Western Cape Government
Education

DIRECTORATE: GET

MATHEMATICS
GRADE 9

DATE: ....

LESSON 1: DAY 1 AND 2

TOPIC: LINEAR EQUATIONS

CONCEPTS & SKILLS TO BE ACHIEVED:
By the end of the lesson learners should know and be able to:
- solve equations by inspection
- solve equations by using additive and multiplicative inverses
- solve equations with brackets.

If you add a number and then subtract the same number, you are back where you started. This is why addition and subtraction are called inverse operations.
If you multiply by a number and then divide by the same number, you are back where you started. This is why multiplication and division are called inverse operations

RESOURCES:	DBE Workbook 1, Sasol-Inzalo book ,Textbooks
ONLINE RESOURCES	https://www.youtube.com/watch?v=DopnmxeMt-s https://www.youtube.com/watch?v=R3o5bixyKLE https://www.youtube.com/watch?v=-hwVNMKvx_g

LESSON DEVELOPMENT
INTRODUCTION:

NOTE TO LEARNER:

An algebraic **expression** is a mathematical phrase that contains numbers and/or variables. Though it cannot be solved because it does not contain an equals sign (=), it **can** be simplified.

Example
Algebraic expression:
$3x + 1 + x - 5$

SIMPLIFIED

$4x - 4$

An **equation** is made up of two **expressions** connected by an equal sign.

$$2x + 1 + x - 5 = -7 + 15$$

$$3x - 4 = 8$$

When we solve equations, numbers do not "jump" from one side of the equation to the other side but you add the additive inverses.

$$3x - 4 + 4 = 8 + 4$$
$$3x = 12$$

$$\frac{3x}{3} = \frac{12}{3}$$

You can solve algebraic equations.

SOLUTION

$$x = 4$$

The following steps provide a good method to use when solving linear equations:

Step1: **Simplify** each side of the equation by adding like terms.

Step 2: Use addition or subtraction to **isolate the variable** term on one side of the equation.

Step 3:
Use **multiplication** or **division** to **solve** for the variable.

NOTE:

To make an equation you can do the same operation on both sides.		To solve an equation you can do the inverse operation on both sides.
	$x = 4$	
Multiply with 8	$8x = 32$	Divide by 8
add 3	$8x + 3 = 35$	subtract 3
subtract $5x$	$3x + 3 = 35 - 5x$	add $5x$

LESSON PREPARATION AND DEVELOPMENT

EXAMPLES: Solve for x:

1.

$$\begin{aligned} x - 5 &= 11 \\ x - 5 + \mathbf{5} &= 11 + \mathbf{5} \\ x &= 16 \end{aligned}$$

Note that this example can be solve by **inspection.** When you are solving equations by inspection, you look for the value of the variable that will make the equation true. You can solve these equations without having to write them down.

Use multiplication or **division** to solve for the variable.

2.

$$\begin{aligned} 2x - 5 &= 11 \\ 2x - 5 + \mathbf{5} &= 11 + \mathbf{5} \\ 2x &= 16 \\ \frac{2x}{\mathbf{2}} &= \frac{16}{\mathbf{2}} \\ x &= 8 \end{aligned}$$

Use **addition** or subtraction to isolate the variable term on one side of the equation.

3.

$$\begin{aligned} \frac{x}{4} + 3 &= 9 \\ \frac{x}{4} + 3 - \mathbf{3} &= 9 - \mathbf{3} \\ \frac{x}{4} &= 6 \\ \frac{x}{4} \times \mathbf{4} &= 6 \times \mathbf{4} \\ x &= 24 \end{aligned}$$

Use addition or **subtraction** to isolate the variable term on one side of the equation.

Use **multiplication** or division to solve for the variable.

4.

$$\begin{aligned} 5x - 2 &= 3x + 4 \\ 5x - 2 + \mathbf{2} &= 3x + 4 + \mathbf{2} \\ 5x &= 3x + 6 \\ 5x - \mathbf{3x} &= 3x - \mathbf{3x} + 6 \\ 2x &= +6 \\ \frac{2x}{\mathbf{2}} &= \frac{6}{\mathbf{2}} \\ x &= 3 \end{aligned}$$

We want all the terms with the $variable\ (x)$ on the left. Use addition or **subtraction** to isolate the variable term on one side of the equation.

5.

$$\begin{aligned} -x - 7 - 3x + 8 &= 2x - 5 - 3x \\ -4x + 1 &= -1x - 5 \\ -4x + \mathbf{1x} + 1 &= -1x + \mathbf{1x} - 5 \\ -3x + 1 &= -5 \\ -3x + 1 - \mathbf{1} &= -5 - \mathbf{1} \\ -3x &= -6 \\ \frac{-3x}{\mathbf{-3}} &= \frac{-6}{\mathbf{-3}} \\ x &= 2 \end{aligned}$$

Once the value of unknown has been found, you can always check your answer by substituting the value into the original equation.

- Step1: **Simplify each side** of the equation by adding like terms.
- Step 2: Use **addition or subtraction** to isolate the variable term on one side of the equation.
- Step 3:
  Use **multiplication** or **division** to solve for the variable.

