PQ5 Date:________________________, Name_____________________________________

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

**State whether the function is a polynomial function or not. If it is, give its degree. If it is not, tell why not.**

1) $f(x) = 3x + 4x^2$ 1) ________

A) Yes; degree 2 B) Yes; degree 4 C) Yes; degree 1 D) Yes; degree 3

2) $f(x) = 8x^5 + 4x^4 - 4$ 2) ________

A) No; the last term has no variable B) Yes; degree 10
C) Yes; degree 9 D) Yes; degree 5

3) $f(x) = \frac{1 - x^5}{4}$ 3) ________

A) Yes; degree 1 B) Yes; degree 5
C) No; it is a ratio D) No; x is a negative term

4) $f(x) = \frac{4}{3} - \frac{1}{3}x$ 4) ________

A) Yes; degree 3 B) Yes; degree 1
C) No; x has a fractional coefficient D) Yes; degree 0

5) $f(x) = 15$ 5) ________

A) Yes; degree 1 B) No; it contains no variables
C) Yes; degree 0 D) No; it is a constant

6) $f(x) = 1 + \frac{9}{x}$ 6) ________

A) Yes; degree 0 B) Yes; degree 1
C) No; x is raised to a negative power D) Yes; degree 9

7) $f(x) = \frac{x^2 - 3}{x^4}$ 7) ________

A) No; it is a ratio of polynomials B) Yes; degree 4
C) Yes; degree 2 D) Yes; degree −4

8) $f(x) = x^{3/2} - x^5 + 5$ 8) ________

A) Yes; degree 3 B) Yes; degree 5
C) No; x is raised to non−integer 3/2 power D) Yes; degree 3/2

9) $9(x - 1)^{12}(x + 1)^5$ 9) ________

A) Yes; degree 12 B) Yes; degree 9
C) Yes; degree 108 D) Yes; degree 17

10) $f(x) = \sqrt{x}(\sqrt{x} - 6)$ 10) _______

A) No; x is raised to non−integer power B) No; it is a product
C) Yes; degree 2 D) Yes; degree 1

11) $f(x) = -18x^3 + \pi x^2 - \frac{6}{5}$ 11) _______

A) No; $x^2$ has a non–integer coefficient
B) Yes; degree 3
C) Yes; degree 5
D) Yes; degree 6

**Form a polynomial whose zeros and degree are given.**

12) Zeros: –3, –2, 2; degree 3 12) _______

A) $f(x) = x^3 + 3x^2 - 4x - 12$ for a = 1
B) $f(x) = x^3 - 3x^2 + 4x - 12$ for a = 1
C) $f(x) = x^3 - 3x^2 - 4x + 12$ for a = 1
D) $f(x) = x^3 + 3x^2 + 4x + 12$ for a = 1

13) Zeros: 0, – 6, 5; degree 3 13) _______

A) $f(x) = x^3 + x^2 + x - 30$ for a = 1
B) $f(x) = x^3 + x^2 + x + 30$ for a = 1
C) $f(x) = x^3 + x^2 + 30x$ for a = 1
D) $f(x) = x^3 + x^2 - 30x$ for a = 1

14) Zeros: –1, 1, – 9; degree 3 14) _______

A) $f(x) = x^3 + 9x^2 + x + 9$ for a = 1
B) $f(x) = x^3 + 9x^2 - x - 9$ for a = 1
C) $f(x) = x^3 - 9x^2 - x + 9$ for a = 1
D) $f(x) = x^3 - 9x^2 + x - 9$ for a = 1

15) Zeros: –3, –4, 4; degree 3 15) _______

A) $f(x) = x^3 - 16x + 3x^2 - 48$ for a = 1
B) $f(x) = x^3 + 16x + 3x^2 + 48$ for a = 1
C) $f(x) = x^3 - 16x - 3x^2 + 48$ for a = 1
D) $f(x) = x^3 + 16x - 3x^2 - 48$ for a = 1

16) Zeros: 2, multiplicity 2; –2, multiplicity 2; degree 4 16) _______

A) $f(x) = x^4 + 4x^3 - 8x^2 + 8x - 16$
B) $f(x) = x^4 - 4x^3 + 8x^2 - 8x + 16$
C) $f(x) = x^4 + 8x^2 + 16$
D) $f(x) = x^4 - 8x^2 + 16$

