Learner Pack

Functional Mathematics

Level 3 Unit 2: Algebra

Acknowledgements

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April 2012

Activity A1: Profits of a business

Activity Profits of a business A1

(Google images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.4** and **2.5.**

Introduction

In this activity we will give an example of a real life situation involving algebra: how it can be used to share the profits of a business equally.

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life.
2. Demonstrate an understanding of the language and concepts of algebra.
3. Write algebraic expressions for real – life examples.
4. Solve a selection of algebraic problems based on real – life examples.

Activity A1: Profits of a business

Key Learning Points

1. Defining algebra using simple terminology
2. Examining examples of real – life situations in which algebra is used
3. Recognising the benefits of understanding algebra to everyday life
4. Using the language of algebra
5. Understanding common terms used in algebra such as variable, constant, coefficient, term, like term, expression, and product.
6. Understanding the concepts of algebra
7. Developing a glossary of algebraic terms
8. Writing algebraic expressions
9. Constructing algebraic expression of problem

Materials you will need for this activity

- Practice Sheet A1
- Solution Sheet A1

What do you need to know before you start?

Maths

Algebra is an important topic within mathematics and everyday life. It is often called the language of mathematics. Algebra involves writing problems mathematically and using **variables** to represent **unknown values**.

What does variable mean?

A variable is a symbol which represents a number we don't know yet. It can be any letter of the alphabet. Its value can change depending on the problem or situation.

Activity A1: Profits of a business

Business and Profit

A business is an organisation that sells goods or services, or both. They aim to make a profit.

Profit is the ‘selling price’ minus the ‘cost price’.

The '**cost price**' is how much it costs the business owners to run their business and to produce and provide the goods or service.
The ‘**selling price’** is how much the customers pay for the goods or service.
If the business gets paid more for the goods or services than it costs to provide them, the difference is the '**profit**':

Activity A1: Profits of a business

Getting Started

Algebra involves writing problems mathematically using **variables** to **represent unknown values**.

When we write problems using variables to represent unknown values, we call that an **algebraic expression**.

Words you will need

- A **variable** is a symbol which represents a number we don't know yet. It can be any letter of the alphabet. **Its value can change** depending on the problem or situation.

- A **constant** is a **fixed** value.

- A **coefficient** is the number in front of the variable.

- An **algebraic expression** is a group of terms which may combine variables and constants. For example, 50**d** + 20 is an algebraid expression. **d** is a variable, 50 is a coefficient and 20 is the constant.

- A **term** is any letter or number or a product of both.
  For example, the algebraic expression 50d + 20 has two terms; 50d and 20.

- **Like terms** are those whose variables are the same, that is, 2a + 6a; 5d + 4d

- A **product** is what you get when you multiply two numbers by each other.
  For example, 25 is a product of 5 × 5.

Activity A1: Profits of a business

Worked Example: Using algebra in a real life situation

'Cutting Edge Landscapes' is a business that has a number of owners.
The owners share the profits equally.
The total profit for the year 2011 was €12,000.

Write an algebraic expression to show each owner's profit.

Solution

We don't know how many owners the business has. We can use a **variable** to represent this **unknown number**. The variable can be any letter. Let's use the variable *h*.

h is the number of owners the business has.

The profit is €12,000. This must be divided equally between each owner.

Therefore, each owner's profit is €12,000 divided by *h.*

We can write this as an **algebraic expression** as follows: $\frac{12000}{h}$ euro.

Activity A1: Profits of a business

Task 1

The profit of 'Xpect Hair Salon' in 2011 was €8,400.

The business is owned by a number of investors and the profit is divided equally between them each year.

Allow a variable to represent the number of owners of the business.

Write an algebraic expression to show each owner's profit.

Activity A1: Profits of a business

Task 2

The yearly profit of 'Easy Fit Kitchens' is €80 for every day the business is open in that year.

- Allow a variable to represent the number of days the business is open in 2011.

- Write an algebraic expression to show the profit of the business in 2011.

- Identify the variable and coefficient in the algebraic expression.

Activity A1: Profits of a business

Task 3

The yearly profit of 'Greenhills Bakery' is €50 for every day the business is open in that year, plus €500.

- Allow a variable to represent the number of days the business was open in 2010.

