# DAY 1 – Using Differences & Different Forms

1. Determine what type of relation is each table. Linear, Quadratic or Neither?

a.

| $x$ | $y$ |
|---|---|
| 0 | -9 |
| 2 | -10 |
| 4 | -7 |
| 6 | 0 |
| 8 | 11 |
| 10 | 26 |

b.

| $n$ | $P$ |
|---|---|
| 1 | -8 |
| 7 | 2 |
| 13 | 12 |
| 19 | 22 |
| 22 | 27 |
| 25 | 32 |

c.

| Time (years) | Radiation level |
|---|---|
| 1 | 17 |
| 2 | 9 |
| 3 | 5 |
| 4 | 3 |
| 5 | 2 |
| 6 | 1.5 |

d.

| Length | Area of figure |
|---|---|
| 1 | 2 |
| 2 | 5 |
| 3 | 10 |
| 4 | 17 |
| 5 | 26 |
| 6 | 37 |

e.

| # of items | Cost |
|---|---|
| 10 | 7 |
| 12 | 9 |
| 14 | 11 |
| 16 | 13 |
| 18 | 15 |
| 20 | 17 |

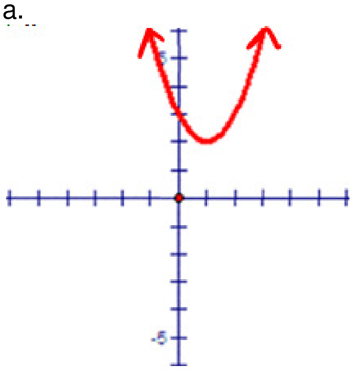
2. Decide what type of relation is given by expanding and simplifying. Linear or Quadratic?

a.
$y = (2-x)(x+3)$

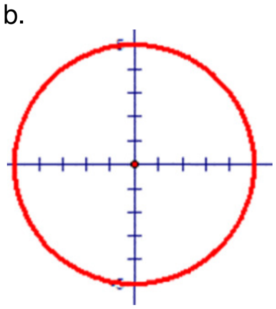
b.
$y = 5 + 4(x-2) - 8x$

3. Decide what type of relation is given. Linear or Quadratic or Neither?

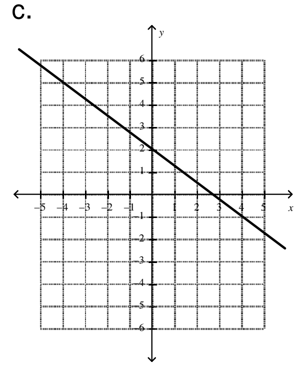
a.



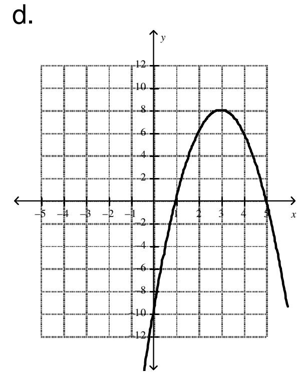

b.



c.



d.



