

DIRECTIONS: Show all work on this test paper. Most problems must have work shown. Each problem is worth 4 points unless stated otherwise.

Determine a window which gives a complete graph of the polynomial function.

1) $y = 3x^3 - 26x^2 + 18x - 47$

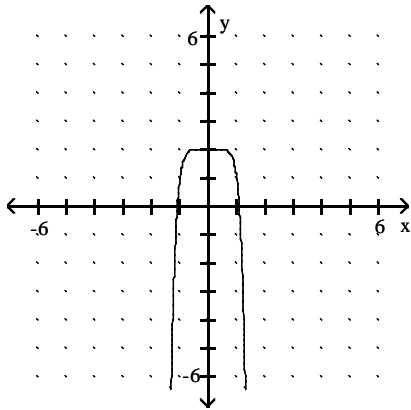
1) _____

A) $[-3, 10]$ by $[-400, 100]$

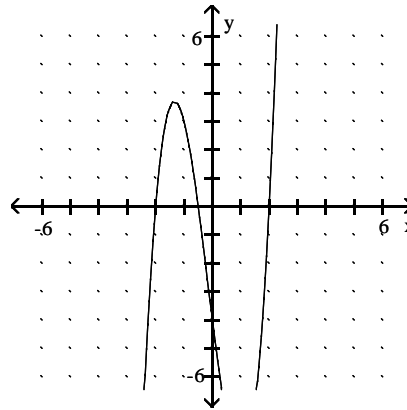
B) $[-5, 5]$ by $[-500, 100]$

State whether the leading coefficient is positive or negative.

2) a.



b.)



2) a. _____

b. _____

Classify the polynomial as cubic or quartic.

3) a) $g(x) = 282x^2 + 4147x^3$

b) $f(x) = 12x^4 - 12 + 0.18x^2 - 5x$

3) a. _____

b. _____

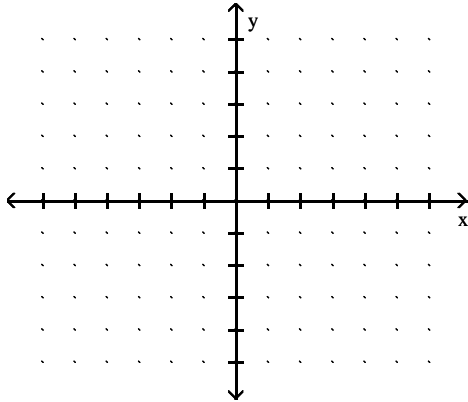
Approximate the coordinates of each turning point by graphing $f(x)$ in the standard viewing rectangle.

4) $y = -x^3 + \frac{3}{2}x^2 + 6x - 3$

4) _____

Draw a graph with the following parameters.

- 5) Cubic polynomial with two distinct real zeros and a positive leading coefficient 5)



Solve the problem.

- 6) The table shows the number of dollars spent in Country X (in millions) on environmental protection programs during the years 1985 ($x = 1$) through 1995 ($x = 11$). Find the cubic model that is the best fit for this data. Round coefficients to three decimal places. 6) _____

Year	Spending (millions of dollars)
1985	5.5
1986	5.8
1987	6.1
1988	6.9
1989	7.1
1990	7.0
1991	6.5
1992	7.3
1993	7.6
1994	7.8
1995	7.9

Solve the polynomial equation by factoring. Show all work necessary to justify each answer. (5 points each)

7) $x^3 + 2x^2 - 9x - 18 = 0$ 7) _____

8) $-9x^4 + 6x^3 + 8x^2 = 0$ 8) _____

Solve the polynomial equation by using the root method. Show all work necessary to justify each answer.

