

# Solutions

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1. Determine whether each function is linear or quadratic. Give a reason for your answer.

a)

x	y
-2	15
-1	11
0	7
1	3
2	-1

1<sup>ST</sup> differences are constant  $\Rightarrow$  LINEAR

$-4$   
 $-4$   
 $-4$   
 $-4$

c)

x	y
-2	4
-1	8
0	12
1	16
2	20

1<sup>ST</sup> differences are constant  $\Rightarrow$  LINEAR

$+4$   
 $+4$   
 $+4$   
 $+4$

b)

x	y
-2	1
-1	3
0	6
1	10
2	15

2<sup>ND</sup> differences are constant  $\Rightarrow$  QUADRATIC

$+2$   
 $+3$   
 $+4$   
 $+5$   
 $+1$   
 $+1$   
 $+1$

d)

x	y
-2	7
-1	4
0	3
1	4
2	7

2<sup>ND</sup> differences are constant  $\Rightarrow$  QUADRATIC

$-3$   
 $-1$   
 $+1$   
 $+3$   
 $+2$   
 $+2$   
 $+2$

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2. State whether each parabola opens up or down.

a)  $f(x) = 3x^2$

"a" is positive  
 $\Rightarrow$  opens up

c)  $f(x) = -(x+5)^2 - 1$

"a" is negative  
 $\Rightarrow$  opens down

b)  $f(x) = -2(x-3)(x+1)$

"a" is negative  
 $\Rightarrow$  opens down

d)  $f(x) = \frac{2}{3}x^2 - 2x - 1$

"a" is positive  
 $\Rightarrow$  opens up

Recall:  
 "a" is the coefficient  
 of  $x^2$

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3. Given  $f(x) = -3(x-2)(x+6)$ , state

a) the zeros

b) the direction of opening

a)  $0 = -3(x-2)(x+6)$

$\Rightarrow (x-2) = 0$

$x-2 = 0$

$x = 2$

$\Rightarrow (x+6) = 0$

$x+6 = 0$

$x = -6$

Zeros are  $x=2$  and  
 $x=-6$

b) Check the  
 sign of "a"

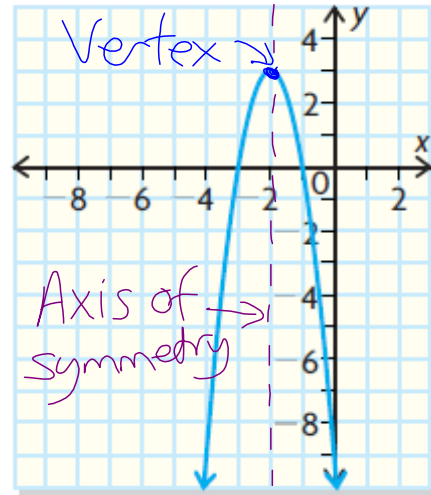
$a = -3$

"a" is negative

$\Rightarrow$  opens down

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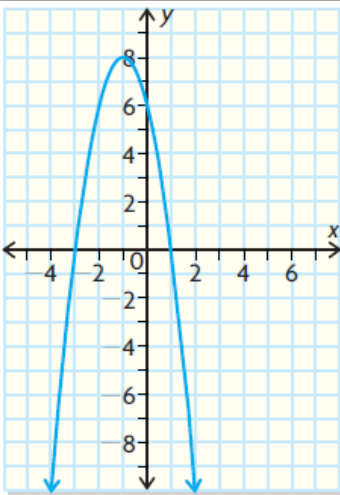
4. Given the parabola at the right, state  
 a) the vertex  
 b) the equation of the axis of symmetry



a) Vertex (point where the parabola changes direction)  
 $\Rightarrow (-2, 3)$

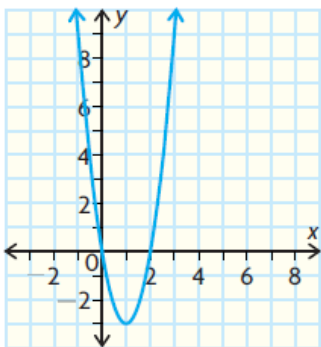
b) Axis of symmetry is a vertical line of the form  $x = h$ , where  $h$  is the  $x$ -component of the vertex  $\Rightarrow x = -2$