LESSON PREPARATION AND DEVELOPMENT

Note to learner:
In order to solve an **equation** with **brackets** you should usually first multiply the number outside of the **brackets** by each term inside, and then solve as you would solve a linear **equation**.

- Remember the exponential law: $a^m \times a^n = a^{m+n}$
- How to simplify an expression with brackets: $-3x^2(x+2) \quad -(x^2-5)$

Remember the invisible 1

Simplify

$$= -3x^3 - 6x^2 \quad - x^2 + 5$$
$$= -3x^3 - 7x^2 + 5$$

Example

$$-3-(x+1) = 2(x+5)$$
$$-3-x-1 = 2x+10$$
$$-x-4 = 2x+10$$
$$-x-2x = 10+4$$
$$-3x = 14$$
$$x = -\frac{14}{3}$$

Remember BODMAS
First multiply then add/subtract.

- Remove the brackets by multiplying the number outside the brackets with each term inside.
- Then solve as you would solve a linear **equation**.

CLASSWORK AND HOMEWORK

Activity 1

Work through the exercise.
Only consult the answers at the end of the lessons, once you have completed the exercise:

Solve for the unknown ($x; y, k, p\ etc.$):

1. $x + 3 = 11$

2. $-3x + 8 = 2$

3. $\frac{x}{3} + 1 = 9$

4. $-3x - 5 = 2x + 10$

5. $3x + 5x - 5 = 7 - 3 - x$

6. $5(x - 2) = 3x + 4$

7. $6x + 6 = 3(2 + x)$

8. $2(p + 2) = -18$

9. $4 + 2(x - 1) = 5(x + 1)$

10. $3(k - 4) - 4 = 11$

11. $\frac{1}{4}(4 + 8y) = 3 + y$

12. $\frac{1}{2}(6x + 4) - \frac{1}{3}(12x - 9) = 0$

13. $3(2p - 5) - \frac{1}{2}(p - 8) = 6p$

LESSON 2: DAY 3 AND 4

TOPIC: LINEAR EQUATIONS WITH FRACTIONS

CONCEPTS & SKILLS TO BE ACHIEVED:
By the end of the lesson learners should know and be able to:

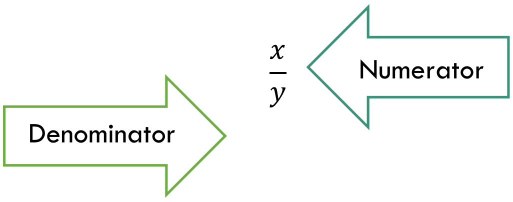
- solve equations with fractions

RESOURCES:	DBE Workbook 1, Sasol-Inzalo book 1,Textbooks
ONLINE RESOURCES	https://www.youtube.com/watch?v=N-Y0Kvcnw8g https://www.youtube.com/watch?v=HJ96MpWvxBU https://www.youtube.com/watch?v=F-aqjOfs_Cw

INTRODUCTION

Terminology for fractions

- The **numerator** is the top part of a fraction, and the **denominator** is the bottom part of a fraction.
- The **numerator** represents how many parts of that whole are being considered, while the **denominator** represents the total number of parts created from the whole.



- The least common multiple of the denominator**(LCD):**

Examples:

1.	$\frac{1}{2}\ ;\ \frac{1}{3}\ ;\ \frac{1}{4} \rightarrow LCD = 12$	2.	$x+\frac{3}{5}=\frac{2}{10} \rightarrow LCD = 10$	3.	$\frac{x+3}{6}-\frac{1}{3}=\frac{2}{5} \rightarrow LCD = 30$

LESSON PREPARATION AND DEVELOPMENT

Solving equations with fractions:

- To solve an equation with fractions, we transform it into an equation without fractions, which we know how to solve.

Examples:

Solve for x:

1.	$\frac{x}{2}-\frac{5}{6}=\frac{x}{12}$ $\frac{x}{2}-\frac{5}{6}=\frac{x}{12}$ $\times\frac{6}{6}$ $\times\frac{2}{2}$ $\times\frac{1}{1}$ $\frac{\mathbf{6}x}{12}-\frac{10}{12}=\frac{x}{12}$ $6x-10=x$ $5x=10$ $x=2$	Clear of fractions as follows: In this equation, the terms have now all been divided by 12. As with all equations, using inverse operations, or doing the opposite, keeps the equation balanced. Therefore, we will multiply each term with 12. Step 1: Choose a **LCD** In this case it is 12. Step 2: **Multiply both sides** of the equation -- every term -- by the LCM of denominators. (in this case × 12) We will then have an equation without fractions. Step 3: **Solve** linear equation as always.
1.	$\frac{x}{3}+\frac{x-2}{5}=6$ $\frac{x}{3}+\frac{(x-2)}{5}=\frac{6}{1}$ $\times\frac{5}{5}$ $\times\frac{3}{3}$ $\times\frac{15}{15}$ $\frac{\mathbf{5}x}{15}+\frac{\mathbf{3}(x-2)}{15}=\frac{15\times 6}{15}$ $5x+3(x-2)=90$ $5x+3x-6=90$ $8x=96$ $x=\frac{96}{8}=12$	Clear of fractions as follows: Remember: • $6=\frac{6}{1}$ • if the numerator has more than one term put it in **brackets** Step 1: Choose a LCD In this case it is 15. Step 2: Multiply both sides of the equation -- every term -- by the LCM of denominators. (in this case × 15) We will then have an equation without fractions. Step 3: Solve linear equation as always.

