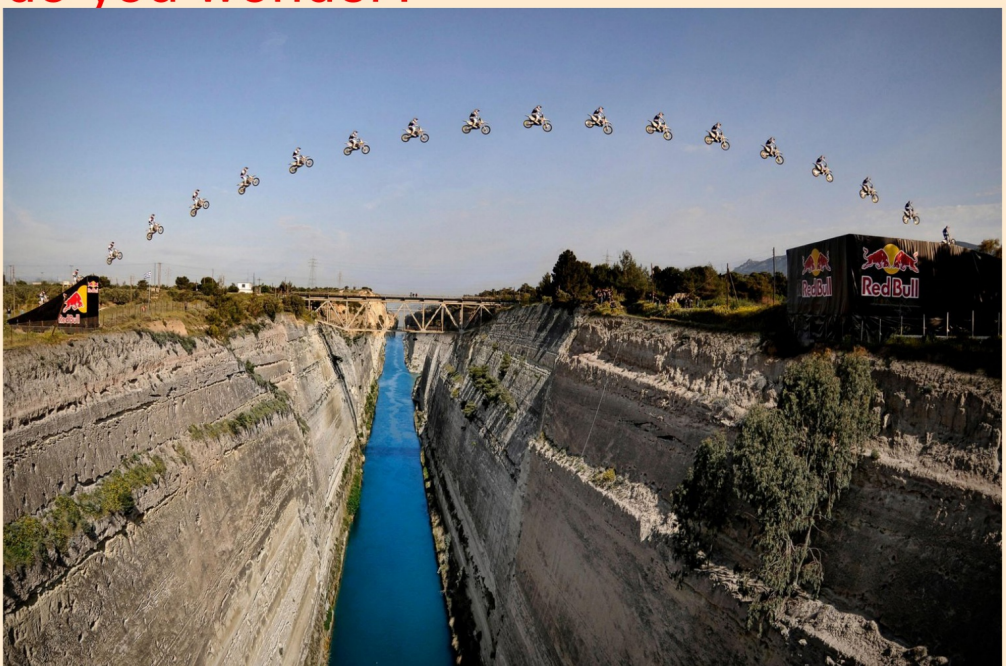
Welcome Back to MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 3/5 Topic:_____	0 1 2	No Homework (Test Friday)
Tuesday Date: 3/6 Topic:_____	0 1 2	No Homework
Wednesday Date: _____ Topic:_____	0 1 2	
Thursday Date: _____ Topic:_____	0 1 2	
Friday Date: _____ Topic:_____	0 1 2	

Warm-up: What do you notice? What do you wonder?



Class Plan:

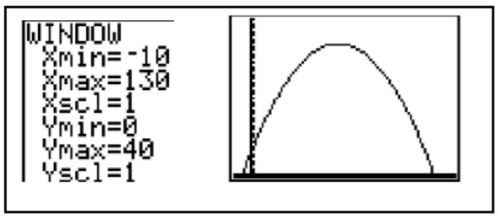
1. Warm-up
2. 21A Quadratic Functions
3. Video Break!
4. Practice

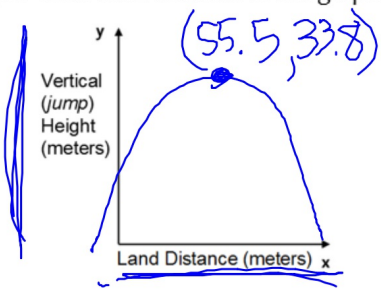
Step 1:

Guided Notes:

*Stun motorcyclist Marvin is attempting a world record jump of 110 meters. His height above ground at the point where he has travelled **x** meters horizontally from the take-off is modeled by the equation below.*

a) Enter the equation $H = -0.009x^2 + x + 6$ into the "y =" of your graphing calculator.
b) Adjust your window ~~to look at the picture~~ of your graph. Then draw a sketch of the graph.