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7. Examine the parabola at the left.  
 a) State the direction of opening.  
 b) Name the coordinates of the vertex.  
 c) List the values of the  $x$ -intercepts.

a) Down  
 b)  $(-1, 8)$   
 c)  $x = -3, x = 1$



8. Examine the parabola at the left.  
 a) State the direction of opening.  
 b) Find the coordinates of the vertex.  
 c) What is the equation of the axis of symmetry?

a) Up  
 b)  $(1, -3)$   
 c)  $x = 1$

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9. Each pair of points  $(x, y)$  are the same distance from the vertex of their parabola. Determine the equation of the axis of symmetry of each parabola.

a)  $(-2, 2), (2, 2)$

$$h = \frac{-2+2}{2}$$

$$h = \frac{0}{2} = 0$$

$$\Rightarrow x = 0$$

b)  $(-9, 1), (-5, 1)$

$$h = \frac{-9+(-5)}{2}$$

$$h = \frac{-14}{2} = -7$$

$$\Rightarrow x = -7$$

c)  $(6, 3), (18, 3)$

$$h = \frac{6+18}{2}$$

$$h = \frac{24}{2} = 12$$

$$\Rightarrow x = 12$$

d)  $(-5, 7), (1, 7)$

$$h = \frac{-5+1}{2}$$

$$h = \frac{-4}{2} = -2$$

$$\Rightarrow x = -2$$

e)  $(-6, -1), (3, -1)$

$$h = \frac{-6+3}{2}$$

$$h = \frac{-3}{2}$$

$$\Rightarrow x = -\frac{3}{2}$$

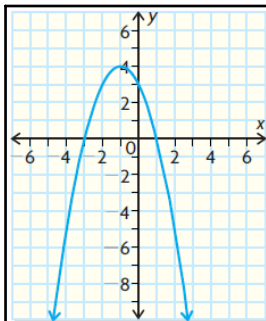
f)  $(-\frac{11}{8}, 0), (\frac{3}{4}, 0)$

$$h = \frac{-\frac{11}{8} + \frac{3}{4}}{2}$$

$$h = \frac{-\frac{11}{8} + \frac{6}{8}}{2} = \frac{-\frac{5}{8}}{2} = -\frac{5}{16}$$

$$\Rightarrow x = -\frac{5}{16}$$

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10. Examine the parabola shown at the left.

a) Copy and complete this table.

$x$	-2	-1	0	1	2
$f(x)$	3	4	3	0	-5

1 -1 -3 -5  
-2 -2 -2

b) Calculate the second differences of the function. How could you have predicted their signs?

Opens down  $\Rightarrow$  2<sup>nd</sup> differences are negative

c) Determine the equation of the function.

$y = a(x-h)^2 + k$  *Vertex*  
 using  $(h, k) = (-1, 4)$  *Any point on parabola*  
 $(x, y) = (0, 3)$   
 $\Rightarrow 3 = a(0 - (-1))^2 + 4$   
 $3 = a(1)^2 + 4$   
 $3 = a + 4$   
 $-1 = a \Rightarrow y = -(x+1)^2 + 4$

*OR*  
 $y = a(x-r)(x-s)$   
 using  $r = -3, s = 1$   
 $(x, y) = (0, 3)$   
 $\Rightarrow 3 = a(0 - (-3))(0 - 1)$   
 $3 = a(3)(-1)$   
 $\frac{3}{-3} = \frac{-3a}{-3} \Rightarrow -1 = a$   
 $\Rightarrow y = -(x+3)(x-1)$

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14. The first differences and second differences of a quadratic function with domain ranging from  $x = -2$  to  $x = 3$  are given. If  $f(-2) = 19$ , copy the table and complete the second row by determining the missing values of the function.

Note: domain means "x values" and  $f(x)$  means "y"

<b>x</b>	-2	-1	0	1	2	3
<b>f(x)</b>	19	9	3	1	3	9
<b>First Differences</b>		-10	-6	-2	2	6
<b>Second Differences</b>		4	4	4	4	

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