

Many of the problems say SHOW YOUR WORK.

If no work is shown then NO CREDIT will be given.

Exercises	Point Value	Pts Awarded
True/False	10 (1pt each)	
1	8	
2	5	
3	4	
4	6	
5	6	
6	8	
7	6	
8	6	
9	6	
10	4	
11	7	
12	5	
13	5	
14	5	
15	5	
16	4	
	Total 100	
	Total Points Awarded →	

TRUE/FALSE Print the appropriate response on the line provided.

False 1. An odd function is symmetric about the y-axis.

True 2. The vertex form for a parabola is $y = a(x-h)^2 + k$. If we increase the value of k, then the graph shifts upward.

FALSE 3. The graph of every power function increases.

TRUE 4. At a zero of even multiplicity the graph of a polynomial does not cross the x-axis.

TRUE 5. If a linear system of 2 equations in 2 unknowns has infinitely many solutions then the equations are dependent.

FALSE 6. $f(x) = x^4 + 3x^2 + 1$ is not an even function.

TRUE 7. If the discriminant of $ax^2 + bx + c$ is positive, then the graph of $f(x) = ax^2 + bx + c$ has two different zeros.

FALSE 8. The domain of power function $f(x) = x^b$ is all real numbers for any value of b.

FALSE 9. Every consistent linear system of 2 equations in 2 unknowns has a unique solution.

TRUE 10. The graph of $y = x^3$ has no turning points.

1. (a) Find the equation of the line segment shown in the figure. Answer: $y = -\frac{1}{2}x + \frac{1}{2}$ others are possible

Pt: $(-7, 4)$ $(-3, 2)$ $m = \frac{2-4}{-3-(-7)} = -\frac{1}{2}$

$$y - 4 = -\frac{1}{2}(x + 7)$$

$$y + 2 = -\frac{1}{2}(x + 3) \text{ or } y = -\frac{1}{2}x + \frac{1}{2}$$

(b) Find the equation of a line through the point A in the figure that is perpendicular to the line $y - 2 = -\frac{2}{3}(x + 1)$.

Answer: $y = \frac{3}{2}x + \frac{1}{2}$ Others

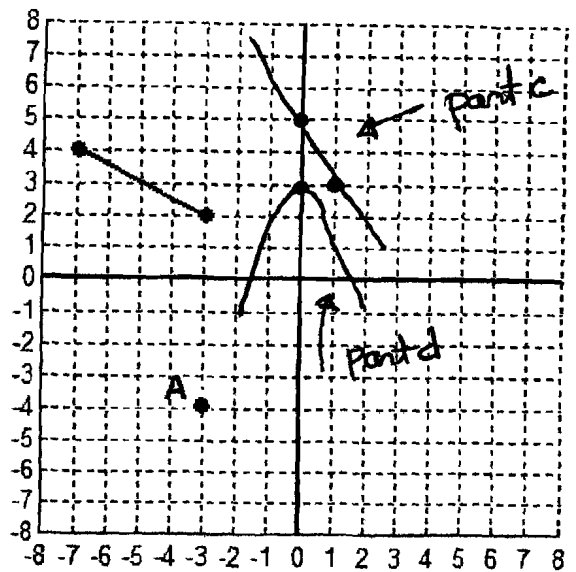
$$m = \frac{-1}{-\frac{2}{3}} = \frac{3}{2} \quad A(-3, -4)$$

$$y + 4 = \frac{3}{2}(x + 3)$$

$$y = \frac{3}{2}x + \frac{1}{2}$$

(c) On the figure draw the line which has y-intercept 5 and slope -2. $y = -2x + 5$

(d) On the figure draw the parabola $-x^2 + 3$.



