

# Maths Study Notes

# Grade 8 - Term 4

## 2024

## Hi grade 8s!

Congratulations on making it to the end of the year 🎉 I am so proud of you all. It has been amazing to watch you learn and grow this year. We are now at the final assessments and I hope that you will finish strong. Goodluck and all the best for studying! 🤓

Miss Stemp

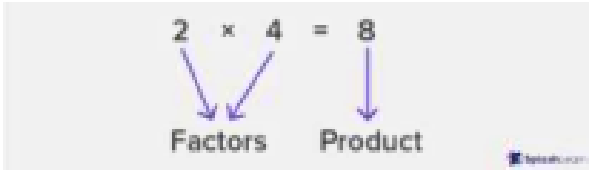
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## Factors, multiples, prime numbers:

- **Factors:** A number that can go into another number without a remainder.
- **Multiples:** A multiple of a number is that number multiplied by a natural number. Commonly known as the 'times tables.'
- **Prime Numbers:** A number that has only two factors – one and itself. The first five prime numbers are: 2 ; 3 ; 5 ; 7 ; 11.
- **Highest Common factor (HCF):** The highest factor that can go into two or more numbers that is common to both of them. E.g: the HCF of 10 and 15 is 5.
- **Lowest Common Multiple (LCM):** The lowest multiple of two or more numbers that is common to both of them. E.g: the LCM of 8 and 6 is 24.

## Worked Examples:




**6. Multiples**

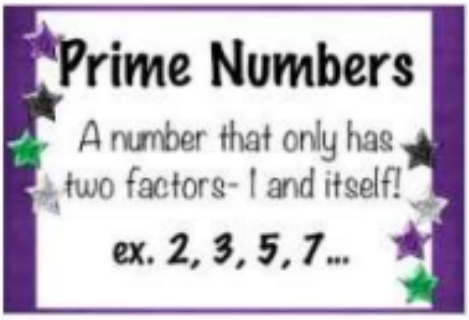
Multiplication Tables. $M_7 = \{7; 14; 21; 28 \ldots.\}$

**7. Prime numbers**

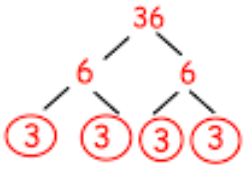
A prime number has only 2 factors: 1 and itself.

e.g. $F_3 = \{1; 3\}$

3 is therefore a prime number.

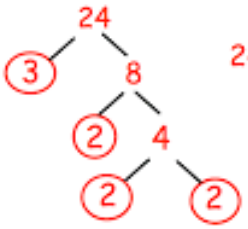


Express 36 as a product of its prime factors.




$36 = 3 \times 3 \times 3 \times 3$

Write 24 as the product of its prime factors.
Give your answer in index form.




$24 = 2 \times 2 \times 2 \times 3$

## THE PERFECT CHEAT SHEET

| PERFECT SQUARES | PERFECT CUBES |
|---|---|
| $1^2 = 1$ | $1^3 = 1$ |
| $2^2 = 4$ | $2^3 = 8$ |
| $3^2 = 9$ | $3^3 = 27$ |
| $4^2 = 16$ | $4^3 = 64$ |
| $5^2 = 25$ | $5^3 = 125$ |
| $6^2 = 36$ | $6^3 = 216$ |
| $7^2 = 49$ | $7^3 = 343$ |
| $8^2 = 64$ | $8^3 = 512$ |
| $9^2 = 81$ | $9^3 = 729$ |
| $10^2 = 100$ | $10^3 = 1{,}000$ |

## THE HIGHEST COMMON FACTOR OF 18 AND 24

The highest common factor of 18 and 24 is 6. Your child can work that out by doing the following:

| 18 | 24 |
|---|---|
| 1 x 18 | 1 x 24 |
| 2 x 9 | 2 x 12 |
| 3 x 6 | 3 x 8 |
| | 4 x 6 |

