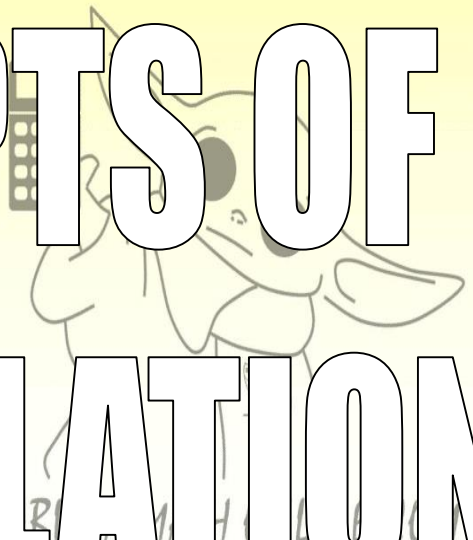
ST. JEAN DE BREBEUF MATHEMATICS

CHAPTER 5.5

THE x-INTERCEPTS OF A QUADRATIC RELATION



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

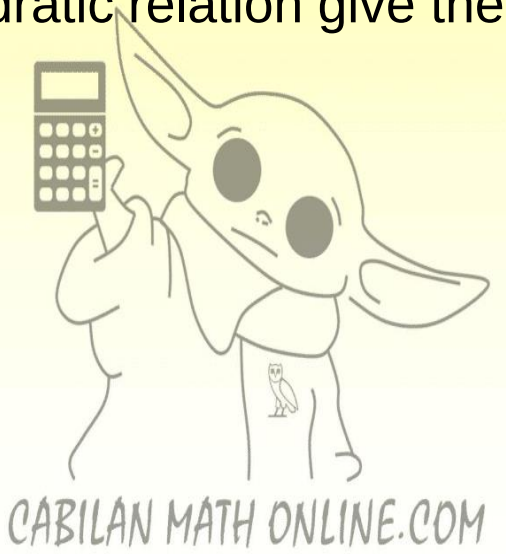
KEY CONCEPTS

Given a quadratic relation in intercept form, $y = a(x - r)(x - s)$, the **zeros**, or ***x*-intercepts**, are r and s.

→Recall that *x-intercepts* are the points where the graph crosses the **x-axis**

To solve for the **zeros/x-intercepts**, you **let y = 0** and solve for *x* algebraically

The **vertex**, **standard**, and **intercept** forms of a quadratic relation give the same parabola when graphed.



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

KEY CONCEPTS

SUMMARY

VERTEX FORM	STANDARD FORM	INTERCEPT FORM
$y = a(x - h)^2 + k$	$y = ax^2 + bx + c$	$y = a(x - r)(x - s)$
Vertex is ***(h, k)***	**c** is the *y*-intercept (where graph crosses the *y*-axis)	***r*** and ***s*** are the **zeros** or **x-intercepts** of the graph
For all forms, the ***a*** indicates the direction the parabola opens When **a > 0**, the parabola opens up When **a < 0**, the parabola opens down		

DAY 2

PREVIOUS

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

(a) $y = 4x^2 + 8x - 12$

$\frac{4}{4} \quad \frac{8x}{4} \quad \frac{-12}{4}$

GCF = 4

$y = \mathbf{4}(x^2 + 2x - 3)$

P = -3 : $+3$ $\times$ -1

S = $+2$: $+3$ -1

$y = \mathbf{4}(x + 3)(x - 1)$

$0 = 4(x + 3)(x - 1)$

1st zero: $0 = x + 3$, $-3 = x$

2nd zero: $0 = x - 1$, $+1 = x$

STEPS (FACTORING and SOLVING FOR ZEROS)

→**Common factor** by finding the **greatest common factor (GCF)** and dividing each term by the GCF

→Factor the remaining terms by finding the **product (P)** and the **sum (S)**

→Solve for the **zeros** by letting **y = 0** and solve for the *x* values algebraically