17) Zeros: –5, multiplicity 2; 1, multiplicity 1; degree 3 17) _______

A) $x^3 + 10x^2 + 15x - 25$
B) $x^3 - 9x^2 - 10x + 25$
C) $x^3 + 9x^2 + 15x - 25$
D) $x^3 - 9x^2 + 15x + 25$

18) Zeros: –3, 1, 2, 3; degree 4 18) _______

A) $x^4 + 3x^3 - 7x^2 - 27x - 18$
B) $x^4 - 3x^3 - 7x^2 + 27x - 18$
C) $x^4 - 3x^3 - 7x^2 - 18x - 18$
D) $x^4 + 3x^2 - 18$

**For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x –axis at each x –intercept.**

19) $f(x) = 3(x + 6)(x + 5)^4$ 19) _______

A) 6, multiplicity 1, crosses x–axis; 5, multiplicity 4, touches x–axis
B) –6, multiplicity 1, crosses x–axis; –5, multiplicity 4, touches x–axis
C) –6, multiplicity 1, touches x–axis; –5, multiplicity 4, crosses x–axis
D) 6, multiplicity 1, touches x–axis; 5, multiplicity 4, crosses x–axis

20) $f(x) = 4(x + 3)(x - 1)^3$ 20) _______

A) 3, multiplicity 1, touches x–axis; –1, multiplicity 3
B) –3, multiplicity 1, crosses x–axis; 1, multiplicity 3, crosses x–axis
C) –3, multiplicity 1, touches x–axis; 1, multiplicity 3
D) 3, multiplicity 1, crosses x–axis; –1, multiplicity 3, crosses x–axis

21) $f(x) = 2(x^2 + 2)(x + 6)^2$ 21) ________

A) –2, multiplicity 1, touches x–axis; –6, multiplicity 2, crosses x–axis
B) –2, multiplicity 1, crosses x–axis; –6, multiplicity 2, touches x–axis
C) –6, multiplicity 2, crosses x–axis
D) –6, multiplicity 2, touches x–axis

22) $f(x) = \left(x + \frac{1}{3}\right)^4 (x + 7)^5$ 22) ________

A) $\frac{1}{3}$, multiplicity 4, touches x–axis; 7, multiplicity 5, crosses x–axis
B) $\frac{1}{3}$, multiplicity 4, crosses x–axis; 7, multiplicity 5, touches x–axis
C) $-\frac{1}{3}$, multiplicity 4, crosses x–axis; –7, multiplicity 5, touches x–axis
D) $-\frac{1}{3}$, multiplicity 4, touches x–axis; –7, multiplicity 5, crosses x–axis

23) $f(x) = \left(x + \frac{1}{4}\right)^4 (x^2 + 1)^5$ 23) ________

A) $\frac{1}{4}$, multiplicity 4, touches x–axis; 1, multiplicity 5, crosses x–axis
B) $-\frac{1}{4}$, multiplicity 4, crosses x–axis
C) $-\frac{1}{4}$, multiplicity 4, touches x–axis
D) $-\frac{1}{4}$, multiplicity 4, touches x–axis; –1, multiplicity 5, crosses x–axis

24) $f(x) = \frac{1}{5}x(x^2 - 3)$ 24) ________

A) $\sqrt{3}$, multiplicity 1, touches x–axis;
$-\sqrt{3}$, multiplicity 1, touches x–axis
B) 0, multiplicity 1
C) 0, multiplicity 1, crosses x–axis;
$\sqrt{3}$, multiplicity 1, crosses x–axis;
$-\sqrt{3}$, multiplicity 1, crosses x–axis
D) 0, multiplicity 1, touches x–axis;
$\sqrt{3}$, multiplicity 1, touches x–axis;
$-\sqrt{3}$, multiplicity 1, touches x–axis

25) $f(x) = \frac{1}{4}x^4(x^2 - 3)$ 25) ________

A) 0, multiplicity 4, touches x–axis;
$\sqrt{3}$, multiplicity 1, crosses x–axis;
$-\sqrt{3}$, multiplicity 1, crosses x–axis
B) 0, multiplicity 4, touches x–axis
C) 0, multiplicity 4, crosses x–axis;
$\sqrt{3}$, multiplicity 1, touches x–axis;
$-\sqrt{3}$, multiplicity 1, touches x–axis
D) 0, multiplicity 4, crosses x–axis