## THE LOWEST COMMON MULTIPLE OF 5 AND 35

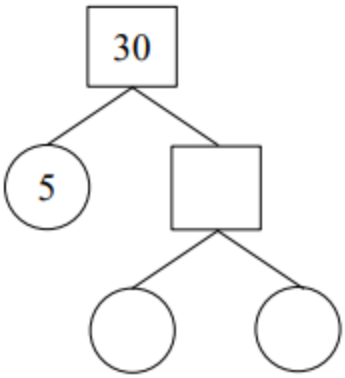
The lowest common multiple of 5 and 7 is 35. Your child can work that out by doing the following:

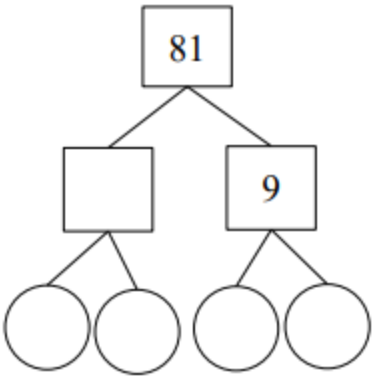
| 5 | 7 |
|---|---|
| 5 | 7 |
| 10 | 14 |
| 15 | 21 |
| 20 | 28 |
| 25 | 35 |
| 30 | |
| 35 | |

## Practice:

Find the Least Common Multiple and Greatest Common Factor.

| | LCM | GCF |
|---|---|---|
| 16, 10 | _____ | _____ |
| 14, 6 | _____ | _____ |
| 3, 27 | _____ | _____ |




1. $2^2 =$ $3^2 =$ $4^2 =$

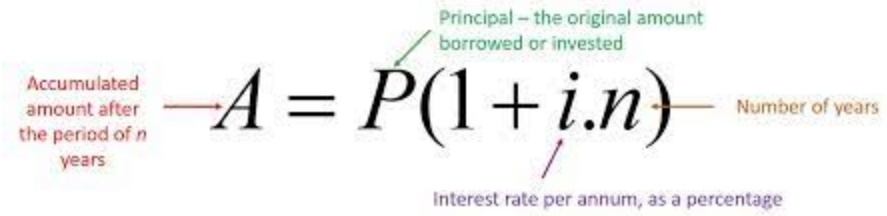
2. $5^2 =$ $6^2 =$ $7^2 =$

8. $\sqrt{25} =$ $\sqrt{81} =$ $\sqrt{256} =$

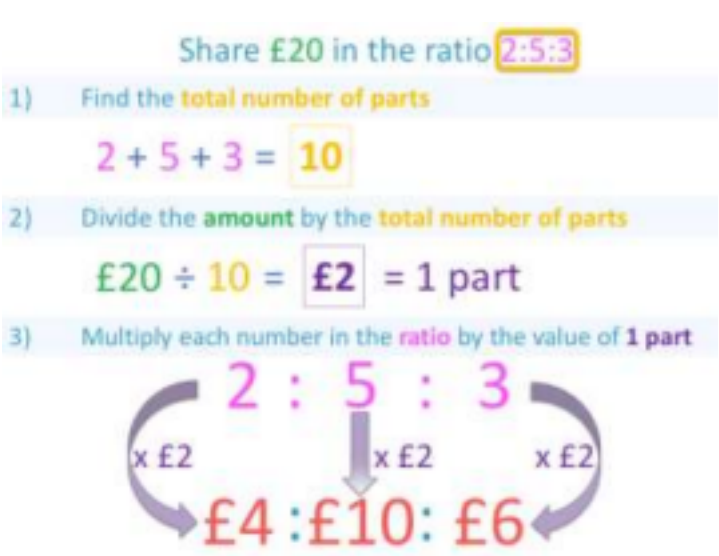
# Ratio and Financial Maths:

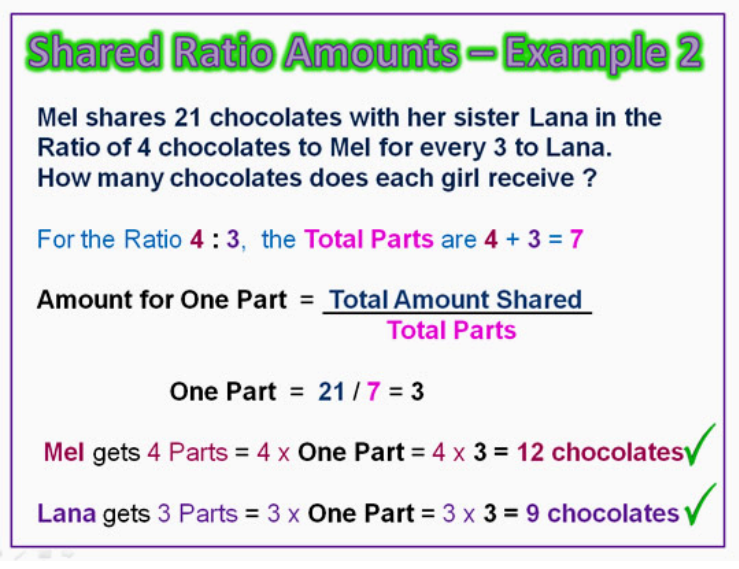
- **Ratio:** A relationship between quantities of the same unit.
- **Interest:** The extra money paid back after taking a loan.
- **Simple Interest:** The interest on a loan is calculated on a yearly basis.
- **Hire Purchase:** A plan used to buy items from a shop and pay for it monthly.
- **Deposit:** A sum of money paid as a first installment on an item with the understanding that the balance will be paid at a later stage.

## Simple interest formula




## Worked Examples:



# Practice:

Questions 2

## Sharing in a Given Ratio

1. Share 350 ml of milk between a cat and her kitten in the ratio 4 : 3

2. Share 1.2 litres of milk between a dog and a cat in the ratio 7 : 5

3. Share 240 g of sweets between Alison and Stephen in the ratio 3 : 5

4. Share 120 g of cereal between Stuart and Julie in the ratio 3 : 7

1. _____ How much interest does a $318 investment earn at 9% over one year?

2. _____ If you borrow $675 for six years at an interest rate of 10%, how much interest will you pay?

3. _____ If you borrow $421 for nine years at an interest rate of 4%, how much interest will you pay?

4. _____ If the balance at the end of eight years on an investment of $630 that has been invested at a rate of 9% is $1,083.60, how much was the interest?

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## Algebraic expressions:

**Algebraic expression:** an expression which is made up of **variables** and **constants**, along with **algebraic operations** (addition, subtraction, etc.). For example 4m + 5.

**Common factor:** the **largest factor** which is **common** to two or more numbers. For example, the factors of 4 are 1, 2, and 4.

**Simplify:** **reducing** the expression/fraction/problem in a **simpler form**.

**Monomial:** algebraic expression with a **single term** but can have **multiple variables,** for example, $9x^3yz$.

**Binomial:** a **two-term** algebraic expression. For example, $x + 2$.

**Polynomial:** an algebraic expression consisting of **many terms.** For example, $3xyz + 3xy2z$.

**Exponent:** the way in which large numbers are expressed in terms of powers. For example, 4 multiplied 3 times by itself can be expressed as 4 × 4 × 4 = 43.