CLASSWORK AND HOMEWORK

Activity 2

Work through the exercise.
Only consult the answers at the end of the lessons, once you have completed the exercise:
Solve for x:

1. $\frac{x}{2}=\frac{2x}{5}+1$
2. $\frac{2x}{3}=\frac{x}{6}-9$
3. $\frac{x-1}{4}=\frac{x}{7}$
4. $\frac{x-2}{5}=\frac{x}{2}-\frac{x}{3}$
5. $\frac{x-1}{3}-\frac{2x+1}{2}=x-2$
6. $\frac{x+3}{4}-\frac{x+2}{8}=\frac{x}{2}-1$

LESSON 3: DAY 5 AND 6

TOPIC: QUADRATIC EQUATIONS

CONCEPTS & SKILLS TO BE ACHIEVED: **By the end of the lesson learners should know and be able to:** ○ solve quadratic equations.	
RESOURCES:	DBE Workbook 1, Sasol-Inzalo book 1,Textbooks
ONLINE RESOURCES	https://www.youtube.com/watch?v=zfrO_mvXBhc https://www.youtube.com/watch?v=g6RnAY_VkMs

INTRODUCTION

Definition of **Quadratic Equation**: An equation where the highest exponent of the variable (usually x) is a square.

The name Quadratic comes from "quad" meaning square, because the variable gets squared (like x^2).It is also called an "Equation of Degree 2" (because "2" is the highest exponent at the x)

The power of 2 is what makes it quadratic.

- **Standard form** of a quadratic equation: $\boldsymbol{ax^2 + bx + c = 0}$
  $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$ are known values ($a \neq 0$) and x is the variable.

Examples of quadratic equations:

1.	$x^2 - x - 6 = 0$	$a = 1\,; b = -1$ and $c = -6$
2.	$-12x + 2x^2 + 18 = 0$ $2x^2 - 12x + 18 = 0$	Must be rearranged first! (Always write in descending order). $a = 2\,; b = -12$ and $c = 18$
3.	$4x^2 - x = 0$	$a = 4; b = -1$ and $c = 0$
4.	$x^2 - 16 = 0$	$a = 1; b = 0$ and $c = -16$
5.	$2x + 5 = 0$	This is NOT a quadratic equation. There is no x^2.

Factorizing a quadratic equation:

1.	$x^2 - x - 6$	$(x-3)(x+2) = 0$	The **product** of the two factors must be equal to the $c -$value: $-3 \times 2 = -6$ The **sum** of the two values must be equal to the $b -$value. $-3 + 2 = -1$
2.	$-12x + 2x^2 + 18$	$2x^2 - 12x + 18$ $2(x^2 - 6x + 9)$ $2(x-3)(x-3)$	Always look for a common factor first! The **product** of the two factors must be equal to the $c -$value: $-3 \times -3 = +9$ The **sum** of the two values must be equal to the $b -$value. $-3 - 3 = -6$
3.	$4x^2 - x$	$x(4x - 1)$	Always look for a common factor first!
4.	$x^2 - 16$	$(x-4)(x+4)$	The difference between two squares.

LESSON PRESENTATION AND DEVELOPMENT

If $a \times b = \mathbf{0}$ **then** $\boldsymbol{a} = \mathbf{0}$ or $\boldsymbol{b} = \mathbf{0}$

For example:

(1) If $5 \times \boldsymbol{k} = 0$ → then $k = 0$
(2) If $\boldsymbol{p} \times -3 = 0$ → then $p = 0$
(3) If $(\boldsymbol{x} + \mathbf{1}) \times 7 = 0$ → then $x + 1 = 0 \therefore x = -1$

(4) If $(x + 1)(x - 3) = 0$
Then $(x + 1) = 0 \quad or \quad (x - 3) = 0$
$\therefore x = -1 \qquad or \qquad x = 3$

SOLVING QUADRATIC EQUATION

Examples:

1.	$x^2 - x - 6 = 0$ $(x - 3)(x + 2) = 0$ $x - 3 = 0 \ or \ x + 2 = 0$ $x = 3 \qquad x = -2$	• Step 1: Write the equation in **standard form** (Put all terms on one side of the equal sign, leaving zero on the other side.) • Step 2: **Factorise** the equation. • Step 3: Set each factor **equal to zero**. • Step 4: **Solve** each of these equations. Check your answer by inserting your answer in the original equation.
2.	$-12x + 2x^2 = -18$ $2x^2 - 12x + 18 = 0$ $2(x^2 - 6x + 9) = 0$ $2(x - 3)(x - 3) = 0$ $x - 3 = 0 \quad or \ x - 3 = 0$ $x = 3 \quad or \quad x = 3$	• Step 1: Standard form. • Step 2: Factorise the equation. Always look for a common factor first! • Step 3: Set each factor equal to zero. • Step 4: Solve each of these equations.
3.	$4x^2 - x = 0$ $x(4x - 1) = 0$ $x = 0 \ \ or \ \ 4x - 1 = 0$ $4x = 1$ $x = \frac{1}{4}$	• Step 1: Standard form (given). • Step 2: Factorise the equation. • Step 3: Set each factor equal to zero. • Step 4: Solve each of these equations.
4.	$x^2 - 16$ $(x - 4)(x + 4) = 0$ $x - 4 = 0 \quad or \quad x + 4 = 0$ $x = 4 \ \ or \ \ x = -4$	The difference between two squares.