- Write an algebraic expression to show the profit of the business in 2010.

- Identify the variable, coefficient and constant in the algebraic expression.

Activity A1: Profits of a business

Practise your skills

- Use Practice Sheet A1.

- Algebra is also about patterns and **sequences**.

  These are sets of numbers that repeat in a predictable manner. An example of a sequence is: 2, 4, 6, 8,10.

  What does each variable stand for in the following sequences?

  a) 3, 9, 12, a, b, c

  b) 3, 5, 7, a, b, c

  c) 8, 16, 24, a, b, c

Activity A2: All-Ireland championships

Activity All – Ireland championships A2

(Google images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.3** and **2.4.**

Introduction

Equations are used to solve a wide range of problems. An **equation** is a mathematical sentence with numbers, letters and an equals sign (=).

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life
2. Demonstrate an understanding of the language and concepts of algebra
3. Solve a selection of algebraic problems to include simple equations
4. Write algebraic expressions for real – life examples.

Activity A2: All-Ireland championships

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Using the language of algebra
4. Understanding common terms used in algebra such as variable and equation
5. Understanding the concepts of algebra
6. Developing a glossary of algebraic terms
7. Building simple equations
8. Expressing 'stories' as mathematical sentences.

Materials you will need for this activity

- Practice Sheet A2
- Solution Sheet A2

What do you need to know before you start?

Maths

An equation is like a balance scale. Everything must be equal on both sides.
For example; 2 + 3 + 6 = 11

All Ireland Championships

The All-Ireland Championship is the premier competition in GAA. Counties compete with each other for the All-Ireland Championship in both hurling and football.

Activity A2: All-Ireland championships

Getting Started

A key step in solving a problem is **building the equation**.

To build the equation, start with the sentence that describes the problem.

Then translate that sentence into an equation that models the problem.

For example:

Sentence	Equation
The sum of y and 3 is equal to 8	y + 3 = 8
Increasing a number by 2 results in 7	k + 2 = 7
5 less than a number is 4	d – 5 = 4

Activity A2: All-Ireland championships

Worked Example — Building simple equations

When 12 is added to the number of senior football All – Irelands Galway has won, the result is 21.

Allow a **variable** to represent the number of senior football All – Irelands Galway has won. **Build an equation** that models this problem.

Solution

If we allow the variable 'F' to represent the number of senior football All – Irelands Galway has won, then we can say:

$$F + 12 = 21$$

Activity A2: All-Ireland championships

Task 1

When we add 9 to the number of senior hurling All – Irelands Limerick has won, the result is 16.

Allow a variable to represent the number of senior hurling
All – Irelands Limerick has won. Build an equation that models this problem.

Activity A2: All-Ireland championships

Task 2

If we subtract 6 from the number of senior football All – Irelands Kerry has won, the result is 27.

Allow a variable to represent the number of senior football All – Irelands Kerry has won. Build an equation that models this problem.

Activity A2: All-Ireland championships

Task 3

Increasing the number of senior hurling All – Irelands Wexford has won by 8, results in 15.

Allow a variable to represent the number of senior hurling All – Irelands Wexford has won and build an equation that models this problem.

Practise your skills

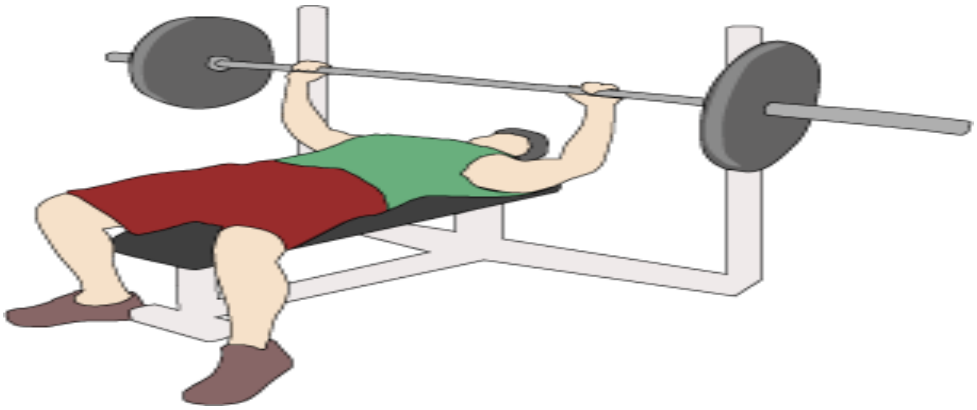
- Use Practice Sheet A2.