26) $f(x) = 5(x^2 + 7)(x^2 + 6)^2$ 26) _______

A) $\sqrt{7}$, multiplicity 1, crosses x–axis; $-\sqrt{7}$, multiplicity 1, crosses x–axis; $\sqrt{6}$, multiplicity 2, touches x–axis; $-\sqrt{6}$, multiplicity 2, touches x–axis

B) No real zeros

C) –7, multiplicity 1, touches x–axis; –6, multiplicity 2, crosses x–axis

D) –7, multiplicity 1, crosses x–axis; –6, multiplicity 2, touches x–axis

27) $f(x) = \frac{1}{5}x^2(x^2 - 3)(x - 3)$ 27) _______

A) 0, multiplicity 2, touches x–axis; 3, multiplicity 1, crosses x–axis

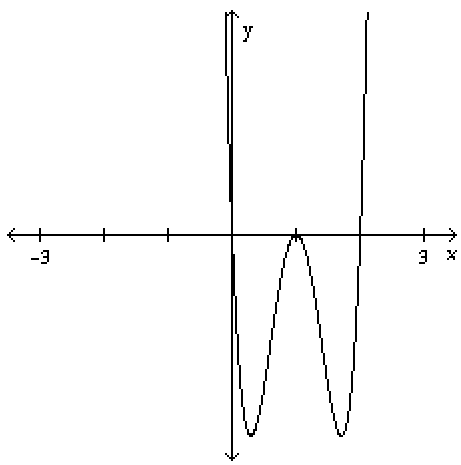
B) 0, multiplicity 2, touches x–axis; 3, multiplicity 1, crosses x–axis; $\sqrt{3}$, multiplicity 1, crosses x–axis; $-\sqrt{3}$, multiplicity 1, crosses x–axis

C) 0, multiplicity 2, crosses x–axis; 3, multiplicity 1, touches x–axis

D) 0, multiplicity 2, crosses x–axis; 3, multiplicity 1, touches x–axis; $\sqrt{3}$, multiplicity 1, touches x–axis; $-\sqrt{3}$, multiplicity 1, touches x–axis

**Solve the problem.**

28) Which of the following polynomial functions might have the graph shown in the illustration below? 28) _______




A) $f(x) = x(x - 2)(x - 1)^2$

B) $f(x) = x^2(x - 2)^2(x - 1)^2$

C) $f(x) = x(x - 2)^2(x - 1)$

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

**Find the x– and y–intercepts of f.**

29) $f(x) = (x + 14)^2$ 29) _______

A) x–intercept: –14; y–intercept: 196

B) x–intercept: 14; y–intercept: 196

C) x–intercept: 14; y–intercept: 0

D) x–intercept: –14; y–intercept: 0

30) $f(x) = 4x^2(x - 2)^3$ 30) _______

A) x–intercepts: 0, 2; y–intercept: 4

B) x–intercepts: 0, –2; y–intercept: 0

C) x–intercepts: 0, 2; y–intercept: 0

D) x–intercepts: 0, –2; y–intercept: 4

31) $f(x) = (x + 5)^3$ 31) _______

A) x–intercept: –5; y–intercept: 125
B) x–intercept: –5; y–intercept: –15
C) x–intercept: –5; y–intercept: 15
D) x–intercept: –5; y–intercept: –125

32) $f(x) = (x + 3)(x - 2)(x + 2)$ 32) _______

A) x–intercepts: –3, –2, 2; y–intercept: –12
B) x–intercepts: –2, 2, 3; y–intercept: –12
C) x–intercepts: –3, –2, 2; y–intercept: 12
D) x–intercepts: –2, 2, 3; y–intercept: 12

33) $f(x) = 9x - x^3$ 33) _______

A) x–intercepts: 0, –9; y–intercept: 0
B) x–intercepts: 0, 3, –3; y–intercept: 0
C) x–intercepts: 0, 3, –3; y–intercept: 9
D) x–intercepts: 0, –9; y–intercept: 9

34) $f(x) = (x + 1)(x - 7)(x - 1)^2$ 34) _______

A) x–intercepts: –1, 1, 7; y–intercept: 7
B) x–intercepts: –1, 1, 7; y–intercept: –7
C) x–intercepts: –1, 1, –7; y–intercept: –7
D) x–intercepts: –1, 1, –7; y–intercept: 7

