Unit 4 - Quadratics

1) Complete the following charts:

a)

Property	$y = (x - 5)^2 + 4$
Vertex	
axis of symmetry	
stretch or compression (a value)	
direction of opening	
values that x may take	
values that y may take	

c)

Property	$y = -3(x + 1)^2 - 3$
Vertex	
axis of symmetry	
stretch or compression (a value)	
direction of opening	
values that x may take	
values that y may take	

b)

Property	$y = \frac{1}{3}(x + 1)^2 - 4$
Vertex	
axis of symmetry	
stretch or compression (a value)	
direction of opening	
values that x may take	
values that y may take	

d)

Property	$y = 4x^2 - 2$
Vertex	
axis of symmetry	
stretch or compression (a value)	
direction of opening	
values that x may take	
values that y may take	

2) Describe the transformations to the graphs of the following quadratic relations compared to the graph of $y = x^2$

a) $y = -\frac{1}{4}(x + 3)^2 - 4$

b) $y = 7(x - 7)^2 + 2$

3) The graph of $y = x^2$ is compressed vertically by a factor of 1/2, reflected in the x-axis, and then translated 2 units down and 2 units right.
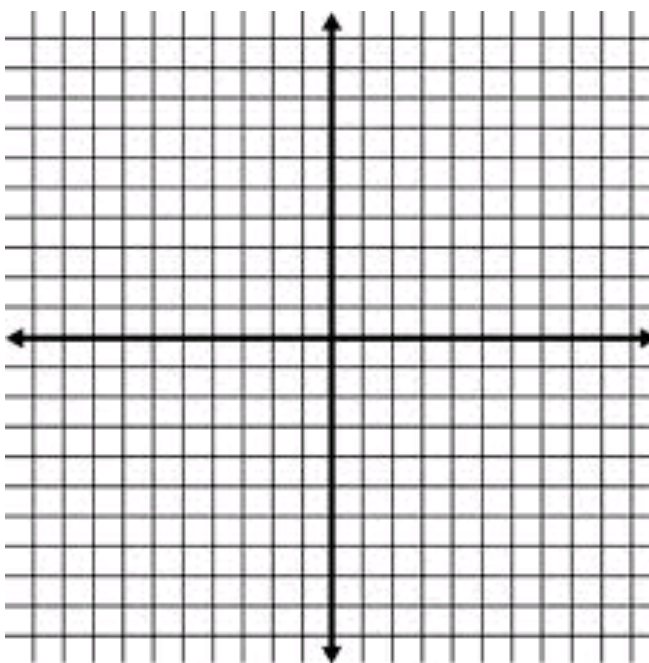
    a) Write the equation of the parabola in vertex form:

    b) State the vertex:
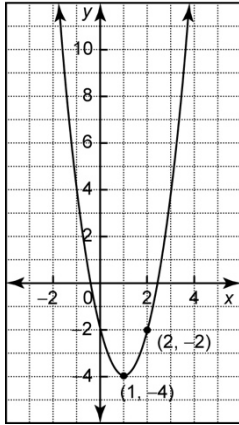
    c) State the axis of symmetry:

    d) Graph the parabola by finding points to the left and right of the vertex (label the vertex)
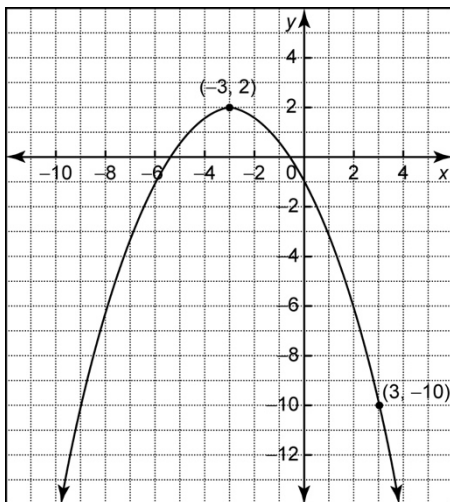
x	y

4) Write the equation of each of the following parabolas in vertex form, $y=a(x-h)^2+k$

a)

Graph showing parabola with points (2, –2) and (1, –4)

Equation in vertex form: _____

b)

Graph showing parabola with vertex (–3, 2) and point (3, –10)

Equation in vertex form: _____

5) Rewrite each equation in vertex form by completing the square. Then state the vertex and if it is a max or min point.