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

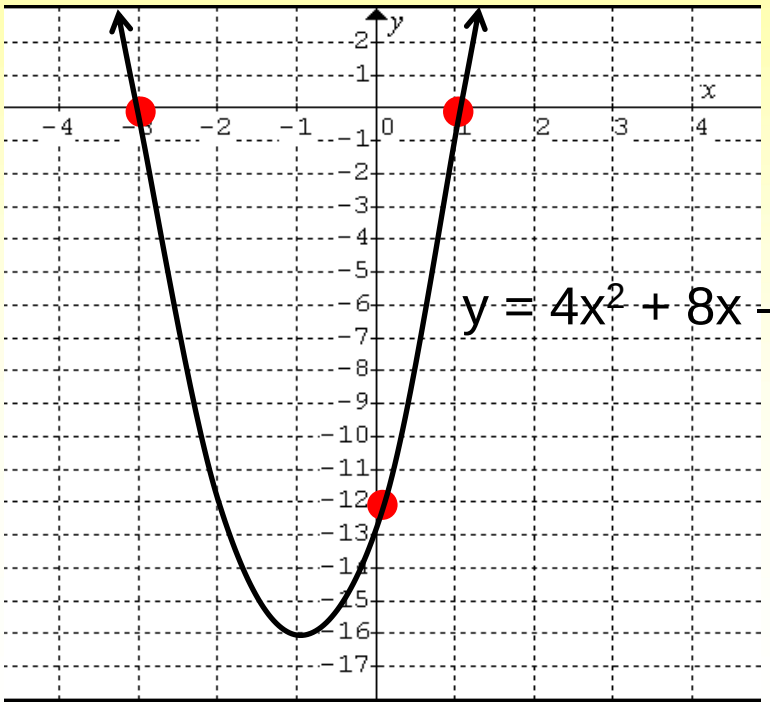
(a) $y = 4x^2 + 8x - 12$

1st zero

$-3 = x$

2nd zero

$+1 = x$



STEPS (SKETCHING THE GRAPH)

→Plot the **zeros/x-intercepts**

→Plot the **y-intercept** (look at the **c** term in the *standard* form)

→Draw a **smooth curve**

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

(b) $y = -3x^2 - 18x - 24$ GCF = -3

Negative has to be part of GCF

$\frac{-3}{-3} \quad \frac{-18x}{-3} \quad \frac{-24}{-3}$

$y = -3(x^2 + 6x + 8)$

P = $+8$ $+4$

S = $+6$ $+2$

$y = -3(x + 4)(x + 2)$

$0 = -3(x + 4)(x + 2)$

1st zero 2nd zero

$0 = x + 4$ $0 = x + 2$

$-4 = x$ $-2 = x$

STEPS (FACTORING and SOLVING FOR ZEROS)

→**Common factor** by finding the **greatest common factor (GCF)** and dividing each term by the GCF

→Factor the remaining terms by finding the **product (P)** and the **sum (S)**

→Solve for the **zeros** by letting **y = 0** and solve for the *x* values algebraically