| Laws of Exponents | |
|---|---|
| Product of Powers Rule | $x^m \times x^n = x^{m+n}$ |
| Quotient of Powers Rule | $x^m \div x^n = x^{m-n}$ |
| Power of Power Rule | $(x^m)^n = x^{m \times n}$ |
| Power of Product Rule | $(x \times y)^m = x^m \times y^m$ |
| Power of Quotient Rule | $(x \div y)^m = x^m \times y^m$ |
| Zero Power Rule | $x^0 = 1$ |

| Like Term | Unlike Term |
|---|---|
| $3x + 4x$ | $3x + 4y$ |
| $7y^2 + 5y^2$ | $7w^2 + 5v^2$ |
| $10w + 8w$ | $10x + 8z^2$ |
| $10t^3 + 8t^3$ | $3t^3 + 7t^5$ |
| $56s^5 + 78s^5$ | $69g^5 + 96s^7$ |

# Worked Examples:

## Simplifying Algebraic Fractions

**Simplifying algebraic fractions** involves simplifying a fraction that contains algebra.

We do this in the same way as for numerical fractions - we cancel common factors from the numerator and the denominator until no common factors remain.

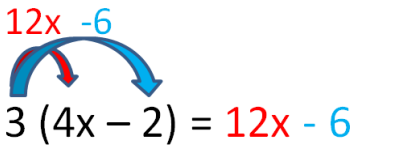
Example

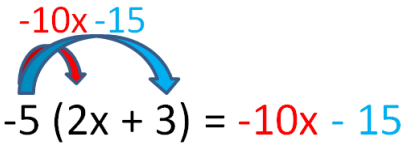
$$\frac{5x}{15} = \frac{\cancel{5} \times x}{\cancel{5} \times 3} = \frac{x}{3}$$

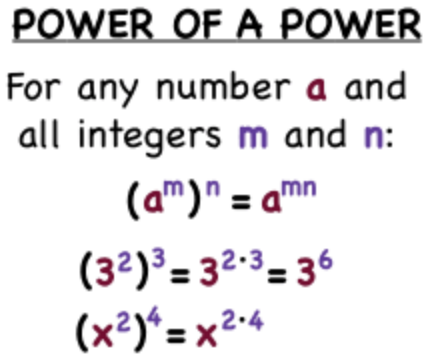
$5$ is the highest common factor of the terms $5x$ and $15$, so we can divide by $5$ ('cancel the $5$')

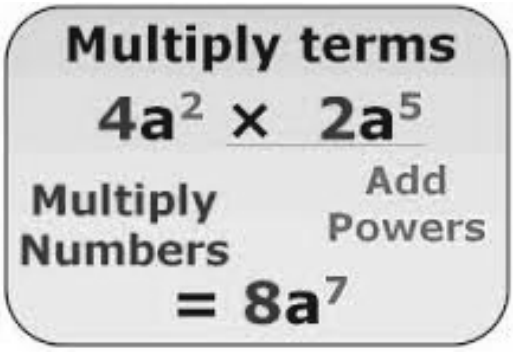
THIRD SPACE LEARNING

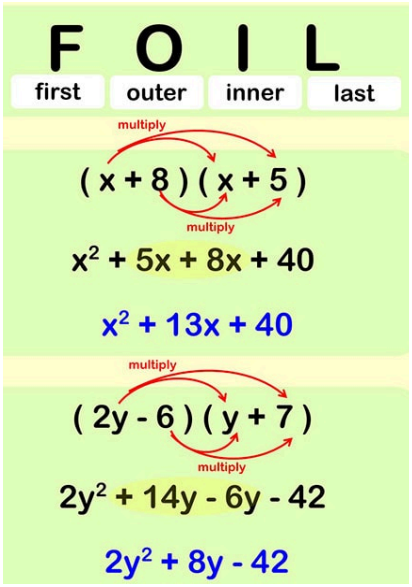
## Multiplying algebraic expressions

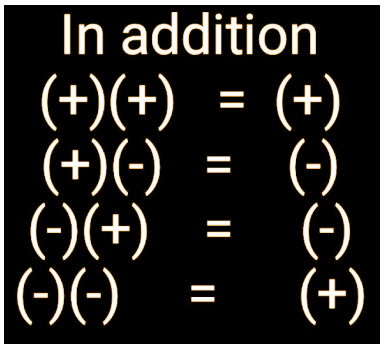



**REMEMBER: When multiplying terms you need to be mindful of signs and whether they will change . The picture on the right is a reminder of how the signs can change.**