Questions:

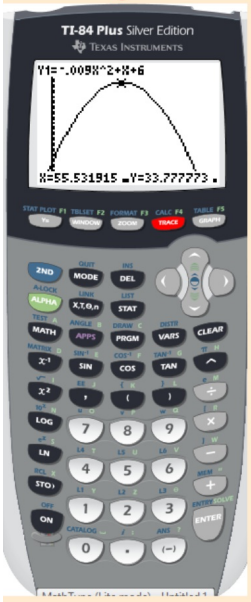
i. What is the highest part of Marvin's jump?

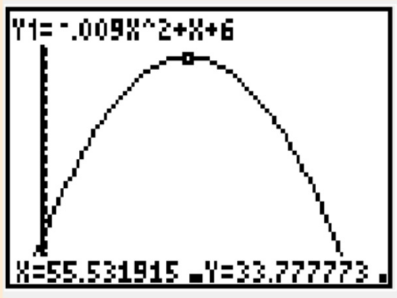
33.8m

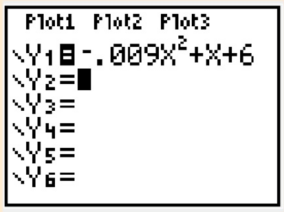
ii. After how many meters did he reach this height?

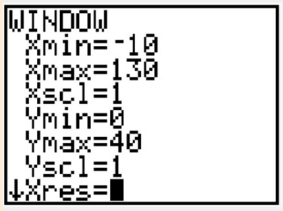
55.5m

Guided Notes: What the calculator shows..... Using the **TRACE** key.





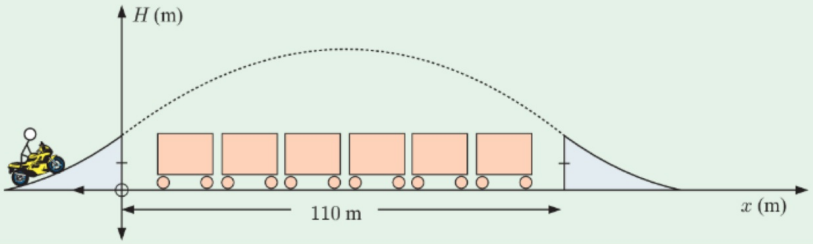




Marvin reaches his maximum height of *about* 33.8 m after traveling for *about* 55.5 meters horizontally.

OPENING PROBLEM

Stunt motorcyclist Marvin is attempting a world record jump of 110 metres.



His height above ground at the point where he has travelled x metres horizontally from the take-off ramp, is given by $H = -0.009x^2 + x + 6$ metres, for $0 \leqslant x \leqslant 110$.

Things to think about:

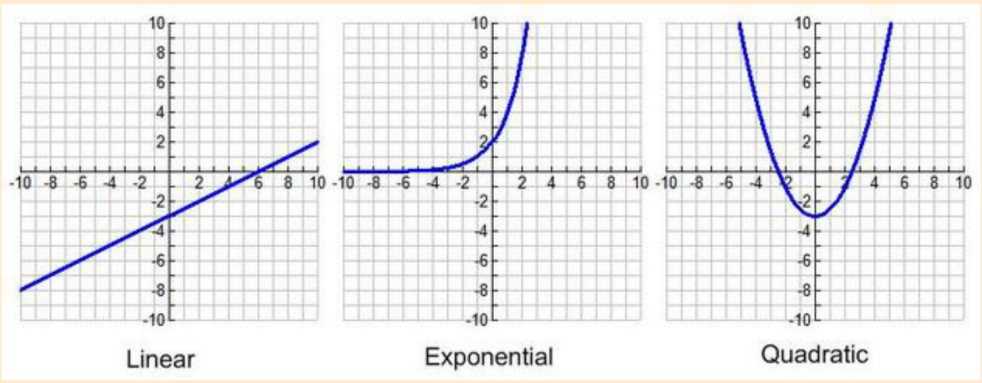
a What type of function is this?

b How high is Marvin above the ground:

i the instant he leaves the take-off ramp

ii after travelling 80 metres horizontally?

c Will Marvin safely reach the landing ramp?