35) $f(x) = -x^2(x + 4)(x^2 + 1)$ 35) _______

A) x–intercepts: –4, –1, 0; y–intercept: 4
B) x–intercepts: –4, –1, 0, 1; y–intercept: 0
C) x–intercepts: –4, –1, 0; y–intercept: –4
D) x–intercepts: –4, 0; y–intercept: 0

36) $f(x) = x^2(x - 4)(x - 2)$ 36) _______

A) x–intercepts: 0, 4, 2; y–intercept: 8
B) x–intercepts: 0, –4, –2; y–intercept: 0
C) x–intercepts: 0, 4, 2; y–intercept: 0
D) x–intercepts: 0, –4, –2; y–intercept: 8

**Determine the maximum number of turning points of f.**

37) $f(x) = -x^2(x + 3)^3(x^2 - 1)$ 37) _______

A) 5 B) 7 C) 2 D) 6

38) $f(x) = 5x - x^3$ 38) _______

A) 1 B) 2 C) 3 D) 4

**Use the x–intercepts to find the intervals on which the graph of f is above and below the x–axis.**

39) $f(x) = (x + 16)^2$ 39) _______

A) above the x–axis: $(-16, \infty)$
below the x–axis: $(-\infty, -16)$

B) above the x–axis: no intervals
below the x–axis: $(-\infty, -16), (-16, \infty)$

C) above the x–axis: $(-\infty, -16)$
below the x–axis: $(-16, \infty)$

D) above the x–axis: $(-\infty, -16), (-16, \infty)$
below the x–axis: no intervals

40) $f(x) = (x + 4)^3$ 40) _______

A) above the x–axis: $(-4, \infty)$
below the x–axis: $(-\infty, -4)$

B) above the x–axis: no intervals
below the x–axis: $(-\infty, -4), (-4, \infty)$

C) above the x–axis: $(-\infty, -4), (-4, \infty)$
below the x–axis: no intervals

D) above the x–axis: $(-\infty, -4)$
below the x–axis: $(-4, \infty)$

41) $f(x) = (x - 4)^2(x + 5)^2$ 41) _______

A) above the x-axis: $(-5, 4)$
below the x-axis: $(-\infty, -5)$, $(4, \infty)$

B) above the x-axis: $(-\infty, -5)$, $(4, \infty)$
below the x-axis: $(-5, 4)$

C) above the x-axis: no intervals
below the x-axis: $(-\infty, -5)$, $(-5, 4)$, $(4, \infty)$

D) above the x-axis: $(-\infty, -5)$, $(-5, 4)$, $(4, \infty)$
below the x-axis: no intervals

**Solve the problem.**

42) The amount of water (in gallons) in a leaky bathtub is given in the table below. Using a graphing utility, fit the data to a third degree polynomial (or a cubic). Then approximate the time at which there is maximum amount of water in the tub, and estimate the time when the water runs out of the tub. Express all your answers rounded to two decimal places. 42) _______

| t (in minutes) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| V ( in gallons) | 20 | 26 | 45 | 63 | 86 | 94 | 90 | 67 |

A) maximum amount of water after 5.30 minutes; water never runs out
B) maximum amount of water after 5.30 minutes; water runs out after 8.23 minutes
C) maximum amount of water after 8.23 minutes; water runs out after 19.73 minutes
D) maximum amount of water after 5.37 minutes; water runs out after 11.06 minutes

**Find the domain of the rational function.**

43) $F(x) = \dfrac{3x}{x + 5}$ 43) _______

A) $\{x \mid x \neq 0\}$
B) $\{x \mid x \neq -5\}$
C) $\{x \mid x \neq 5\}$
D) all real numbers

44) $G(x) = \dfrac{3x}{(x + 6)(x - 1)}$ 44) _______

A) $\{x \mid x \neq -6, x \neq 1, x \neq -3\}$
B) $\{x \mid x \neq -6, x \neq 1\}$
C) $\{x \mid x \neq 6, x \neq -1\}$
D) all real numbers