- A unit of electricity costs 14c. The standing charge is 20c per day.

  Allow a variable to represent the number of units used.
  Build an equation to work out a bill (B) for December.

Activity A3: The bench press

Activity # The bench press **A3**



(Google images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.3** and **2.5.**

Introduction

The Bench Press is one of the most popular lifts in the gym. When lifting, it is important that there is an equal amount of weight on each side of the bar.

In equations it is also important that the right hand side is equal to the left hand side.

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life
2. Demonstrate an understanding of the language and concepts of algebra
3. Solve a selection of algebraic problems to include simple equations
4. Solve a selection of algebraic problems based on real – life situations.

Activity A3: The bench press

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Understanding the concepts of algebra
4. Solving simple equations
5. Solving a selection of algebraic problems.

Materials you will need for this activity

- Practice Sheet A3
- Solution Sheet A3

What do you need to know before you start?

Maths

In Activity A2, we learned that an equation is a mathematical sentence with numbers, letters and an equals sign (=). An equation is like a balance scale: both sides must be equal.

Lifting Weights

The Bench Press is an upper body exercise used in weight training, bodybuilding and other types of fitness training. It helps to develop the chest.
When lifting, it is important that there is an equal amount of weight on each side of the bar. This is vital for balance and it ensures a similar buildup of muscle on both sides of the body.
In equations it is also important that the right hand side is equal to the left hand side.

Activity A3: The bench press

Getting Started

We solve equations by **balancing**.

This is the Golden Rule:

> **'Whatever we do to one side of an equation,**
> **we must do the same to the other side'**

Worked Example: Building and solving simple equations

While training for the 2012 London Olympics, Irish boxer Katie Taylor noticed that some weights were bigger than the others. But the trainer told her that there was the same weight on each side.

On closer inspection Katie noticed that she had 25 kg on the right hand side of the bar. On the left hand side she had 10g and an unknown weight which had no marking on it.

If we **let x stand for the unknown weight** on the left hand side of the bar, we could write this problem as follows: $x + 10 = 25$

What is the unknown weight?

Activity A3: The bench press

Solution

x + 10 = 25

In order to solve this equation and find out what the unknown weight is, we need to **isolate the variable** x. That means we need to leave the variable x by itself on the left hand side of the equation.

The opposite of adding 10 is subtracting 10. To isolate the variable x, we must subtract the 10 on the left. Remember the Golden Rule:

'Whatever we do to one side of an equation,
we must do the same to the other side'

If we subtract 10 from both sides, we will remove the + 10 on the left.

x + 10 = 25
x + 10 – 10 = 25 – 10
x = 15

The unknown weight on the left hand side of the bar is 15kg.

Activity A3: The bench press

Task 1

In the next day's session Katie noticed that she had 28kg on the right hand side of the bar. On the left hand side she had 16kg and an unknown weight which had no marking on it.

If we let x stand for the unknown weight on the left hand side of the bar, we could write this problem as $x + 16 = 28$

What is the unknown weight?

Activity A3: The bench press

Task 2

Later the same day, in a cool -down session Katie observed that she had 15 kg on the right hand side of the bar. However she noticed that the trainer had taken off an extra 10kg from the original weights on the left hand side.

If we let x stand for the original weights on the left hand side of the bar, we could write this problem as

$x - 10 = 15$

What is the current weight on the left hand side of the bar?

Activity A3: The bench press

Practise your skills

- Use Practice Sheet A3.

- In Week 5 of the 2010 X Factor show, Mary Byrne received 565,000 votes from Britain.

  In the same show, Matt Cardle got 780,000 votes in total.

  If Mary's votes from Ireland are added in, she received the same amount of votes altogether as Matt.