## Practice:

1. $3(x+4)$

3x + 12

2. $8(x-7)$

8x - 56

a) $m^6 \times m^3 = m^{\square}$

b) $m^3 \times m^6 = m^{\square}$

e) $d^6 \times d^6 = \square$

f) $a^5 \times \square = a^8$

1. $\frac{3}{12}$
2. $\frac{3x}{12}$
3. $\frac{3}{12x}$

10.) $x^2 + 2x^2 =$ 11.) $4x^2 - 3x^2 =$ 12.) $3x^2 + 2x^2 =$

## Patterns and finding the “nth rule”:

**Consecutive:** One after the other.

**Constant difference:** Same number being added or subtracted to form a sequence.

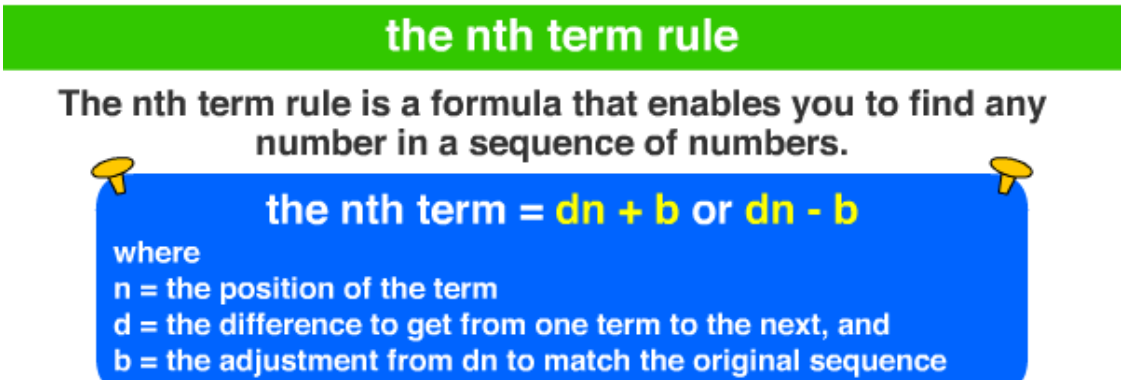
**Rule:** Explanation of how a pattern is formed. E.g Add two and divide by 3

**Formula:** Instructions in an algebraic form. Will have variables in it. E.g y= 2x

**Term:** A number in a given sequence. E.g: In the sequence: 5 ; 0 ; -5 ; -10 , all four numbers represent terms and each one of them are in a particular position.

**Position:** The place in the sequence held by one of the terms. E.g: In the sequence: 2 ; 4 ; 6 ; 8…. 6 is in the 3rd position

**Nth Rule:** In any sequence, the position of a term (1st, 2nd, 3rd etc.) is represented by the letter 'n'. In linear sequences only, the 'nth-term rule' allows you to find any number in a sequence of numbers.



# Worked examples:




## examples

### The nth term rule of the sequence 5, 10, 13, …

- 3 is being added to all the numbers
- the first term in a 3s sequence is 3
- to match the first term in the original sequence (3 to 5), add 2
- nth term rule = 3n + 2

### To find the 40th term in the sequence above

- we know the nth term rule = 3n + 2
- the 40th term = (3 x 40) + 2
- the 40th term = 122

### The nth term rule of the sequence -4, 0, 4, …

- 4 is being added to all the numbers
- the first term in a 4s sequence is 4
- to match the first term in the given sequence (4 to -4), subtract 8
- nth term rule = 4n - 8

### To find the 100th term in the sequence above

- we know the nth term rule = 4n - 8
- the 100th term = (4 x 100) - 8
- the 100th term = 392