2. Find the length of the longest side of the rectangle whose sides are $4x$ and $3x + 2$, given that its perimeter is 25. Answer: 6.5 (SHOW YOUR WORK.)

$$2(4x) + 2(3x + 2) = 25$$

$$8x + 6x + 4 = 25$$

$$14x = 21$$

$$x = \frac{21}{14} = \frac{3}{2}$$

$$\text{So } 4x = 4\left(\frac{3}{2}\right) = 6$$

$$3x + 2 = 3\left(\frac{3}{2}\right) + 2$$

$$= \frac{9}{2} + 2 = 4\frac{1}{2} + 2$$

$$= 6\frac{1}{2} = 6.5$$

3. A home owner is fencing a rectangular play area in his backyard of length L and width W so that one side is against his garage. If he has 2400 feet of fencing, construct a quadratic equation that can be solved to determine the dimensions that the area is a maximized. (Your equation is to be of the form $A = aW^2 + bW + c$, where A is area and a, b, c are numerical values.)

Answer: _____ (SHOW YOUR WORK.)

Hint: Draw a picture. Garage

One Soln:

$$2W + L = 2400 \Rightarrow L = 2400 - 2W$$

$$A = LW$$

$$A = (2400 - 2W)W = 2400W - 2W^2$$

$$\boxed{A = -2W^2 + 2400W}$$

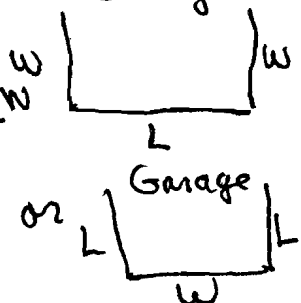
Other Soln

$$2L + W = 2400 \Rightarrow L = \frac{2400 - W}{2}$$

$$A = LW$$

$$A = \left(\frac{2400 - W}{2}\right)W$$

$$\boxed{A = -\frac{1}{2}W^2 + 1200W}$$



4. Find the vertex and x-intercepts of the graph of $y = 3x^2 - 24x + 45$. (SHOW YOUR WORK.)

Vertex: $h = \underline{4}$ $k = \underline{-3}$

$a = 3$ $b = -24$

x-intercepts: $\underline{5, 3}$

$h = -\frac{b}{2a} = \frac{24}{6} = 4$

Quad formula

$R = 3(16) - 24(4) + 45$
 $= 48 - 96 + 45 = -3$

$x = \frac{24 \pm \sqrt{(24)^2 - 12(45)}}{6}$

$= \frac{24 \pm \sqrt{36}}{6} = \frac{24 \pm 6}{6} = \begin{cases} 5 \\ 3 \end{cases}$

5. Part A. A box is to be constructed from cardboard so that its volume is 90 cubic inches. The length of the base must be 5 inches longer than the width of the base, while its height is to be 3 inches.

Let $W = x$, $L = x + 5$

Determine a formula for the volume of the box. Answer: $\underline{3x(x+5) = 90}$

Part B. A baseball is hit so that its height in feet after t seconds is $s(t) = -16t^2 + Kt + 4$.

Determine the value of K so that after 1 second the ball is 32ft high. Answer = $\underline{44}$

$32 = -16 + K + 4 \Rightarrow 44 = K$

Part C. A large hotel has a group rate for conventions. The regular room price is \$120, but for each room rented the price decreases by \$2. Write a formula for a the revenue if x rooms are rented.

Answer = $\underline{R = x(120 - 2x)}$

6. Solve the linear system $\begin{cases} 3x - 4y = -14 \\ x + 6y = 32 \end{cases}$. SHOW ALL STEPS. No credit when no work is shown.

By substitution:

$x = 32 - 6y$

$3(32 - 6y) - 4y = -14$

$96 - 18y - 4y = -14$

$-22y = -110$

$y = +5$

then $x = 32 - 30$

$x = \underline{2}$ $y = \underline{+5}$

By Elimination

$\begin{array}{r} 3x - 4y = -14 \\ -3(x + 6y = 32) \end{array} \Rightarrow \begin{array}{r} 3x - 4y = -14 \\ -3x - 18y = -96 \end{array}$

$\underline{-22y = -110}$

$y = 5$

$3(x) - 4(5) = -14$

$3x = 6$

$x = 2$

7. The peanut butter nougats sell for \$2.50 a pound and the chocolate covered raisins sell for \$4.00 a pound. The store wants to make 5 pound bags of a mixture of these two candies that sell for \$17.60. How many pounds of each type of candy should be used in each bag of the mixture? (Show all your work.)