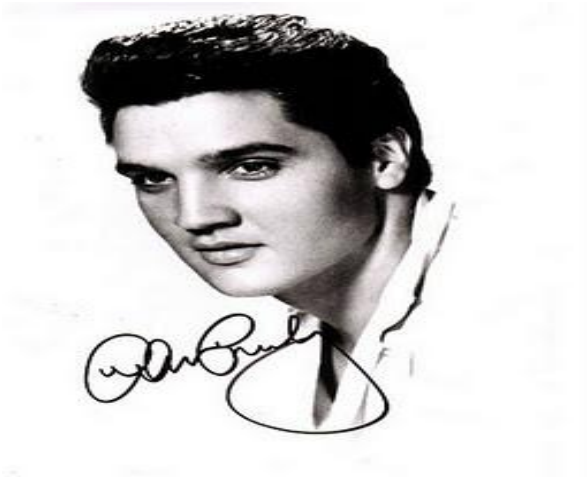
  If we let x stand for the number of votes Mary receives from Ireland, we could write this equation as:

  x + 565,000 = 780,000

  Solve this equation for x and find out how many votes Mary got from Ireland.

Activity A4: Elvis Presley's number 1 hits

Activity Elvis Presley's number 1 hits A4



(Google images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.3, 2.4** and **2.5.**

Introduction

Elvis Presley was one of the most popular American singers of the 20th century. A cultural icon, he is often referred to as the "King of Rock and Roll" or simply "the King". To this day, he remains one of the most critically acclaimed and commercially successful singers in history. He had many Number 1 hits in many countries.

Activity A4: Elvis Presley's number 1 hits

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life.
2. Demonstrate an understanding of the language and concepts of algebra
3. Solve a selection of algebraic problems to include simple equations
4. Write algebraic expressions for real-life examples
5. Solve a selection of algebraic problems based on real – life situations.

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Understanding the concepts of algebra
4. Building simple equations
5. Solving simple equations
6. Expressing 'stories' as mathematical sentences
7. Solving selection of algebraic problems

Materials you will need for this activity

- Practice Sheet A4
- Solution Sheet A4

What do you need to know before you start?

Maths

An equation is a mathematical sentence with numbers, letters and an equals sign (=). An equation is like a balance scale. Everything must be equal on both sides.

Activity A4: Elvis Presley's number 1 hits

Getting Started

To build – or construct - an algebraic equation for a real life situation, **allow a variable to stand for the unknown value** and **construct the equation** around this.

Then solve the equation. You do this by using algebraic procedures to **isolate the variable on one side** of the equals sign.

Worked Example: Building and solving simple equations

If you add 13 to the amount of Number 1 hits Elvis achieved in the US, the result is 41. How many Number 1 hits did he have in the US?

Solution

Step 1: Let a variable, for example, *x,* stand for the amount of Number 1 hits Elvis had.

Step 2: Build the equation

Remember: When 13 is **added** to the amount of Number 1 hits the result is 41.

Therefore $x + 13 = 41$

Step 3: Solve the equation

$x + 13 – 13 = 41 – 13$

$x = 18$

Therefore Elvis had 18 Number 1 Hits in the US.

Activity A4: Elvis Presley's number 1 hits

Task 1

If you add 26 to the amount of Number 1 hits Elvis achieved in the UK, the result is 47.

How many Number 1 hits did he have in the UK?

Activity A4: Elvis Presley's number 1 hits

Task 2

If you subtract 22 from the amount of Number 1 hits Elvis achieved worldwide, the result is 90.

How many Number 1 hits did he have worldwide?

Activity A4: Elvis Presley's number 1 hits

Practise your skills

- Use Practice Sheet A4.

- U2 are one of the most successful international rock bands of all time. They have sold over 150 million records and have been nominated for 34 Grammy Awards. These are awards presented annually by the National Academy of Recording Arts and Sciences of the United States, for outstanding achievements in the music industry.

(Google Images)

When 17 is added to the amount of Grammy Awards U2have won, the result is 39.

Construct an algebraic equation to represent this information.
Solve this equation and find out how many Grammy Awards U2 have won.

Activity A5: How wide is that bed?

Activity How wide is that bed? A5

(Google images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.3, 2.4** and **2.5.**

Introduction

Bed size refers to the dimensions of a mattress and the names by which standard bed sizes are called. The three main types of bed size in Ireland are single, double and king size.