Unit 1	Unit 5	Unit 6
		
Linear	Exponential	Quadratic
$y = mx + b$	$y = ab^x$	$y = ax^2 + bx + c$

A Guided Notes QUADRATIC FUNCTIONS

A **quadratic function** is a relationship between two variables which can be written in the form $y = ax^2 + bx + c$, where x and y are the variables, and a, b, and c are constants, $a \neq 0$.

The constants a, b, and c are called the **coefficients** of the quadratic function.

Define Quadratic: $y = ax^2 + bx + c$, **where a, b, c are** constant numbers **and x and y are** variables

For example:

- $y = 3x^2 - 2x + 1$ is a quadratic function with $a = 3$, $b = -2$, $c = 1$
- $y = 2x^2 + 3x$ is a quadratic function with $a = 2$, $b = 3$, $c = 0$.

A **Guided Notes** **QUADRATIC FUNCTIONS**

1) Circle the equations that represent a quadratic equation. Identify the ***a***, ***b***, and ***c*** of the equations that represent a quadratic equation.

$y = -x^2 + 3x^1 + 1x^0$ $y = x^3 + 8^2$ $y = 1 - x + 4x^2$

$a=-1, b=3, c=1$ $a=4$ $b=-1$ $c=1$

$y = 4x^2 - 1x^1 + 1$

2) Do the points **A(2, -8)** and **B(-3, 4)** lie on the parabola of $y = -x^2 - 3x + 2$?

$Y = -(2)^2 - 3(2) + 2$

$Y = -4 - 6 + 2$

$Y = -8$

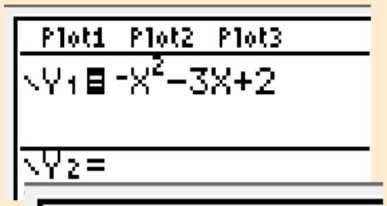
(2, -8) is on the parabola

A Using Calculator **QUADRATIC FUNCTIONS**

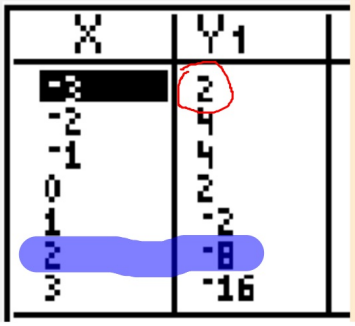
2) Do the points **A(2, -8)** and **B(-3, 4)** lie on the parabola of $y = -x^2 - 3x + 2$?

Does (-3,4) lie on the curve?

1) Enter equation in "y="



2) **2nd, GRAPH** to view table.



(-3,4) is not on the parabola, but (2, -8) is!

A Guided Notes **QUADRATIC FUNCTIONS**

Solutions

1) Circle the equations that represent a quadratic equation. Identify the ***a, b,*** and **c** of the equations that represent a quadratic equation.

$y = -x^2 + 3x + 1$ $\qquad$ $y = x^3 + 8^2$ $\qquad$ $y = 1 - x + 4x^2$

a= -1, b= 3, c= 1

$4x^2 - x + 1$

a= 4, b= -1, c= 1

2) Do the points **A(2, 4)** and **B(-3, -14)** lie on the parabola of $y = -x^2 + 3x + 2$?

A: $4 \stackrel{?}{=} -2^2 + 3(2) + 2$

$4 \stackrel{?}{=} -4 + 6 + 2$

$4 = 4$ ✓

A is on the parabola!

B: $-14 \stackrel{?}{=} -(-3)^2 + 3(-3) + 2$

$-14 \stackrel{?}{=} -9 - 9 + 2$

$-14 \neq -16$ X

B is not on the parabola!

How can he reach the optimal height?

