ D) $27xe^{-x^2} + 18e^{-x^2}$

Find the requested value of the second derivative of the function.

44) $f(x) = 9x^2 + 9x - 9$; Find $f''(0)$. 44) _____

A) 0 B) 18 C) −18 D) 9

45) $f(x) = 7e^{-x^2}$; Find $f''(2)$. 45) _____

A) $98e^{-4}$ B) $112e^4$ C) $126e^{-8}$ D) $105e^{-8}$

Find the indicated derivative of the function.

46) $f'''(x)$ of $f(x) = 6x^3 + 6x^2 - 6x$ 46) _____

A) 18 B) 18x +36 C) 36x + 18 D) 36

47) $f^{(4)}(x)$ of $f(x) = 2x^6 - 4x^4 + 6x^2$ 47) _____

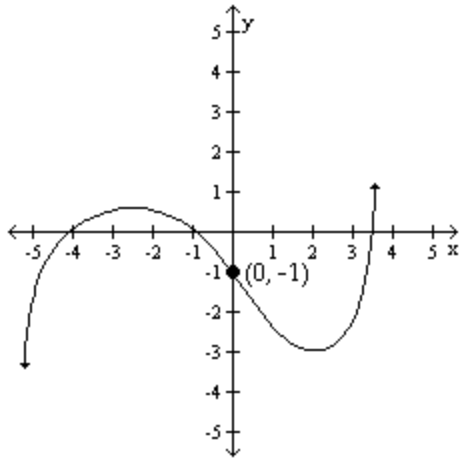
A) $720x^2 - 96x$ B) $480x^2 - 48x$ C) $720x^2 - 96$ D) $480x^2 - 48$

48) $f'''(x)$ of $f(x) = \dfrac{x}{x+1}$ 48) _____

A) $-6(x+1)^{-4}$ B) $6(x+1)^{-4}$ C) $-6(x+1)^{-3}$ D) $6(x+1)^{-3}$

Find the open intervals where the function is concave upward or concave downward. Find any inflection points.

49) 49) _____



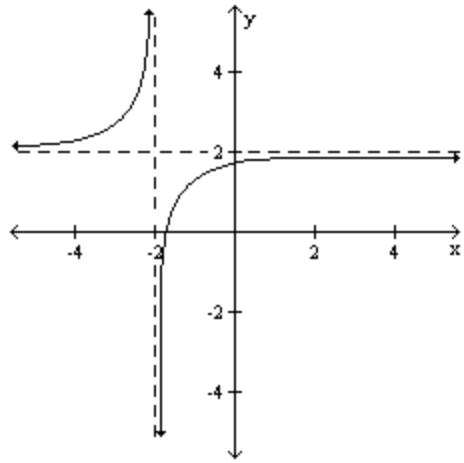
A) Concave upward on $(0, \infty)$; concave downward on $(-\infty, 0)$; inflection points at $(-4, 0)$, $(-1, 0)$, and $\left(\frac{7}{2}, 0\right)$

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

C) Concave upward on $(-1, \infty)$; concave downward on $(-\infty, 2)$; inflection point at $(2, -3)$

D) Concave upward on $(-1, \infty)$; concave downward on $(-\infty, 2)$; inflection points at $(-1, 0)$ and $(2, -3)$

50) 50) _____



A) Concave upward on $(-2, \infty)$; concave downward on $(\infty, -2)$; inflection point at $(-2, 2)$

B) Concave upward on $(-\infty, -2)$; concave downward on $(-2, \infty)$; no inflection points

C) Concave upward on $(-\infty, -2)$; concave downward on $(-2, \infty)$; inflection point at $(-2, 2)$

D) Concave upward on $(-2, \infty)$; concave downward on $(-\infty, -2)$; no inflection points

Find the largest open intervals where the function is concave upward.

