education

Department of Education
FREE STATE PROVINCE

TEACHER GUIDE

SUBJECT	:	MATHEMATICS
CLASS	:	GRADE 8
TASK	:	INFORMAL ACTIVITIES ALGEBRAIC EXPRESSIONS
NUMBER	:	11 ACTIVITIES

This document consists of 31 pages including cover page

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MD, Phillips., J, Basson., J, Odendaal. (2015) Mind Action Series Mathematics Grade 8 and 9 3rd edn., Sanlamhof: Allcopy Publishers.

Kevin Smith. (2017) Maths Handbook and Study Guide. Berlut Books CC.

1. NUMBERS, OPERATIONS AND RELATIONSHIPS

WHOLE NUMBERS:

Describe the real number system by recognising, defining and distinguishing properties of real numbers.

Real number system consists of many different classifications. Types of numbers learnt so far and introduction of rational and irrational numbers.

NATURAL NUMBERS

$\{1; 2; 3; 4; \ldots\}$

Start at 1 and increase in ones up to infinity (∞).

The symbol used for a set of natural numbers is: $\mathbb{N}$

WHOLE NUMBERS

$\{0; 1; 2; 3; 4; \ldots\}$

Start at 0 and increase in ones up to infinity (∞).

The symbol used for a set of natural numbers is: $\mathbb{N}_0$

INTEGERS

$\{\ldots; -4; -3; -2; -1; 0; 1; 2; 3; 4; \ldots\}$

They extend whole numbers to include negative numbers.

Integers start at $-\infty$ and increase in ones up to $+\infty$.

The symbol used for a set of integers is: $\mathbb{Z}$

RATIONAL NUMBERS

Numbers which can be written as fraction (where numerator and denominator are integers and denominator cannot be zero), thus $\frac{any\ integer}{any\ non-zero\ integer}$.

The set includes: natural numbers, whole numbers and integers. It also includes terminating $\{0{,}25;\ 3{,}14;\ 1{,}75\}$ and recurring $\{0,\dot{6};\ 1,\dot{2}\dot{5};\ 0,\dot{3}\}$ decimals.

Example: $0{,}25 = \frac{25}{100} = \frac{1}{4}$ and $0,\dot{6} = \frac{3}{2}$

The symbol used for a set of rational numbers is: $\mathbb{Q}$

IRRATIONAL NUMBERS

Numbers that cannot be written as a fraction or with terminating or recurring decimals. They are non – terminating and non – recurring.

The set includes: square and cube roots of numbers that are not perfect squares and cubes, pi (π).

The symbol for a set of irrational numbers is: $\mathbb{Q}'$

NOTE THE FOLLOWING POINTS:

- If a number is rational, it cannot be irrational and vice versa.
- A natural number is also a whole number, integer and rational number.
- A whole number is also an integer and natural rational number.
- An integer is also a rational number.

REAL NUMBERS

The set of rational ($\mathbb{Q}$) and irrational ($\mathbb{Q}'$) numbers.

The symbol for a set of real numbers is: $\mathbb{R}$

NB: This are system of numbers done up to now and as a results we are now going to study this numbers when they are used with letters of alphabets.

2. PATTERNS, FUNCTIONS AND ALGEBRA

ALGEBRAIC EXPRESSIONS

Algebra is a study of numbers in which letters of alphabets are used. Those letters are used to stand for numbers.

Think of a natural numbers less than 4. Double this number and add 1.

There are three possible answers:

$2 \times 1 + 1 = 3$

$2 \times 2 + 1 = 5$

$2 \times 3 + 1 = 7$

If natural number chosen is not known, the rule used was going to be:

$2 \times number + 1$

Instead of "number" we can write "n" which will represent the number chosen and therefore the rule used is $2 \times n + 1$. We can also use "x" for the number chosen and the rule changes to $2 \times x + 1$.