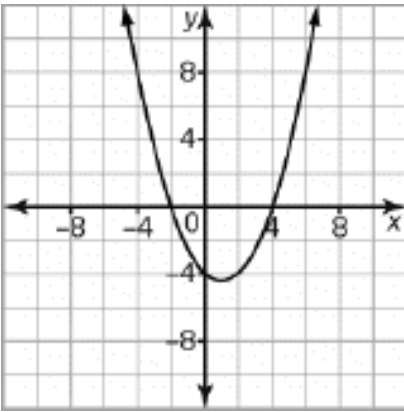**a)** $y = x^2 + 6x + 13$ **b)** $y = 2x^2 - 24x + 5$ **c)** $y = -4x^2 - 8x + 1$

6) State the x-intercepts of the following
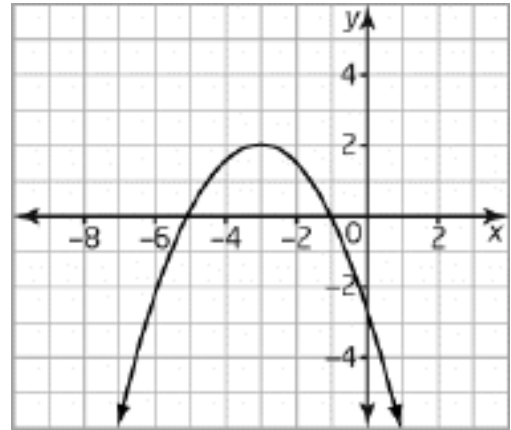
    a) y = (x+3)(x+2)   **b)** y= ½(2x+1)(x-30)

7) Write the equation of each parabola in factored form

a)

b)

8) For the quadratic relation y = 2(x+4)(x-2) :

a. What are the x-intercepts?

b. What is the axis of symmetry?

c. What is the vertex?

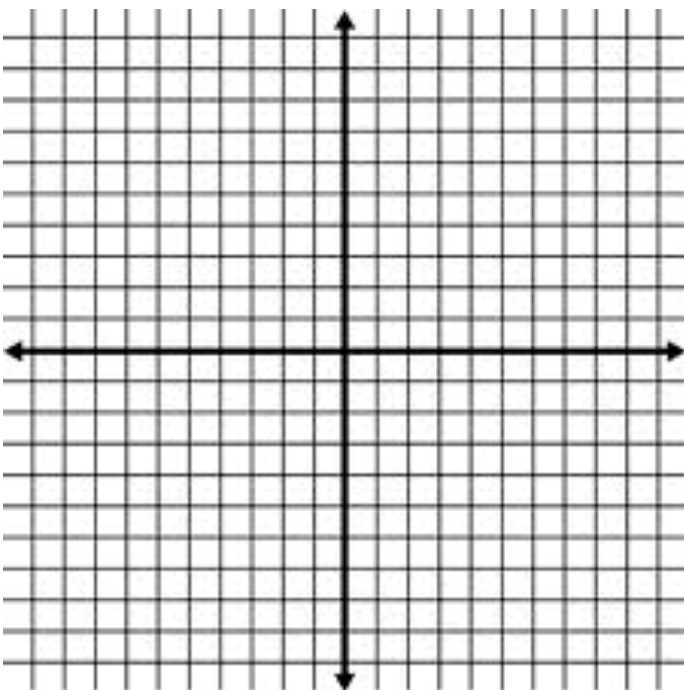d. Sketch the graph
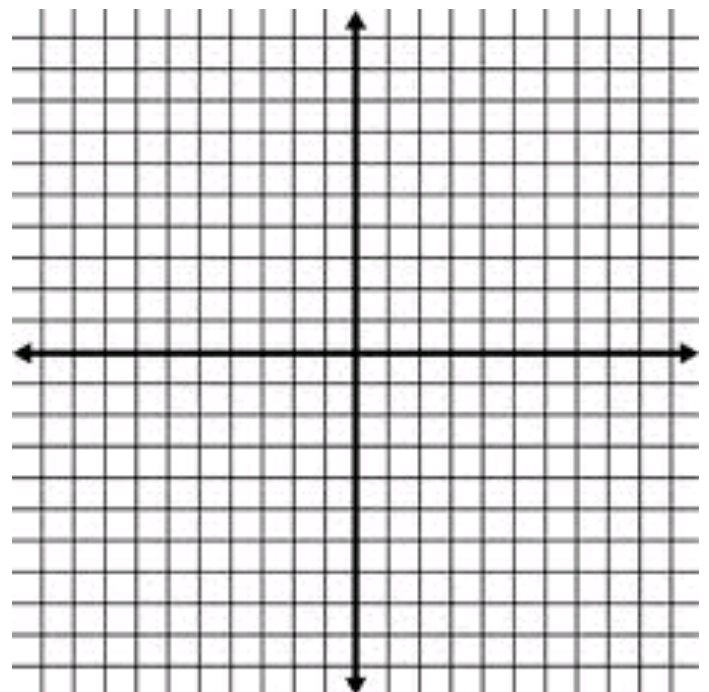   (label the vertex and x-intercepts)