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

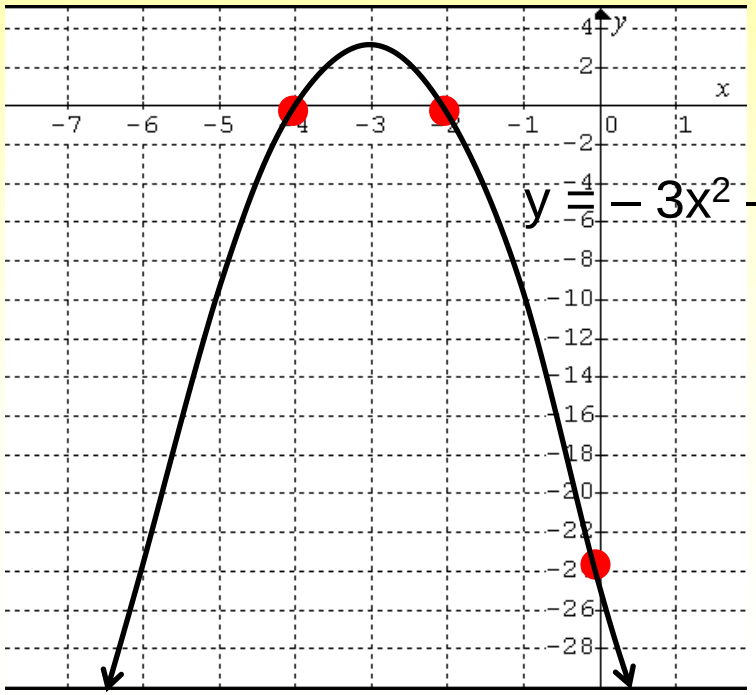
(b) $y = -3x^2 - 18x - 24$

1st zero

$-4 = x$

2nd zero

$-2 = x$



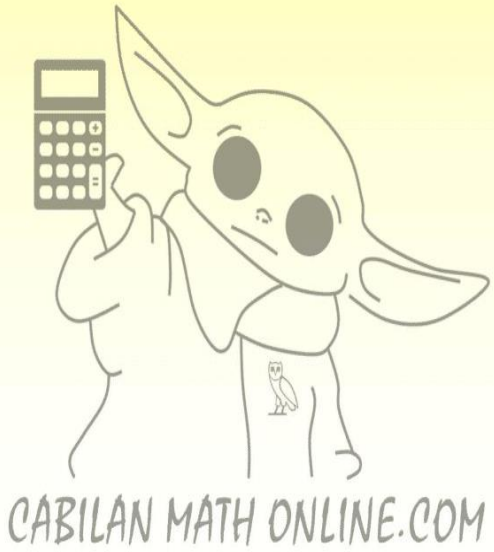
$y = -3x^2 - 18x - 24$

STEPS (SKETCHING THE GRAPH)

→Plot the **zeros/x-intercepts**

→Plot the **y-intercept** (look at the **c** term in the *standard* form)

→Draw a **smooth curve**



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

(c) $y = x^2 - 8x$ GCF = x

$x \quad x$

$y = \mathbf{x(}\ x - 8\ \mathbf{)}$

$0 = x(x - 8)$

1^{st} zero 2^{nd} zero

$0 = x$ $0 = x - 8$

$+ 8 = x$

STEPS (FACTORING and SOLVING FOR ZEROS)

→**Common factor** by finding the **greatest common factor (GCF)** and dividing each term by the GCF

→Factor the remaining terms by finding the **product (P)** and the **sum (S)**

→Solve for the **zeros** by letting **y = 0** and solve for the *x* values algebraically