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life.
2. Demonstrate an understanding of the language and concepts of algebra.
3. Solve a selection of algebraic problems to include simple equations.
4. Write algebraic expressions for real-life examples.
5. Solve a selection of algebraic problems based on real – life situations.

Activity A5: How wide is that bed?

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Understanding the concepts of algebra
4. Building simple equations
5. Solving simple equations
6. Expressing 'stories' as mathematical sentences
7. Solving a selection of algebraic problems

Materials you will need for this activity

- Practice Sheet A5
- Solution Sheet A5

What do you need to know before you start?

Maths

The **perimeter** is the total distance or the length around the outside of a shape. The perimeter can be calculated by the formula: Perimeter = 2(width) + 2(length)

Getting Started

In order to construct an algebraic equation for a real life situation, allow a variable to stand for the unknown value and construct the equation around this. Once constructed, solve the equation using algebraic procedures to isolate the variable on one side of the equals sign.

Activity A5: How wide is that bed?

Worked Example Building and Solving Simple Equations

The length of a king sized bed is approximately 50 cm more than its width. The perimeter of the bed is 700 cm. Find the width of the bed.

Solution

Remember: Perimeter = 2(width) + 2(length)

Step 1: Let width = x

Let length = x + 50

Step 2: Form the equation (Represent perimeter in terms of x)

Perimeter = 2(width) + 2(length)

= 2(x) + 2(x + 50)

= 2x + 2x + 100

Perimeter = 4x + 100

Step 3: Fill in remaining information and solve (Perimeter = 700)

4x + 100 = 700

4x + 100 – 100 = 700 - 100

4x = 600

x = 150

A king sized bed is 150 cm wide.

Activity A5: How wide is that bed?

Task 1

The length of a single bed is approximately 100 cm more than its width. The perimeter of the bed is 560 cm. Find the width of the bed.

Activity A5: How wide is that bed?

Task 2

The length of a double bed is approximately 55 cm more than its width. The perimeter of the bed is 650 cm. Find the width of the bed.

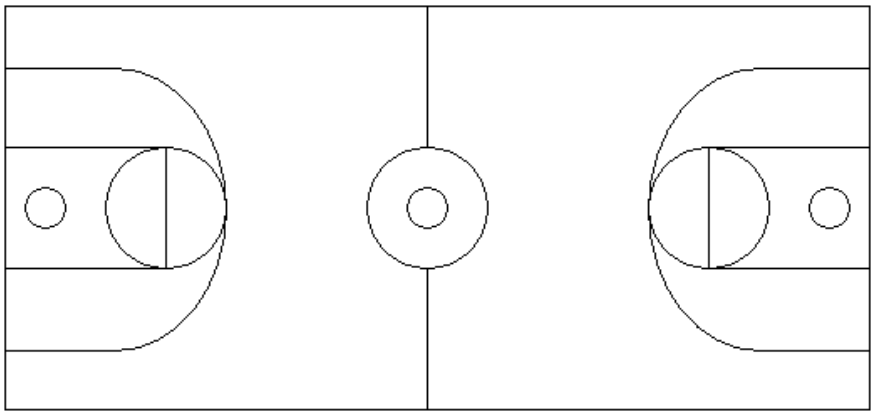
Activity A5: How wide is that bed?

Practise your skills

- Use Practice Sheet A5.

- Basketball is a team sport with two teams of five players each. The game can be played indoors or outdoors on a court which has a hoop at either end. Each team tries to score points by throwing a ball through the top of a hoop while following a set of rules.

  The length of a basketball court is 13 meters more than its width. The perimeter of a basketballcourt is 86 meters.



(Google Images)

Construct an algebraic equation to represent this information.

Solve this equation.

How wide is a basketball court?

Activity A6: How old is that singer?

Activity # How old is that singer? **A6**

(Google images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.3, 2.4** and **2.5.**

Introduction

This activity will progress in difficulty from the previous four activities in building and solving equations and will be aimed at calculating the age of famous singers.

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life
2. Demonstrate an understanding of the language and concepts of algebra
3. Solve a selection of algebraic problems to include simple equations
4. Write algebraic expressions for real-life examples
5. Solve a selection of algebraic problems based on real – life situations.

Activity A6: How old is that singer?