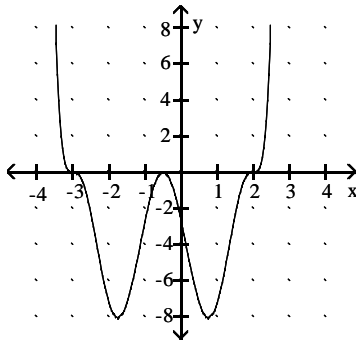
9) $2x^4 - 512 = 0$

9) _____

Use the graph of the polynomial function $f(x)$ to solve $f(x) = 0$.

10)

10) _____



Solve the problem.

11) If the price for a product is given by $p = 100 - x^2$, where x is the number of units sold, then the revenue is given by $R = px = 100x - x^3$. How many units must be sold to give zero revenue? (5 points)

11) _____

12) Suppose a business can sell x gadgets for $p = 250 - 0.01x$ dollars apiece, and it costs the business $c(x) = 1000 + 25x$ dollars to produce the x gadgets. Determine the production level and cost per gadget required to maximize profit. (Remember $R = px$)

12) _____

Give the equations of any vertical asymptotes for the graphs of the rational functions. (2 points each)

13) $f(x) = \frac{8x + 6}{4x - 5}$ 13) _____

14) $f(x) = \frac{x - 6}{x^2 - 25}$ 14) _____

Give the equations of any horizontal asymptotes for the graphs of the rational functions. (2 points each)

15) $g(x) = \frac{x^2 + 3x - 9}{x - 9}$ 15) _____

16) $g(x) = \frac{x + 3}{x^2 - 4}$ 16) _____

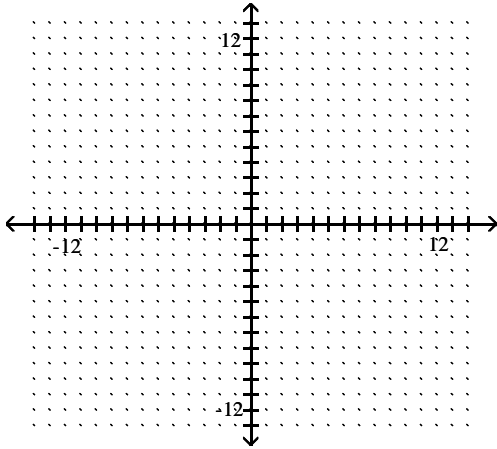
17) $h(x) = \frac{6x^2}{2x^2 - 2}$ 17) _____

Use analytical methods to solve the equation. Show all work necessary to justify each answer. (5 points)

18) $\frac{6}{x - 6} = 1 + \frac{8}{x + 6}$ 18) _____

Graph the function. Give the equations of the a) vertical and b) horizontal asymptotes. Give the c) y intercept and use the asymptotes and other points to graph the function. (6 points)

$$19) f(x) = \frac{4x + 1}{x - 2}$$



19) a. _____

b. _____

c. _____

Solve the problem.

20) The average number of vehicles waiting in line at a toll booth of a super highway is modeled by the function $n(x) = \frac{x^2}{0.5(1 - x)}$, where x is a quantity between 0 and 1 known as the traffic intensity. To the nearest tenth, find the average number of vehicles waiting if the traffic intensity is .81. 20) _____

highway is modeled by the function $n(x) = \frac{x^2}{0.5(1 - x)}$, where x is a quantity between 0 and 1 known as the traffic intensity. To the nearest tenth, find the average number of vehicles waiting if the traffic intensity is .81.

21) Suppose that during a flu epidemic in a particular city, the number of people, $N(x)$, infected (in thousands) at the end of x weeks is approximated by 21) _____

$$N(x) = \frac{102x}{x + 29}$$

What is the horizontal asymptote of the graph of this function? What does this suggest about the maximum number of people who will eventually be infected? Explain your reasoning.