51) $f(x) = x^2 + 2x + 1$ 51) _____

A) $(-1, \infty)$ B) $(-\infty, -1)$ C) None D) $(-\infty, \infty)$

52) $f(x) = 4x^3 - 45x^2 + 150x$ 52) _____

A) $\left(-\frac{15}{4}, \infty\right)$ B) $\left(-\infty, -\frac{15}{4}\right)$ C) $\left(-\infty, \frac{15}{4}\right)$ D) $\left(\frac{15}{4}, \infty\right)$

53) $f(x) = x^3 - 3x^2 - 4x + 5$ 53) _____

A) $(-\infty, 1), (1, \infty)$ B) None C) $(1, \infty)$ D) $(-\infty, 1)$

54) $f(x) = \frac{x}{x^2 + 1}$ 54) _____

A) None B) $(-\infty, -1), (-1, \infty)$ C) $(\sqrt{3}, \infty)$ D) $(-\infty, -1)$

55) $f(x) = 5x - 6e^{-x}$ 55) _____

A) None B) $(0 , \infty)$ C) $(-\infty, \infty)$ D) $(-\infty , 0)$

Find any inflection points given the equation.

56) $f(x) = 3x^2 + 12x$ 56) _____

A) Inflection point at (4,–12) B) No inflection points

C) Inflection point at (–4,–12) D) Inflection point at (–2,–12)

57) $f(x) = \frac{8x}{x^2 + 4}$ 57) _____

A) Inflection points at (0, 0), (–2, –2), (2, 2)

B) Inflection points at $(0, 0), \left(-2\sqrt{3}, -2\sqrt{3}\right), \left(2\sqrt{3}, 2\sqrt{3}\right)$

C) No inflection points

D) Inflection points at (–2, –2), (2, 2)

58) $f(x) = \ln (10 - x^2)$ 58) _____

A) Inflection point at $(0, -\ln 10)$ B) Inflection point at $(0, \ln 10)$

C) Inflection point at $(-\ln 10, 0)$ D) No inflection points

Solve the problem.

59) The percent of concentration of a certain drug in the bloodstream x hours after the drug is administered is given by $K(x) = \frac{5x}{x^2 + 9}$. At what time is the concentration a maximum? 59) _____

A) 3 hr B) 0.9 hr C) 0.5 hr D) 5 hr

60) The population of a certain species of fish introduced into a lake is described by the logistic equation 60) _____

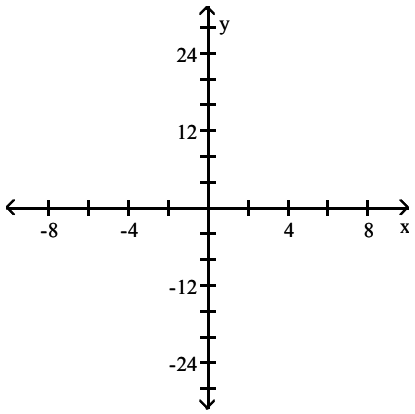
$$G(t) = \frac{15{,}000}{1 + 24e^{-1.2t}},$$

where G(t) is the population after t years. Find the point at which the growth rate of this population begins to decline.

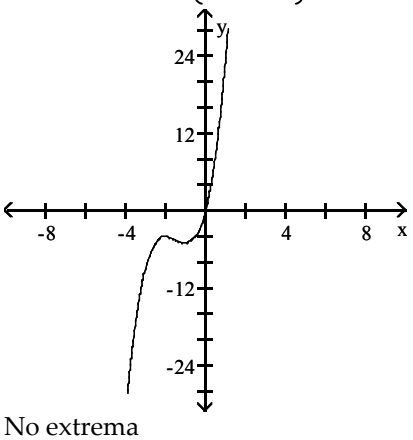
A) (3.81, 7500) B) (5.13, 11,250) C) (2.65, 7500) D) (3.56, 11,250)

Sketch the graph and show all extrema, inflection points, and asymptotes where applicable.

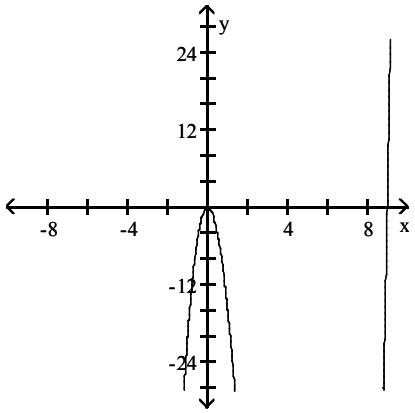
61) $f(x) = 2x^3 + 9x^2 + 12x$ 61) _____