The letter x in this rule can take on three different values depending on the numbers chosen:

If 1, then $x = 1$ and the answer is $2 \times 1 + 1 = 3$

If 1, then $x = 2$ and the answer is $2 \times 2 + 1 = 5$

If 1, then $x = 3$ and the answer is $2 \times 3 + 1 = 7$

Using algebraic notation, we can state that $x \in \{1; 2; 3\}$. Therefore the meaning is x is an element ($\in$) of set ($\{\}$) of natural numbers less than 4.

Writing the rule $2 \times x + 1$ in a simplified form will be $2x + 1$ where $2 \times x$ have the same meaning as $2x$. $2 \times x$ can also be written as $2.x$ or $2(x)$.

The expression $2x + 1$ is called **algebraic expression**.

If asked to state the value of x if the answer got was 7, then the rule will be seen as $2x + 1 = 7$ and it is now called the **algebraic equation**.

And now we will know that the value of x is 3 $(x = 3)$ in order to get 7 because we know that $2(3) + 1 = 7$.

You are also allowed to use any alphabet in algebra and you are also allowed to use more than one alphabet in algebra.

Multiplying two numbers you don't know can be expressed as the rule $x \times y$ or xy. If you chose $x = 2$ and $y = 3$, then your answer will be $(2)(3) = 6$.

Note that in algebra we prefer to write letters in alphabetical order. Therefore the expression $x \times y$ is written as xy rather than yx.

$5 + 3$ is called a number expression involving addition and it can be simplified to 8.

An expression containing one or more letters is called an algebraic expression. For an example $x + 2$ is an algebraic expression which can only be simplified if the value of x is given and as it stands, it is not possible to simplify $x + 2$.

In algebra word statements are also translated into mathematical terms with numbers and variables (letters).

TERMINOLOGY AND NOTATION

Four basic operations required to know:

- Addition $(+)$
- Subtraction $(-)$
- Multiplication $(\times)$
- Division $(\div)$

Various ways that the basic operations can be expressed in words.

Expressions in words	Operations
Sum of / More than / Plus / Add / Exceeds	Addition $(+)$
Less than / Decrease / Differences	Subtraction $(-)$
Products / Multiply / Times	Multiplication $(\times)$
Divide / Quotient	Division $(\div)$

There are other symbols which can be expressed in words which you are required to know.

Expressions in words	Symbol
Squared	$(\ )^2$
Square root	$\sqrt{\ }$
Cubed	$(\ )^3$
Cube root	$\sqrt[3]{\ }$

CLASSWORK 1 DATE:

BASELINE ACTIVITY

1. Complete the table below: Level 1

	Statement	Algebraic Expression
1.1	Sum of 2 and a number.	$2 + x$
1.2	A number multiplied by 3 and then increased by 4.	$3x + 4$
1.3	The sum of a number and 1 then multiplied by 6.	$(x + 1)6$ OR $6(x + 1)$
1.4	10 less than a number.	$x - 10$
1.5	The difference between 10 and a number.	$10 - x$
1.6	8 less than a product of 9 and a number.	$9x - 8$
1.7	The quotient of twice a number and 7	$\frac{2x}{7}$