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Understanding concepts of algebra
4. Building simple equations
5. Solving simple equations
6. Expressing 'stories' as mathematical sentences
7. Solving selection of algebraic problems

Materials you will need for this activity

- Practice Sheet A6
- Solution Sheet A6

What do you need to know before you start?

Maths

An equation is a mathematical sentence with numbers, letters and an equals sign (=). An equation is like a balance scale. Everything must be equal on both sides.

Getting Started

In order to construct an algebraic equation for a real life situation, allow a variable to stand for the unknown value and construct the equation around this. Once constructed, solve the equation using algebraic procedures to isolate the variable on one side of the equals sign.

Activity A6: How old is that singer?

Worked Example: Building and solving simple equations

Justin Bieber is a Canadian pop/ R & B singer and songwriter.

When you take 5 from three times Justin's age, the result is the same as when you add 12 to two times his age.

How old is Justin?

Solution

Allow Justin's age to be represented by the variable x.

Take 5 from three times Justin's age:

$3x - 5$

Add 12 to two times his age:

$2x + 12$

Build the equation:

$3x - 5 = 2x + 12$

Bring x to one side and all the numbers to the other.

$3x - 2x - 5 + 5 = 2x - 2x + 12 + 5$

$3x - 2x = 12 + 5$

$x = 17$

Justin Bieber is 17 years old.

Justin was born on 1st March 1994. (This problem was written in 2011).

Activity A6: How old is that singer?

Task 1

Madonna is an American singer and songwriter.

When 12 is taken from four times Madonna's age, the result is the same as when 94 is added to two times her age.

How old is Madonna?

Activity A6: How old is that singer?

Task 2

Bruce Springsteen is an American singer and songwriter.

When 6 is added to two times Bruce's age, the result is the same as when 56 is subtracted from three times his age.

How old is Bruce?

Task 3

Damien Rice is an Irish singer and songwriter from Co. Kildare.

When 76 is added to four times Damien's age, the result is the same as 6 times his age.

How old is Damien?

Practise your skills

- Use Practice Sheet A6.

Activity A7: How many text messages can I send?

Activity # How many text messages can I send? **A7**

(Google Images)

This activity links to **award learning outcomes** **2.1, 2.2, 2.3** and **2.5.**

Introduction

Meteor, Vodafone and 02 are three of the main mobile communication networks in Ireland. Each network currently has a new value plan. The plans allow their customers to make unlimited calls and send a limited number text messages for a fixed price per month. We can use **inequalities** to calculate how many free text messages customers can send using each network.

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life.
2. Demonstrate an understanding of the language and concepts of algebra.
3. Solve a selection of algebraic problems to include simple inequalities of one variable.
4. Solve a selection of algebraic problems based on real – life situations.

Activity A7: How many text messages can I send?

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Using the language of algebra
4. Understanding common terms used in algebra such as inequality
5. Understanding the concepts of algebra
6. Tracing an equation back to a real life example
7. Developing a glossary of algebraic terms
8. Discovering what inequalities are
9. Solving inequalities of one variable
10. Solving a selection of algebraic problems

Materials you will need for this activity

- Practice Sheet A7
- Solution Sheet A7

What do you need to know before you start?

Maths

In A2 we learned that in an equation everything must be equal on both sides. However **in an inequality, one side is not equal to the other side**. Therefore in an inequality we get **a set of solutions** as opposed to just one solution.

This is how we write an equation: $x + 3 = 6$ (Equation)

This is how we write an inequality: $\mathbf{x + 3 \geq 6}$ (Inequality)

Activity A7: How many text messages can I send?

These are the **four different inequality signs**:

- x **>** 2 means ‘x is greater than 2’
- x **<** 2 means ‘x is less than 2’
- x **≥** 2 means ‘x is greater than or equal to 2’
- x **≤** 2 means ‘x is less than or equal to 2’

Getting Started

Words you will need

- An **inequality** is a term or group of terms >, <, ≥, ≤ to some value.

In order to solve a **linear inequality** we use similar methods to solving equations, except that there are extra rules when using multiplication and division.

You may multiply or divide both sides by a positive number. However, **when you multiply or divide both sides by a negative number,** you must **turn the inequality sign around.**

Activity A7: How many text messages can I send?