4. For each of the following identify what form each quadratic is written in. Standard or Vertex or Factored?

(a) $y = (2x + 4)(x + 1)$ (b) $y = -2x^2 + 4x$ (c) $y = 2(x - 3)(4x + 8)$

(d) $y = 2(x - 3)^2 - 1$ (e) $y = -3(x - 2)(x + 3)$ (f) $y = x^2 - 4$

(g) $y = -3x^2 - 4x + 6$ (h) $y = (x - 3)^2 - 3$ (i) $y = -3(x + 1)^2$

(j) $y = -(x - 6)^2 + 12$ (k) $y = 2x(x + 4)$ (l) $y = -(x + 2)^2 - 7$

REVIEW

5. Expand each of these to get the quadratic into standard form

a. $y = 2x(x + 4)$

b. $y = (2x + 4)(x + 1)$

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

d. $y = 2(x - 3)^2 - 1$

6. Factor each of these to get the quadratic into factored form

a. $y = 4x^2 - 9$

b. $y = x^2 - x - 72$

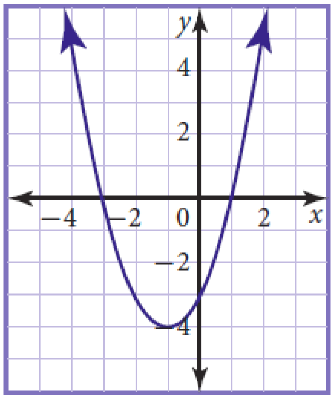
c. $y = 2x^2 - 22x + 60$

d. $y = 27x^2 - 3$

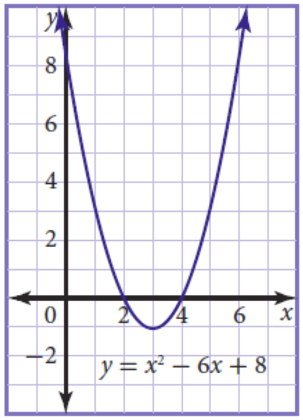
# DAY 2 - Vocabulary

1. Identify all the key features of the following graphs

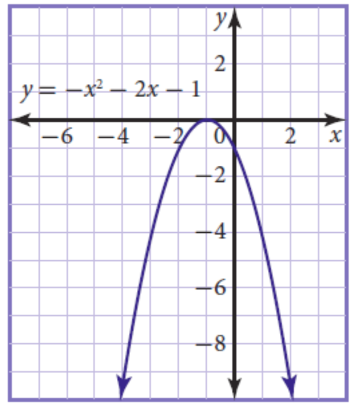
a.



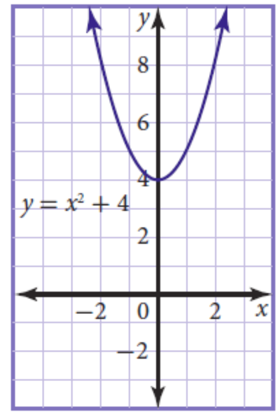

b.




c.




d.




| a. | b. | c. | d. |
|---|---|---|---|
| Max or Min ? | Max or Min ? | Max or Min ? | Max or Min ? |
| Optimal Value | Optimal Value | Optimal Value | Optimal Value |
| Axis of symm | Axis of symm | Axis of symm | Axis of symm |
| Vertex | Vertex | Vertex | Vertex |
| Zeros/x-int | Zeros/x-int | Zeros/x-int | Zeros/x-int |
| Y-intercept | Y-intercept | Y-intercept | Y-intercept |

2. Is each relation linear or quadratic or neither?

**a)** $y = x^2 + 1$ **b)** $y = 2x + 1$ **c)** $y = 3x^2$

d)

| x | y |
|---|---|
| −3 | −18 |
| −2 | −13 |
| −1 | −8 |
| 0 | −3 |
| 1 | 2 |
| 2 | 7 |
| 3 | 12 |

e)

| x | y |
|---|---|
| 0 | 8 |
| 1 | 6.5 |
| 2 | 6 |
| 3 | 6.5 |
| 4 | 8 |
| 5 | 10.5 |
| 6 | 14 |
| 7 | 18.5 |

3. Use the table of values to sketch each of the following.

a.

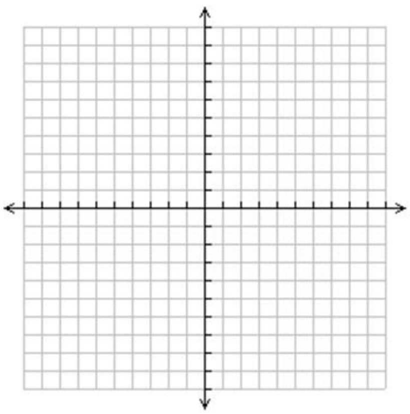
| x | $y = x^2$ |
|---|---|
| | |
| | |
| 0 | |
| | |
| | |

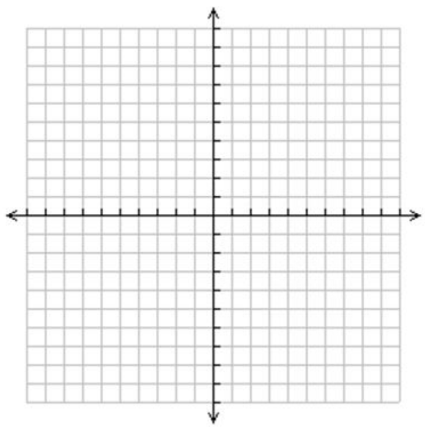
c.