45) $R(x) = \dfrac{x + 3}{x^2 - 4}$ 45) _______

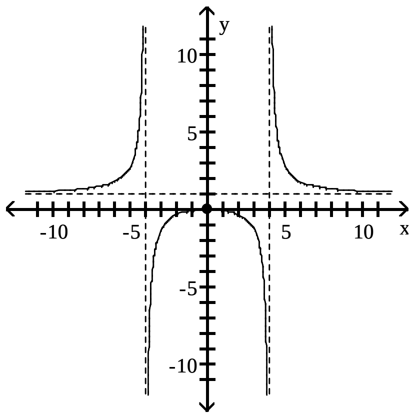
A) $\{x \mid x \neq -2, x \neq 2\}$
B) $\{x \mid x \neq 0, x \neq 4\}$
C) $\{x \mid x \neq -2, x \neq 2, x \neq -3\}$
D) all real numbers

46) $G(x) = \dfrac{x + 6}{x^2 + 49}$ 46) _______

A) $\{x \mid x \neq 0, x \neq -49\}$
B) $\{x \mid x \neq -7, x \neq 7, x \neq -6\}$
C) $\{x \mid x \neq -7, x \neq 7\}$
D) all real numbers

**Use the graph to determine the domain and range of the function.**

47) 47) _______




A) domain: {x | x ≤ 0 or x > 1}
range: {y | y ≠ −4, y ≠ 4}

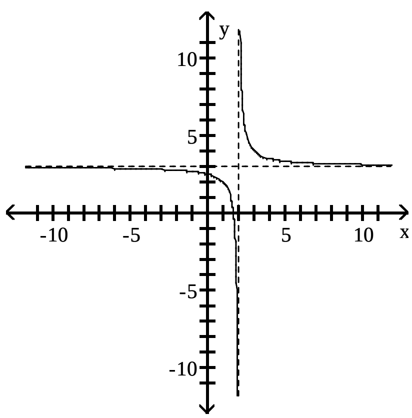
B) domain: {x | x ≠ −4, x ≠ 4}
range: {y | y ≤ 0 or y ≥ 1}

C) domain: {x | x ≠ −4, x ≠ 4}
range: {y | y ≤ 0 or y > 1}

D) domain: all real numbers
range: all real numbers

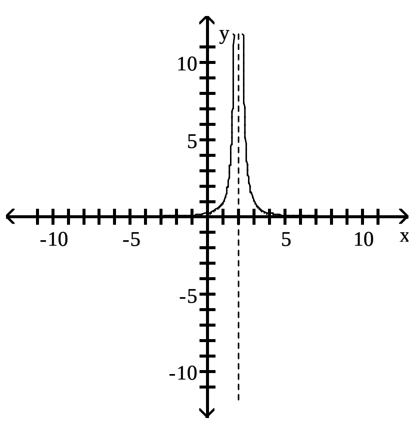
**Use the graph to find the vertical asymptotes, if any, of the function.**

48) 48) _______



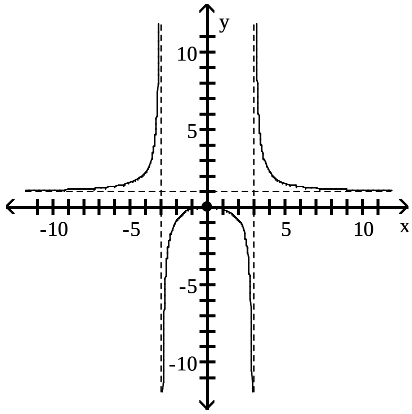

A) x = 2, y = 3    B) x = 2, x = 0    C) y = 3    D) x = 2

49) 49) _______




A) x = 2, x = 0    B) x = 2    C) y = 2    D) none

50)




A) $x = -3, x = 3, y = 1$

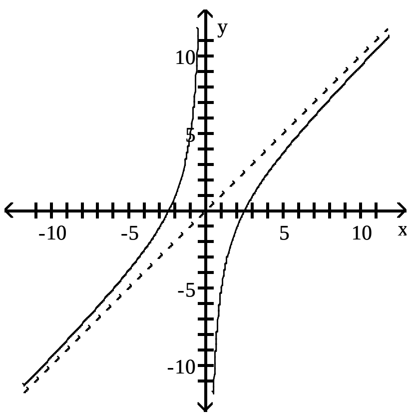
B) $x = -3, x = 3, x = 0$

C) $x = -3, x = 3, x = 0, y = 1$

D) $x = -3, x = 3$

50) _______

51)




