

1) Use finite differences to determine if each relation is linear, quadratic, or neither.

a)

$x$	$y$
0	4
1	5
2	6
3	7
4	8

Handwritten notes:  $5-4=1$ , and three arrows pointing to the differences between consecutive y-values, each labeled with '1'.

Linear

b)

$x$	$y$
0	3
1	4
2	7
3	12
4	19

Handwritten notes: Differences between consecutive y-values are 1, 3, 5, 7. Differences between these differences are 2, 2, 2.

Quadratic

c)

$x$	$y$
1	0
3	1
5	8
7	27
9	64

Handwritten notes: Differences between consecutive y-values are 1, 7, 19, 37. Differences between these differences are 6, 12, 18.

Neither

d)

$x$	$y$
-2	6
1	0
4	12
7	42
10	90

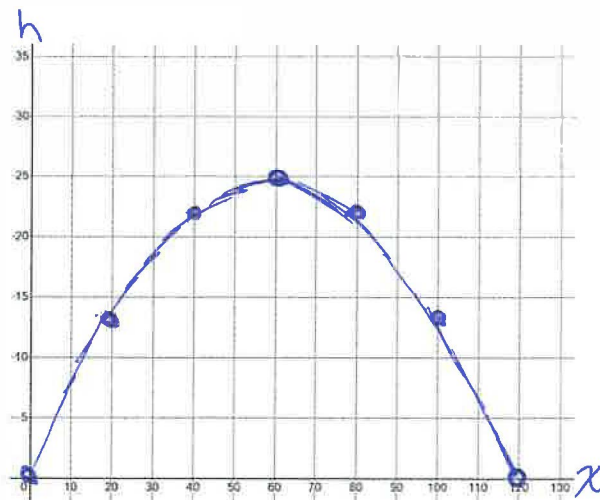
Handwritten notes: Differences between consecutive y-values are -6, 12, 30, 48. Differences between these differences are 18, 18, 18.

Quadratic

2) The parabolic shape of the Humber River Pedestrian Bridge in Toronto can be approximated by the equation  $h = -\frac{1}{144}x^2 + \frac{5}{6}x$ , where  $x$  is the horizontal distance, in meters, from one end and  $h$  is the height, in meters, above the water.

a) Graph the quadratic relation using a table of values

$x$	$y$
0	0
20	13.9
40	22.2
60	25
80	22.2
100	13.9
120	0



b) What is the height of the bridge 12 meters horizontally from one end?

$$h(12) = 9 \text{ meters}$$

c) How wide is the bridge at its base?

$$120 \text{ m}$$

d) What is the maximum height of the bridge and at what horizontal distance does it reach that height?

Max height of 25 m at a horizontal distance of 60 m

e) Identify the axis of symmetry of the bridge.

$$x = 60$$

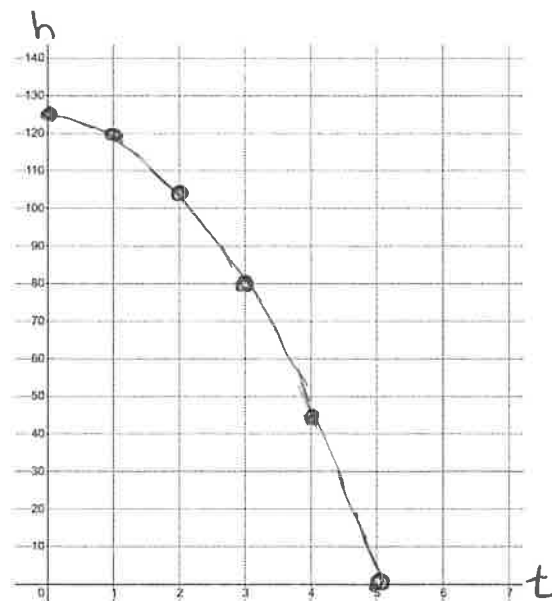
3) A flying bird drops a seed that it had picked up off the ground. The height,  $h$ , in meters, of the seed above the ground can be modelled by the relation  $h = -5t^2 + 125$ , where  $t$  is seconds since the seed was dropped.

a) At what height was the seed dropped from?

$$\begin{aligned} h(0) &= -5(0)^2 + 125 \\ &= 125 \text{ m} \end{aligned}$$

b) Graph the quadratic relation using a table of values.

$x$	$y$
0	125
1	120
2	105
3	80
4	45
5	0



c) How long does it take from when the bird drops the seed until it hits the ground?

5 seconds

4) How can you tell if the vertex of a parabola is a maximum or minimum without graphing?

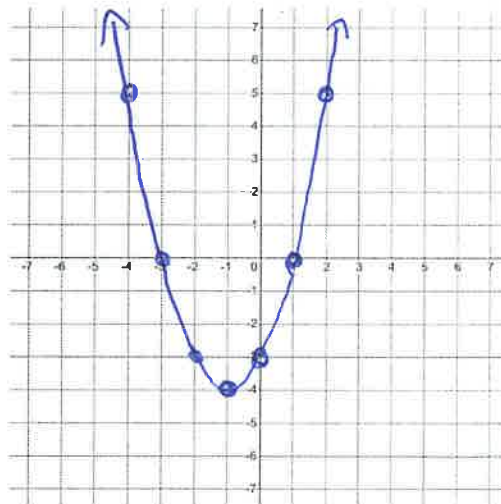
If the coefficient of  $x^2$  is  $> 0$ , it opens up and the vertex is a Min  
If the coefficient of  $x^2$  is  $< 0$ , it opens down and the vertex is a Max