Use analytical and graphical methods to solve the inequality. (5 points each)

22) $(x + 9)(x^2 - 36) > 0$

22) _____

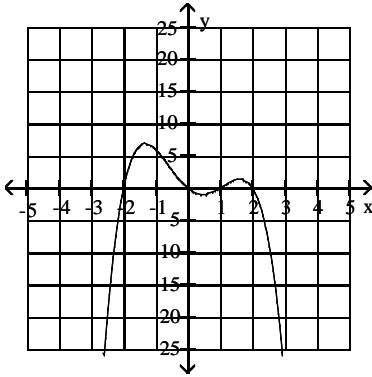
23) $\frac{x + 24}{x + 1} < 7$

23) _____

Use the graph of $f(x)$ to solve the inequality.

24) $f(x) > 0$

24) _____



Solve the problem.

25)

25) _____

The future value of \$4000 invested for 5 years at rate r , compounded annually, is given by $S = 4000(1 + r)^5$. Find the rate r , as a percent, that gives a future value from \$5610 to \$6442, inclusive. Round to the nearest whole percent.

26) **THIS IS A BONUS PROBLEM WORTH 4 BONUS POINTS. YOU MUST SET UP AN EQUATION AND USE IT TO SOLVE THE PROBLEM. YOU MAY SOLVE YOUR EQUATION GRAPHICALLY.**

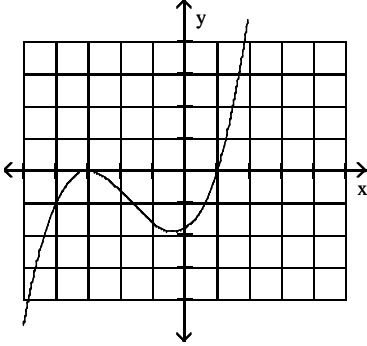
A rectangular piece of cardboard measuring 30 inches by 35 inches is to be made into a box with an open top by cutting equal size squares from each corner and folding up the sides. Let x represent the length of a side of each such square. For what value of x will the volume be a maximum? If necessary, round to 2 decimal places.

26) _____

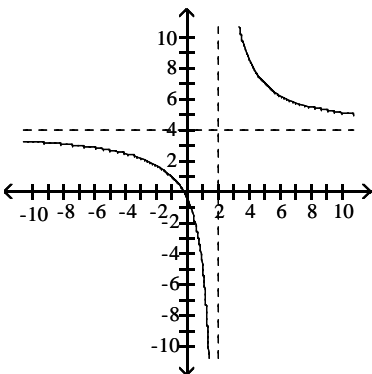
Answer Key

Testname: EXAM 4

- 1) A
- 2) a) 4: Leading coefficient is negative. b) cubic : leading coefficient is positive
- 3) a) Cubic b) Quartic
- 4) (-1, -6.5) and (2, 7)
- 5) One example



- 6) $f(x) \approx 0.005x^3 - 0.102x^2 + 0.805x + 4.697$
- 7) 3, -3, -2
- 8) $-\frac{2}{3}, \frac{4}{3}, 0$
- 9) 4, -4
- 10) $-3, -\frac{1}{2}, 2$
- 11) 0, 10
- 12) 11,250 gadgets at \$137.50 each
- 13) $x = \frac{5}{4}$
- 14) $x = 5, x = -5$
- 15) None
- 16) $y = 0$
- 17) $y = 3$
- 18) 10, -12
- 19) a) $x = 2$ b) $y = 4$ c) $(0, \frac{-1}{2})$



Answer Key

Testname: EXAM 4

20) 6.9 vehicles

21) Answers will vary. Possible answer: The horizontal asymptote is $y = 102$. This suggests that as x gets larger, the number of people with the flu approaches 102,000. The fact that there is a horizontal asymptote suggests that there is an upper bound on the number of people who will eventually get the flu, namely 102,000.

22) $-9 < x < -6$ or $x > 6$

23) $x < -1$ or $x > \frac{17}{6}$

24) $-2 < x < 0$ or $1 < x < 2$

25) $7\% \leq r \leq 10\%$

26) 5.37 in.