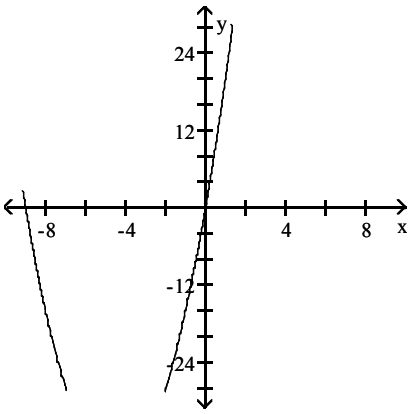
A) Rel max (–2, –4), Rel min: (–1, –5)
Inflection point: $\left(-\frac{3}{2}, -\frac{9}{2}\right)$



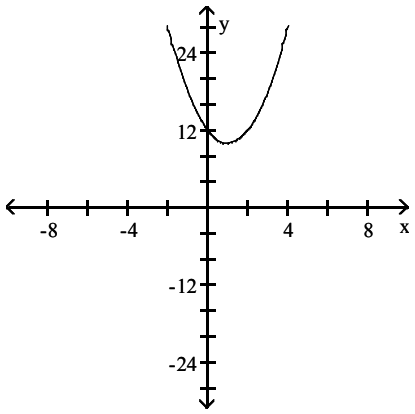
B) Rel max: (0, 0), Rel min: (–6, 216)
Inflection point: (–3, 108)



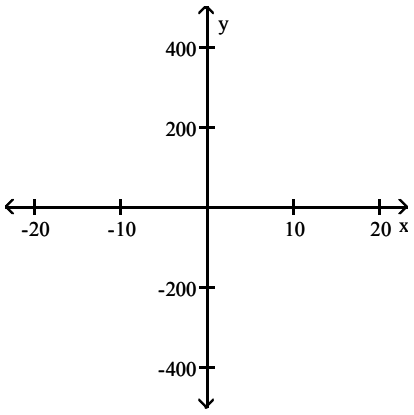
C) No extrema
Inflection point: (0, 0)



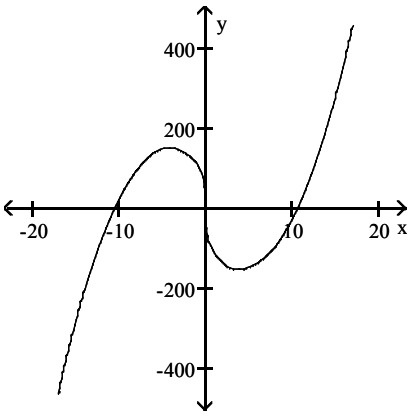
D) Rel min: (1, 10)
No inflection points



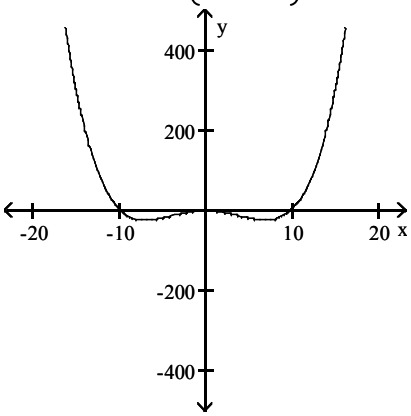
62) $f(x) = x^{1/3}(x^2 - 112)$ 62) _____



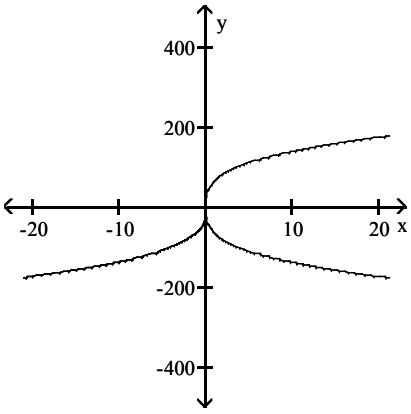
A) Rel max: $(-4, 96\sqrt[3]{4})$, Rel min: $(4, -96\sqrt[3]{4})$
Inflection point: (0,0)



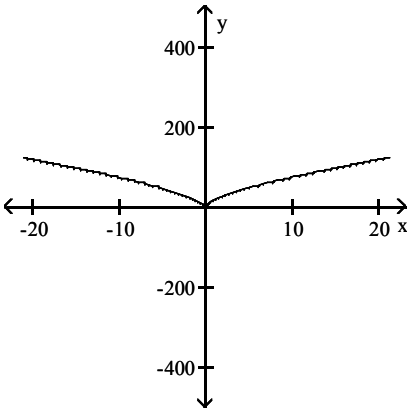
B) Rel max: (0,0), Rel min: $\left(\pm\sqrt{48}, -24\right)$
Inflection point: $\left(\pm 4, -\frac{20}{3}\right)$