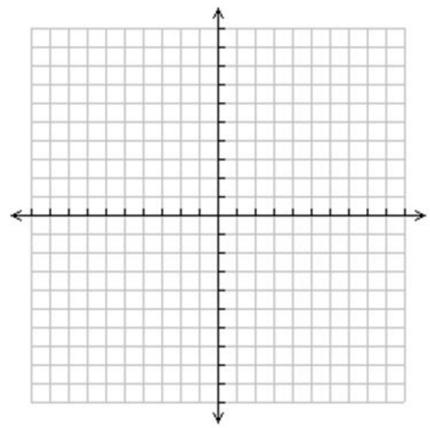
| x | $y = x^2 + 2x - 6$ |
|---|---|
| | |
| | |
| -1 | |
| | |
| | |

d.

| x | $y = -2x(x - 4)$ |
|---|---|
| | |
| | |
| 2 | |
| | |
| | |





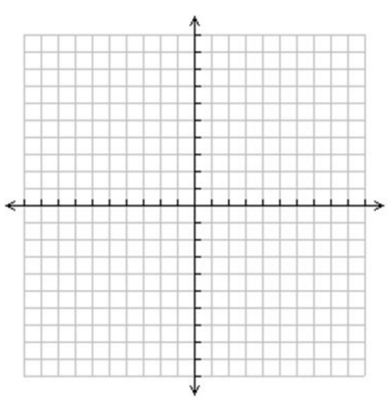


4. Identify all the key features for the above parabolas

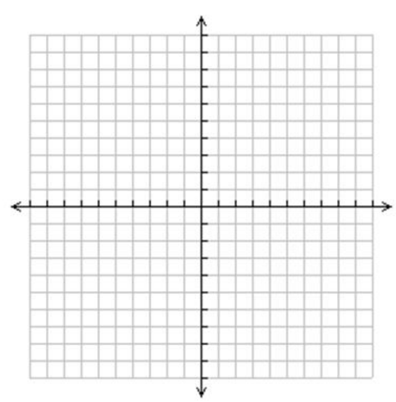
| | | |
|---|---|---|
| Max or Min ? | Max or Min ? | Max or Min ? |
| Optimal Value | Optimal Value | Optimal Value |
| Axis of symm | Axis of symm | Axis of symm |
| Vertex | Vertex | Vertex |
| Zeros/x-int | Zeros/x-int | Zeros/x-int |
| Y-intercept | Y-intercept | Y-intercept |

5. Use the information provided to sketch the parabolas

a.
optimal value y = -8
zeros at (-4, 0) and (10, 0)



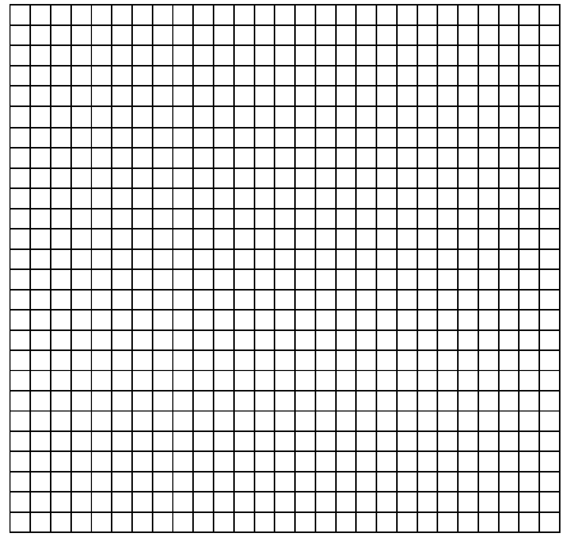
b.
axis of symm x = 4
vertex (4, 3)
zero (0, 0)
y-int 0