9) For the quadratic relation y = 2(x+5)(x+1)

a. What are the x-intercepts?

b. What is the axis of symmetry?

c. What is the vertex?

d. Sketch the graph
   (label the x-intercepts and vertex)

10) Expand and simplify the following

a) $(x-2)(x+4)$

e) $2(2x+1)(x-3)$

b) $(x+6)(x+7)$

f) $(x-5)(x+5)$

a) $3(x+4)(x-1)$

g) $(x+4)^2$

b) $(x-10)(x-6)$

11) Fully factor each of the following

a) $5x - 35y$

b) $4x^2y^3 - 16x^3y^3 + 8xy^5$

c) $x^2 - 7x + 10$

d) $2x^2 - 4x - 48$

e) $x^2 + 8xy + 15y^2$

f) $2x^2 - 5x - 12$

g) $12x^2 + 11x - 5$

h) $x^4 - 3x^2 - 10$

12) Solve each of the following quadratics by factoring

a) $x^2 - x - 12 = 0$ **b)** $x^2 + 3x = 18$

c) $x^2 + 11x + 24 = 0$ **d)** $2x^2 - 2x - 60 = 0$

e) $x^2 - 81 = 0$ **f)** $2x^2 + 7x + 3 = 0$

g) $6x^2 + 11x + 4 = 0$ **h)** $6x^2 + 10x = 4$

13) Use the quadratic formula to solve the following quadratic equations

a) $x^2 - x - 4 = 0$

d) $-3x^2 + 4x = -1$

b) $7x^2 - 2x - 2 = 0$

e) $5x^2 + 2x + 6 = 0$

c) $2x^2 + 8x = 3$
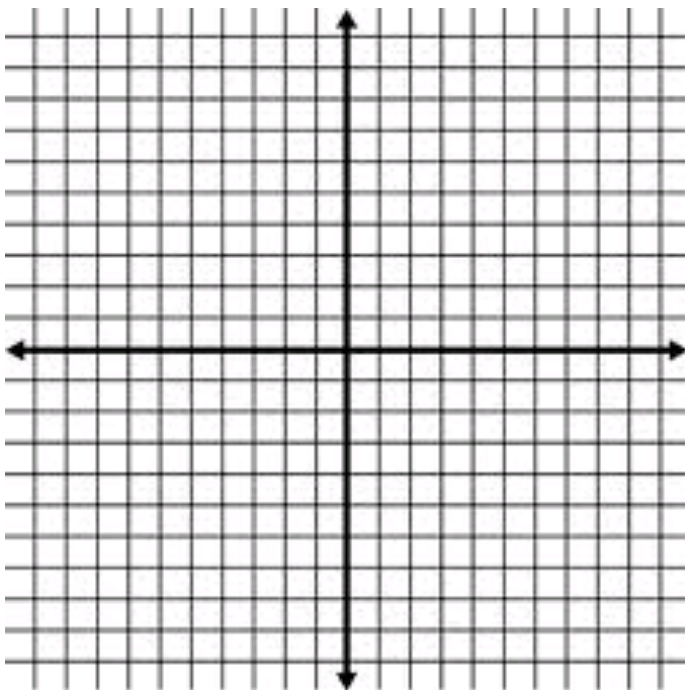
f) $9x^2 - 24x + 16 = 0$