CLASSWORK AND HOMEWORK

Activity 3

Work through the exercise.
Only consult the answers at the end of the lessons, once you have completed the exercise:

Solve for the unknown:

1. $(x+1)(x-3)=0$
2. $x^2-3x-4\ =\ 0$
3. $-5x+4+x^2=0$
4. $x^2-2x=8$
5. $2x^2-24=8x$
6. $3p^2\ =12$
7. $6x-x^2=0$
8. $(w+4)^2\ =\ 49$
9. $48-3m^2\ =0$
10. $-x^2+8x\ =\ +12$
11. $x(x-7)=-12$
12. $(x-8)(x+1)\ =\ -18$

LESSON 4: DAY 7 AND 8

TOPIC: EXPONENTIAL EQUATIONS

CONCEPTS & SKILLS TO BE ACHIEVED:
By the end of the lesson learners should know and be able to:

- solve equations by using laws of exponents.

RESOURCES:	DBE Workbook 1, Sasol-Inzalo book ,Textbooks
ONLINE RESOURCES	https://www.youtube.com/watch?v=DdfJj0pWG9g https://www.youtube.com/watch?v=racvKZ95IJs

INTRODUCTION

Laws of exponents

- The following laws of exponents should be known and used in solving equations involving exponents. In the table below, m and n are integers and a and b are not equal to **0**:

$a^m \times a^n = a^{m+n}$	$a^m \div a^n = a^{m-n}$
Examples	
a) $2^3 \times 2^4 = 2^{3+4} = 2^7 = 128$	$3^5 \div 3^2 = 3^{5-2} = 3^3 = 27$
b) $x^3 \times x^4 = 3^{3+4} = x^7$	$x^5 \div x^3 = x^{5-3} = x^2$
$(a^m)^n = a^{m \times n}$	$(a \times b)^n = a^n \times b^n$
Examples	
c) $(2^3)^2 = 2^6 = 64$	$(3x^2)^3 = 3^3x^6 = 27x^6$
$a^0 = 1$	$a^{-m} = \frac{1}{a^m}$
Examples	
d) $(37)^0 = 1$	$5^{-3} = \frac{1}{5^3} = \frac{1}{125}$
e) $(4x^2)^0 = 1$	$7^3 \div 7^5 = 7^{-2} = \frac{1}{7^2} = \frac{1}{49}$

LESSON PRESENTATION AND DEVELOPMENT

To solve exponential equations, you need to have equations with comparable exponential expressions on either side of the "equals" sign, so you can compare the powers and solve. In other words, you must have "(some base) to (some power) equals (the same base) to (some other power)", where you set the two powers equal to each other, and solve the resulting equation.

For example: $2^x = 2^5$

$\therefore x = 5$

Since the bases ("2" in each case) are the same, then the only way the two expressions could be equal is for the powers also to be the same.

SOLVING EXPONENTIAL EQUATION

Examples:

1.	$5^{x-1} = 125$ $5^{x-1} = 5^3$ $x - 1 = 3$ $x - 1 + 1 = 3 + 1$ $x = 4$	• Step 1: write the constant in the **same base** as the term with exponent. • Step 2 **equate the exponents** and solve for x.
2.	$7^x = \frac{1}{49}$ $7^x = 49^{-1}$ $7^x = 7^{-2}$ $x = -2$	• Step 1: write the constant in the **same base** as the term with exponent. • Step 2 equate the exponents and solve for x.
3.	$\frac{1^x}{2} = \frac{1}{16}$ $a^{-m} = \frac{1}{a^m}$ $2^{-x} = 2^{-4}$ $-x = -4$ $x = 4$	• Step 1: write the constant in the **same base** as the term with exponent. • Step 2 equate the exponents and solve for x.
4.	$9^x + 1 = 28$ $9^x = 27$ Make sure that the terms with x are on their own on one side. $(3^2)^x = 3^3$ $3^{2x} = 3^3$ $2x = 3$ $x = \frac{3}{2}$	• Step 1: write the constant in the **same base** as the term with exponent. • Step 2: equate the exponents and solve for x.
5.	Make sure that the coefficient of the term with the exponent is one. $5.8^x = 5$ $8^x = 1$ $8^x = 8^0$ $a^0 = 1$ $x = 0$	• Step 1: write the constant in the **same base** as the term with exponent. • Step 2: equate the exponents and solve for x.