2. Write the following in a more simplified form:

2.1 $1x^1$

$= x$

2.2 $8 \times y^1$

$= 8y$

2.3 $3 \times y^1 \times x^1 \times 8$

$= 3y \times 8x$

$= 24xy$

2.4 $b \times c \times a$

$= abc$

3. If $x \in \{0; 1; 2\}$ what are the values of the following:

3.1 $3x$

If $x = 0$ then $3(0) = 0$

If $x = 1$ then $3(1) = 3$

If $x = 2$ then $3(2) = 6$

3.2 $4x - 2$

If $x = 0$ then $4(0) - 2 = -2$

If $x = 1$ then $4(1) - 2 = 2$

If $x = 2$ then $4(2) - 2 = 6$

3.3 $\frac{x^2}{2}$

If $x = 0$ then $\frac{(0)^2}{2} = 0$

If $x = 1$ then $\frac{(1)^2}{2} = \frac{1}{2}$

If $x = 2$ then $\frac{(2)^2}{2} = \frac{4}{2} = 2$

4. If $x \in \{0; 7; 8\}$, determine the value of x which will make the following algebraic equations true.

4.1 $4x + 1 = 29$

If $x = 0$ then $4(0) + 1 = 1 \neq 29$

If $x = 7$ then $4(7) + 1 = 29$

If $x = 8$ then $4(8) + 1 = 33 \neq 29$

4.2 $\frac{x}{5} = 0$

If $x = 0$ then $\frac{0}{5} = 0$

If $x = 7$ or 8 then $\frac{7}{5} = 1\frac{2}{5} \neq 0$ $\frac{8}{5} = 1\frac{3}{5} \neq 0$

HOMEWORK 2 DATE:

1. Complete the table below: Level 1

	Statement	Algebraic Expression
1.1	The difference between a number and 5.	$x - 5$
1.2	The difference between 5 and a number.	$5 - x$
1.3	The square root of a number.	$\sqrt{x}$
1.4	The cube of a number.	x^3
1.5	6 more than a quotient of three time a number and 4.	$\frac{3x}{4} + 6$
1.6	The product of 5 less than a number and 7.	$(x - 5)7$
1.7	The quotient of 5 more than a number and 2.	$\frac{x+5}{2}$

2. Write the following in a more simplified form:

2.1 $1a^1$

$= a$

2.2 $z^1 \times 8$

$= 8z$

2.3 $3 \times n^1 \times 8 \times m^1$

$= 3n \times 8m$

$= 24mn$

3. If $x \in \{0; 1; 2\}$ what are the values of the following:

3.1 $2x^3$

If $x = 0$ then $2(0)^3 = 2(0) = 0$

If $x = 1$ then $2(1)^3 = 2(1) = 2$

If $x = 2$ then $2(2)^3 = 2(8) = 16$

3.2 $3(x+2)$

If $x=0$ then $3(0+2)=3(2)=6$

If $x=1$ then $3(1+2)=3(3)=9$

If $x=2$ then $3(2+2)=3(4)=12$

3.3 $\frac{x^2}{2}$

If $x=0$ then $\frac{(0)^2}{2}=\frac{0}{2}=0$

If $x=1$ then $\frac{(1)^2}{2}=\frac{1}{2}$

If $x=2$ then $\frac{(2)^2}{2}=\frac{4}{2}=2$

4. If $x \in \{5;7;8\}$, determine the value of x which will make the following algebraic equations true.

4.1 $x-4=1$

If $x=5$ then $5-4=1$

If $x=7$ then $7-4=3\neq 1$

If $x=8$ then $8-4=4\neq 1$

4.2 $\frac{x}{2}=4$

If $x=5$ then $\frac{5}{2}=2\frac{1}{2}\neq 4$

If $x=7$ then $\frac{7}{2}=3\frac{1}{2}\neq 4$

If $x=8$ then $\frac{8}{2}=4$

UNKNOWN NUMBERS AS VARIABLES

Unknown numbers are written as variables in algebra. These are usually letters of the alphabet such as a and b.

Example: The sum of a number and 5 can be written as: $y + 5$.

Any letter of the alphabets can be used as the unknown.

Take note of the following when multiplying numbers and variables in Algebraic expressions:

1. **It is not necessary to separate numbers and variables with brackets or a multiplication sign.**

   Example: $2 \times a$ can be written as $2a$.

2. **When dealing with numbers and variables the order in which they are written does not matter. But we usually write the number first followed by the variables written in alphabetical order.**

   Example: $n \times 4 \times m$ can be written as $n4m$. But we will normally write it as $4mn$. It will also be correct to write it as $4nm$. However by convention the letters should be written in alphabetic order.

3. **It is not necessary to write 1 in front of the product of 1 and variable(s).**

   Example: $1 \times x$ can be written as $1x$. But we normally write it as x.

4. **It is not necessary to write 1 when variable is raised to the exponent of 1.**

   Example: x^1 can be written as x.