# DAY 3 – Interpret Quadratic Graphs

1. The table shows the horizontal distance travelled and the height reached by a toy rocket after it was launched from the ground.

| Horizontal Distance (m) | Height (m) |
|---|---|
| 0 | 0.7 |
| 1 | 1.7 |
| 2 | 2.3 |
| 3 | 2.5 |
| 4 | 2.3 |
| 5 | 1.7 |



a) What is the independent variable (x) and what is the dependent variable (y)?

b) Graph the data. Label axes and give graph a title.

c) Determine the horizontal distance travelled by the rocket when it reached its maximum height.

d) How high above the ground was the launch pad or the initial height?

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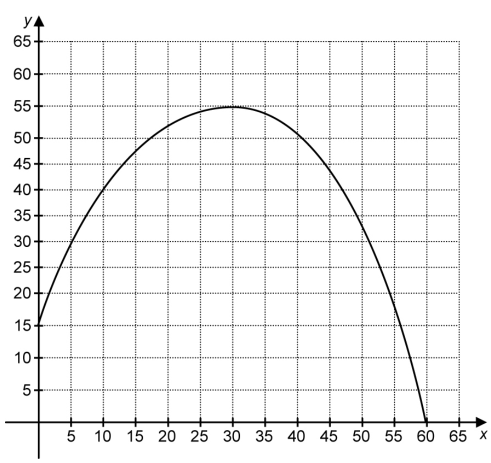
2. A sprinkler system sprays a stream of water onto the grass. The path of the water can be modelled by the quadratic relation shown below. The height and the horizontal distance are measured in centimetres. Label axes and give the graph a title.




**a)** What is the maximum height reached by the stream of water?

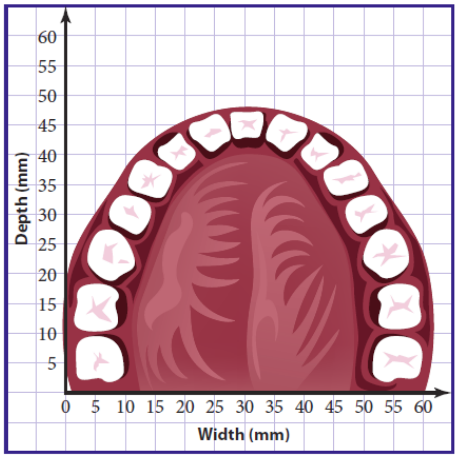
**b)** How far from the sprinkler does the stream of water reach this maximum height?

**c)** Suppose a dog stands 20 cm away from the sprinkler and does not get wet. What is the maximum height of the dog?

**d)** How high above the ground is the sprinkler head?

 **10P** Date:____________ Name: ________________________

3. Use the graph of a human mouth to answer questions.

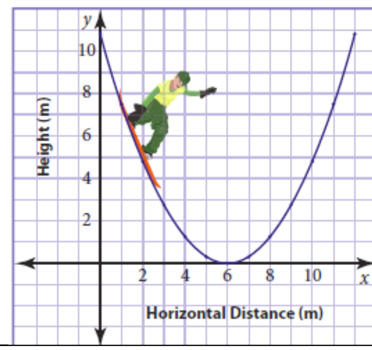



a) What is the maximum depth of the mouth?

b) What is the width of the mouth if the depth is 25 mm?

4.

In the second run, the snowboarder travels down one side of a parabolic curve and up the other. For this run, graphing height against horizontal distance from the starting point produces a parabola.