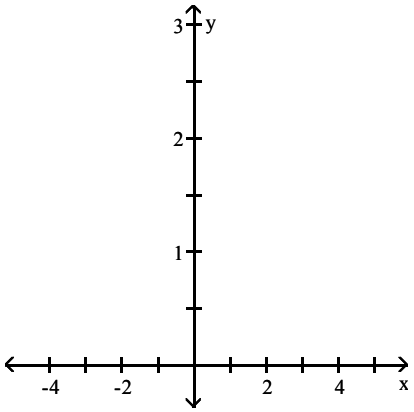
C) No extrema
Inflection point: (0, 0)



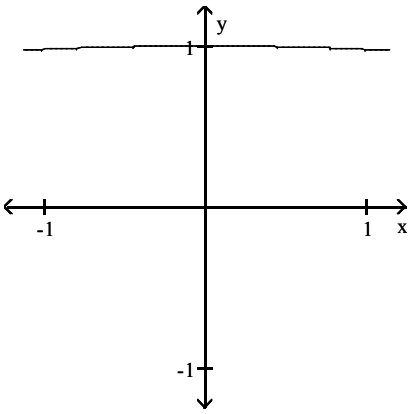
D) Rel min: (0, 0)
No inflection points



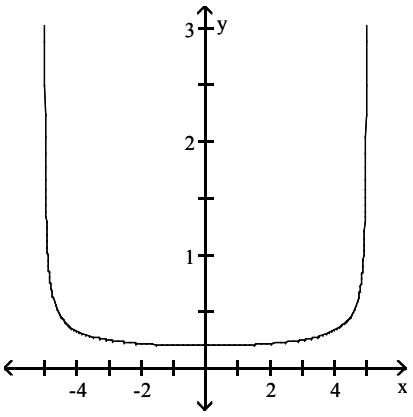
63) $f(x) = \dfrac{1}{\sqrt{25 - x^2}}$ 63) _____



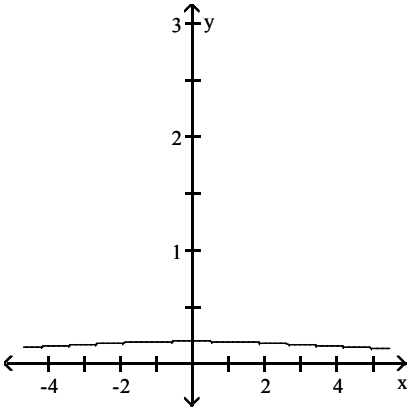
A) Rel max: (0, 1)
No inflection points



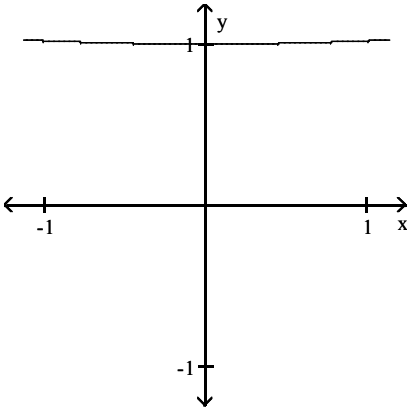
B) Rel min: $\left(0, \dfrac{1}{5}\right)$
No inflection points



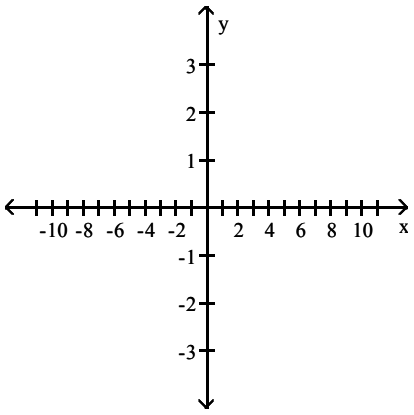
C) Rel max: $\left(0, \dfrac{1}{5}\right)$
No inflection points