Robbie Maddison jumps 278 feet over Corinth Canal in Greece

https://www.youtube.com/watch?v=Rw1fxd_Aklw

A **Guided Notes** **QUADRATIC FUNCTIONS**

Step 2: Evaluate $y = x^2$ from x = -3 to x = 3. **Show work evaluating the equation.**

a) x = -3, y =? (-3, 9)

$y = (-3)^2$

$y = 9$

b) x = -2, y =?

c) x = -1, y =?

$y = (-1)^2$

$y = 1$

d) x = 0, y =?

$y = 0^2$

$y = 0$

(0, 0)

e) x = 1, y =?

f) x = 2, y =?

$y = 2^2$

$y = 4$

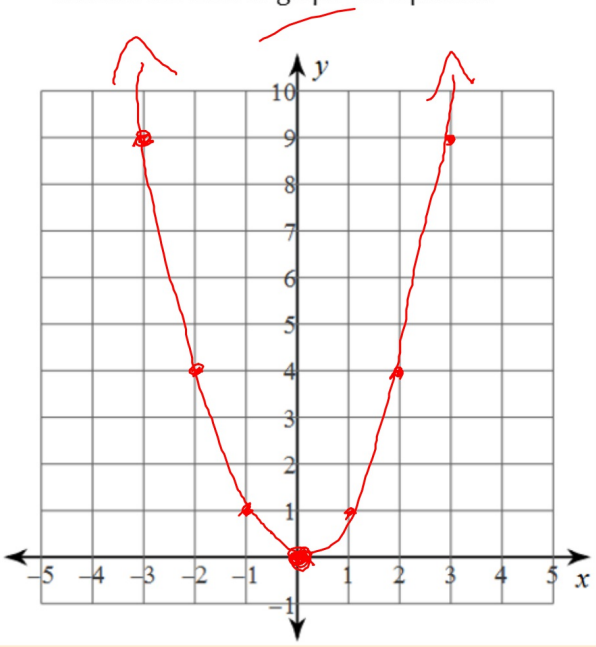
g) x = 3, y =?

$y = (3)^2 = 9$

A **Guided Notes** **QUADRATIC FUNCTIONS**

Step 3: Complete the table of $y = x^2$ and use the table to graph the equation.

X	Y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



A Guided Notes QUADRATIC FUNCTIONS

Solutions

Step 2: Evaluate $y = x^2$ from x = -3 to x = 3. **Show work evaluating the equation.**

a) x = -3, y =?

$y = (-3)^2$

$y = 9$

b) x = -2, y =?

$y = (-2)^2$

$y = 4$

c) x = -1, y =?

$y = (-1)^2$

$y = 1$

d) x = 0, y =?

$y = 0^2$

$y = 0$

e) x = 1, y =?

$y = (1)^2$

$y = 1$

f) x = 2, y =?

$y = (2)^2$

$y = 4$

c) x = 3, y =?

$y = (3)^2$

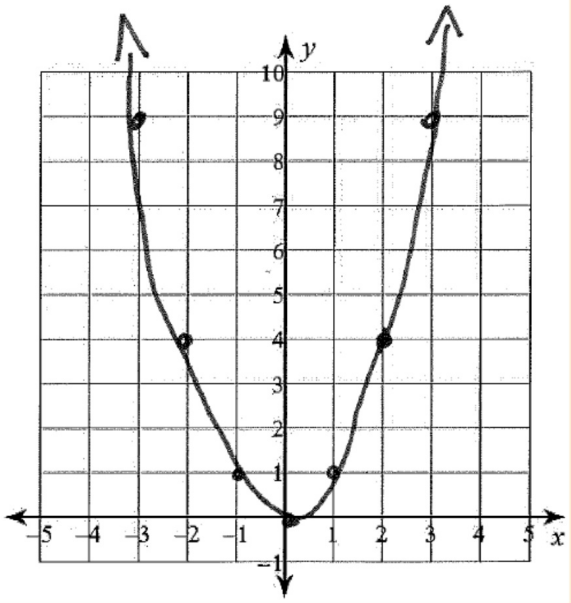
$y = 9$

A Guided Notes **QUADRATIC FUNCTIONS**

Solutions

Step 3: Complete the table of $y = x^2$ and use the table to graph the equation.

