Date:________________ **2.1 Solving Quadratic Equations: Two More Methods**

1. Solve using ***inverse operations*** to isolate the variable, $x, y \in C$.

a) $(y-4)^2 - 25 = 0$ **b)** $-3x^2 - 24 = 0$ **c)** $4(x+1)^2 + 4 = 0$

d) $9\left(x - \frac{1}{3}\right)^2 - 1 = 0$ **e)** $(y+0.5)^2 - 1.21 = 0$ **f)** $\frac{(y-6)^2}{8} = -2$

2. Solve using the ***quadratic formula*** $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, where $ax^2 + bx + c = 0$ and $x, y \in C$.

a) $x^2 - 4x + 8 = 0$ **b)** $3y^2 + 6y + 1 = 0$ **c)** $3y - 1 + y^2 = 0$ **d)** $3 = 3x - x^2$

e) $4y - 1 = 5y^2$ **f)** $\frac{y^2}{5} - \frac{1}{2} - \frac{y}{5} = 0$ **g)** $x^2 + 4 = -6x$ **h)** $2 - 4x + 3x^2 = 0$

3. Solve by ***factoring***.

a) $-2x^2 + 5x = 0$ **b)** $12t^2 + 14t = 6$ **c)** $100 - 64m^2 = 0$

d) $8 = 17x - 9x^2$ **e)** $\frac{a^2}{2} - \frac{a}{3} = \frac{1}{6}$ **f)** $\frac{x^2}{4} - x + 1 = 0$

4. Solve using the ***most appropriate method***, $x, y \in C$.

a) $-3x(x+2) = 7x^2 - x$ **b)** $2x(x+3) - x(4-x) = 6$ **c)** $\frac{y^2}{2} - \frac{y^2}{3} = -2$

d) $16\left(x + \frac{3}{4}\right)^2 - 1 = 0$ **e)** $(x+3)^2 = -2x$ **f)** $(y+6)(2y+5) = -8$

g) $(3y+2)^2 - (2y-5)^2 = 0$ **h)** $x - \frac{x}{x+1} = 2$ **i)** $\frac{3}{x} - \frac{4}{x+1} = 1$

5. Write a ***quadratic equation*** in expanded form with integer coefficients having the given roots.

a) $-\frac{2}{5}, \frac{5}{3}$ **b)** $-5-4i,\ -5+4i$ **c)** $3-2\sqrt{7},\ 3+2\sqrt{7}$

6. Solve the equation $4x^2 - 4xy + y^2 - 2x + y - 6 = 0$ for y by using a variety of factoring techniques.

2.1 Answers

1. a) $-1, 9$ **b)** $-2i\sqrt{2}, 2i\sqrt{2}$ **c)** $-1-i, -1+i$ **d)** $0, \frac{2}{3}$ **e)** $-1.6,\ 0.6$ **f)** $6-4i, 6+4i$

2. a) $2-2i, 2+2i$ **b)** $\frac{-3-\sqrt{6}}{3}, \frac{-3+\sqrt{6}}{3}$ **c)** $\frac{-3-\sqrt{13}}{2}, \frac{-3+\sqrt{13}}{2}$ **d)** $\frac{3-i\sqrt{3}}{2}, \frac{3+i\sqrt{3}}{2}$ **e)** $\frac{2-i}{5}, \frac{2+i}{5}$ **f)** $\frac{1-\sqrt{11}}{2}, \frac{1+\sqrt{11}}{2}$

g) $-3-\sqrt{5}, -3+\sqrt{5}$ **h)** $\frac{2-i\sqrt{2}}{3}, \frac{2+i\sqrt{2}}{3}$

3. a) $0, \frac{5}{2}$ **b)** $-\frac{3}{2}, \frac{1}{3}$ **c)** $-\frac{5}{4}, \frac{5}{4}$ **d)** $\frac{8}{9}, 1$ **e)** $-\frac{1}{3}, 1$ **f)** $2, 2$

4. a) $-\frac{1}{2}, 0$ **b)** $\frac{-1-\sqrt{19}}{3}, \frac{-1+\sqrt{19}}{3}$ **c)** $-2i\sqrt{3}, 2i\sqrt{3}$ **d)** $-1, -\frac{1}{2}$ **e)** $-4-\sqrt{7}, -4+\sqrt{7}$ **f)** $\frac{-17+i\sqrt{15}}{4}, \frac{-17-i\sqrt{15}}{4}$ **g)** $-7, \frac{3}{5}$

h) $1-\sqrt{3}, 1+\sqrt{3};\ x \neq -1$ **i)** $-3, 1;\ x \neq -1, 0$

5. a) $15x^2 - 19x - 10 = 0$ **b)** $x^2 + 10x + 41 = 0$ **c)** $x^2 - 6x - 19 = 0$

6. $y = 2x - 3,\ y = 2x + 2$

Date:____________ **2.2 Solving Cubic and Quartic Equations**

Note: *A polynomial of the* n^{th} *degree has n roots.*

1. Solve for x in each of the following, $x \in C$.

a) $4x^3 - 9x = 0$ **b)** $-2x^3 + 3x^2 - x = 0$ **c)** $12x^3 - 40x^2 - 52x = 0$

d) $x^4 - 5x^2 + 4 = 0$ **e)** $x^2 + 4 = \frac{32}{x^2}$ **f)** $20x^4 - 25x^2 - 45 = 0$

g) $x^3 - 3x^2 + 4x - 12 = 0$ **h)** $4x^3 + 8x^2 - x - 2 = 0$ **i)** $2x^4 - 4x^3 - 8x^2 + 16x = 0$