14) For the quadratic $y = 2x^2 - 11x - 6$

a) Find the x-intercepts

b) Find the axis of symmetry (x- coordinate of vertex)

c) Find the vertex

d) graph (label x-intercepts and vertex)

15) The path of a rocket is given by the relation $h = -5(x - 2)(x - 12)$, where x represents the horizontal distance, in meters, the rocket travels and h represents the height, in meters, above the ground of the rocket at this horizontal distance.

   a) At what horizontal distance does the rocket reach its maximum height?
   b) What is the maximum height of the rocket?
   c) At what horizontal distance does the rocket hit the ground?

16) The path of a rocket can be modeled by the equation $h = -4.9t^2 + 60t + 3$ where 'h' is the height of the rocket in meters, and 't' is the time in seconds after the rocket is launched.

   a) When does the rocket land?
   b) At what time does the rocket reach its maximum height? (axis of symmetry)
   c) What is the maximum height?

17) Twice the width of a rectangle is 3 m more than the length. If the area of the rectangle is 209 m², find the dimensions of the rectangle.

18) 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 revenue?

Answers

1. **a)** (5,4) , x=5, none, up, any real #, y > or = 4 **b)** (-1,-4) , x=-1,compressed by 1/3, up, any real #, y > or =- 4
   c) (-1,-3) , x=-1, stretched by 3, down, any real #, y < or = -3 **d)** (0,-2) , x=0, stretched by 4, up, any real #, y > or = -2
2. **a)** compressed by ¼, reflected in x-axis, left 3, down 4 **b)** stretch by 7, right 7, up 2
3. **a)** y=-1/2(x-2)²-2 **b)** (2,-2) **c)** x=2
4. **a)** y=2(x-1)²-4 **b)** y=-1/3(x+3)²+2
5. **a)** (-3,4) min **b)** (6,-67) min **c)** (-1,5) max
6. **a)** -3 and -2 **b)** -1/2 and 30
7. **a)** y=1/2(x+2)(x-4) **b)** y=-1/2(x+1)(x+5)
8. **a)** -4 and 2 **b)** x=-1 **c)** (-1,-18)
9. **a)** -5 and -1 **b)** x=-3 **c)** (-3,-8)
10. **a)** x²+2x-8 **b)** x²+13x+42 **c)** 3x²+9x-12 **d)** x²-16x+60 **e)** 4x²-10x-6 **f)** x²-25 **g)** x²+8x+16
11. **a)** 5(x-7y) **b)** 4xy³(x-4x²+2y²) **c)** $(x-2)(x-5)$ **d)** $2(x+4)(x-6)$ **e)** $(x+3y)(x+5y)$
    f) $(2x+3)(x-4)$ **g)** $(3x-1)(4x+5)$ **h)** $(x^2+2)(x^2-5)$
12. **a)** 4 and -3 **b)** -6 and 3 **c)** -8 and -3 **d)** 6 and -5 **e)** 9 and -9 **f)** -3 and -1/2 **g)** -4/3 and -1/2 **h)** -2 and 1/3
13. **a)** 2.6 and -1.6 **b)** 0.7 and -0.4 **c)** 0.3 and -4.3 **d)** -0.2 and 1.5 **e)** none **f)** 4/3
14. **a)** 6 and -0.5 **b)** x=2.75 **c)** (2.75,-21.1)
15. **a)** 7 meters **b)** 125 meters **c)** 12 meters
16. **a)** 12. 3 seconds **b)** 6.1 seconds **c)** 186.7 meters
17. width 11 m, length 19 m
18. $1000