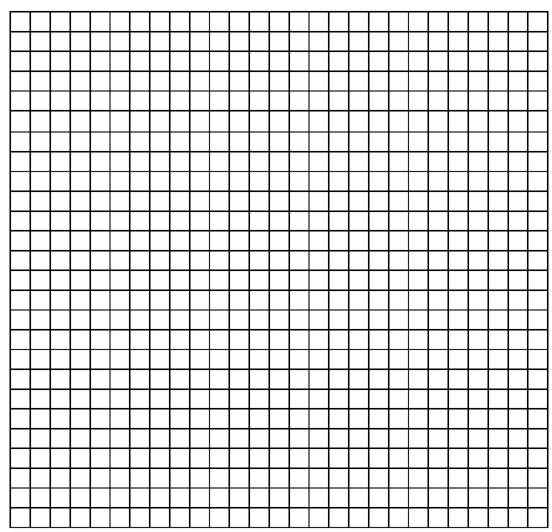



a) Where does the minimum height occur horizontally?

b) How wide apart is the half pipe?

5. The table shows the height and horizontal distance of a golf ball after it is hit.

| Horizontal Distance (m) | Height (m) |
|---|---|
| 0 | 0 |
| 20 | 7.2 |
| 40 | 12.8 |
| 60 | 16.8 |
| 80 | 19.2 |
| 100 | 20.0 |
| 120 | 19.2 |
| 140 | 16.8 |
| 160 | 12.8 |



a) Graph the relation. Label axes and give the graph a title.
b) When does the maximum height of the ball occur?

c) What is the maximum height?

d) What is the initial height?

e) When does the ball land on the ground again?

# DAY 4 - Application in Real Life – VERTEX form

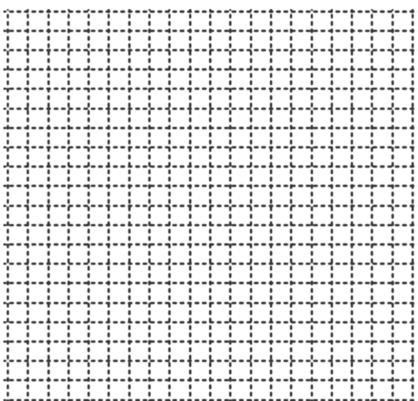
1.

A scuba diver starts her ascent to the surface of the water. The equation that models her ascent is $d = 2.5t^2 - 250$, where $d$ is the depth in feet below the surface of the water and $t$ the time in seconds taken to get to the surface.

a) Fill in table using vertex and two other points

| t | d |
|---|---|
| | |
| 0 | |
| | |

Sketch



b) What is the vertex?

c) How deep was the diver when she started to ascend?

d) How long did it take the diver to get to the surface? (sub depth= 0)

e) Suppose the diver had 20 sec of air left in her scuba tank, would she reach the surface safely?

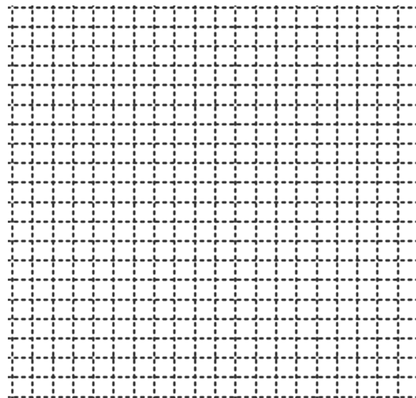
2.

If an object on land falls from a height of 100 m, its path can be represented by the equation $h = -5t^2 + 100$, where $h$ represents the height of the object in metres, and $t$ represents time in seconds.

a) Fill in table using vertex and two other points

| t | h |
|---|---|
| | |
| 0 | |
| | |

Sketch



b) What is the vertex?

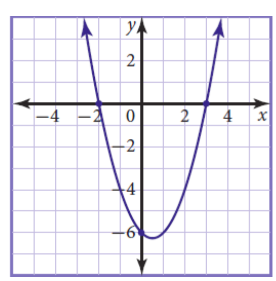
c) From what height was the object dropped?

d) How long does it take to reach the ground? (sub h=0 and solve for t)

3.

Which of these equations does the parabola represent?

**a)** $y = (x + 2)(x - 3)$
**b)** $y = (x - 2)(x + 3)$
**c)** $y = x^2 + x - 6$



4.