2. Solve for x in each of the following, $x \in C$.

a) $(x^2 - 2x)^2 - 11(x^2 - 2x) + 24 = 0$ **b)** $(2x^2 + 5x)^2 - 10(2x^2 + 5x) - 24 = 0$

c) $(x^2 + 2x)^2 - (x^2 + 2x) - 12 = 0$ **d)** $\left(x + \frac{6}{x}\right)^2 - 2\left(x + \frac{6}{x}\right) - 35 = 0$

e) $\left(x + \frac{1}{x}\right)^2 - 5\left(x + \frac{1}{x}\right) + 6 = 0$ **f)** $\left(x - \frac{1}{x}\right)^2 - \frac{77}{12}\left(x - \frac{1}{x}\right) + 10 = 0$

2.2 Answers

1. a) $-\frac{3}{2}, 0, \frac{3}{2}$ **b)** $0, \frac{1}{2}, 1$ **c)** $-1, 0, \frac{13}{3}$ **d)** $-2, -1, 1, 2$ **e)** $-2, 2, -2i\sqrt{2}, 2i\sqrt{2}$ **f)** $-\frac{3}{2}, \frac{3}{2}, -i, i$ **g)** $-2i, 2i, 3$

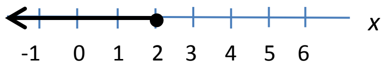
h) $-2, -\frac{1}{2}, \frac{1}{2}$ **i)** $-2, 0, 2, 2$

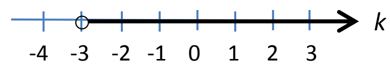
2. a) $-2, -1, 3, 4$ **b)** $-4, -2, -\frac{1}{2}, \frac{3}{2}$ **c)** $-1-\sqrt{5}, -1+\sqrt{5}, -1-i\sqrt{2}, -1+i\sqrt{2}$ **d)** $-3, -2, 1, 6$

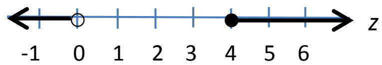
e) $1, 1, \frac{3 \pm \sqrt{5}}{2}$ **f)** $-\frac{1}{3}, -\frac{1}{4}, 3, 4$

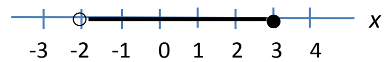
Date:_____________ **2.3 Solving Linear and Quadratic Inequalities**

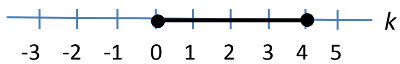
1. Write an inequality represented by each of the following:

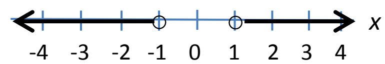
a) 

b) 

c) 

d) 

e) 

f) 

2. Solve each of the following ***linear inequalities*** and ***graph*** on a number line.

a) $2(x+3)<-(x+3)$ **b)** $6-3z\le 2(z-2)$ **c)** $6x-3(x+1)>x+5$

d) $0.8k+2.5<-2.3$ **e)** $\dfrac{x+5}{3}\ge x+2$ **f)** $\dfrac{2-3x}{2}+\dfrac{2}{3}<\dfrac{3x-2}{6}$

g) $-1\le 2x+7<7$ **h)** $0\le -3k-9\le 6$ **i)** $4>\dfrac{x+3}{2}>-1$

j) $2x-3>3-x \text{ or } 2x-3<x-3$ **k)** $2(k-1)\le 3(k-2) \text{ or } 2(k+1)\ge 3(k+2)$

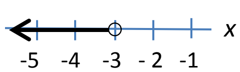
3. Solve each of the following ***quadratic inequalities*** and ***graph*** on a number line.

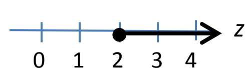
a) $4k^2-16<0$ **b)** $-3k^2+12k\le 0$ **c)** $x^2-2x-3>0$

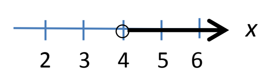
d) $2x^2+5x+2\le 0$ **e)** $-x^2-x+2>0$ **f)** $3k^2\ge 13k-4$

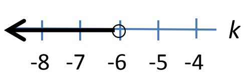
2.3 Answers

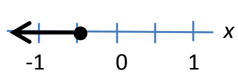
1. a) $x\le 2$ **b)** $k>-3$ **c)** $z<0 \text{ or } z\ge 4$ **d)** $-2<x\le 3$ **e)** $0\le k\le 4$ **f)** $x<-1 \text{ or } x>1$

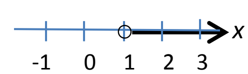
2. a) $x<-3$; 

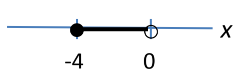
b) $z\ge 2$; 

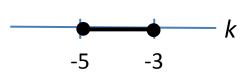
c) $x>4$; 

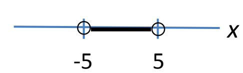
d) $k<-6$; 

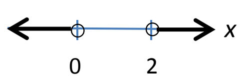
e) $x\le -\frac{1}{2}$; 

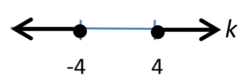
f) $x>1$; 

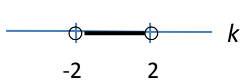
g) $-4\le x<0$; 

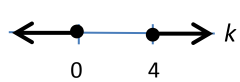
h) $-5\le k\le -3$; 

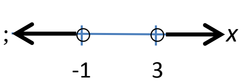
i) $-5<x<5$; 

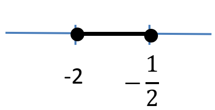
j) $x<0 \text{ or } x>2$; 

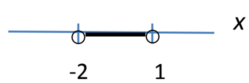
k) $k\le -4 \text{ or } k\ge 4$; 

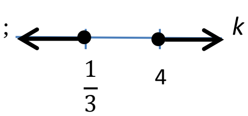
3. a) $-2<k<2$; 

b) $k\le 0 \text{ or } k\ge 4$; 

c) $x<-1 \text{ or } x>3$; 

d) $-2\le x\le -\frac{1}{2}$; 

e) $-2<x<1$; 