## to work out the nth term rule

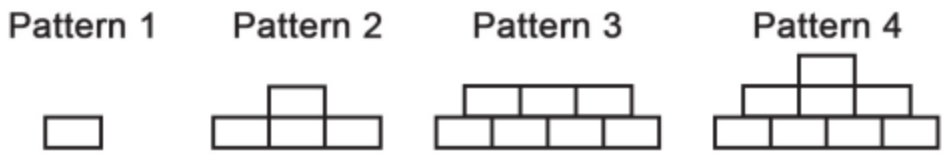
1. Work out the difference between each term, d.
2. Multiply n by that difference, dn, and write that sequence.
3. Look at the difference between the first term of the dn sequence and first term of the original sequence.
4. Write the adjustment b needed for them to match.

| position in sequence | n | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| sequence | | 2 | 6 | 10 | 14 | 18 |
| difference | d | | +4 | +4 | +4 | +4 |
| d x n | dn | 4 | 8 | 12 | 16 | 20 |
| adjustment needed | b | -2 | -2 | -2 | -2 | -2 |

nth term = 4n - 2

# Practice:

Consider the following pattern formed by bricks being laid:




i. List the number of bricks in each of the patterns shown above.

ii. How many bricks will be in the next pattern?

iii. Find the general term which represents this pattern.

iv. Use the rule to find how many bricks will be required for the 12th pattern.

12, 14, 16, 18, ____, ____, ____
The rule is _____

9, 13, 19, 25, ____, ____, ____
The rule is _____

110, 130, 150, 170, ____, ____, ____
The rule is _____

# Equations:

**Equation:** A mathematical statement with an equal sign that includes a variable. E.g: 3x-5=20

**Variable:** Letters of the alphabet which could represent different values. E.g: In the expression m + 2, m is a variable

**Like Terms:** Terms that have exactly the same variables. E.g: 2a and 4a are like terms and can be added or subtracted.

**Inverse Operation:** The opposite operation that will 'undo' an operation that has been performed. E.g: + and - are inverse.

## Worked examples:

**Balancing method**

$8a - 5 = 11$

$+5 \quad +5$

$8a = 16$

$\div 8 \quad \div 8$

$a = 2$

$x + 3 = 8$ the variable is x

$x + 3 - 3 = 8 - 3$ we are adding 3 to the variable, so to get rid of the added 3, we do the opposite--- subtract 3.

$x = 5$ remember to do this to both sides of the equation.