X	Y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



Example 1 Self Tutor

Explain whether each function is quadratic:

a $y = -x^2 + 3x - 4$ **b** $y = 2x^2 + 1$ **c** $y = x^3 + 2x + 7$

a Yes, with $a = -1$, $b = 3$, $c = -4$.

b Yes, with $a = 2$, $b = 0$, $c = 1$.

c No, as it has an x^3 term rather than an x^2 term.

FINDING y GIVEN x

For any given value of x, the corresponding value of y can be found by **substituting** into the function.

Example 2 Self Tutor

Suppose $y = 2x^2 - 3x + 4$. Find the value of y when:

a $x = 2$ **b** $x = -1$

a When $x = 2$,

$$\begin{aligned} y &= 2(2)^2 - 3(2) + 4 \\ &= 8 - 6 + 4 \\ &= 6 \end{aligned}$$

b When $x = -1$,

$$\begin{aligned} y &= 2(-1)^2 - 3(-1) + 4 \\ &= 2 \times 1 + 3 + 4 \\ &= 2 + 3 + 4 \\ &= 9 \end{aligned}$$

Example 3 Self Tutor

Draw the graph of $y = x^2 - 2x - 1$ from a table of values from $x = -3$ to $x = 3$.

When $x = -3$, $y = (-3)^2 - 2(-3) - 1$
$= 9 + 6 - 1$
$= 14$

When $x = -2$, $y = (-2)^2 - 2(-2) - 1$
$= 4 + 4 - 1$
$= 7$

When $x = -1$, $y = (-1)^2 - 2(-1) - 1$
$= 1 + 2 - 1$
$= 2$

When $x = 0$, $y = (0)^2 - 2(0) - 1$
$= -1$

When $x = 1$, $y = 1^2 - 2(1) - 1$
$= 1 - 2 - 1$
$= -2$

When $x = 2$, $y = 2^2 - 2(2) - 1$
$= 4 - 4 - 1$
$= -1$

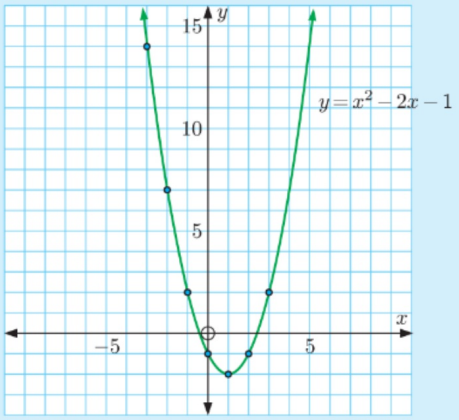
When $x = 3$, $y = 3^2 - 2(3) - 1$
$= 9 - 6 - 1$
$= 2$

Example 3 Self Tutor

Draw the graph of $y = x^2 - 2x - 1$ from a table of values from $x = -3$ to $x = 3$.

The tabled values are:

x	-3	-2	-1	0	1	2	3
y	14	7	2	-1	-2	-1	2



Given the coordinates of a point, we can use **substitution** to test if the point lies on the graph of a function. We substitute the x-coordinate of the point into the function, and see if the resulting value matches the y-coordinate of the point.

Example 4 **Self Tutor**

Do $A(2, -8)$ and $B(-3, 4)$ lie on the graph of the quadratic function $y = -x^2 - 3x + 2$?

When $x = 2$,

$$\begin{aligned} y &= -(2)^2 - 3(2) + 2 \\ &= -4 - 6 + 2 \\ &= -8 \end{aligned}$$

The coordinates of A satisfy the function, so A lies on its graph.

When $x = -3$,

$$\begin{aligned} y &= -(-3)^2 - 3(-3) + 2 \\ &= -9 + 9 + 2 \\ &= 2 \quad \text{which is } \neq 4 \end{aligned}$$

The coordinates of B do not satisfy the function, so B does not lie on its graph.