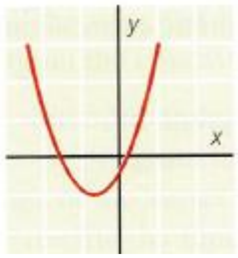
f) $k\le \frac{1}{3} \text{ or } k\ge 4$; 

Date:______________

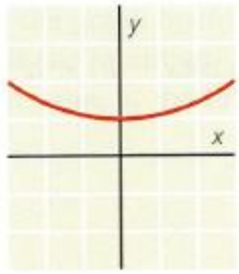
2.4 The Discriminant

1. The graphs of various *quadratic relations* are pictured below. State whether the *discriminant* of the corresponding *quadratic equation* is greater than 0, equal to 0, or less than 0.

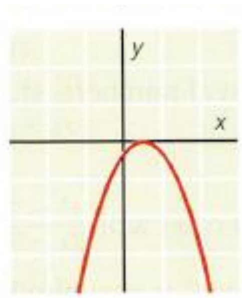
a)



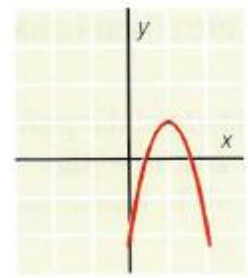
b)



c)



d)



2. Use the *discriminant* to determine the nature of the roots of each quadratic equation.

a) $x^2+4x+5=0$ **b)** $2x^2=x+3$ **c)** $x^2-4\sqrt{3}\,x+12=0$

d) $2-2x-\frac{1}{4}x^2=0$ **e)** $\sqrt{2}\,x^2+3\sqrt{2}=2x+2\sqrt{2}$ **f)** $2x^2-12x+16=-x^2+6x-11$

3. Determine the value(s) of k that give the following equations *two equal real roots.*

a) $x^2-6x+3k=0$ **b)** $2kx^2+3x+2k=0$ **c)** $-kx^2+(3k+1)x-2k=0$

4. Determine the value(s) of k that give the following equations *two distinct real roots.*

a) $(1-2k)x^2-6x-1=0$ **b)** $2x^2-kx+k=0$ **c)** $x^2+(k+7)x+(7k+1)=0$

5. Determine the value(s) of k that give the following equations *two non-real roots.*

a) $kx^2-8x-9=0$ **b)** $9x^2+3kx+k=0$ **c)** $x^2-2kx+8k-15=0$

6. For what value(s) of k does the *quadratic relation* $y=3x^2-4x+k$ have no x-intercepts?

7. The graph of the *quadratic relation* $y=x^2-kx+k+8$ touches the x-axis at one point. What are the possible value(s) of k?

2.4 Answers

1. a) $D>0$ **b)** $D<0$ **c)** $D=0$ **d)** $D>0$

2. a) 2 *non-real roots* **b)** 2 *distinct real roots* **c)** 2 *equal real roots* **d)** 2 *distinct real roots*
e) 2 *non-real roots* **f)** 2 *equal real roots*

3. a) $k=3$ **b)** $k=-\frac{3}{4},\frac{3}{4}$ **c)** $k=-3-2\sqrt{2},-3+2\sqrt{2}$

4. a) $k<5$ **b)** $k<0$ *or* $k>8$ **c)** $k<5$ *or* $k>9$

5. a) $k<-\frac{16}{9}$ **b)** $0<k<4$ **c)** $3<k<5$

6. $k>\frac{4}{3}$

7. $k=-4,8$

Date:_____________ **2.5 Applications: Quadratic Equations**

1. The volume, V, in hundreds of shares, of a company's stock, after being listed on the stock exchange for t weeks, can be modelled by the relation $V = 250t - 5t^2$. Use the ***discriminant*** to determine if the volume will ever reach
 a) 275 000 shares in a week; $V = 2750$ **b)** 400 000 shares in a week

2. Anthony owns a business that sells parts for electronic game systems. His profit, P, in thousands of dollars, can be modelled by the relation $P = -\frac{1}{2}x^2 + 8x - 24$, where x is the quantity sold, in thousands. Determine how many parts Anthony must sell in order for his business to
 a) break even; $P = 0$ **b)** make a profit; $P > 0$

3. The relation $h = -5t^2 + 20t + 2$ gives the approximate height, h metres, of a thrown football, t seconds since it was thrown.
 a) How long was the ball in the air, to the nearest tenth of a second?
 b) For how many seconds was the height of the ball at least 17 *m*?

4. Subtracting a number from half of its square gives a result of 13. Express the possible values of the number in simplest radical form.

5. The sum of a number and its reciprocal is 6.41. What are the possible numbers?

6. A rectangular nuclear-waste holding facility is 100 *m* long and 70 *m* wide. A safety zone of a uniform strip must be constructed around the facility. Determine the width of the strip of land to the nearest metre, if the area of the facility and strip is 90 000 m^2.

7. A mural is to be painted on a wall that is 15 *m* long and 12 *m* high. A border of uniform width is to surround the mural. If the mural is to cover 75% of the area of the wall, how wide must the the border be, to the nearest hundredth of a metre?

8. If the same length is cut off three pieces of wood measuring 21 *cm*, 42 *cm*, and 45 *cm*, the three pieces of wood can be assembled into a right triangle. What length must be cut off each piece?

9. A right triangle has a height 8 *cm* more than twice the length of the base. If the area of the triangle is 96 cm^2 , what are the dimensions of the triangle?

10. A rectangular garden with an area of 150 m^2 is to be enclosed on all four sides by 60 *m* of fencing. Determine the dimensions of the garden to the nearest tenth of a metre, if necessary.