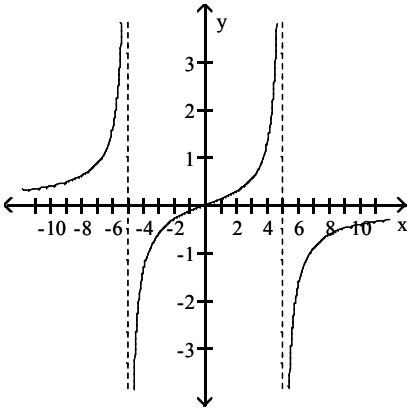
D) Rel min: (0, 1)
No inflection points



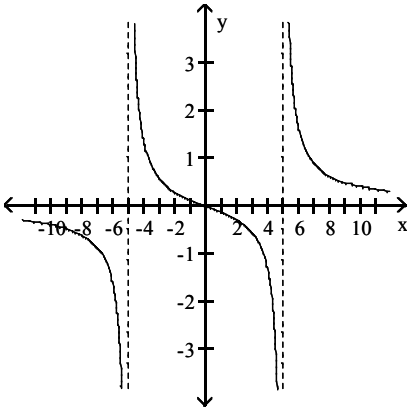
64) $f(x) = \dfrac{3x}{x^2 - 25}$ 64) _____



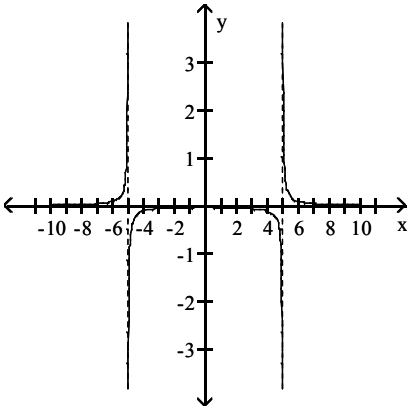
A) No extrema
Inflection point: (0, 0)



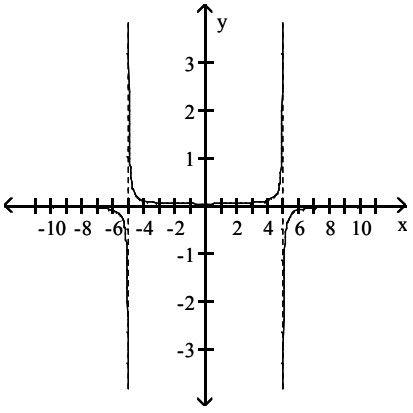
B) No extrema
Inflection point: (0, 0)



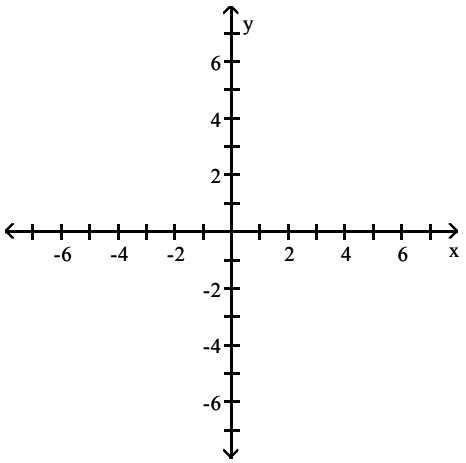
C) Rel max: $\left(0, -\dfrac{1}{25}\right)$
No inflection points



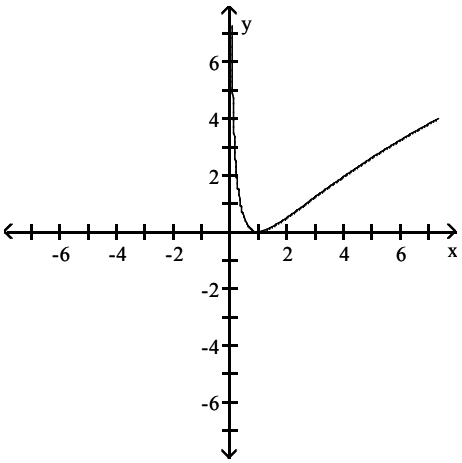
D) Rel min: $\left(0, \dfrac{1}{25}\right)$
No inflection points