Worked Example: Building and solving simple equations

John signs up to Meteor's new value plan. For €40 a month, it includes a standard charge of €30 for all calls. The remaining €10 allows John to send a limited number of text messages which are charged at €0.10 each. If he exceeds this €10 worth of text messages, he will be charged for each extra message.

If we allow 'x' to stand for the amount of text messages John sends, we can represent this information mathematically as:

$$0.10x + 30 \quad 40$$

a) If John exceeds the €10 worth of text messages, what inequality sign should go in the box?

$$0.10x + 30 \quad 40$$

b) If John does not exceed the €10 worth of text messages, what inequality sign should go in the box?

$$0.10x + 30 \quad 40$$

Solve this inequality and find how many text messages John can send per month without being charged extra.

Activity A7: How many text messages can I send?

Solution

a) If John exceeds the €10 worth of text messages:
$0.10x + 30 > 40$

b) If John does **not** exceed the €10 worth of text messages;
$0.10x + 30 \leq 40$

In order to solve this inequality we need to isolate the variable x so that it is on the left hand side of the equation by itself.

$0.10x + 30 - 30 \leq 40 - 30$
$0.10x \leq 10$

The opposite of multiplying by 0.10 is dividing by 0.10.

If we divide 0.10 into both sides, we will remove the + 0.10 on the left.

$x = 100$

Therefore John can send 100 text messages per month without being charged extra.

Activity A7: How many text messages can I send?

Task 1

Aoife has signed up to Vodafone's new value plan.

For €45 a month, it includes a standard charge of €30 for all calls. The remaining €15 allows Aoife to send a limited number of text messages.

Text messages are charged at €0.12 each. If Aoife exceed this €15 worth of text messages, she will be charged accordingly.

Aoife does not wish to spend any more than €45 per month on her mobile phone bill. How many text messages can she send per month without being charged extra?

If we allow 'x' to stand for the amount of text messages Aoife sends, we can represent this information mathematically through the inequality:

$$0.12x + 30 \leq 45$$

Aoife does not wish to spend any more than €45 per month on her mobile phone bill.

How many text messages can Aoife send per month without being charged extra?

Activity A7: How many text messages can I send?

Task 2

Fiona has signed up to O2's new value plan. For €50 a month, it includes a standard charge of €32 for all calls. The remaining €18 allows Fiona to send a limited number of text messages.

Text messages are charged at €0.09 each. If Fiona exceeds this €18 worth of text messages, she will be charged accordingly.

Fiona does not wish to spend any more than €50 per month on her mobile phone bill. How many text messages can she send per month without being charged extra?

If we allow 'x' to stand for the amount of text messages Fiona sends, we can represent this information mathematically through the inequality;

$0.09x + 32 \leq 50$

How many text messages can Fiona send per month without being charged extra?

If Fiona exceeds this €18 worth of text messages what inequality sign should go in the box?

$0.09x + 32 \quad 50$ ☐

Practise your skills

- Use Practice Sheet A7.

Activity A8: How much is a ticket?

Activity How much is a ticket? A8

(Google Images)

This activity links to **award learning outcomes** 2.1, 2.2, 2.3, 2.4 and 2.5

Introduction

Different prices are often charged for different tickets at some events. We can use **simultaneous equations** to calculate the price of tickets if we know how many different type tickets are sold and the takings for each.

What will you learn?

Learning Outcomes

You will be able to:

1. Explain basic algebra and its application to everyday life
2. Demonstrate an understanding of the language and concepts of algebra
3. Solve a selection of algebraic problems to include simultaneous equations
4. Write algebraic expressions for real life examples
5. Solve a selection of algebraic problems based on real – life situations.

Activity A8: How much is a ticket?

Key Learning Points

1. Examining examples of real – life situations in which algebra is used
2. Recognising the benefits of understanding algebra to everyday life
3. Using the language of algebra
4. Understanding common terms used in algebra such as simultaneous equations
5. Understanding the concepts of algebra
6. Developing a glossary of algebraic terms
7. Discovering what simultaneous equations are
8. Solving simultaneous equations
9. Expressing 'stories' as mathematical sentences
10. Solving selection of algebraic problems

Materials you will need for this activity

- Practice Sheet A8
- Solution Sheet A8

What do you need to know before you start?