TERMS IN AN ALGEBRAIC EXPRESSIONS

A term in algebraic expressions can be a single number or a combination of numbers and variables multiplied together.

Example: $5, 5x, 5x^2y, \frac{2}{3}p$.

Terms are separated by a plus or minus sign.

Example: $x + 4, 3a + 2b - 8, (2d + 5) - (1 + e), \frac{a+7}{2b-3} + 4$.

POLYNOMIALS

An algebraic expression which consists of one or more terms is refer to as polynomial.

Different types of polynomials:

A monomial is a polynomial consisting of one term.

Example: $3, 4z, (3r + s), \frac{4x-3}{2}, \frac{4x-3}{x-2}, (f + 3)(h - 2)$

A binomial is a polynomial consisting of two terms.

Example: $3 + t, 7k - 1, (a - 5) + (b + 8)^2$

A trinomial is a polynomial consisting of three terms.

Example: $2x + x^2 - 9, \frac{1}{2}x^3 - x^2 + x, (x - 2)(x + 1) - xy + 1$

8 components of a polynomial.

1. **Degree of a polynomial is determine by the highest exponent of any variable in an expression.**
2. **Arrange the polynomial in a particular order.**
3. **Type of a polynomial.**
4. **Variables (letters used to represent numbers).**
5. **Coefficients (the number next to a variable(s) in a term. Basically a coefficient of a particular term is an expression which when you multiply by it with will give you that term.**
6. **Constant terms (the term with no variable).**
7. **Exponent is a number a variable is raised to.**
8. **Determine the value of the polynomial if the value(s) is/are given.**

Example: Examine the polynomial $6x - 1 + 5x^2$

1. **Polynomial is of second degree. The highest exponent is 2.**
2. **Arrange the polynomial in descending order of x.**
   $5x^2 + 6x - 1$
3. **Type of a polynomial is trinomial.**
4. **Variable is x.**
5. **Coefficient of x^2 is 5 and of x is 6.**
6. **A constant term is -1**
7. **Determine the value of $5x^2 + 6x - 1$ if $x = -2$.**

   $5x^2 + 6x - 1$

   $= 5(-2)^2 + 6(-2) - 1$

   $= 20 - 6 - 1$

   $= 20 - 7$

   $= 13$

CLASSWORK 3 DATE:

Examine the polynomial $6x + 5x^3 - 3 - 2x^2$ and answer the questions that follow: **Level 1**

1. **Arrange the polynomial in descending power of x.**

   $5x^3 - 2x^2 + 6x - 3$

2. **What is the degree of a polynomial?**

   The polynomial is of third degree.

3. **How many terms are there in the polynomial?**

   4 terms

4. **Write down the constant term in the polynomial.**

   -3

5. **What is the coefficient of x^2?**

   $-2x$

6. **Determine the value of the polynomial if $x = -1$.** **Level 1**

   $6x + 5x^3 - 3 - 2x^2$

   $= 6(-1) + 5(-1)^3 - 3 - 2(-1)^2$

   $= -6 - 5 - 3 - 2$

   $= -16$

HOMEWORK 4 DATE:

Examine the polynomial $4x^5 + 6x$ and answer the questions that follow:

Level 1

1. What type of polynomial is shown above?

Binomial

2. What is the coefficient of x?

6

3. Write down the constant term?

0

4. What is the degree of the polynomial?

The polynomial is of fifth degree.

5. Determine the value of the polynomial if $x = 1$. **Level 1**

$4x^5 + 6x$

$= 4(1)^5 + 6(1)$

$= 4 + 6$

$= 10$

LIKE AND UNLIKE TERMS

If you have 3 oranges and 2 apples in a basket and you place an additional 2 oranges and 5 apples in the basket you would have a total of 5 oranges and 7 apples.

Oranges and apples are considered unlike terms. You can only add or subtract like terms. If you have one orange and you add 1 apple you will have 1 orange and 1 apple.