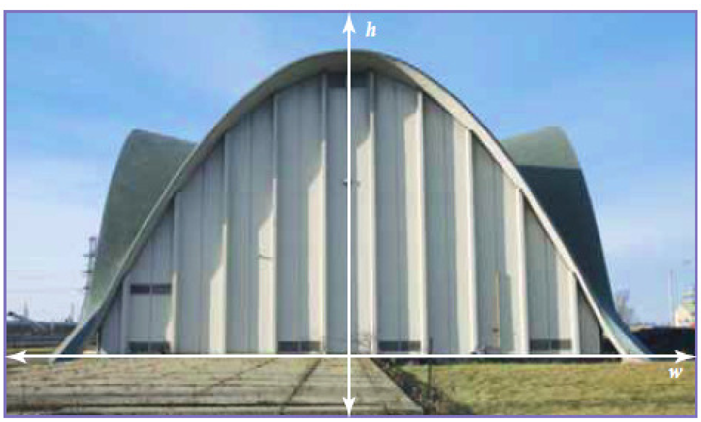
This building contains the equipment that pumps water from Lake Ontario to the Woodward Avenue Water Treatment Facility. A cross-section of the building is in the shape of a parabola. Its shape can be modelled by the quadratic relation $h = -0.045w^2 + 18$, where $h$ represents the height in metres and $w$ represents the horizontal distance in metres.

a) What form(s) is the equation in?

b) Find the zeros by factoring.

c) Find the zeros by subbing in h=0 and solving for w

d) Label the vertex and zeros onto the given sketch




e) What is the height of the building?

f) Find the width of the building at ground level.

5. Find the zeros from factored form

**a)** $y = (x + 3)(x + 1)$ **b)** $y = -(x - 7)(x - 3)$

c) $y = x(3x+6)$ d) $y = -2(4-x)(10-5x)$

6. What form(s) are the following in standard/factored/vertex? If two forms, state which ones

a. $y = (2x+6)(5-x)$ b. $y = -5x^2 + 6x$

c. $y = x(12-2x)$ d. $y = 1.5(x-3)^2$

# DAY 5 - Application in Real Life – STANDARD form think of it as Balance (money gain/owe)

1.

A homemade solar oven makes use of a parabola to reflect the sun's rays through its vertex. The solar oven can actually cook food. Its shape can be modelled by the equation $y = -2x^2 - 4x + 30$

a) Factor the equation and find zeros

b) Fill in table using zeros and middle point

| x | y |
|---|---|
| 3 | |
| | |
| -5 | |

Sketch - label key values

c) Let x represent horizontal distance in feet and y represent height in centimeters. What is the maximum height?

d) How wide is the solar oven at its base?

2.

The minimum cost of maintaining an overhead crane depends on the number of hours the crane is in operation. The cost is given by the relation $C = 2t^2 - 36t + 154$, where $C$ represents the cost in hundreds of dollars and $t$ represents the time in hours that the crane has been operated.

a) Factor the equation and find zeros

b) Fill in table using zeros and middle point

| t | C |
|---|---|
| 7 | |
| | |
| 11 | |

Sketch - label key values

c) What is the minimum cost of maintaining the crane?

d) What number of hours does the crane need to operate for this minimum cost?

e) What is the cost if the crane sits idle? (ie. t=0)

3.

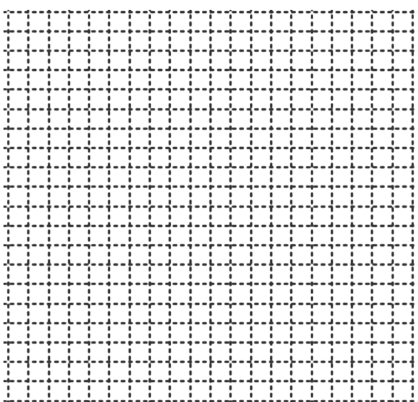
A model rocket is launched from a platform. Its flight path can be represented by the relation $h = -5t^2 + 100t + 220$, where $h$ represents the height of the rocket in metres and $t$ represents time in seconds.

a) Factor to find the zeros

b) Fill in table using zeros and middle point

| t | h |
|---|---|
| -2 | |
| | |
| 22 | |

Sketch



c) What is the height of the platform?

d) What is the maximum height?

e) How long is the rocket in the air?

f) How high is the rocket at 10 sec?