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

The y-intercept is **y = 0**

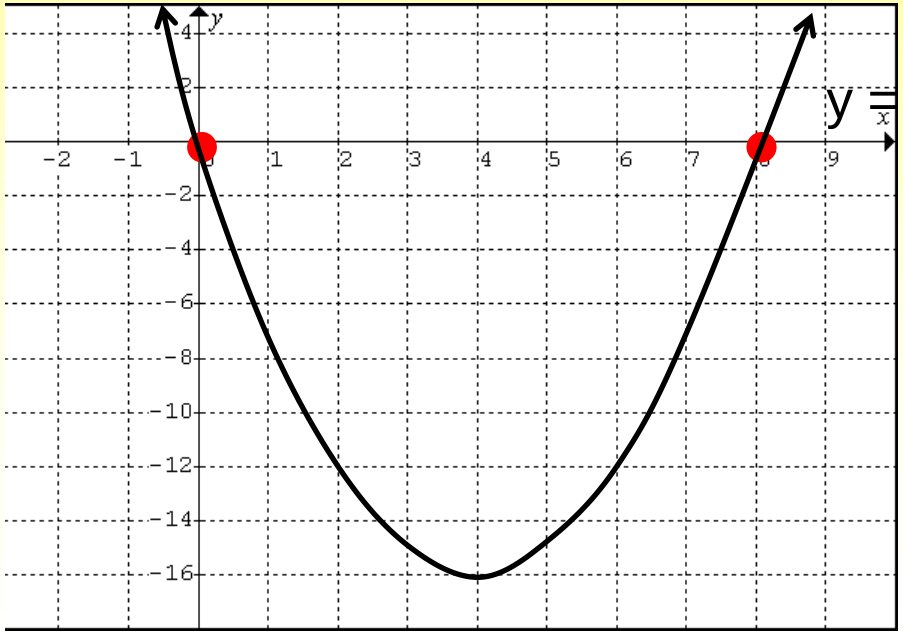
(c) $y = x^2 - 8x$

1st zero

$0 = x$

2nd zero

$+ 8 = x$

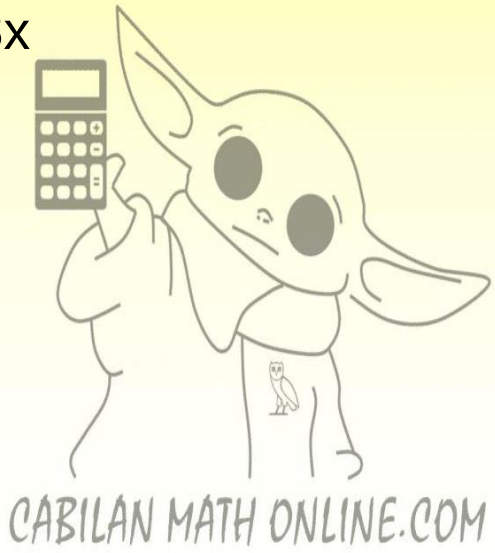


STEPS (SKETCHING THE GRAPH)

→Plot the **zeros/x-intercepts**

→Plot the **y-intercept** (look at the **c** term in the *standard* form)

→Draw a **smooth curve**



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

(d) $y = x^2 + 2x - 15$

$y = (x + 5)(x - 3)$

$0 = (x + 5)(x - 3)$

1st zero: $0 = x + 5$, $-5 = x$

2nd zero: $0 = x - 3$, $+3 = x$

Common factoring not required

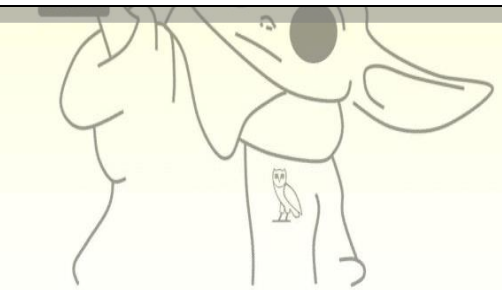
$P = -15$, $S = +2$ → $+5$, -3

STEPS (FACTORING and SOLVING FOR ZEROS)

→**Common factor** by finding the **greatest common factor (GCF)** and dividing each term by the GCF

→Factor the remaining terms by finding the **product (P)** and the **sum (S)**

→Solve for the **zeros** by letting **y = 0** and solve for the *x* values algebraically



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CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 1 *Factor to Find the Zeros of a Quadratic Relation*

Factor each of the following and solve for the **zeros**. Sketch the graph using the **zeros** and the **y-intercept**.

STEPS (SKETCHING THE GRAPH)

→Plot the **zeros/x-intercepts**

→Plot the **y-intercept** (look at the **c** term in the *standard* form)

