## Quadratic Function

1. A parabola is defined by the equation $y = ax^2$ and passes through the point A(-4, 8). Point B on this parabola has an x-coordinate of 6.

   **What is the y-coordinate of point B?**

Find the rule $a = \frac{y}{x^2} = \frac{8}{(-4)^2} = \frac{8}{16} = 0.5$

$y = 0.5x^2$

$x = 6 \quad y = 0.5(6)^2$

$= 0.5(36)$

$\boxed{y = 18}$

## Quadratic Function

2. A table of values for the quadratic function g(x) is given.

**What is the rule of function g(x)?** $g(x) = 1.5x^2$

| x | g(x) |
|---|---|
| 0 | 0 |
| 5 | 37.5 |
| 8 | 96 |

$$a = \frac{y}{x^2} = \frac{96}{8^2}$$

$$= 1.5$$

## Quadratic Function

3. A pebble is dropped into a well,

The table of values illustrates the quadratic function, which gives the distance travelled by the pebble (in m) as a function of the drop time (in seconds).

| x<br>Drop time (sec) | y<br>Distance travelled (m) |
|---|---|
| 0 | 0 |
| 1 | 5 |
| 2 | 20 |

**Determine the drop time if the well has a depth of 180 m.**

Find the rule $a = \frac{y}{x^2} = \frac{5}{1^2} = 5$

$y = 5x^2$

$y = 180$

$\frac{180}{5} = \frac{5x^2}{5}$

$36 = x^2$

$\sqrt{36} = \sqrt{x^2}$

$6 = x$

The drop time is 6 seconds

## Quadratic Function

4. Aiden is celebrating his birthday by setting off a rocket. The height of the rocket he launches varies with time according to a quadratic function. Some of the values of this function are shown in the table below.

| | Time (seconds) | 2 | 4 | 6 | 10 |
|---|---|---|---|---|---|
| x | **Time (seconds)** | 2 | 4 | 6 | 10 |
| y | **Height (metres)** | 16 | 64 | 144 | 400 |

The rocket is designed to explode when it reaches a height of 1600 metres. y

**How many seconds after launch will the rocket explode?**

Rule $a = \frac{y}{x^2} = \frac{16}{2^2} = \frac{16}{4} = 4$

$y = 4x^2$

$y = 1600$

$\frac{1600}{4} = \frac{4x^2}{4}$

$\sqrt{400} = \sqrt{x^2}$

$20 = x$

It will take 20 sec for the rocket to reach a height of 1600m.

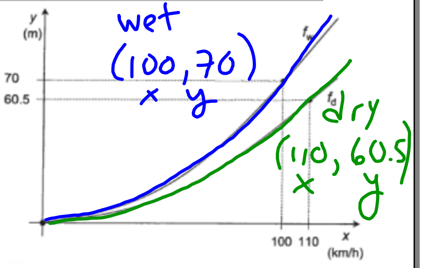
## Quadratic Function

5. Gabriel is doing some road tests with his new car. The braking distance depends on the speed of the car when the brakes are applied and on the road conditions.

| where | |
|---|---|
| | x:speed of the car, in km/h, when the brakes are applied |
| | $f_d(x)$: braking distance on a dry surface, in m |
| | $f_w(x)$: braking distance on a wet surface, in m |

The rules of functions $f_d$ and $f_w$ are of the form $f(x) = ax^2$.

Gabriel is travelling at a certain speed on a wet surface. When he suddenly brakes, the braking distance of his car is 44.8 m.




**If Gabriel were travelling at the same speed on a dry surface, what would be the braking distance of his car?**

Find the rules (there are 2 functions)

(1) Wet Road

$a = \frac{y}{x^2}$

$a = \frac{70}{100^2}$

$= \frac{70}{10000}$

$= 0.007$

$y = 0.007x^2$

(2) Dry Road

$a = \frac{y}{x^2}$

$a = \frac{60.5}{110^2}$

$= 0.005x^2$

$y = 0.005x^2$

$y = 44.8$ Find $x$

(3) $44.8 = 0.007x^2$

$\frac{44.8}{0.007} = x^2$

$6400 = x^2$

$80 = x$

We know the speed is 80 km/h

(4) $y = 0.005(80)^2$

$y = 32\text{m}$

The braking distance on a dry surface when the speed is 80 km/h is 32m

## Quadratic Function

6. An experiment is designed to test the braking distance in two cars. Each of the tables below gives the distance the car travelled from the moment the brakes were applied to the moment the car stopped completely.

Car A

| x<br>speed (km/h) | f(x) y<br>braking distance (m) |
|---|---|
| 50 | 25 |
| 80 | 64 |

Car B

| x<br>speed (km/h) | g(x) y<br>braking distance (m) |
|---|---|
| 40 | 24 |
| 90 | 121.5 |

It is determined that both functions follow a quadratic model. **What is the difference in the braking distance of car A and car B when both cars were travelling at 100 km/h?**

Rule f(x)

$y = 0.01x^2$

$x = 100$

$y = 0.01(100)^2$

$= 100m$

g(x)

$y = 0.015x^2$

$y = 0.015(100)^2$

$= 150$

$150 - 100 = 50m$

The difference in the braking distance of Car A and Car B is 50 m.