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**CHAPTER 8:** Represent Quadratic Equations

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3	8.3 - The Quadratic Relation $y = ax^2 +$	Page 341 – 343 #2a – d, 3a – d,
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## **8.1 – INTERPRET QUADRATIC RELATIONS**

#### **KEY CONCEPTS**

A quadratic relation can be represented by a graph, or by an equation of the form y = a $x^2 + bx + c$  ( $a \ne 0$ ).

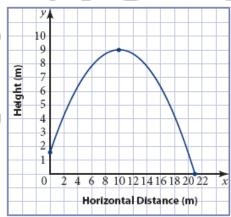
The equation or the graph of a quadratic relation can be used to solve problems.

#### **EXAMPLE 1**

The path of a soccer ball that was thrown in the air is modelled by the graph. The *y*-values represent the **height of the ball** in *metres* and the *x*-values represent the **horizontal distance** in *metres* that the ball has travelled.







- (a) What was the **maximum height** of the ball?
- (b) How far did the ball travel horizontally to reach this maximum height? \_\_\_\_\_
- (c) What **horizontal distance** did the ball travel before hitting the *ground*? \_\_\_\_\_
- (d) At what height was the ball thrown from?



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## **EXAMPLE 2**

The arched support of a bridge can be modelled by the quadratic relation  $y = -0.024x^2$ + 2.4x, where y represents the height in feet, and x represents the horizontal distance in feet. Vertical support posts are to be installed at various lengths from the base of the arch.

How tall should the support post be

(a) at **50 feet** 

(b) at **60 feet** 



Homework: Page 323 - 328 # 1 - 3, 4b - d, 5b - d, 10



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## 8.2 - REPRESENT QUADRATIC RELATIONS IN DIFFERENT WAYS

#### **KEY CONCEPTS**

A **quadratic relation** can be expressed several ways. In this lesson we will look at the two listed below.

STANDARD FORM	FACTORED FORM	
A quadratic relation in standard form is expressed in the form $y = ax^2 + bx + c$ , where $a \neq 0$	Any quadratic relation in the factored form is expressed in the form $y = a(x - r)(x - s)$	
The "c" term is the <b>y-intercept</b> of the relation	The "r" and the "s" represent the x-intercepts of the relation	
Any quadratic relation in standard form	The x-intercepts are also known as the	
can be <b>factored</b> and expressed in factored form	zeros  →When solving for the zeros, you let y =	
	0 and you solve for each x separately	
The "a" value for both standard and factored form are the same		

The "a" value for both standard and factored form are the same

- → When **a** is positive, the parabola opens up and has a **minimum**
- →When **a** is <u>negative</u>, the parabola <u>opens down</u> and has a **maximum**

# **EXAMPLE 1** Analyzing a Quadratic Relation

- (a) Given the quadratic relation  $y = x^2 + 8x + 15$ 
  - (i) Does this relation have a **minimum** or **maximum** value? How do you know?
  - (ii) What is the **y-intercept** of this relation?
  - (iii) Factor the trinomial. This will give you the factored form.



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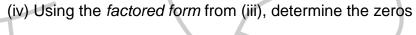
(iv) Using the factored form from (iii), determine the zeros

When finding zeros, you let **y** = \_\_\_\_\_

- (b) Given the quadratic relation  $y = x^2 + 2x 8$ 
  - (i) Does this relation have a minimum or maximum value? How do you know?

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- (ii) What is the **y-intercept** of this relation?
- (iii) Factor the trinomial. This will give you the factored form.



When finding zeros, you let **y** = \_\_\_



# **EXAMPLE 2** Interpret a Quadratic Relation

The curve formed by a rope bridge can be modelled by the relation  $y = x^2 - 9x + 18$ , where x is the horizontal distance in metres and y is the height in metres.

(i) Factor the trinomial. This will give you the *factored* form.



(ii) Using the factored form from (i), determine the zeros

When finding zeros, you let y =\_\_\_\_

(iii) What is the horizontal distance of the bridge from one end to the other?

**Homework**:

Page 333 – 335 #1, 2, 4, 6



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# 8.3 – THE QUADRATIC RELATION $y = ax^2 + c$

#### **KEY CONCEPTS**

For a quadratic relation of the form  $y = ax^2 + c$ , the *maximum* or *minimum* value occurs at c, which is the y-intercept.

When **a** is <u>positive</u>, the parabola **opens** <u>up</u> and has a <u>minimum</u> When **a** is <u>negative</u>, the parabola **opens** <u>down</u> and has a <u>maximum</u>

**EXAMPLE 1** Finding the Maximum or Minimum

For each relation, identify the following:

- →The **a** value
- → The direction of the opening of the parabola
- → Maximum or minimum and its value

RELATION	VALUE OF "a"	DIRECTION OF OPENING	MAXIMUM OR MINIMUM? VALUE
$y = 5x^2$			
$y = x^2 - 16$			
$y = -3x^2 + 27$			

**EXAMPLE 2** Finding the Zeros of a Quadratic Relation

Without graphing, find the zeros of the following relations. Be sure to factor first!!!

Recall: When finding *zeros*, let \_\_\_\_\_ and solve for *x* 

(a) 
$$y = x^2 - 25$$

(b) 
$$y = x^2 - 16$$

(c) 
$$y = 25x^2 - 225$$



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# **EXAMPLE 3** Finding the Equation of a Quadratic Relation

The graph of the quadratic relation  $y = ax^2 + 5$  passes through the point (2, 21). Find the value of **a** and the **equation** for this quadratic relation.

## **EXAMPLE 4**

Application: Hitting a Golf Ball

Cheetah hits a golf ball from the top of a mountain. The path of the ball can be represented by the relation  $h = -5t^2 + 245$ , where **h** represents the **height** of the ball in *metres* and **t** represents the **time**, in *seconds*.



(a) From what height was the ball hit from?

(b) How many seconds was the ball in the air before hitting the ground?

When the ball hits the ground, h = \_\_\_\_



Page 341 – 343 #2a – d, 3a – d, 4, 5, 7, 10



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## 8.4 - SOLVE PROBLEMS INVOLVING QUADRATIC RELATIONS

#### **KEY CONCEPTS**

Many situations can be modelled using quadratic relations.

Problems can be solved by finding

- →the maximum or minimum
- →the *y*-intercept
- →the **zeros**.

### **EXAMPLE 2**

The Trajectory of a Model Rocket

A model rocket is launched from a platform. The trajectory of the rocket can be modelled by the relation  $\mathbf{h} = -5t^2 + 100t + 1$ , where  $\mathbf{h}$  is the height of the model rocket in *metres* and  $\mathbf{t}$  is the time in seconds.



To solve for the height, we let  $t = \underline{\hspace{1cm}}$  and solve for h

(b) What is the height of the rocket after 5 seconds?

<u>Homework</u>: Page 347 – 351 #1a, 2 (omit e), 4 (omit e), 7a