→Draw a **smooth curve**

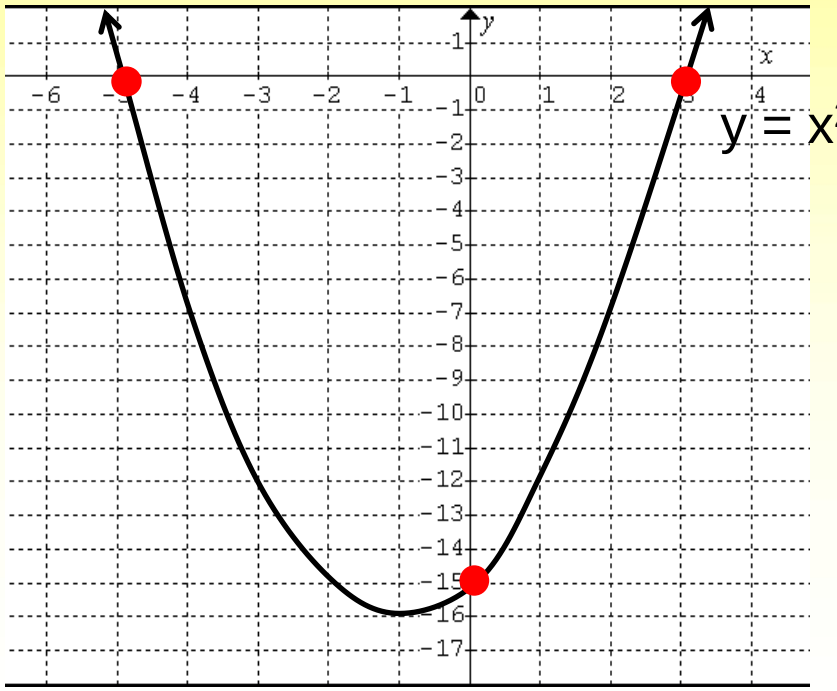
(d) $y = x^2 + 2x - 15$

1st zero

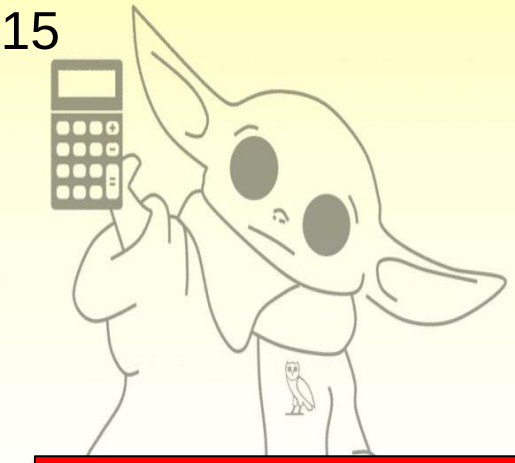
$-5 = x$

2nd zero

$+3 = x$



$y = x^2 + 2x - 15$



End of Day 1

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 2 *Different Forms of a Quadratic Relation*

Consider the quadratic relation $\mathbf{y = 3(x + 4)^2 - 108}$

h **k**

(a) What *form* is the quadratic relation in? What information does it tell you?

The relation is in **vertex form**

→Tells you the co-ordinates of the **vertex (h, k)**

→Vertex = (– 4 , – 108)

(b) Expand the quadratic relation into **standard form**. What information does this form tell you?

$y = 3(x + 4)^2 - 108$

$y = 3(x + 4)(x + 4) - 108$

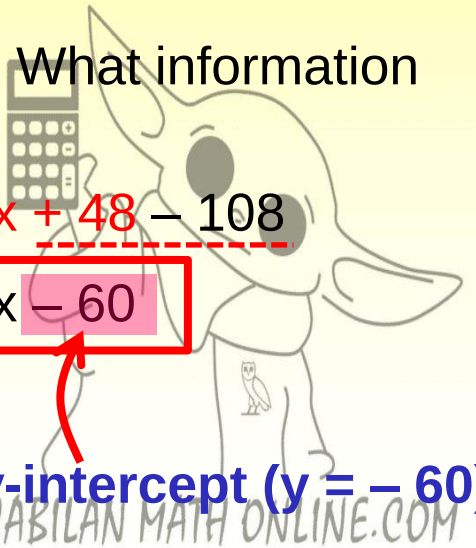
$y = 3(x^2 + 4x + 4x + 16) - 108$

$y = 3(x^2 + 8x + 16) - 108$

$y = 3x^2 + 24x + 48 - 108$

$y = 3x^2 + 24x - 60$

This is the **y-intercept (y = – 60)**



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 2 *Different Forms of a Quadratic Relation*

Consider the quadratic relation $\mathbf{y = 3(x + 4)^2 - 108}$

(c) Factor the quadratic relation and express in **intercept form**. Solve for the **zeros**.

Use relation in *standard form* from (b)

$y = \frac{3x^2}{3} + \frac{24x}{3} - \frac{60}{3}$

GCF = 3

- Common factor
- Find the **product (P)** and **sum (S)**

$y = \mathbf{3}(x^2 + 8x - 20)$

P = – 20 → + 10 × – 2

S = + 8

$y = 3(x + 10)(x - 2)$

- Solve for *zeros* by letting **y = 0**

$0 = 3(x + 10)(x - 2)$

1st zero

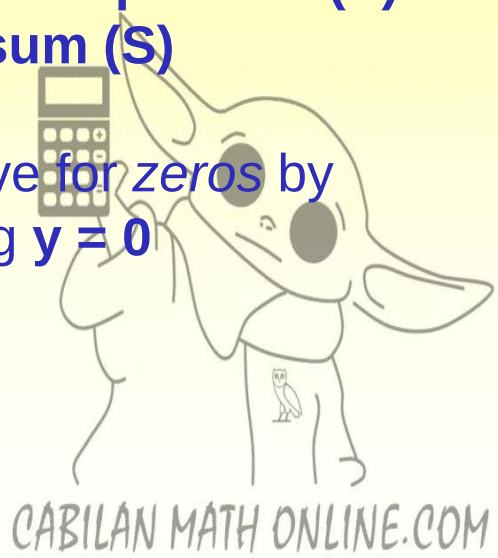
$0 = x + 10$

$-10 = x$

2nd zero

$0 = x - 2$

$+2 = x$



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 3 *Application: Projectile Motion*