A) $x = 0$

B) $x = 0, y = 0$

C) $y = 0$

D) none

51) _______

**Find the vertical asymptotes of the rational function.**

52) $F(x) = \dfrac{7x}{x + 9}$

A) $x = 9$

B) $x = -9$

C) $x = 7$

D) none

52) _______

53) $F(x) = \dfrac{-x^2 + 16}{x^2 + 5x + 4}$

A) $x = 1, x = -4$

B) $x = -1, x = 4$

C) $x = -1$

D) $x = -1, x = -4$

53) _______

54) $H(x) = \dfrac{2x}{(x - 9)(x - 1)}$

A) $x = 9, x = 1, x = -2$

B) $x = -9, x = -1$

C) $x = 9, x = 1$

D) $x = -2$

54) _______

55) $R(x) = \dfrac{x + 8}{x^2 - 25}$

A) $x = -5, x = 5$

B) $x = -5, x = 5, x = -8$

C) $x = 25, x = -8$

D) $x = 0, x = 25$

55) _______

56) $H(x) = \frac{x + 8}{x^4 - 25}$ 56) ________

A) $x = 0, x = 25$
B) $x = -5, x = 5, x = -8$
C) $x = -5, x = 5$
D) $x = 25, x = -8$

**Solve the problem.**

57) A company that produces bicycles has costs given by the function $C(x) = 15x + 20{,}000$ , where x is the number of bicycles manufactured and C(x) is measured in dollars. The average cost to manufacture each bicycle is given by 57) ________

$$\bar{C}(x) = \frac{15x + 20{,}000}{x}.$$

Find $\bar{C}(50)$. (Round to the nearest dollar, if necessary.)

A) \$55
B) \$58
C) \$385
D) \$415

58) A drug is injected into a patient and the concentration of the drug is monitored. The drug's concentration, C(t), in milligrams after t hours is modeled by 58) ________

$$C(t) = \frac{6t}{2t^2 + 3}.$$

What is the horizontal asymptote for this function? Describe what this means in practical terms.

A) $y = 3.00$; 3.00 is the final amount, in milligrams, of the drug that will be left in the patient's bloodstream.
B) $y = 0$; 0 is the final amount, in milligrams, of the drug that will be left in the patient's bloodstream.
C) $y = 1.20$; After 1.20 hours, the concentration of the drug is at its greatest.
D) $y = 3.00$; After 3.00 hours, the concentration of the drug is at its greatest.

59) A drug is injected into a patient and the concentration of the drug is monitored. The drug's concentration, C(t), in milligrams per liter after t hours is modeled by 59) ________

$$C(t) = \frac{6t}{2t^2 + 1}.$$

Estimate the drug's concentration after 2 hours. (Round to the nearest hundredth.)

A) 2.40 milligrams per liter
B) 2.45 milligrams per liter
C) 0.72 milligrams per liter
D) 0.67 milligrams per liter

60) The rational function 60) ________

$$C(x) = \frac{150x}{100 - x}, \quad 0 \le x < 100$$

describes the cost, C, in millions of dollars, to inoculate x% of the population against a particular strain of the flu. Determine the difference in cost between inoculating 85% of the population and inoculating 50% of the population. (Round to the nearest tenth, if necessary.)

A) \$1.2 million
B) \$700.0 million
C) \$1.3 million
D) \$699.9 million

61) A company that produces scooters has costs given by the function $C(x) = 20x + 15{,}000$, where x is the number of scooters manufactured and C(x) is measured in dollars. The average cost to manufacture each scooter is given by 61) ________

$$\bar{C}(x) = \frac{20x + 15{,}000}{x}.$$

What is the horizontal asymptote for the function $\bar{C}$ ? Describe what this means in practical terms.

A) y = 20; $20 is the least possible cost for producing each scooter.
B) y = 15,000; $15,000 is the least possible cost for running the company.
C) y = 20; 20 is the minimum number of scooters the company can produce.
D) y =15,000; 15,000 is the maximum number of scooters the company can produce.