CLASSWORK AND HOMEWORK

Activity 4

Work through the exercise.
Only consult the answers at the end of the lessons, once you have completed the exercise:

Solve for x:

1. $2^{x+3} = 8$
2. $5^x = \frac{1}{25}$
3. $6^x = 36$
4. $9^{3x} = 27$
5. $4.7^x = 4$
6. $25^x = 125$
7. $4^{2x} = \frac{1}{32}$
8. $-5.6^x = -30$
9. $2^x - 2 = 62$
10. $2^{x+1} = 0{,}5$
11. $8.4^x = 1$
12. $2.3^{2x} + 1 = 163$
13. $10^x = 0{,}001$
14. $4^{-x} = \frac{1}{16}$
15. $3^{x^2-3x} = 81$
16. $2^x = -4$

LESSON 5: DAY 9 AND 10

TOPIC: SOLVING WORD PROBLEMS WITH EQUATIONS

CONCEPTS & SKILLS TO BE ACHIEVED: **By the end of the lesson learners should know and be able to:** ○ solve word problems by using equations.	
RESOURCES:	DBE Workbook 1, Sasol-Inzalo book 1, Textbooks
ONLINE RESOURCES	https://www.youtube.com/watch?v=csKApuPGCWU https://www.youtube.com/watch?v=pX2_JxVRzBM https://www.youtube.com/watch?v=NOaRimA4_Xc

INTRODUCTION

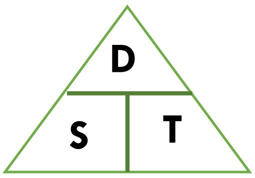
WORD PROBLEMS

Some word problems can be solved by inspection, for others we need to construct an equation to help us solve the problem. Here are some hints to help you solve word problems:

- Hint 1: Decide what value will be the unknown and call it x.
- Hint 2: Convert the language into mathematics symbols and operations.

Algebra as a language	
Examples	
*5 **more** than a number*	$x + 5$
*5 **less** than a number*	$x - 5$
*5 **times** than a number*	$5 \times x$
3 consecutive numbers.	$x\ ; x + 1\ ; x + 2$
3 consecutive even (or uneven) numbers.	$x\ ; x + 2\ ; x + 4$

- Hint 3: Know your formulas

Example of Formulas that you might need:	
Perimeter of a rectangle *Area of a rectangle*	$P = 2l + 2b$ $A = l \times b$
Perimeter of a triangle *Area of a triangle*	$P = S_1 + S_2 + S_3$ $A = \frac{1}{2} \times b \times h$
Speed (S), distance(D) and time(T) 	$S = \frac{D}{T}$ $T = \frac{D}{S}$ $D = S \times T$

LESSON PRESENTATION AND DEVELOPMENT

Examples

	Questions	Answers
	NUMBERS	
1.	5 times a number, less 3 is equal to 12. Determine the number.	Let the number be x. $5x - 3 = 12$ $5x = 12 + 3$ $5x = 15$ $x = 3$ The number is: 3
2	The sum of 3 consecutive numbers is equal to 18. Calculate the numbers.	Let the first number be x. ∴ 2nd number = $x + 1$ ∴ 3rd number = $x + 1 + 1 = x + 2$ $x + x + 1 + x + 2 = 18$ $3x + 3 = 18$ $3x = 15$ $x = 5$ The numbers are: 5; 6 and 7
3.	The sum of 3 consecutive even numbers is equal to 18. Calculate the numbers.	Let the first number be x. ∴ 2nd number = $x + 2$ ∴ 3rd number = $x + 2 + 2 = x + 4$ $x + x + 2 + x + 4 = 18$ $3x + 6 = 18$ $3x = 12$ $x = 4$ The numbers are: 4; 6 and 8
	AREA / PERIMETER	
4.	The length of a rectangle is 10cm longer than its breadth. The perimeter is 48cm. Determine the area of the rectangle	Let the breadth be x. ∴ length = $x + 10$ $2b + 2l = P$ $2x + 2(x + 10) = 48$ $2x + 2x + 20 = 48$ $4x + 20 = 48$ $4x = 28$ $x = 7$ $\therefore b = 7\ and\ l = 17$ The area = $l \times b = 7 \times 17 = 119cm^2$

<table>
<tr><td></td><td colspan="2">AGE</td></tr>
<tr><td>5.</td><td>The total age of 3 children in our family is 32 years. I am twice the age of my sister and my brother is 2 years older than me. How old am I? $(let\ the\ sister's\ age\ be = x)$</td><td>Let my sister's age be x.
∴ My age = $2x$
∴ My brother's age = $2x + 2$