11. A rectangular box is 20 *cm* high and twice as long as it is wide. If it has a surface area of 1600 cm^2, determine
 a) the dimensions of the box **b)** the volume of the box

12. The ION has 4000 passengers daily, each paying a fare of $3.25. For each $0.15 increase in the fare, Grand River Transit estimates it will lose 40 passengers per day. If the ION needs to take in $15200 per day to stay in business, what fare should be charged?

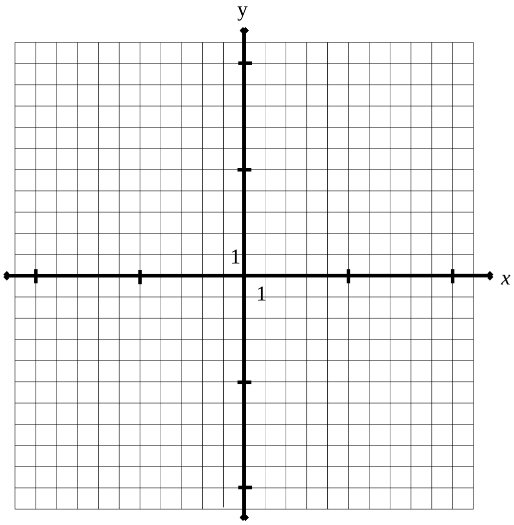
2.5 Answers

1. a) *yes* **b)** *no* **2. a)** 4000 *or* 12000 *parts* **b)** *between* 4000 *and* 12000 *parts* **3. a)** 4.1 *s* **b)** 2 *s* **4.** $1-3\sqrt{3}, 1+3\sqrt{3}$ **5.** 0.16, 6.25 **6.** 108 *m* **7.** 0.89 *m* **8.** 6 *cm* **9.** $b = 8\ cm, h = 24\ cm$ **10.** $l = 23.7\,m, w = 6.3\,m$ **11. a)** $20\,cm \times 10\,cm \times 20\,cm$ **b)** $4000\,cm^3$ **12.** $4.00

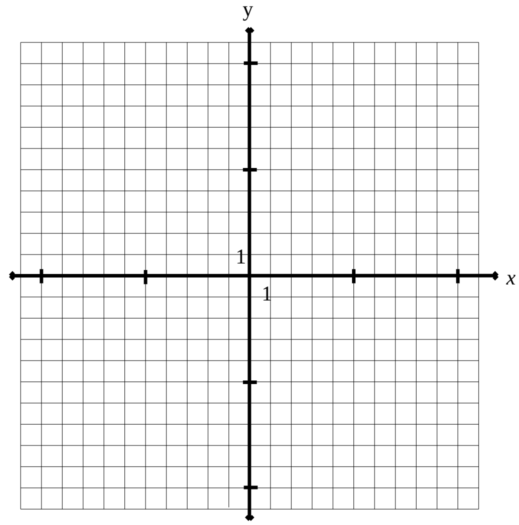
Date:_____________ 2.6 Graphing Quadratic Relations Given Any Form

Graph each quadratic relation and state the maximum or minimum value and when it occurs.