62) A can in the shape of a right circular cylinder is required to have a volume of 700 cubic centimeters. The top and bottom are made up of a material that costs 8¢ per square centimeter, while the sides are made of material that costs 5¢ per square centimeter. Find a function that describes the total cost of the material as a function of the radius r of the cylinder. 62) ________

A) $C(r) = 0.08\pi r^2 + \dfrac{70}{r}$
B) $C(r) = 0.16\pi r^2 + \dfrac{140}{r}$
C) $C(r) = 0.16\pi r^2 + \dfrac{70}{r}$
D) $C(r) = 0.08\pi r^2 + \dfrac{140}{r}$

63) Economists use what is called a Leffer curve to predict the government revenue for tax rates from 0% to 100%. Economists agree that the end points of the curve generate 0 revenue, but disagree on the tax rate that produces the maximum revenue. Suppose an economist produces this rational function 63) ________

$R(x) = \dfrac{10x(100 - x)}{75 + x}$, where R is revenue in millions at a tax rate of x percent. Use a graphing calculator to graph the function. What tax rate produces the maximum revenue? What is the maximum revenue?

A) 39.6%; $209 million
B) 34.9%; $207 million
C) 35.8%; $209 million
D) 37.5%; $210 million

64) Economists use what is called a Leffer curve to predict the government revenue for tax rates from 0% to 100%. Economists agree that the end points of the curve generate 0 revenue, but disagree on the tax rate that produces the maximum revenue. Suppose an economist produces this rational function 64) ________

$R(x) = \dfrac{10x(100 - x)}{15 + x}$, where R is revenue in millions at a tax rate of x percent. Use a graphing calculator to graph the function. What tax rate produces the maximum revenue? What is the maximum revenue?

A) 28.1%; $470 million
B) 26.5%; $469 million
C) 31.4%; $464 million
D) 29.7%; $467 million

65) The concentration of a drug in the bloodstream, measured in milligrams per liter, can be modeled by the function, $C(t) = \frac{12t + 4}{3t^2 + 2}$, where t is the number of minutes after injection of the drug. When will the drug be at its highest concentration? Approximate your answer rounded to two decimal places. 65) _______

A) at the time of injection
B) $t = 3.65$ minutes after the injection is given
C) $t = 4$ minutes after the injection is given
D) $t = 0.55$ minutes after the injection is given

66) A closed box with a square base has to have a volume of 9000 cubic inches. Find a function for the surface area of the box. 66) _______

A) $S(x) = 2x^2 + \frac{36,000}{x}$
B) $S(x) = 2x^2 + \frac{9000}{x}$
C) $S(x) = x^2 + \frac{36,000}{x}$
D) $S(x) = 2x^2 + \frac{54,000}{x}$

**Solve the inequality. Express the solution using interval notation.**

67) $(x - 3)^2(x + 7) < 0$ 67) _______

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

68) $(x + 6)(x + 2)(x - 2) > 0$ 68) _______

A) $(2, \infty)$
B) $(-6, -2)$ or $(2, \infty)$
C) $(-\infty, -6)$ or $(-2, 2)$
D) $(-\infty, -2)$

69) $(x + 3)(x - 2)(x - 4) < 0$ 69) _______

A) $(-\infty, -3)$ or $(2, 4)$
B) $(-\infty, 2)$
C) $(4, \infty)$
D) $(-3, 2)$ or $(4, \infty)$

70) $x^3 - 6x^2 > 0$ 70) _______

A) $(-\infty, 0)$ or $(6, \infty)$
B) $(6, \infty)$
C) $(-\infty, 6)$
D) $(0, 6)$

71) $x(x + 3)(5 - x) \geq 0$ 71) _______

A) $[0, 5]$
B) $[-3, 5]$
C) $(-\infty, -3]$ or $[0, 5]$
D) $[-3, 0]$ or $[5, \infty)$

72) $x^4 < 16x^2$ 72) _______

A) $(-\infty, -4)$ or $(4, \infty)$
B) $(-\infty, -4)$ or $(0, 4)$
C) $(-4, 0)$ or $(4, \infty)$
D) $(-4, 0)$ or $(0, 4)$

**Solve the problem.**

73) For what positive numbers will the cube of a number exceed 3 times its square? 73) _______

A) $\{x \mid 0 < x < 9\}$; $(0, 9)$
B) $\{x \mid 0 < x < 3\}$; $(0, 3)$
C) $\{x \mid x > 9\}$; $(9, \infty)$
D) $\{x \mid x > 3\}$; $(3, \infty)$