Example: $3oranges + 2apples + 2oranges + 5apples$

$= 5oranges + 7apples$

The same principle can be applied to variables

Example: $3a + 2b + 2a + 5b$

$= 5a + 7b$

Terms having the same bases and the same exponents are referred to as like terms. Therefore anything except that is an unlike term.

Like terms can be added/subtracted together but unlike terms cannot.

Example: Simplify $5x^2 + 8x - 7x^2 + 8x - 4 - 4x^2 + 1$ by firstly collecting the like terms.

Solution: $5x^2 + 8x - 7x^2 + 8x - 4 - 4x^2 + 1$

$= 5x^2 - 7x^2 - 4x^2 + 8x + 8x - 4 + 1$

$= -2x^2 - 4x^2 + 16x - 3$

$= -6x^2 + 16x - 3$

CLASSWORK 5 DATE:

Simplify the following algebraic expressions by first collecting the like terms: Level 2

1. $5x - 2y - 3x - y$

$= 5x - 3x - 2y - y$

$= 2x - 3y$

2. $2y^3 - 3y - 6y^3 - 3y$

$= 2y^3 - 6y^3 - 3y - 3y$

$= -4y^3 - 6y$

3. $5x^2y + 8xy^2 + 3yx^2 - 2y^2x$

$= 5x^2y + 3x^2y + 8xy^2 - 2xy^2$

$= 8x^2y + 6xy^2$

4. $5x - 4y + 3y - 2x + 2z - 4z + 3x$

$= 5x - 2x + 3x - 4y + 3y + 2z - 4z$

$= 6x - y - 2z$

5. $2x^2 + 2x - 5x^2 - y^2 + 5x - 5y$

$= 2x^2 - 5x^2 + 2x + 5x - y^2 - 5y$

$= -3x^2 + 7x - y^2 - 5y$

6. $3xyz + 3xy - 5yxz + yx + 2yz$

$= 3xyz - 5xyz + 3xy + xy + 2yz$

$= -2xyz + 4xy + 2yz$

7. $-3a^3bc + 4bca^3 - ab^3c + b^3ca$

$= -3a^3bc + 4a^3bc - ab^3c + ab^3c$

$= a^3bc$

HOMEWORK 6 DATE:

Simplify the following algebraic expressions by first collecting the like terms: **Level 2**

1. $2a + 3b - a + 2b$

   $= 2a - a + 3b + 2b$

   $= a + 5b$

2. $4xyz - 3wz + 2xzy - zy$

   $= 4xyz + 2xyz - 3wz - yz$

   $= 6xyz - 3wz - yz$

3. $4x + 6y + 2x - 4y + 3$

   $= 4x + 2x + 6y - 4y + 3$

   $= 6x + 2y + 3$

4. $4x^2 + 3x + 4 + x^2 - 2x + 2$

   $= 4x^2 + x^2 + 3x - 2x + 4 + 2$

   $= 5x^2 + x + 6$

5. $3ab + 3by - 3xa - 9ab - 3yb + 12ax$

   $= 3ab - 9ab + 3by - 3by - 3ax + 12ax$

   $= -6ab + 9ax$

6 $9x^3y^2 - 15y^2x^3 - 7x^3y - 9yx^3 - x^2y^2 + 4y^2x^2$

   $= 9x^3y^2 - 15x^3y^2 - 7x^3y - 9x^3y - x^2y^2 + 4x^2y^2$

   $= -6x^3y^2 - 16x^3y + 3x^2y^2$

CLASSWORK 7 DATE:

1. Simplify the following: Level 2

1.1 $2 \times 3x$

$= 6x$

1.2 $(-3xy) \times (-2xy^2)$

$= 6x^2y^3$

1.3 $2(4 + 1)$

$= 2(5)$

$= 10$

OR

$2(4 + 1)$

$= 2 \times 4 + 2 \times 1$

$= 8 + 2$

$= 10$

1.4 $-5a(2b - c)$

$= -5a \times 2b - 5a \times -c$

$= -10ab + 5ac$

1.5 $-3(2 - a - a^2)$

$= -3 \times 2 - 3 \times -a - 3 \times -a^2$

$= -6 + 3a + 3a^2$

1.6 $7x(x^4 - 2x^3 + 3)$

$= 7x \times x^4 + 7x \times -2x^3 + 7x \times 3$

$= 7x^5 - 14x^4 + 21x$

1.7 $-\frac{16a^{12}b^7}{12a^8b^2}$

$= -\frac{16}{12} \times \frac{a^{12}}{a^3} \times \frac{b^7}{b^2}$

$= -\frac{4}{3}a^9b^5$

1.8 $\frac{3x+6}{3}$

$= \frac{3x}{3} + \frac{6}{3}$

$= x + 2$

1.9 $\frac{x^3+9x^2-10x}{x}$

$= \frac{x^3}{x} + \frac{9x^2}{x} - \frac{10x}{x}$

$= x^2 + 9x - 10$

1.10 $\frac{8a^3-2a^2+4a}{-2a}$

$= \frac{8a^3}{-2a} - \frac{2a^2}{-2a} + \frac{4a}{-2a}$

$= -4a^2 + a - 2$

2. **Add $x^2 + 2x + 4$ and $3x^2 - 4x - 5$** **Level 2**

$= (x^2 + 2x + 4) + (3x^2 - 4x - 5)$

$= x^2 + 2x + 4 + 3x^2 - 4x - 5$

$= x^2 + 3x^2 + 2x - 4x + 4 - 5$

$= 4x^2 - 2x - 1$

3. Subtract $3x^2 - 2x - 1$ from $-2x^2 + 7x - 5$ **Level 2**

$$(-2x^2 + 7x - 5) - (3x^2 - 2x - 1)$$

$$= -2x^2 + 7x - 5 - 3x^2 + 2x + 1$$

$$= -2x^2 - 3x^2 + 7x + 2x - 5 + 1$$

$$= -5x^2 + 9x - 4$$

HOMEWORK 8 DATE:

1. Simplify the following: Level 2

1.1 $3x \times -4y$

$= -12xy$

1.2 $4xy^2 \times 5x^2y$

$= 20x^3y^3$

1.3 $2(4x + 1)$

$= 2 \times 4x + 2 \times 1$

$= 8x + 1$

1.4 $-3x(-y - z)$

$= -3x \times -y - 3x \times -z$

$= 3xy + 3xz$

1.5 $x(x^2 - 2x - 2)$

$= x \times x^2 + x \times -2x + x \times -2$

$= x^3 - 2x^2 - 2x$

1.6 $\frac{4xy}{2}$

$= 4 \div 2 \times x \times y$

$= 2xy$

1.7 $\frac{-12a^7}{-3a^2}$

$= -12 \div -3 \times a^7 \times a^2$

$= 4a^5$

1.8 $\frac{8p-16q}{4}$

$= \frac{8p}{4} - \frac{16q}{4}$

$= 2p - 4q$

1.9 $\frac{3p^5+15p^4-9p^3}{3p^2}$

$= \frac{3p^5}{3p^2} + \frac{15p^4}{3p^2} - \frac{9p^3}{3p^2}$

$= p^3 + 5p^2 - 3p$

1.10 $\frac{6m^3n^4+12m^2n^5-18mn^6}{3mn^4}$

$= \frac{6m^{3n^4}}{3mn^4} + \frac{12m^2n^5}{3mn^4} - \frac{18mn^6}{3mn^4}$

$= 2m^2 + 4mn - 6n^2$

2. **From $6y^2 + 3y - 2$ subtract the sum of $-3y^2 + 2y + 3$ and $2y^2 + y + 1$.** **Level 2**