4. Find the zeros from standard form – FACTOR first

a) $y = x^2 - 5x + 4$

b) $y = 2x^2 - 4x - 30$

c) $y = -5x^2 + 25x$

d) $y = x^2 - 64$

5. What form(s) are the following in standard/factored/vertex? If two forms, state which ones

a. $y = 3x + 5 - x^2$

b. $y = 2(x+4)(x-9)$

c. $y = -3(x+4)^2 + 1$

d. $y = 2x^2 - 5$

# DAY 6 - Application in Real Life

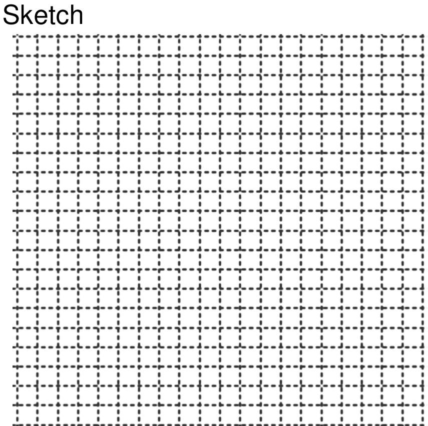
1. The shape of one of the skateboard ramps to be built in the park can be modelled by the quadratic relation $d = 0.08l^2 - 0.8l$, where $d$ represents the depth in metres and $l$ represents the horizontal distance in metres.

a) Factor to find the zeros

b) Fill in table using zeros and middle point

| l | d |
|---|---|
| 0 | |
| | |
| 10 | |

Sketch



c) Find the minimum value of this skateboard ramp.

d) What is the horizontal distance to this minimum point?

e) How wide is the ramp?

2. Are the relations linear or quadratic or neither?

**a)** $y = x + 4$

**b)** $y = 4x(x-1)$

**c)** $y = 2^{2+x}$

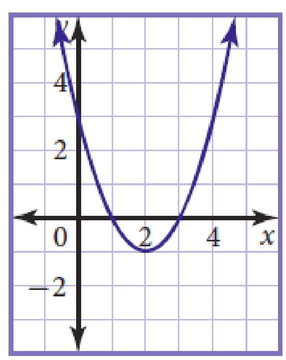
**d)**

| $x$ | $y$ |
|---|---|
| −3 | 15 |
| −2 | 8 |
| −1 | 1 |
| 0 | −6 |
| 1 | −13 |
| 2 | −20 |

**e)**

| $x$ | $y$ |
|---|---|
| −3 | 19 |
| −2 | 17 |
| −1 | 15 |
| 0 | 13 |
| 1 | 11 |
| 2 | 9 |

3.




Max or Min ?

Optimal Value

Axis of symm

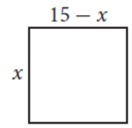
Vertex

Zeros/x-int

Y-intercept

4.

Find the maximum area, in square metres, of a rectangle whose area can be represented by the relation $A = x(15 - x)$.




a) The equation is already factored, find zeros

b) Fill in table using zeros and middle point

| x | A |
|---|---|
| 0 | |
| | |
| 15 | |

Sketch - label key values

c) What is the maximum area?

d) What dimensions of the rectangle give this maximum area?

5.

A cross-section of a satellite dish can be modelled by the quadratic relation $d = -0.0016w(w - 300)$, where $w$ represents the horizontal distance across the dish in centimetres and $d$ represents the depth of the dish in centimetres.

**a)** Copy and complete the table.

| ***w* (cm)** | ***d* (cm)** |
|---|---|
| 0 | |
| 50 | |
| 100 | |
| 150 | |
| 200 | |
| 250 | |

b) Sketch

c) What is the maximum depth?

d)Find the zeros from the equation.

d) Use the zeros to find the width at the base.