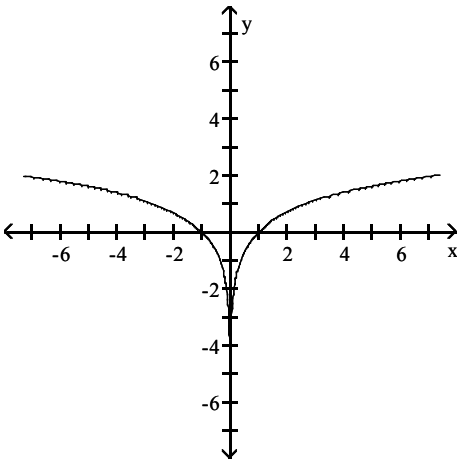
65) $f(x) = \ln(x^2)$ 65) _____



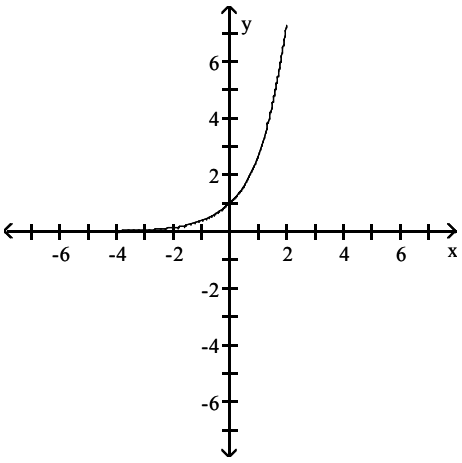
A) Rel min: (1, 0)
Inflection point: (1, 0)



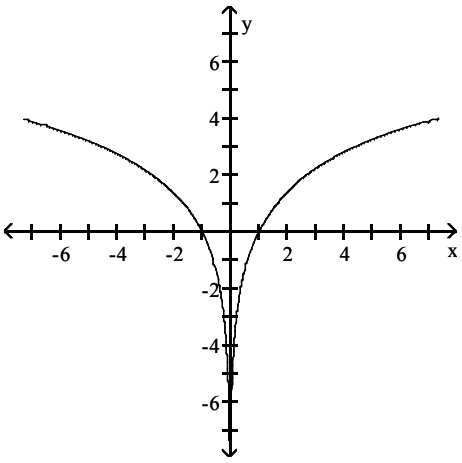
B) No extrema
No inflection points



C) Rel min: (–3, 0)
No inflection points



D) No extrema
No inflection points



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

Sketch a graph of a single function that has these properties.

66) a) Continuous and differentiable for all real numbers 66) _____

b) $f'(x) > 0$ on $(-3, -1)$ and $(2, \infty)$

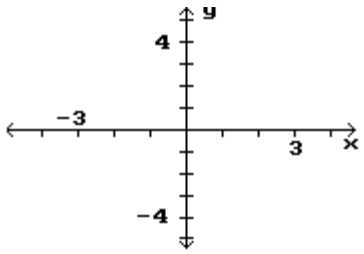
c) $f'(x) < 0$ on $(-\infty, -3)$ and $(-1, 2)$

d) $f''(x) > 0$ on $(-\infty, -2)$ and $(1, \infty)$

e) $f''(x) < 0$ on $(-2, 1)$

f) $f'(-3) = f'(-1) = f'(2) = 0$

g) $f''(x) = 0$ at $(-2, 0)$ and $(1, 1)$



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

Find f"(x) for the function.

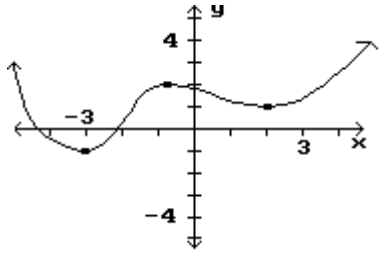
67) $f(x) = \sqrt{3x - 7}$ 67) _____

A) $\frac{10}{4(3x - 7)^{3/2}}$ B) $-\frac{9}{4(3x - 7)^{3/2}}$ C) $\frac{9}{4(3x - 7)^{3/2}}$ D) $-\frac{10}{4(3x - 7)^{3/2}}$

Answer Key
Testname: PRACTICE FOR THE TEST

1) B
2) A
3) A
4) B
5) C
6) C
7) C
8) C
9) C
10) B
11) C
12) D
13) D
14) C
15) A
16) C
17) D
18) A
19) A
20) D
21) C
22) C
23) B
24) C
25) A
26) A
27) C
28) D
29) C
30) B
31) A
32) D
33) B
34) B
35) C
36) C
37) A
38) D
39) C
40) D
41) A
42) D
43) A
44) B
45) A
46) D
47) C
48) B
49) B
50) B

51) D
52) D
53) C
54) C
55) A
56) B
57) B
58) D
59) A
60) C
61) A
62) A
63) B
64) B
65) D
66)



67) B