A soccer ball is kicked from ground level. Its path is given by the relation $h = -4.9t^2 + 22.54t$, where ***h*** **is the ball's height** above the ground, in *metres*, and ***t*** **is the time**, in *seconds*.

a) Write the relation in **intercept form**.

We have to **factor** the given relation

$h = -4.9t^2 + 22.54t$ GCF $= -4.9t$ - Common factor

$-4.9t \quad -4.9t$

$h = -4.9t(t - 4.6)$

(b) How high was the ball after **2.5 seconds**?

Let **t = 2.5** and substitute into relation

$h = -4.9t^2 + 22.54t$

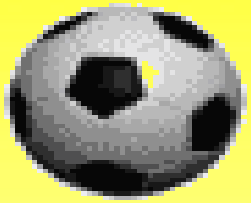
$h = -4.9(2.5)^2 + 22.54(2.5)$

$h =$ **25.725 m**

The ball was **25.725 metres** after 2.5 seconds.

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 3 *Application: Projectile Motion*



A soccer ball is kicked from ground level. Its path is given by the relation $h = -4.9t^2 + 22.54t$, where ***h* is the ball's height** above the ground, in *metres*, and ***t* is the time**, in *seconds*.

c) Use the intercept form of the relation to **find the zeros**.

Use relation from (a)
→Let **h = 0** and solve for *t*

$h = -4.9t(t - 4.6)$

$0 = -4.9t(t - 4.6)$

1st zero

$0 = -4.9t$

$-4.9 \quad -4.9$

$0 = t$

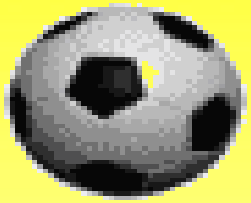
2nd zero

$0 = t - 4.6$

$+4.6 = t$

CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 3 *Application: Projectile Motion*



A soccer ball is kicked from ground level. Its path is given by the relation $h = -4.9t^2 + 22.54t$, where ***h* is the ball's height** above the ground, in *metres*, and ***t* is the time**, in *seconds*.

d) Plot the zeros and your answer from **(b)**. Draw a smooth curve through the points.