$x + 2x + 2x + 2 = 32$
$5x + 2 = 32$
$5x = 30$
$x = 6$
My age is 2(6) = 12 years</td></tr>
<tr><td>6.</td><td>A Father is 20 years older than his son. In four years' time the father's age will be three times the age of his son. Let x be the age of the son now. Calculate the age of the father now.</td><td><table><tr><td></td><td>Son's age</td><td>Father's age</td></tr><tr><td>Now</td><td>x</td><td>$x + 20$</td></tr><tr><td>In four years</td><td>$x + 4$</td><td>$x + 20 + 4$
or
$3(x + 4)$</td></tr></table>
$x + 20 + 4 = 3(x + 4)$
$x + 24 = 3x + 12$
$-2x = -12$
$x = 6$
The father's age is 6+20 = 26 years</td></tr>
<tr><td></td><td colspan="2">SPEED DISTANCE AND TIME</td></tr>
<tr><td>7.</td><td>Thombi ran from his home to the sports club. The distance he travelled was 5 km. He ran for 20 minutes at a constant speed. Calculate Thombi's speed. (In km per hour.)</td><td>Let the speed be $x\ km/h$
Time $= 20\ minutes = \frac{20}{60} = \frac{1}{3}\ hours$
<i>(note that the units must correlate with that of the unit for speed therefore we must convert minutes to hours)</i>
Distance $= 5\ km$
$S = \frac{D}{T}$
$S = \frac{5}{\frac{1}{3}}$
$S = 15\ km/h$</td></tr>
<tr><td></td><td colspan="2">COST</td></tr>
<tr><td>8.</td><td>Monya buys 20 tickets for a concert. The total costs for the tickets was R2080.
The prices for the tickets was as follows:
Adult tickets: $= R120$ each
Children tickets: $= R80$ each

Let x be the number of adults who went to the concert.

7.1 Set up an equation to calculate x.
7.2 Calculate how many children were at the concert.</td><td>7.1 Let x be the number of adults
∴ number of children $= 20 - x$

Total cost for adult tickets $= 120 \times x$
Total cost for children tickets $= 80 \times (20 - x)$

$\therefore Total\ cost = 120x + 80(20 - x) = 2080$

7.2 $120x + 80(20 - x) = 2080$
$120x + 1600 - 80x = 2080$
$40x = 480$
$x = 12$

∴ there were 12 adults and 8 children.</td></tr>
</table>

CLASSWORK AND HOMEWORK

Activity 5

Work through the exercise.

Only consult the answers at the end of the lessons, once you have completed the exercise:

- Use an **equation** and **show all your work** to answer the following questions:

1. Carla is 10 years younger than Duze. Together they are 44 years old. Calculate Carla's age if Duze is x years old.

2 A mother is 3 times as old as her daughter. Six years ago, the mother's age was six times her daughter. How old are they now? (let the daughter's age be x)

3. A rectangle field has an area of 300 square meters and the length is 5 meters more than the breadth. What are the length of the field?

4. A rectangular garden in has a length of 100 meters and a width of 50 meters. A square swimming pool is to be constructed inside the garden. Find the length of one side of the swimming pool if the remaining area (not occupied by the pool) is equal to one half the area of the rectangular garden.

5. A car travels from A to B at a speed of 60 km/h. What is the distance that the car travelled if it took 2 hours to get from A to B?

6. Tom travels 60 km per hour going to a neighboring city and 50 km per hour coming back using the same road. He drove a total of 3 hours and 40 minutes away and back. What is the distance from Tom's house to the city he visited? (round your answer to the nearest km.) Let the distance that Tom travels to the city be equal to x.

7. Elsa has decided to treat her friends to coffee at the Corner Coffee House. Elsa paid R54,00 for four cups of cappuccino and three cups of filter coffee. If a cup of cappuccino costs R3,00 more than a cup of filter coffee, calculate how much a cup of each type of coffee costs?

CONSOLIDATION / CONCLUSION

It is important to remember:

Linear Equations:

Example $2(x+3)=x-5$

Step1: **Simplify** each side by multiplying the brackets of the equation and adding like terms.

Step 2: Use addition or subtraction to **isolate the variable** term on one side of the equation.

Step 3: Use **multiplication** or **division** to **solve** for the variable.

Linear Equations (with fractions):

Example $x+\frac{x+3}{4}=\frac{x}{8}$

Step 1: Choose a **LCD**.

Step 2: **Multiply both sides** of the equation -- every term -- by the LCM of denominators
We will then have an equation without fractions.

Step 3: **Solve** linear equation as always.

Quadratiac Equations:

Example $x^2-3x-4=0$

- Step 1: Write the equation in **standard form** (Put all terms on one side of the equal sign, leaving zero on the other side.)
- Step 2: **Factorise** the equation.
- Step 3: Set each factor **equal to zero**.
- Step 4: **Solve** each of these equations.

Exponential Equations:

Example $2^{x+3}=16$

Make sure that the terms with x are on their own on one side.

- Step 1: write the constant in the **same base** as the term with exponent.
- Step 2 **equate the exponents** and solve for x.

Word problems:

Hint 1: Decide what value will be the unknown and call it x.

Hint 2: Convert the language into mathematics symbols and operations.

Hint 3: Know your formulas.

Check your answer by inserting your answer in the original equation.