5) State the direction of opening and y-intercept of the given quadratic, then make a table of values and sketch the graph to verify.

a)  $y = x^2 + 2x - 3$

opens up  
y-int:  $(0, -3)$

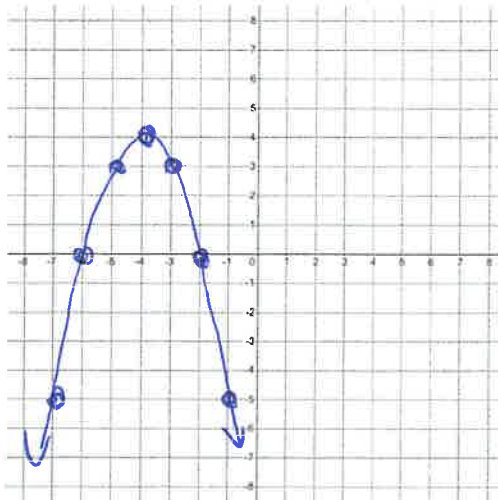
x	y
-4	5
-3	0
-2	-3
-1	-4
0	-3
1	0
2	5



b)  $y = -x^2 - 8x - 12$

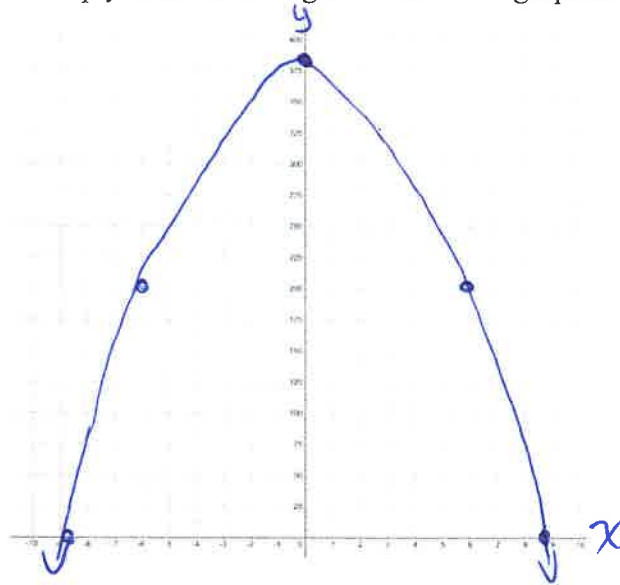
opens Down  
y-int:  $(0, -12)$

x	y
-7	-5
-6	0
-5	3
-4	4
-3	3
-2	0
-1	-5



6) An object dropped from the top of the Empire State Building has a height in meters from the ground,  $y$ , at any time in seconds,  $x$ , according to the formula:  $y = -4.84x^2 + 381$

a) Using graphing technology to help you make a rough sketch of the graph of the function.



b) What is the vertex? Interpret the meaning of the vertex in this context.

$(0, 381)$ ; the height the object is dropped from is 381 m.

c) Find the  $x$ -intercepts and interpret their meaning in this context.

$(-8.872, 0)$  and  $(8.872, 0)$ ; it takes 8.872 seconds for the object to hit the ground.

d) How far from the ground is the object after 3 seconds.

$$\begin{aligned} y(3) &= -4.84(3)^2 + 381 \\ &= 337.44 \end{aligned}$$

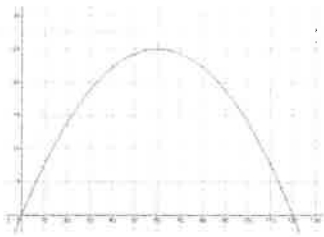
It is 337.44 m above the ground.

## Answers

1) a) linear b) quadratic c) neither d) quadratic

2) a)

x	y
0	0
20	13.9
40	22.2
60	25
80	22.2
100	13.9
120	0



b) 9 m c) 120 m d) max height of 25 m at a horizontal distance of 60 m  
e)  $x = 60$

3) a) 125 m b)

x	y
0	125
1	120
2	105
3	80
4	45
5	0

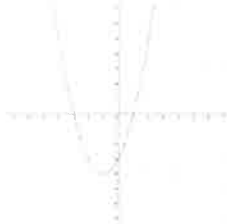


c) 5 seconds

4) By looking at the leading coefficient (the coefficient of the  $x^2$  term). If the leading coefficient is positive, the parabola opens up and has a minimum point. If the leading coefficient is negative, the parabola opens down and has a maximum point.

5) a) opens up; y-int at  $(-3,0)$

x	y
-4	5
-3	0
-2	-4
-1	-4
0	-3
1	0
2	5

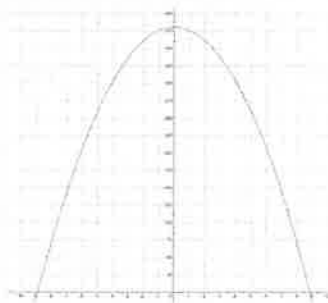


b) opens down; y-int at  $(0,-12)$

x	y
-7	-5
-6	0
-5	3
-4	-1
-3	3
-2	0
-1	-5



6) a)



b)  $(0,381)$ , the object is dropped from a height of 381 meters

c) The  $x$ -intercepts are at  $\pm 8.872$ . The negative  $-8.872$   $x$ -intercept can be ignored since it does not fit the domain of this scenario. The  $x$ -intercept of 8.872 means that it took 8.872 seconds for the object to hit the ground.

d) 337.44 meters