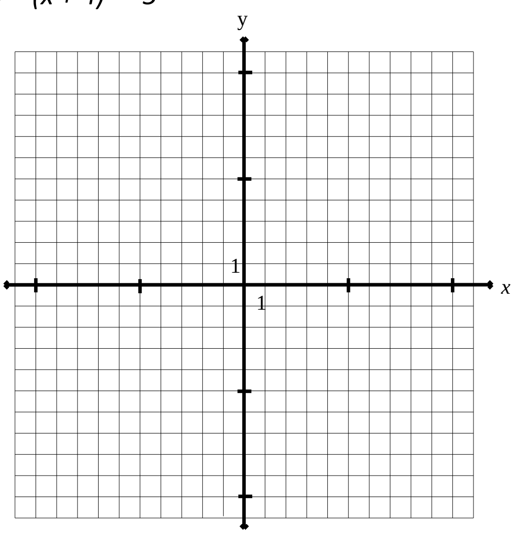
a) $y = -x(x - 6)$



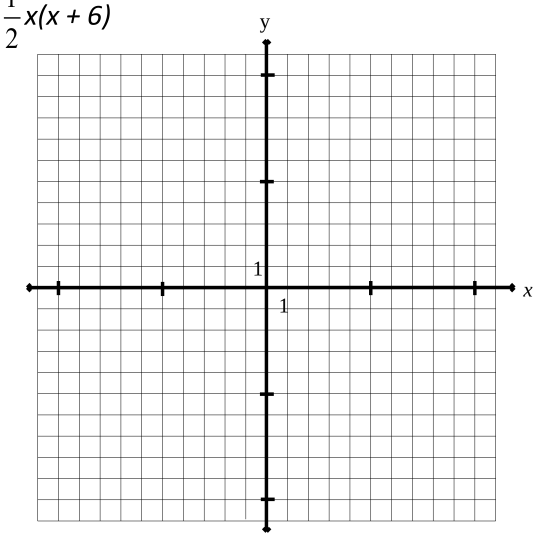
b) $y = (x - 3)^2 + 2$



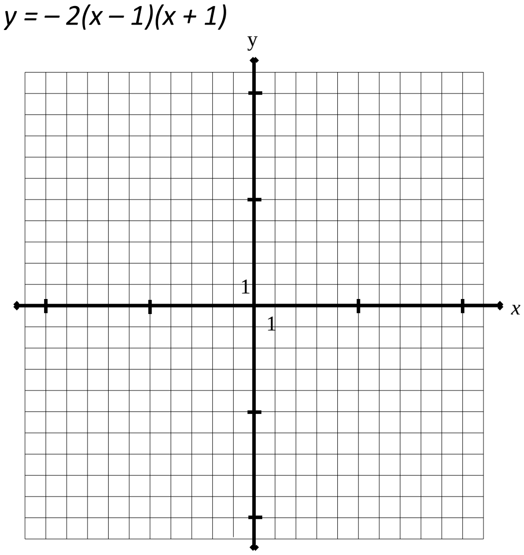
c) $y = (x + 4)^2 - 5$



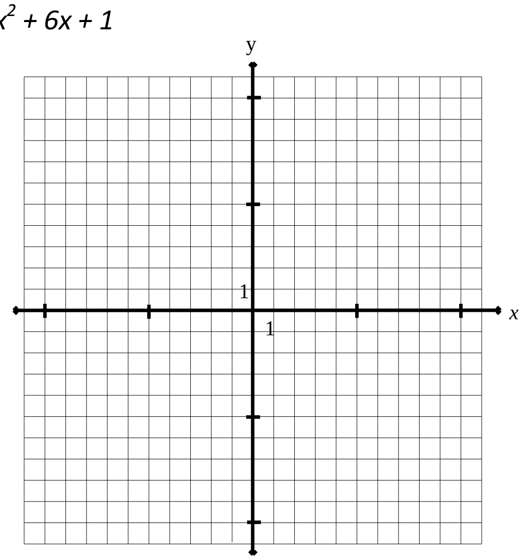
d) $y = \frac{1}{2}x(x + 6)$



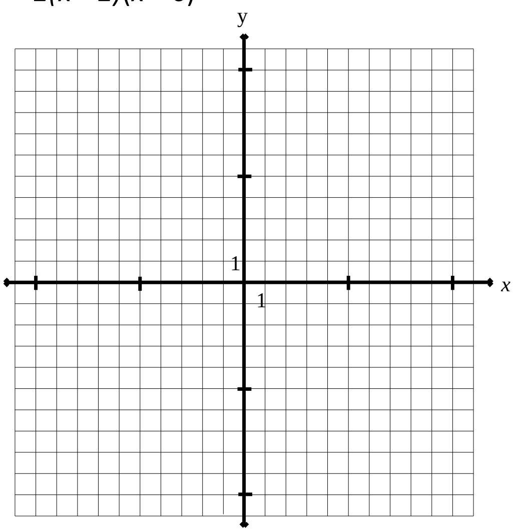
e) $y = -2(x - 1)(x + 1)$



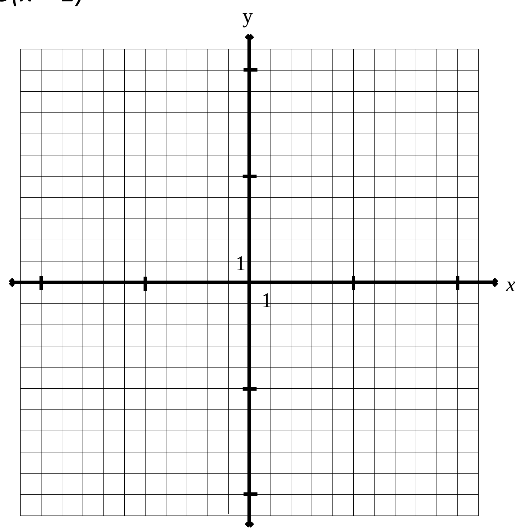
f) $y = 3x^2 + 6x + 1$



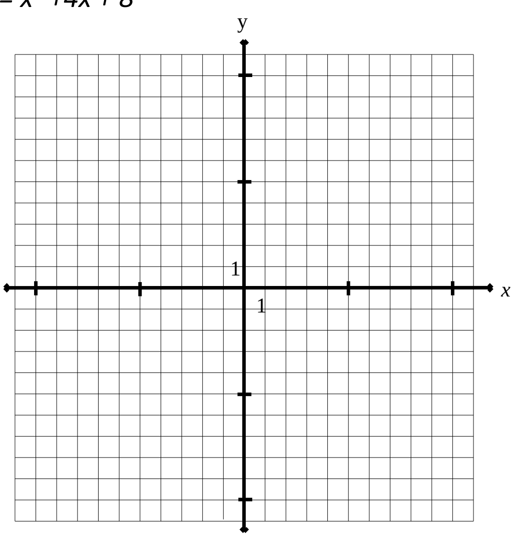
g) $y = 2(x - 2)(x - 6)$



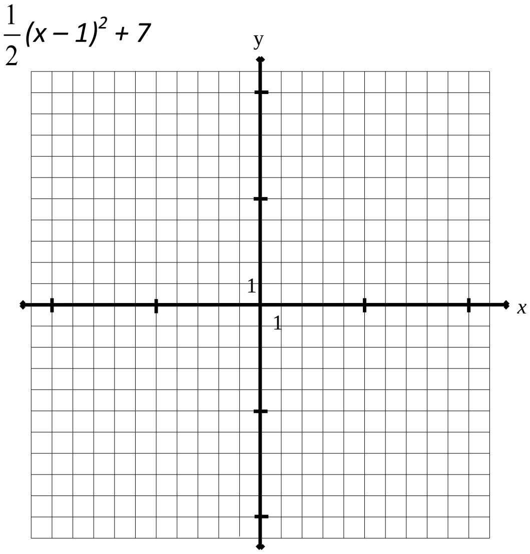
h) $y = -3(x + 1)^2$



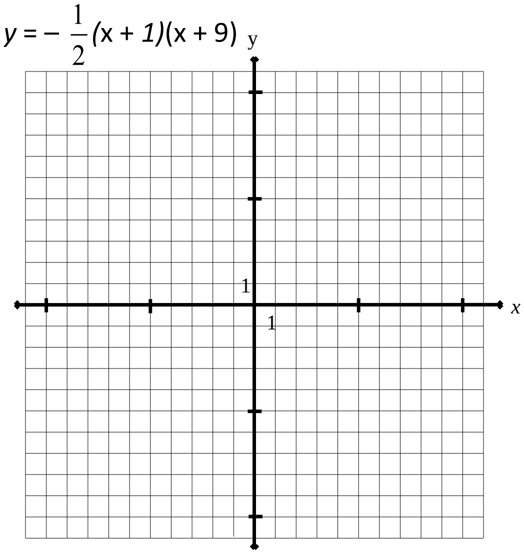
i) $y = x^2 + 4x + 8$



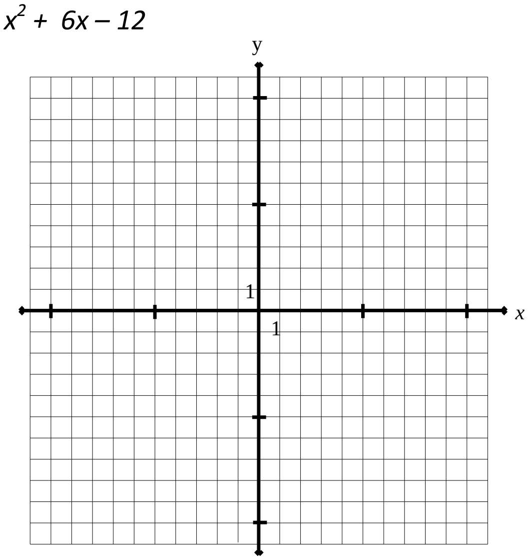
j) $y = -\frac{1}{2}(x - 1)^2 + 7$



k) $y = -\frac{1}{2}(x + 1)(x + 9)$



l) $y = -x^2 + 6x - 12$



Date:_____________ 2.6 Graphing Quadratic Relations Given Any Form

2.6 Answers

Check the accuracy of your graphs by using Desmos or other graphing technology or software.

a) *The maximum value of* y *is* 9 *when* $x = 3$.

b) *The minimum value of* y *is* 2 *when* $x = 3$.

c) *The minimum value of* y *is* -5 *when* $x = -4$.

d) *The minimum value of* y *is* -4.5 *when* $x = -3$.

e) *The maximum value of* y *is* 2 *when* $x = 0$.

f) *The minimum value of* y *is* -2 *when* $x = -1$.

g) *The minimum value of* y *is* -8 *when* $x = 4$.

h) *The maximum value of* y *is* 0 *when* $x = -1$.

i) *The minimum value of* y *is* 4 *when* $x = -2$.

j) *The maximum value of* y *is* 7 *when* $x = 1$.

k) *The maximum value of* y *is* 8 *when* $x = -5$.

l) *The maximum value of* y *is* -3 *when* $x = 3$.

Date:______________ **2.7 Applications: Maximum and Minimum Values**

1. Determine the maximum or minimum value of each relation and when it occurs.

a) $y=-0.3x^2-0.6x-0.1$ **b)** $s=\frac{3}{2}t^2-6t-3$ **c)** $y=\frac{1}{5}x^2+2x+5$

d) $p=-3n^2-5n$ **e)** $y=0.1x^2-2x+1$ **f)** $m=-4n^2+2n-1$

2. The power, P, in watts, supplied to a circuit by a 9 V (volt) battery is given by $P=9I-\frac{1}{2}I^2$, where I is the current in amperes. For what value of the current will the power be a maximum? What is the maximum power?