GRAPHS OF QUADRATIC FUNCTIONS

The graph of a quadratic function is called a **parabola**.

RESEARCH — PARABOLIC CURVES

We use parabolas almost every day without realising it. The parabola is the shape used in the mirror surfaces of motor vehicle headlights, torches, and satellite dishes. Parabolas are also used as arches in buildings and spans of bridges.

Exercises...

21A Exercises (Page 417 – 419)

$y = ax^2 + bx + c$

EXERCISE 21A.1

1 State whether each function is quadratic. If it is, give values for a, b, and c. If it is not, explain why.

a $y = 2x^2 + x + 4$ — $a = 2, b = 1, c = 4$

b $y = 3x + 8$

c $y = -x^2 - x - 1$ — $a = -1, b = -1, c = -1$

d $y = x^2$ — $a = 1, b = 0, c = 0$

e $y = \frac{1}{2}x^2 - 6$ — $a = \frac{1}{2}, b = 0, c = -6$

f $y = -2x + 5x^3$

Ms. Paulson's favorite meme :)

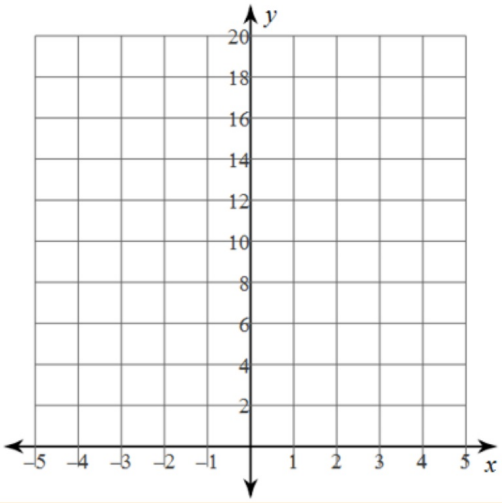
Exercises...

EXERCISE 21A.2

1 Use a table of values from $x = -3$ to $x = 3$ to draw the graph of:

a) $y = 2x^2$

x							
y							



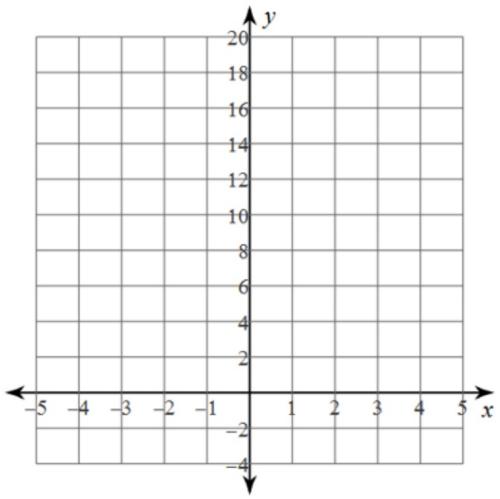
Exercises...

EXERCISE 21A.2

1 Use a table of values from $x = -3$ to $x = 3$ to draw the graph of:

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

X							
y							



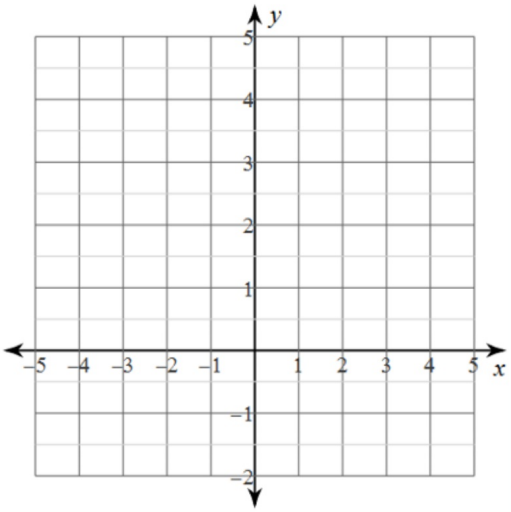
Exercises...