74) What is the domain of the function $f(x) = \sqrt{x^4 - 16}$ ? 74) _______

A) $(-\infty, 2)$ or $(2, \infty)$
B) $(-\infty, -2]$ or $[2, \infty)$
C) $(-\infty, -2)$ or $(2, \infty)$
D) $(-\infty, 2)$

75) What is the domain of the function $f(x) = \sqrt{x^3 - 4x^2}$ ? 75) _______

A) 0 or $[4, \infty)$
B) $[4, \infty)$
C) 0 or $(4, \infty)$
D) 0 or $(-\infty, -4]$

**Determine where the graph of f is below the graph of g by solving the inequality $f(x) \le g(x)$.**

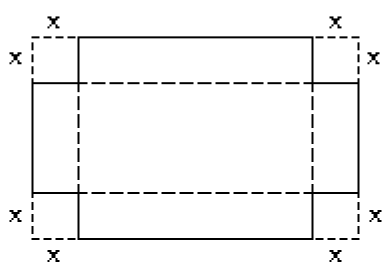
76) $f(x) = x^4 - 41$ 76) _______

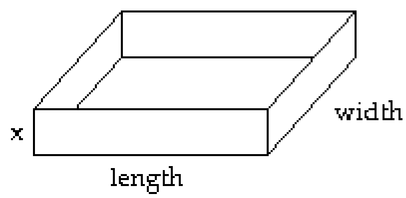
$g(x) = 5x^2 - 5$

A) $f(x) \le g(x)$ if $-3 \le x \le 3$
B) $f(x) \le g(x)$ if $x \le 3$
C) $f(x) \le g(x)$ if $-3 \le x$
D) $f(x) \le g(x)$ if $-3 \ge x$ or $x \ge 3$

**Solve the problem.**

77) A box with an open top is formed by cutting squares out of the corners of a rectangular piece of cardboard and then folding up the sides. If x represents the length of the side of the square cut from each corner, and if the original piece of cardboard is 11 inches by 8 inches, what size square must be cut if the volume of the box is to be 54 cubic inches? 77) _______

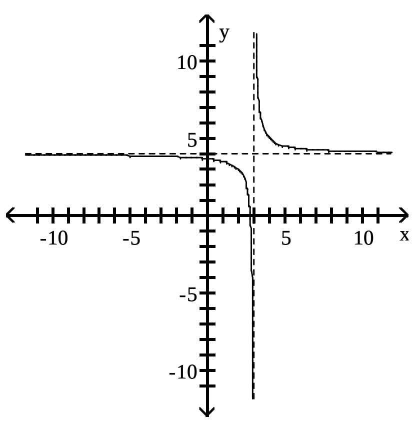



A) 6 in. by 6 in. square
B) 4 in. by 4 in. square
C) 9 in. by 9 in. square
D) 1 in. by 1 in. square

**Use the graph to determine the domain and range of the function.**

78) 78) _______




A) domain: $\{x \mid x \neq -3\}$
range: $\{y \mid y \neq 4\}$

B) domain: $\{x \mid x \neq 4\}$
range: $\{y \mid y \neq -3\}$

C) domain: $\{x \mid x \neq 3\}$
range: $\{y \mid y \neq 4\}$

D) domain: $\{x \mid x \neq 4\}$
range: $\{y \mid y \neq 3\}$

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

**Analyze the graph of the given function f as follows:**
**(a) Determine the end behavior: find the power function that the graph of f resembles for large values of |x|.**
**(b) Find the x– and y–intercepts of the graph.**
**(c) Determine whether the graph crosses or touches the x–axis at each x–intercept.**
**(d) Graph f using a graphing utility.**
**(e) Use the graph to determine the local maxima and local minima, if any exist. Round turning points to two decimal places.**
**(f) Use the information obtained in (a) – (e) to draw a complete graph of f by hand. Label all intercepts and turning points.**
**(g) Find the domain of f. Use the graph to find the range of f.**
**(h) Use the graph to determine where f is increasing and where f is decreasing.**

79) $f(x) = (x + 3)(x - 1)^2$ 79) ______________

80) $f(x) = (x - 3)(x - 1)(x + 2)$ 80) ______________