3. Justin Smoak hits a massive pop-up. The height, h, in metres, of the ball is given by $h=1.2+20t-5t^2$, where t is in seconds. What is the maximum height of the ball? If the ball is caught at the same height at which it was hit, how long is it in the air?

4. The cost, C, in dollars per hour of running a certain steamboat is modelled by the quadratic relation $C=1.8v^2-14.4v+156.5$, where v is the speed in kilometres per hour. At what speed should the boat travel to achieve the minimum cost?

5. What number, n, exceeds its square, n^2, by the greatest possible amount, A?

6. Two numbers have a difference of 20. Find the numbers if the sum of their squares is a minimum.

7. Determine the maximum area of a triangle, in square centimetres, if the sum of its base and its height is 13 *cm*.

8. A rectangular field is to be enclosed with 600 *m* of fencing. What is the maximum area that can be enclosed and what dimensions will give this area?

9. Still using 600 m of fencing, you wish to fence in a rectangular lot along a straight stretch of river (no fence needed along the river). What are the maximum area and dimensions in this case?

10. An electronics store sells an average of 60 entertainment systems per month at an average of $800 more than the cost price. For every $20 increase in the selling price, the store sells one fewer system. What amount over the cost price will maximize profit?

11. Last year, a banquet hall charged $30 per person, and 60 people attended the hockey banquet dinner. This year, the hall's manager has said that for every 10 extra people that attend, he will decrease the price by $1.50 per person. What size group would maximize the revenue for the hall this year?

2.7 Answers

1. a) *The maximum value of* y *is* 0.2 *when* $x=-1$. **b)** *The minimum value of* s *is* -9 *when* $t=2$.

c) *The minimum value of* y *is* 0 *when* $x=-5$. **d)** *The maximum value of* p *is* $\frac{25}{12}$ *when* $n=-\frac{5}{6}$.

e) *The minimum value of* y *is* -9 *when* $x=10$. **f)** *The maximum value of* m *is* $-\frac{3}{4}$ *when* $n=\frac{1}{4}$.