6. Factor.

a. $x^2 - 2x - 35$

b. $x^2 - 64$

c. $0.5x^2 + 5x + 12.5$

d. $2x^2 - 8$

# Practice TEST

1. Identify whether each equation or table given is linear, quadratic or neither. Explain why.

a. $y = 2x - 5$

b. $y = x^3 + x - 4$

c.

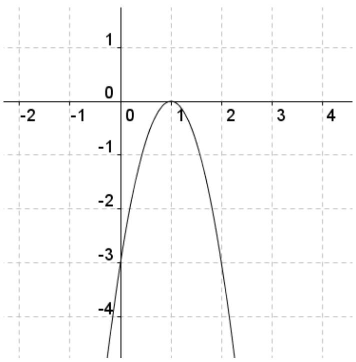
| x | y |
|---|---|
| −4 | 57 |
| −3 | 34 |
| −2 | 17 |
| −1 | 6 |
| 0 | 1 |
| 1 | 2 |
| 2 | 9 |

d.

| x | y |
|---|---|
| -2 | 22 |
| -1 | 18 |
| 0 | 14 |
| 1 | 10 |
| 2 | 6 |
| 3 | 2 |

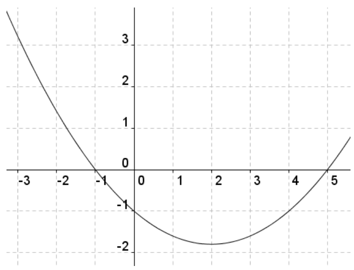
2. Identify all the key features of the following graphs

a.




max or min?
optimal value
Axis of symm
Vertex
Zeros
Y-int

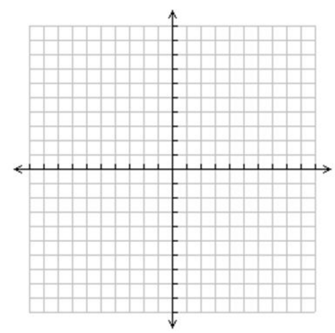
b.




max or min?
optimal value
Axis of symm
Vertex
Zeros
Y-int

c.

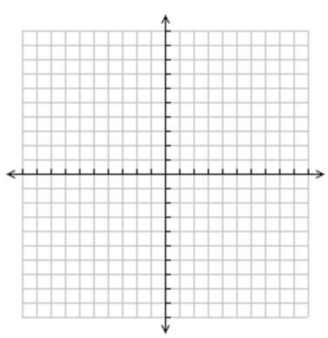
| x | $y = -2x^2 - 4x$ |
|---|---|
| 0 | |
| -1 | |
| -2 | |



max or min?
optimal value
Axis of symm
Vertex
Zeros
Y-int

3. Use the information provided to sketch the parabola

axis of symm x= –6
vertex (–6, 5)
x-int (–2, 0)
y-int (0, – 9)



4. What form(s) are the following in standard/factored/vertex? If two forms, state which ones

a. $y = -4(x+5)(x-7)$

b. $y = 3x^2 + 6$

5. Factor to find the zeros

a. $y = x^2 - 11x + 18$

b. $y = x^2 - 81$

6.
A ball is dropped from a platform. Its path can be represented by the relation $h = -5t^2 + 45$, where $h$ represents the height of the ball in metres and $t$ represents the time in seconds taken for the ball to fall to the ground.

a) Fill in table using vertex and two other points

| t | h |
|---|---|
| | |
| 0 | |
| | |

Sketch

b) What is the vertex?

c) From what height was the ball dropped?

d) How long did it take for the ball to reach the ground? (sub h= 0)

d) What is the height at 2 sec after the drop?

7.
A model rocket is launched from a platform. The trajectory of the rocket can be modelled by the relation $h = -5t^2 + 100t - 180$, where $h$ is the height of the model rocket in metres and $t$ is the time in seconds.

a) Factor to find the zeros

b) Fill in table using zeros and middle point

| t | h |
|---|---|
| | |
| 10 | |
| | |

Sketch

c) What is the height of the underground platform from which the rocket was released?

d) What is the maximum height?

e) How long is the rocket in the air?

f) What is the height of the rocket at 5 sec?