Memorandum – Classwork and homework

Activity 1

1.	$x + 3 = 11$ $x = 8$	2.	$-3x + 8 = 2$ $-3x = -6$ $x = 2$
3.	$\frac{x}{3} + 1 = 9$ $\frac{x}{3} = 8$ $x = 24$	4.	$-3x - 5 = 2x + 10$ $-5x = 15$ $x = -3$
5.	$3x + 5x - 5 = 7 - 3 - x$ $8x - 5 = 4 - x$ $9x = 9$ $x = 1$	6.	$5(x - 2) = 3x + 4$ $5x - 10 = 3x + 4$ $2x = 14$ $x = 7$
7.	$6x + 6 = 3(2 + x)$ $6x + 6 = 6 + x$ $5x = 0$ $x = 0$	8.	$2(p + 2) = -18$ $2p + 4 = -18$ $2p = -22$ $p = -11$
9.	$4 + 2(x - 1) = 5(x + 1)$ $4 + 2x - 2 = 5x + 5$ $-3x = 3$ $x = -1$	10.	$3(k - 4) - 4 = 11$ $3k - 12 - 4 = 11$ $3k = 27$ $k = 9$
11.	$\frac{1}{4}(4 + 8y) = 3 + y$ $1 + 2y = 3 + y$ $y = 2$	12.	$\frac{1}{2}(6x + 4) - \frac{1}{3}(12x - 9) = 0$ $3x + 2 - 4x + 3 = 0$ $-x = -5$ $x = 5$
13.	$3(2p - 5) - \frac{1}{2}(p - 8) = 6p$ $6p - 15 - \frac{p}{2} + 4 = 6p$ $-\frac{p}{2} = 11$ $p = -22$		

Activity 2

1.	$\frac{x}{2}=\frac{2x}{5}+1$ $\frac{5x}{10}=\frac{4x}{10}+\frac{10}{10}$ $5x=4x+10$ $x=10$	2.	$\frac{2x}{3}=\frac{x}{6}-9$ $\frac{4x}{6}=\frac{x}{6}-\frac{54}{6}$ $4x=x-54$ $3x=54$ $x=18$
3.	$\frac{x-1}{4}=\frac{x}{7}$ $\frac{7(x-1)}{28}=\frac{4x}{28}$ $7x-7=4x$ $3x=7$ $x=\frac{7}{3}$	4.	$\frac{x-2}{5}=\frac{x}{2}-\frac{x}{3}$ $\frac{6(x-2)}{30}=\frac{15x}{30}-\frac{10x}{30}$ $6x-12=15x-10x$ $6x-12=-5x$ $x=12$
5.	$\frac{x-1}{3}-\frac{2x+1}{2}=x-2$ $\frac{2(x-1)}{6}-\frac{3(2x+1)}{6}=\frac{6x}{6}-\frac{12}{6}$ $2x-2-6x-3=6x-12$ $-10x=-7$ $x=\frac{7}{10}$	6.	$\frac{x+3}{4}-\frac{x+2}{8}=\frac{x}{2}-1$ $\frac{2(x+3)}{8}-\frac{(x+2)}{8}=\frac{4x}{8}-\frac{8}{8}$ $2x+6-x-2=4x-8$ $-3x=-12$ $x=4$

Activity 3

1.	1.	$(x+1)(x-3)=0$ $x=-1\ ;x=3$	2.	$x^2-3x-4\ =\ 0$ $(x-4)(x+1)=0$ $x=4\ ;x=-1$	
3.	2.	$-5x+4+x^2=0$ $x^2-5x+4=0$ $(x-4)(x-1)=0$ $x=4\ \ ;\ \ x=1$	4.	$x^2-2x=8$ $x^2-2x-8=0$ $(x-4)(x+2)=0$ $x=4\ ;\ \ x=-2$	
5.	3.	$2x^2-24=8x$ $2x^2-8x-24=0$ $2(x^2-4x-12)=0$ $2(x-6)(x+2)=0$ $x=6\ ;\ \ x=-2$	6.	$3p^2=12$ $3p^2-12=0$ $3(p^2-4)=0$ $3(p+2)(p-2)=0$ $p=-2\ ;\ \ p=2$	
7.	5.	$6x-x^2=0$ $-x^2+6x=0$ $-x(x-6)=0$ $x=0\ ;\ \ x=6$	8.	$(w+4)^2\ =\ 49$ $w^2+8w+16=49$ $w^2+8w-33=0$ $(w+11)(w-3)=0$ $w=-11\ ;\ \ w=3$	**OR** $(w+4)=\pm 7$ $w+4=7\ ;\ \ w+4=-7$ $w=3\ ;\ \ w=-11$
9.	7.	$48-3m^2=0$ $3(16-m^2)=0$ $3(4-m)(4+m)=0$ $m=4\ ;\ \ m=-4$	10.	$-x^2+8x\ =\ +12$ $-x^2+8x-12=0$ $-(x^2-8x+12)=0$ $-(x-6)(x-2)=0$ $x=6\ ;\ \ x=2$	
11.	9.	$x(x-7)=-12$ $x^2-7x=-12$ $x^2-7x+12=0$ $(x-4)(x-3)=0$ $x=4\ ;\ x=3$	12.	$(x-8)(x+1)\ =\ -18$ $x^2-7x-8=-18$ $x^2-7x+10=0$ $(x-5)(x-2)=0$ $x=5\ ;x=2$	