How much is a ticket?

Stadiums such as Croke Park and the Aviva charge different prices for standing and seating tickets. Cinemas also charge different prices for student and adult tickets.

Activity A8: How much is a ticket?

Getting Started

Words you will need

- **Simultaneous** means at the same time

- **Simultaneous equations** are **2 equations** with **at least two unknowns**, that is x and y.

In order to solve simultaneous equations they must be simultaneously satisfied by particular values of x and y.

See the worked example on the next page.

Activity A8: How much is a ticket?

Worked Example Solving simultaneous equations

The Football Association of Ireland (FAI)I is trying to decide how much to charge for seated and standing tickets at the Aviva Stadium for an upcoming friendly game. If 25 standing tickets and 55 seated tickets are sold, the takings will amount to €675. However if 50 standing tickets and 30 seated tickets are sold, the takings will amount to €550.

If we **let x stand for the cost of a standing ticket and y stand for the cost of seated ticket,** we could **write two simultaneous equations** as:

25x + 55y = 675
50x + 30y = 550

How much does a standing ticket (x) and a seated ticket (y) cost?

Solution

Step 1: Label the equations A and B

25x + 55y = 675 [A]
50x + 30y = 550 [B]

Step 2: Get the same coefficients for either x **or** y

If we multiply equation [A] by 2 then we will have the same x coefficients

50x + 110y = 1350 [A]
50x + 30y = 550 [B]

Activity A8: How much is a ticket?

Step 3: Make sure the chosen coefficients have opposite signs (that is, + and -).

If we multiply equation [B] by -1 then we will have opposite signs

50x + 110y = 1350 [A]

-50x - 30y = - 550 [B]

Step 4: Add the two equations together

50x + 110y = 1350 [A]

-50x - 30y = - 550 [B]

80y = 800

Step 5: Solve for y

80y = 800

Divide both sides by 80

y = 10

Step 6: Replace y in either equation to solve for x

50x + 30y = 550

50x + 30(10) = 550

50x + 300 = 550

If we subtract 300 from both sides, we will remove the + 300 on the left.

50x + 300 – 300 = 550 – 300

50x = 250

Divide both sides by 50

x = 5

Therefore:

- the cost of a seated ticket (y) = €10
- the cost of a standing ticket(x) = €5

Activity A8: How much is a ticket?

Task 1

The All Ireland club football and hurling finals take place at Croke Park on St. Patrick's Day every year. 2 standing tickets and 20 seated tickets cost €320. However, 3 standing tickets and 19 seated tickets cost €315.

If we **let x stand for the cost of a standing ticket and y stand for the cost of a seated ticket**, we could write **two simultaneous equations** as

$2x + 20y = 320$
$3x + 19y = 315$

How much does a standing ticket (x) and a seated ticket (y) cost?

Activity A8: How much is a ticket?

Task 2

The film, Hangover II, was released in 2011. 500 people, some with 'student' tickets and some with 'adult' tickets, saw the movie on the first night. The student ticket was €7 and the adult ticket was €9. Total takings for the film that night amounted to €4,200.

If we let x stand for the number of students and y stand for the number of adults, we could write two simultaneous equations as;

$x + y = 500$

$7x + 9y = 4,200$

How many students (x) and how many adults (y) watched the film?

Activity A8: How much is a ticket?

Practise your skills

- Use Practice Sheet A8 to apply what you have learned.

- The new Apple iPod Nano 8,000MB (that is, 8GB) can hold up to, 2000 songs and 8 hours of videos.
  If I have 900 songs and 4 hours of videos, the used space on my iPod Nano will amount to 3,800 MB. However, if I have 1,150 songs and 2 hours of videos, the used space will amount to 2,600MB.

  If we let x stand for the MB size of a song and y stand for the MB size of a video, we could write two simultaneous equations as

  $$900x + 4y = 3{,}800$$
  $$1{,}150x + 2y = 2{,}600$$

  How many MB in a song (x) and how many MB in a video (y)?

(Google Images)

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National Development Plan
Transforming Ireland

FÁS
Foras Áiseanna Saothair
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Ireland's EU Structural Funds
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