1st zero

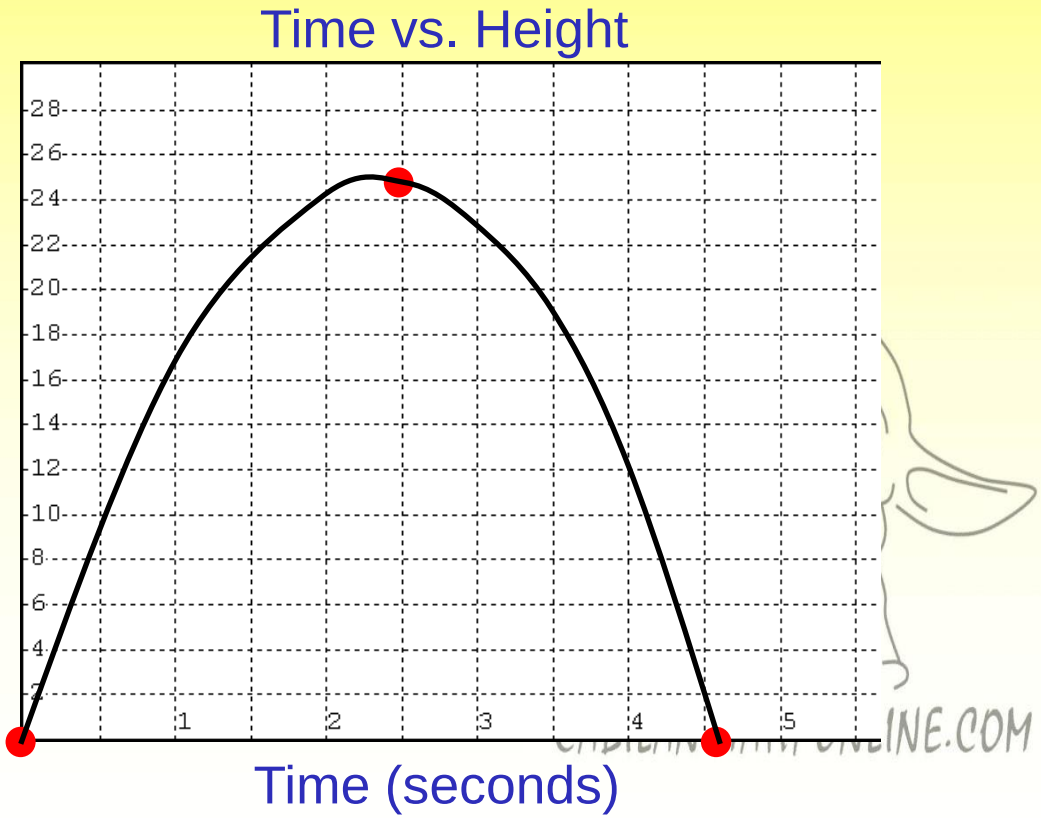
0 = t

2nd zero

+ 4.6 = t

(b) The ball was **25.725 metres** after 2.5 seconds.

→(2.5 , 25.725)



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

EXAMPLE 3 *Application: Projectile Motion*

A soccer ball is kicked from ground level. Its path is given by the relation $h = -4.9t^2 + 22.54t$, where ***h* is the ball's height** above the ground, in *metres*, and ***t* is the time**, in *seconds*.

e) Use *algebraic methods* to determine **when** the ball hit the **ground.**

Same thing as solving for **zeros**
→Let **h = 0** and solve for *t*

* Any time an object hits the ground, **h = 0**

$h = -4.9t(t - 4.6)$

$0 = -4.9t(t - 4.6)$

1st zero

$0 = -4.9t$

$\frac{0}{-4.9} = \frac{-4.9t}{-4.9}$

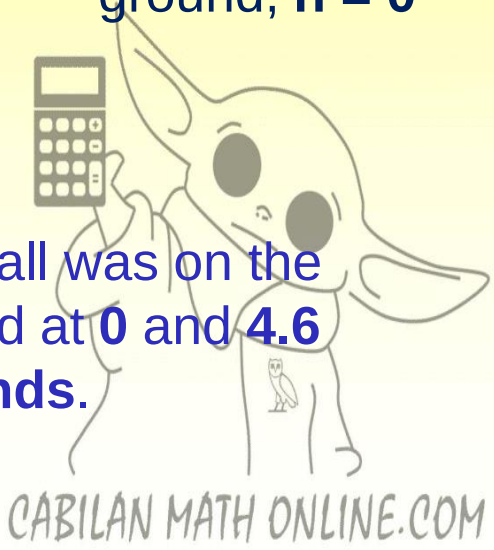
$0 = t$

2nd zero

$0 = t - 4.6$

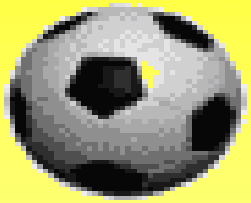
$+4.6 = t$

The ball was on the ground at **0** and **4.6 seconds**.



CHAPTER 5.5 THE x-INTERCEPTS OF A QUADRATIC RELATION

Homework



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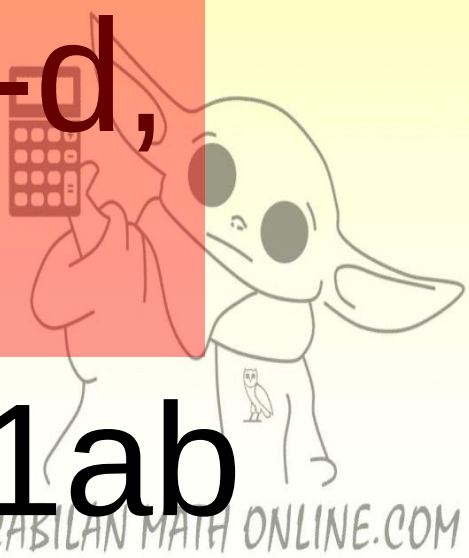
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