Activity 4

1.	$2^{x+3}=8$ $2^{x+3}=2^3$ $x+3=3$ $x=0$	2.	$5^x=\frac{1}{25}$ $5^x=5^{-2}$ $x=-2$	3.	$6^x=36$ $6^x=6^2$ $x=2$
4.	$9^{3x}=27$ $(3^2)^{3x}=3^3$ $3^{6x}=3^3$ $6x=3$ $x=\frac{3}{6}=\frac{1}{2}$	5.	$4.7^x=4$ $7^x=1$ $7^x=7^0$ $x=0$	6.	$25^x=125$ $(5^2)^x=5^3$ $5^{2x}=5^3$ $2x=3$ $x=\frac{3}{2}$
7.	$4^{2x}=\frac{1}{32}$ $(4^2)^{2x}=2^{-5}$ $2^{4x}=2^{-5}$ $4x=-5$ $x=-\frac{5}{4}$	8.	$-5.6^x=-30$ $6^x=6^1$ $x=1$	9.	$2^x-2=62$ $2^x=64$ $2^x=2^6$ $x=6$
10.	$2^{x+1}=0{,}5$ $2^{x+1}=\frac{1}{2}$ $2^{x+1}=2^{-1}$ $x+1=-1$ $x=-2$	11.	$8.4^x=1$ $4^x=\frac{1}{8}$ $(2^2)^x=2^{-3}$ $2^{2x}=2^{-3}$ $2x=-3$ $x=-\frac{3}{2}$	12.	$2.3^{2x}+1=163$ $2.3^{2x}=162$ $3^{2x}=81$ $3^{2x}=3^4$ $2x=4$ $x=2$
13.	$10^x=0{,}001$ $10^x=\frac{1}{1000}$ $10^x=10^{-3}$ $x=-3$	14.	$4^{-x}=\frac{1}{16}$ $2^{-2x}=2^{-4}$ $-2x=-4$ $x=2$	15.	$3^{x^2-3x}=81$ $3^{x^2-3x}=3^4$ $x^2-3x=4$ $x^2-3x-4=0$ $(x-4)(x+1)=0$ $x=4\ ;\ x=-1$
16.	$2^x=-4$ No solution				

Activity 5

1. Let Duze's age be= x

$\therefore$ Carla's age $= x - 10$

$x + x - 10 = 44$
$2x = 54$
$x = 27$

Carla is 17 years old

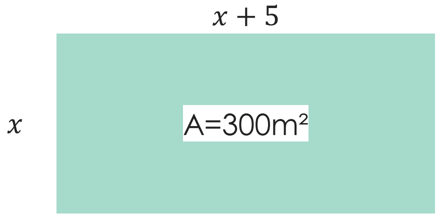
2.

	Daughter's age	Mother's age
Now	x	$3x$
Six years ago	$x - 6$	$3x - 6$ OR $6(x - 6)$

$$3x - 6 = 6(x - 6)$$
$$3x - 6 = 6x - 36$$
$$-3x = -30$$
$$x = 10$$

The daughter is now 10 years old.
The mother is now 30 years old.

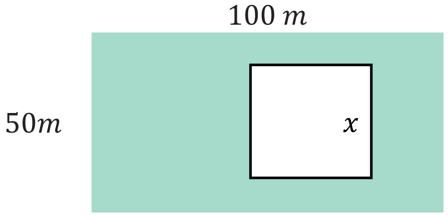
3. Let the breadth be x
then the length is $= x + 5$



$$A = b \times l$$
$$300 = x(x + 5)$$
$$300 = x^2 + 5x$$
$$x^2 + 5x - 300 = 0$$
$$(x - 15)(x + 20) = 0$$
$$x = 15 \;\; ; \;\; x \neq -20$$

The length of the field is:
$15 + 5 \;=\; 20$ meters

4.



Let the length of the swimming pool be $= x$.
Area of the garden $= l \times b$
$= 100 \times 50 = 5\,000$
Area of the swimming pool $= \frac{1}{2} \times 5000$
$= 2500$

Area of the swimming pool is also
$A = side \;\times side = x^2$

$$x^2 = 2500$$
$$x = 50$$

Length of the swimming pool is 50m

5. $S = 60\ km/h$
$T = 2\ h$
$D = x$

$D = S \times T = 60 \times 2 = 120$

The distance between A and B is 120 km

6.	

	Speed	Distance	Time $(T = \frac{D}{S})$
To the city	$60\ km/h$	x	$\frac{x}{60}$
From the city	$50\ km/h$	x	$\frac{x}{50}$

$$\frac{x}{60} + \frac{x}{50} = 3\frac{2}{3}$$
$$\frac{x}{60} + \frac{x}{50} = \frac{11}{3}$$

$$\frac{5x}{300} + \frac{6x}{300} = \frac{1100}{300}$$
$$5x + 6x = 1100$$
$$11x = 1100$$
$$x = 100$$

The distance between A and B is 100 km

7\. Let the cost of one the filter coffee be $= x$
$\therefore$ the cost of one cappuccino $= x + 3$

$$4(x + 3) + 3(x) = 54$$
$$4x + 12 + 3x = 54$$
$$7x = 42$$
$$x = 6$$

Filter coffee cost R6 and a cappuccino cost R9.