$(6y^2 + 3y - 2) - [(-3y^2 + 2y + 3) + (2y^2 + y + 1)]$

$= 6y^2 + 3y - 2 - (-3y^2 + 2y + 3 + 2y^2 + y + 1)$

$= 6y^2 + 3y - 2 - (-y^2 + 3y + 4)$

$= 6y^2 + 3y - 2 + y^2 - 3y - 4$

$= 7y^2 - 6$

CLASSWORK 9 DATE:

Simplify the following: **Level 2**

1. $6 - 5(2a + 2)$

   $= 6 - 10a - 10$

   $= -10a - 4$

2. $5(3x - 1) + 4(x + 2)$

   $= 15x - 5 + 4x + 8$

   $= 19x + 3$

3. $-3(2y + 3) - (4y - 2)$

   $= -6y - 9 - 4y + 2$

   $= -10y - 7$

4. $x - 13 - (x - x^2 + 12)$

   $= x - 13 - x + x^2 - 12$

   $= x^2 - 25$

5. $x(x^2 + 5x - 8) + x^2 - 12$

   $= x^3 + 5x^2 - 8x + x^2 - 12$

   $= x^3 + 6x^2 - 8x - 12$

6. $a(a^2 + 5a - 2) - 2(a^2 + 5a - 2)$

   $= a^3 + 5a^2 - 2a - 2a^2 - 10a + 4$

   $= a^3 + 3a^2 - 12a + 4$

HOMEWORK 10 DATE:

Simplify the following: **Level 2**

1. $4(2p-5)-3(p-1)$

   $=8p-20-3p+3$

   $=5p-17$

2. $x(x+5)+x(x-2)$

   $=x^2+5x+x^2-2x$

   $=2x^2+3x$

3. $2x^2+5x+2-x(x+6)$

   $=2x^2+5x+2-x^2+6x$

   $=x^2+11x+2$

4. $x^2-9x-8-2(x^2-5x-9)$

   $=x^2-9x-8-2x^2+10x-18$

   $=-x^2+x-26$

5. $3x^2-2x+5-(x-9+x^2)$

   $=3x^2-2x+5-x+9-x^2$

   $=2x^2-3x+14$

6. $x^2+5x-2-(x^2+3x-2)$

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

   $=2x$

SQUARES, SQUARE ROOTS, CUBES AND CUBE ROOTS OF AGEBRAIC EXPRESSIONS

There are two main rules that will be used in this section:

1. $(a^x b^y c^z)^p = a^{x\times p} b^{y\times p} c^{z\times p}$

2. $\sqrt{a^x b^y c^z} = a^{\frac{x}{2}} b^{\frac{y}{2}} c^{\frac{z}{2}}$ and $\sqrt[3]{a^x b^y c^z} = a^{\frac{x}{3}} b^{\frac{y}{3}} c^{\frac{z}{3}}$

When finding the square root of an expression, square root numbers normally and then divide the exponents of the variables by 2.

When finding the cube root of an expression, cube root numbers normally and then divide the exponents of the variables by 3.

Example 1: Simplify $\sqrt{16x^8y^4z^2}$

Solution: $\sqrt{16x^8y^4z^2}$

$= 4^{\frac{2}{2}} x^{\frac{8}{2}} y^{\frac{4}{2}} z^{\frac{2}{2}}$

$= 4x^4y^2z$

Example 2: Simplify $\sqrt[3]{27a^{12}b^6c^3}$

Solution: $\sqrt[3]{27a^{12}b^6c^3}$

$= 3^{\frac{3}{3}} a^{\frac{12}{3}} b^{\frac{6}{3}} c^{\frac{3}{3}}$

$= 3a^4b^2c$

CLASSWORK 11 DATE:

Simplify the following:

1. $\frac{(8a^3b)^2}{32a^3b}$ **Level 2**

$= \frac{8^{1\times2}a^{3\times2}b^{1\times2}}{32a^3b}$

$= \frac{+}{+} \times \frac{8}{32} \times \frac{a^6}{a^3} \times \frac{b^2}{b}$

$= +\frac{1}{4} \times a^{6-3} \times b^{2-1}$

$= \frac{1}{4}a^3b$

$= \frac{1}{4} \times \frac{a^3b}{1}$

$= \frac{a^3b}{4}$

2. $\sqrt{16p^4}$ **Level 2**

$= (4^2)^{\frac{1}{2}} \times (p^4)^{\frac{1}{2}}$

$= 4^{\frac{2}{1}\times\frac{1}{2}} \times p^{\frac{4}{1}\times\frac{1}{2}}$

$= 4^{\frac{2}{2}}p^{\frac{4}{2}}$

$= 4p^2$

3. $\sqrt[3]{125m^3n^6o^9p^{12}}$ **Level 2**

$= (5^3)^{\frac{1}{3}} \times (m^3)^{\frac{1}{3}} \times (n^6)^{\frac{1}{3}} \times (o^9)^{\frac{1}{3}} \times (p^{12})^{\frac{1}{3}}$

$= 5^{\frac{3}{1}\times\frac{1}{3}} \times m^{\frac{3}{1}\times\frac{1}{3}} \times n^{\frac{6}{1}\times\frac{1}{3}} \times o^{\frac{9}{1}\times\frac{1}{3}} \times p^{\frac{12}{1}\times\frac{1}{3}}$

$= 5^{\frac{3}{3}}m^{\frac{3}{3}}n^{\frac{6}{3}}o^{\frac{9}{3}}p^{\frac{12}{3}}$

$= 5mn^2o^3p^4$

4. $\sqrt{\frac{4x^6y^4}{z^2}}$ **Level 2**

$$= \frac{(2^2)^{\frac{1}{2}} \times (x^6)^{\frac{1}{2}} \times (y^4)^{\frac{1}{2}}}{(z^2)^{\frac{1}{2}}}$$

$$= \frac{2^{\frac{2}{1}\times\frac{1}{2}} \times x^{\frac{6}{1}\times\frac{1}{2}} \times y^{\frac{4}{1}\times\frac{1}{2}}}{z^{\frac{2}{1}\times\frac{1}{2}}}$$

$$= \frac{2^{\frac{2}{2}} x^{\frac{6}{2}} y^{\frac{4}{2}}}{z^{\frac{2}{2}}}$$

$$= \frac{2x^3y^2}{z}$$

HOMEWORK 12 DATE:

Simplify the following:

1. $\frac{(4b^3)^2}{4b^2+4b^2}$ **Level 2**

$= \frac{4^{1\times2}b^{2\times2}}{8b^2}$

$= \frac{4^2b^4}{8b^2}$

$= \frac{16b^4}{8b^2}$

$= 2b^{4-2}$

$= 2b^2$

2. $\sqrt{9a^4+16a^4}$ **Level 2**

$= \sqrt{25a^4}$

$= 5a^{\frac{4}{1}\times\frac{1}{2}}$

$= 5a^{\frac{4}{2}}$

$= 5a^2$

3. $\sqrt[3]{\frac{125p^3q^{27}}{r^9}}$ **Level 2**

$= \frac{5p^{\frac{3}{1}\times\frac{1}{3}}}{r^{\frac{9}{1}\times\frac{1}{3}}}$

$= \frac{5p^{\frac{3}{3}}q^{\frac{27}{3}}}{p^{\frac{9}{3}}}$

$= \frac{5pq^9}{p^3}$

$= \frac{5q^9}{p^{3-1}}$

$= \frac{5q}{p^2}$

4. $\sqrt[3]{64x^{18}y^{21}}$ **Level 2**

$= 4x^{\frac{18}{1}\times\frac{1}{3}}y^{\frac{21}{1}\times\frac{1}{3}}$

$= 4x^{\frac{18}{3}}y^{\frac{21}{3}}$

$= 4x^6y^7$

5. $\sqrt{\frac{25x^4-7x^4}{2x^2}}$ **Level 2**

$= \sqrt{\frac{18x^4}{2x^2}}$

$= \sqrt{9x^{4-2}}$

$= \sqrt{9x^2}$

$= 3x$