2. 9 A, 40.5 W **3.** 21.2 *m*, 4 *s* **4.** 4 *km/h*, $127.70/*h* **5.** $\frac{1}{2}$ **6.** -10 *and* 10 **7.** 21.125 cm^2 **8.** 22 500 m^2, 150 *m by* 150 *m*

9. 45 000 m^2, 300 *m by* 150 *m* **10.** $1000 **11.** 130

Date:_____________ **2.8 Solving Systems of Equations**

Part A: Solving systems of equations completely to determine the points of intersection

1. Solve each of the following systems algebraically and illustrate the results graphically.

a) $y = \frac{1}{2}x^2$, $x - y = -4$ **b)** $x^2 + y^2 = 20$, $y = -\frac{1}{2}x + 5$ **c)** $y = 2(x+2)^2 - 4$, $y = -x^2 - 2x + 4$

2. Determine ***exact*** points of intersection algebraically for each pair of relations.

a) $x^2 - y^2 = 1 - x$, $y = 2x + 3$ **b)** $x - 2y = 2$, $x^2 + 4y = 0$ **c)** $y = \sqrt{3}\,x^2$, $x^2 + y^2 = 4$

3. Justin is skeet shooting. The height of the skeet is modelled by the relation $h = -5t^2 + 32t + 2$, where *h* is the height in metres *t* seconds after the skeet is released. The path of Justin's bullet is modelled by the relation $h = 31.5t + 1$, with the same units. How long will it take for the bullet to hit the skeet? How high off the ground will the skeet be when it is hit?

Part B: Using the discriminant to determine the number of points of intersection

4. Without solving, determine if each quadratic relation will intersect once, twice, or not at all with the given linear relation.

a) $y = -x^2 + 3x - 5$ and $y = -x - 1$ **b)** $y = 0.5x^2 + 4x - 2$ and $y = x + 3$

5. In a city park, a sprinkler waters an area with a circumference that can be modelled by the relation $x^2 + y^2 = 20$. The sprinkler is located at the origin. A path through the park can be modelled by the relation $2x - y = 12$. Using the ***discriminant***, determine if the sprinkler will spray people walking along the path.

6. Determine the value of *k* in $y = kx^2 - 5x + 4$ that will result in the intersection of the line $y = -3x + 2$ with the quadratic at no point.

7. Determine the value of *k* in $y = -x^2 + 4x + k$ that will result in the intersection of the line $y = 8x - 2$ with the quadratic at two points.

8. A quadratic relation is defined by $y = 3x^2 + 4x - 2$. A linear relation is defined by $y = mx - 5$. What value(s) of the slope, *m*, of the line would make it a tangent to the parabola?

9. Determine the value(s) of *k* such that the line $y = 4x + k$ intersects the parabola $y = 3x^2 + kx + 4$.

2.8 Answers

1. a) $(-2,2), (4,8)$ **b)** $(2,4)$ **c)** $\left(-3\frac{1}{3}, -\frac{4}{9}\right), (0,4)$

2. a) $(-2,-1), \left(-1\frac{2}{3}, -\frac{1}{3}\right)$ **b)** $\left(-1-\sqrt{5}, \frac{-3-\sqrt{5}}{2}\right), \left(-1+\sqrt{5}, \frac{-3+\sqrt{5}}{2}\right)$ **c)** $\left(-1, \sqrt{3}\right), \left(1, \sqrt{3}\right)$

3. $0.5\ s,\ 16.75m$ **4. a)** *The relations intersect once.* **b)** *The relations intersect twice.*

5. *No: the path does not intersect the circumference of the area being watered*.

6. $k > \frac{1}{2}$ **7.** $k > -6$ **8.** $m = -2$ *or* $m = 10$ **9.** $k \le -8$ *or* $k \ge 4$

Date:______________ **Unit 2 Test Review**

1. Solve using the ***most appropriate method***, $x \in C$.

a) $6x^2 - 5x - 4 = 0$ **b)** $3(x-3)^2 = 48$ **c)** $2(x+3)^2 + 24 = 0$

d) $(3x-4)^2 - 2(x+8) = x$ **e)** $\frac{x^2}{2} - \frac{x}{3} - \frac{1}{3} = 0$ **f)** $\frac{4}{x-1} - \frac{5}{x+2} = \frac{3}{x}$

g) $-2x^3 + 3x^2 - x = 0$ **h)** $4x^2 + 31 = \frac{8}{x^2}$ **i)** $2x^3 - 4x^2 - 50x + 100 = 0$

j) $2x^3 + 3x^2 + 18x + 27 = 0$ **k)** $\left(x + \frac{4}{x}\right)^2 - 9\left(x + \frac{4}{x}\right) + 20 = 0$ **l)** $\left(x^2 - 2x\right)^2 - 4\left(x^2 - 2x\right) - 12 = 0$

2. Write a ***quadratic equation*** in expanded form with integer coefficients having the given roots.

a) $-\frac{1}{4}, \frac{1}{3}$ **b)** $2 - 3i\sqrt{3},\ 2 + 3i\sqrt{3}$

3. Solve each of the following ***inequalities*** and ***graph*** on a number line.

a) $3x + 6 \le -4 - x$ **b)** $\frac{2-3x}{2} + \frac{2}{3} < \frac{3x-2}{6}$ **c)** $1 - 2x > 7$ *or* $1 - 2x < -7$

d) $-5 \le 3x + 1 < 10$ **e)** $x^2 - 5x - 6 \ge 0$ **f)** $-4x^2 - 14x > 0$

4. Use the *discriminant* to determine the nature of the roots of each quadratic equation.

a) $2x = 1 - 3x^2$ **b)** $\sqrt{6}\ x^2 - 3\sqrt{2}\ x + \sqrt{6} = 0$ **c)** $\frac{x^2}{9} - \frac{x}{3} + \frac{1}{4} = 0$

5. Determine the value(s) of k that will give the indicated types of roots.

a) $(2k-3)x^2 - 6x + 1 = 0$; 2 *distinct real roots* **b)** $(3k+1)x^2 + kx + 1 = 0$; 2 *equal real roots*

c) $3x^2 + 2kx + 3 = 0$; 2 *non-real roots* **d)** $x^2 + kx + (8-k) = 0$; 2 *real roots*

6. The stopping distance, d, in metres, of a car travelling at a velocity of v *km/h* is given by the formula $d = 0.007v^2 + 0.015v$. How fast, to the nearest *km/h*, is a car travelling if it takes 30 *m* to stop without skidding?