EXERCISE 21A.2

1 Use a table of values from $x = -3$ to $x = 3$ to draw the graph of:

c) $y = \frac{1}{2}x^2 - 2$

x							
y							



Exercises…
Solutions

21A Exercises (Page 417 – 419)

EXERCISE 21A.1

1 State whether each function is quadratic. If it is, give values for a, b, and c. If it is not, explain why.

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

Yes!

$a=2, b=1, c=4$

b $y = 3x + 8$

No, $3x^1$ is linear

c $y = -x^2 - x - 1$

Yes!

$a=-1, b=-1, c=-1$

d $y = x^2$ Yes!

$a=1, b=0, c=0$

e $y = \frac{1}{2}x^2 - 6$ Yes!

$a=\frac{1}{2}, b=0, c=-6$

f $y = -2x + 5x^3$

No

$5x^3$ shows this is a cubic equation

Exercises...
Solutions

EXERCISE 21A.2

1 Use a table of values from $x = -3$ to $x = 3$, to draw the graph of:

a) $y = 2x^2$

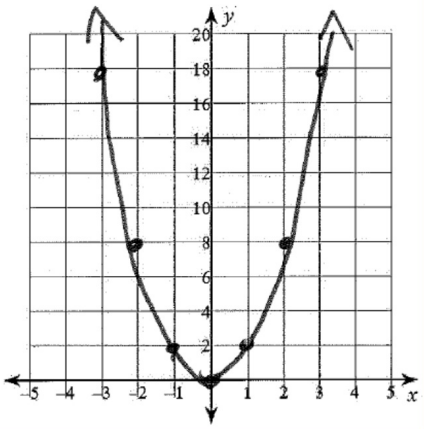
X	-3	-2	-1	0	1	2	3
y	18	8	2	0	2	8	18

$y = 2(-3)^2 = 2(9) = 18$

$y = 2(-2)^2 = 2(4) = 8$

$y = 2(-1)^2 = 2(1) = 2$

$y = 2(0)^2 = 0$



Exercises...
Solutions

EXERCISE 21A.2

1 Use a table of values from $x = -3$ to $x = 3$ to draw the graph of:

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

x	-3	-2	-1	0	1	2	3
y	13	6	1	-2	-3	-2	1

$y = (-3)^2 - 2(-3) - 2 = 13$

$y = (-2)^2 - 2(-2) - 2 = 6$

$y = (-1)^2 - 2(-1) - 2 = 1$

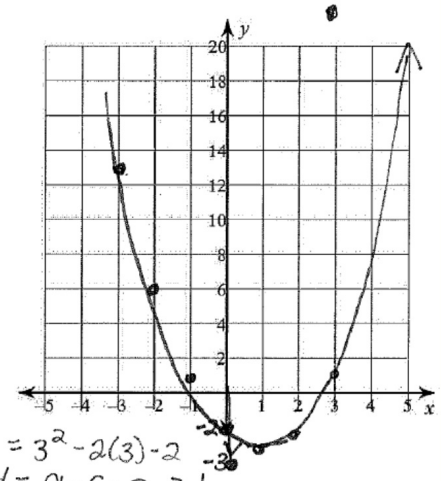
$y = 0^2 - 2(0) - 2 = -2$

$y = 1^2 - 2(1) - 2 = -3$

$y = 2^2 - 4 - 2 = -2$

$y = 3^2 - 2(3) - 2$

$y = 9 - 6 - 2 = 1$



Exercises…
Solutions

EXERCISE 21A.2

1 Use a table of values from $x = -3$ to $x = 3$ to draw the graph of:

c) $y = \frac{1}{2}x^2 - 2$

x	-3	-2	-1	0	1	2	3
y	2.5	0	-1.5	-2	-1.5	0	2.5

$y = \frac{1}{2}(-3)^2 - 2$

$y = \frac{1}{2}(-2)^2 - 2$

$y = \frac{1}{2}(-1)^2 - 2$

$y = -2$