Let $x =$ number pounds of peanut butter nougats, then $5-x =$ amt of choc raisins

$$2.5x + 4(5-x) = 17.60$$

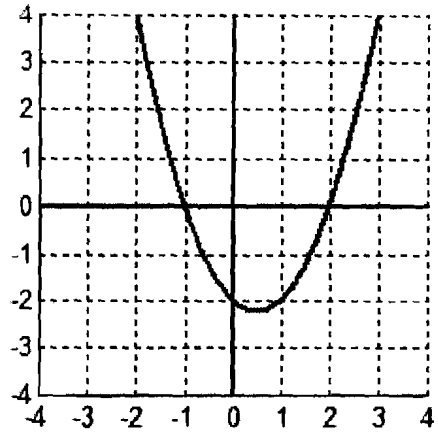
$$2.5x + 20 - 4x = 17.60$$

$$-1.5x = -2.4$$

$$x = 1.6$$

Number of pounds of peanut butter nougats = 1.6
 Number of pounds of chocolate covered raisins = 3.4

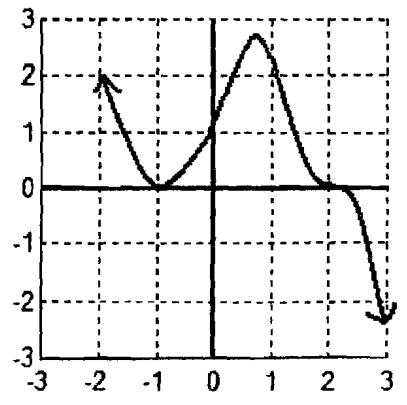
8. The graph of a quadratic is shown. Determine its equation. (Show your work.)



x-intercepts at $-1, 2$
 factors $(x+1)(x-2)$ $k =$ leading coeff
 $y = k(x+1)(x-2)$
 $-2 = k(1)(-2) \Rightarrow k = 1$
 $y = (x+1)(x-2) = x^2 - x - 2$
 y-intercept at $(0, -2)$

Equation: $y = x^2 - x - 2$

9. Use the graph to construct the equation in complete factored form of the degree 5 polynomial $f(x)$ by determining the following.



Sign of the Leading Coefficient = Negative

Factors: $(x+1)^2 (x-2)^3$

Equation: $f(x) = K(x+1)^2(x-2)^3$
 (Here let the letter K represent the leading coefficient.)

TWO EXTRA POINTS if you can determine the value of the leading coefficient. $K =$ $-\frac{1}{8}$

y-intercept at $(0, 1)$
 $1 = y = K(1)^2(-2)^3 \Rightarrow 1 = -8K \Rightarrow K = -\frac{1}{8}$

10. The leading term of a polynomial $f(x)$ is $6x^7$. Answer the following.

(a) Describe the behavior of the graph on the left end; that is, as x goes to $-\infty$.

Graph will go DOWN

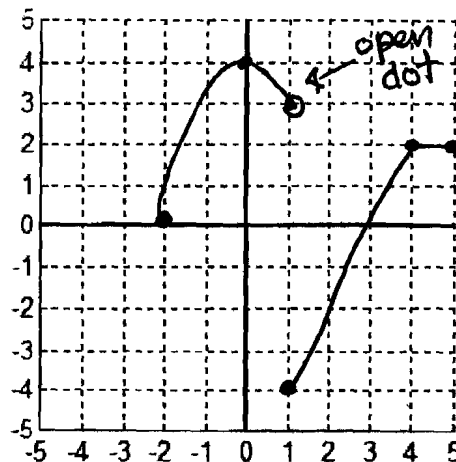
(b) How many turning points are possible? 6

11. Sketch the graph of the function $f(x) = \begin{cases} 4 - x^2, & \text{on } [-2, 1) \\ 2x - 6, & \text{on } [1, 4) \\ 2, & \text{on } [4, 5] \end{cases}$

Is it a continuous function? (Circle your response.)