7. The sum of two numbers is 14, and their product is 37. What are the numbers in simplest radical form?

8. A framed picture has a border the same area as the picture. If the picture is 25 *cm* by 20 *cm*, find the width of the border to the nearest tenth of a centimetre.

9. Determine the maximum or minimum value of each quadratic relation and when it occurs.

a) $y = \frac{1}{4}(x+7)(x-1)$ **b)** $s = -3t^2 + 4t + 2$

10. The height, h, in metres, above the ground of a football t seconds after it is thrown can be modelled by the relation $h = -4.9t^2 + 19.6t + 2$.

a) What is the maximum height reached by the football?

b) How long will the football be in the air to the nearest tenth of a second?

11. A relation models the effectiveness of a TV commercial. An advertising agency predicts after n viewings, the effectiveness, e, is $e = -\frac{1}{90}n^2 + \frac{2}{3}n$. Determine how many times a viewer should see a commercial for it to attain the maximum positive effect on the viewer.

12. A rectangular field is to be enclosed by a fence and divided into two rectangular fields by a fence parallel to one side of the field. If 1200 m of fence are available, find the dimensions of the field giving the maximum area.

13. Canada Trucking Company sells an average of 300 spark plug sets each week at a price of \$6.40 per set. The company decides to reduce the price and estimates that for every \$0.10 decrease in price, they will gain 5 sales per week over the existing average. What price should they set to maximize the weekly revenue? What is the maximum weekly revenue?

14. Solve each of the following systems algebraically and illustrate the results graphically.

a) $x^2 + y^2 = 4$
$x + y = 2$

b) $y = -2(x+6)(x+2)$
$2x + y + 4 = 0$

15. Use the *discriminant* to determine if the line $y = \frac{2}{3}x - 2$ will intersect the parabola $y = \frac{1}{2}(x-2)^2 + 5$ once, twice, or not at all. Illustrate your results *graphically*.

16. A punter kicks a football. It's height, h, in metres t seconds after the kick is modelled by $h = -4.9t^2 + 18.24t + 0.8$. The height of an approaching blocker's hands is modelled by the equation $h = -1.43t + 4.26$, using the same t. Can the blocker knock down the punt? If so, at what point will it happen?

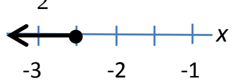
17. Determine the value(s) of k such that $y = 3x - k$ intersects the quadratic relation $y = 2x^2 - 5x + 3$.

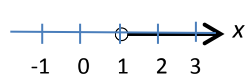
18. Determine the value(s) of k such that the line $y = 12x - 6$ is tangent to the parabola $y = 5x^2 + kx - 1$.

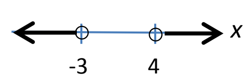
Unit 2 Review Answers

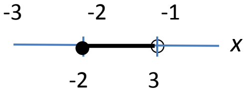
1. a) $-\frac{1}{2}, \frac{4}{3}$ **b)** $-1, 7$ **c)** $-3-2i\sqrt{3}, -3+2i\sqrt{3}$ **d)** $0, 3$ **e)** $\frac{1-\sqrt{7}}{3}, \frac{1+\sqrt{7}}{3}$ **f)** $-\frac{1}{2}, 3$ **g)** $0, \frac{1}{2}, 1$ **h)** $-\frac{1}{2}, \frac{1}{2}, -2i\sqrt{2}, 2i\sqrt{2}$

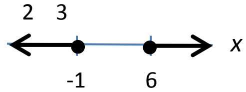
i) $-5, 2, 5$ **j)** $-\frac{3}{2}, -3i, 3i$ **k)** $-1, 2, 2, 4$ **l)** $1-\sqrt{7}, 1+\sqrt{7}, 1-i, 1+i$ **2. a)** $12x^2 - x - 1 = 0$ **b)** $x^2 - 4x + 31 = 0$

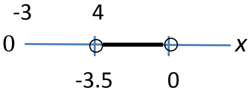
3. a) $x \le -2.5$;


b) $x > 1$;


c) $x < -3$ *or* $x > 4$


d) $-2 \le x < 3$;


e) $x \le -1$ *or* $x \ge 6$;


f) $-3.5 < x < 0$


4. a) *two distinct real roots* **b)** *two non-real roots* **c)** *two equal real roots*

5. a) $k < 6$ **b)** $k = 6 - 2\sqrt{10}$ *or* $k = 6 + 2\sqrt{10}$ **c)** $-3 < k < 3$ **d)** $k \le -8$ *or* $k \ge 4$ **6.** 64 *km/h* **7.** $7 - 2\sqrt{3}, 7 + 2\sqrt{3}$ **8.** 4.6 *cm*

9. a) *The minimum value of* y *is* -4 *when* $x = -3$. **b)** *The maximum value of* s *is* $3\frac{1}{3}$ *when* $t = \frac{2}{3}$.

10. a) 21.6 *m* **b)** 4.1 *seconds* **11.** 30 *times* **12.** 300 *m* by 200 *m* **13.** \$6.20, \$1922 **14. a)** $(0,2), (2,0)$ **b)** $(-5,6), (-2,0)$

15. *not at all* **16.** *Yes,* 0.18 *s after the kick at* $(0.18, 4.0)$ **17.** $k \le 5$ **18.** $k = 2$ *or* $k = 22$