YES

NO



12. Plot the data in the table. Then develop a quadratic model for the data in vertex form. (Show your work.)

x	4	6	8	10
y	6	14	38	78

Use (4,6) as vertex

$$y = a(x-h)^2 + k$$

$$y = a(x-4)^2 + 6$$

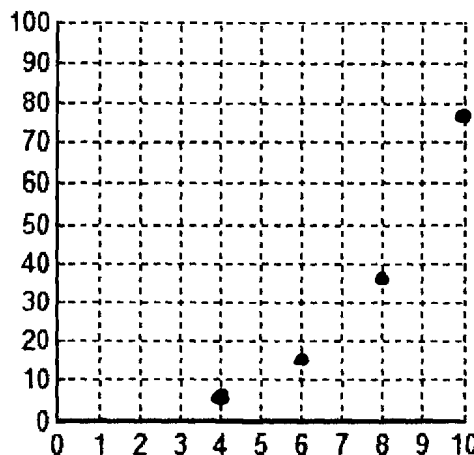
Find a : use any other point; @ (6, 14)

$$14 = a(4) + 6$$

$$8 = 4a \Rightarrow a = 2$$

Equation:

$$y = 2(x-4)^2 + 6$$



13. Solve the equation $\sqrt{1+2x} = x-4$. (Give your answers to the nearest hundredth.)

(SHOW YOUR WORK.)

Square both sides

$$1+2x = (x-4)^2 = x^2 - 8x + 16$$

$$0 = x^2 - 10x + 15$$

Quad formula

$$x = \frac{10 \pm \sqrt{100 - 60}}{2} = \frac{10 \pm \sqrt{40}}{2}$$

Check: only works for 8.16

$$= 5 \pm \sqrt{10} \\ = \begin{cases} 8.16 \\ 2.83 \end{cases}$$

$x =$ 8.16

14. Simplify the expression $\frac{x^2 x^{-2/3}}{\sqrt{x}}$ so that any exponents in the answer are positive rational values.

(Show your work.)

$$\begin{aligned} \frac{x^2 x^{-2/3}}{x^{1/2}} &= \frac{x^{2-2/3}}{x^{1/2}} = \frac{x^{4/3}}{x^{1/2}} = x^{4/3} x^{-1/2} \\ &= x^{4/3 - 1/2} \\ &= x^{8/6 - 3/6} \\ &= x^{5/6} \end{aligned}$$

Answer: $x^{5/6}$

15. The pulse rate of an animal can be approximated by $f(x) = 1607x^{-0.75}$ where x is the length of the animal in inches, and the value of $f(x)$ is the approximate number of heartbeats per minute.

(a) Use $f(x)$ to estimate the number of heartbeats for a dog 3.5 feet long. (Give your answer to the nearest whole number.)

(3.5)(12) = 42 (SHOW your work.)

$$\begin{aligned} f(42) &= 1607 (42)^{-0.75} \\ &= 97.4 \approx 97 \end{aligned}$$

Answer: 97

(b) What length corresponds to a pulse rate of 900 beats per minute?
(SHOW YOUR WORK.)

$$\begin{aligned} 900 &= 1607 x^{-3/4} \Rightarrow \frac{900}{1607} = x^{-3/4} \\ 0.56 &\approx x^{-3/4} \\ (0.56)^{-4/3} &\approx x \end{aligned}$$

Answer: about 2.16 inches

$$x \approx 2.16$$

16. In the figures labeled A – D, determine the equation of the graph from the following list:
 $y = x^2$, $y = x^4$, $y = |x|$, $y = -3x$

A. $y = -3x$

B. $y = x^4$

C. $y = |x|$

D. $y = x^2$