**Balancing method**

$10 + 6y = 34$

$-10 \quad -10$

$6y = 24$

$\div 6 \quad \div 6$

$y = 4$

| x | y |
|---|---|
| 4 | 11 |
| −2 | −1 |
| 0 | 3 |
| 2 | 7 |

$y = 2x + 3$

$y = 2(4) + 3 = 11$

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

$y = 2(0) + 3 = 3$

$y = 2(2) + 3 = 7$

**Balancing method**

$\frac{x}{12} - 5 = 4$

$+5 \quad +5$

$\times 12 \quad \frac{x}{12} = 9 \quad \times 12$

$x = 108$

$\frac{x}{2} = 7$

$2 \times \frac{x}{2} = 2 \times 7$

$x = 2 \times 7$

$x = 14$

## Practice:

1) $5n + 5 = 45$

2) $\frac{y}{6} - 3 = -11$

1) $4(a + 1) = 2$

2) $3 - 9x = -6 - 8x$

1) $9c + 1 = 10$

2) $6y - 5 = 7$

3) $8 = 3a - 4$

4) $\frac{m}{5} + 9 = 11$

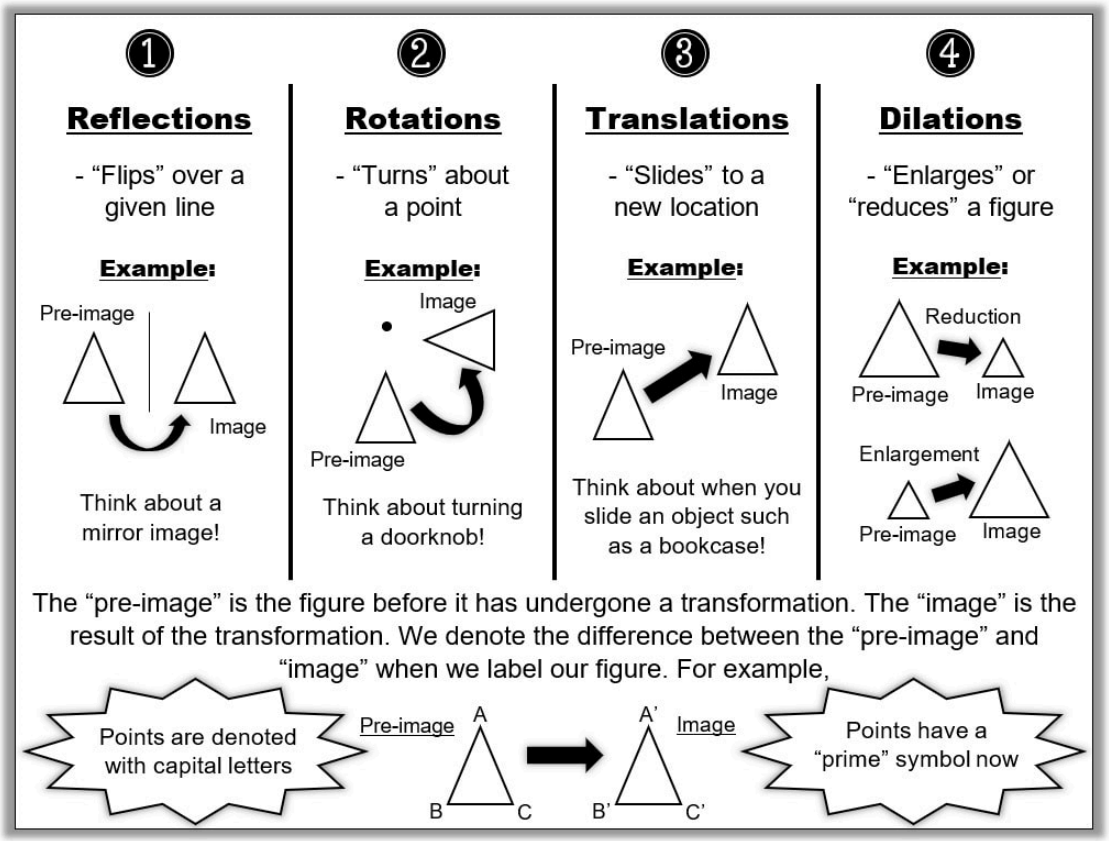
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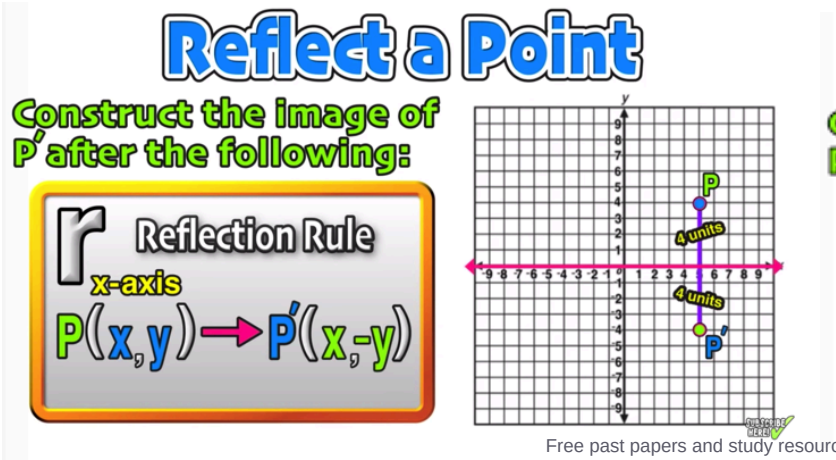
# Transformation Geometry:

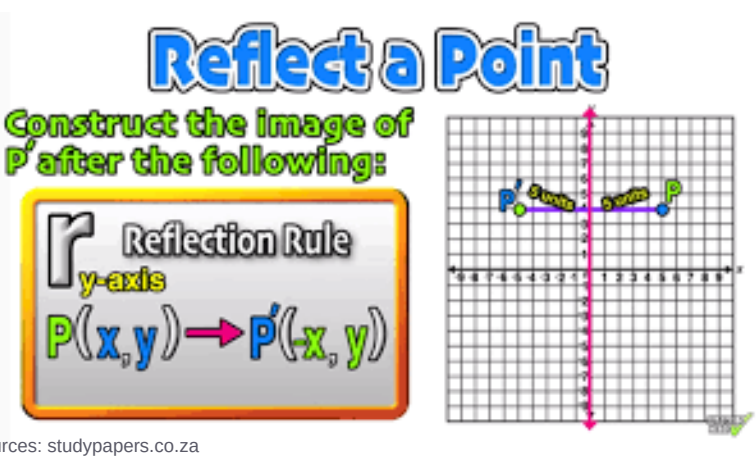
**Translation:** A horizontal and/or vertical slide from one position to another. Every point moves the same distance and in the same direction.

**Reflection:** A mirror image of a shape. In transformation geometry, reflections are done across the x-axis or the y-axis in the Cartesian Plane.

**Rotation:** A turning of a shape around a certain point. In this section it is always around (from) the origin on a Cartesian Plane.



## Practice:

Plot the points A(2;3) and B(-5;8) on a graph (you must draw it).

b) A is reflected in the x-axis to give A'.

i. Plot A'.

ii. Give the coordinates of A'.

c) B is reflected in the y-axis to give B'.

i. Plot B'.

ii. Give the coordinates of B.'

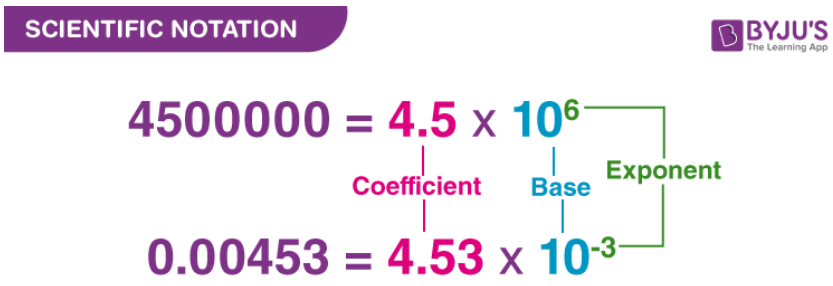
## Scientific notation:

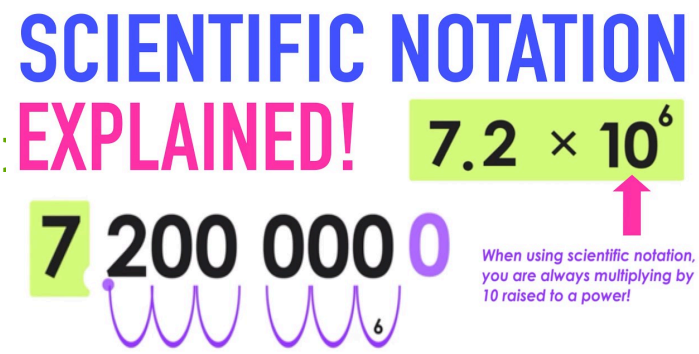
- **Scientific notation:** a way of expressing numbers that are too large or too small to be conveniently written in decimal form.

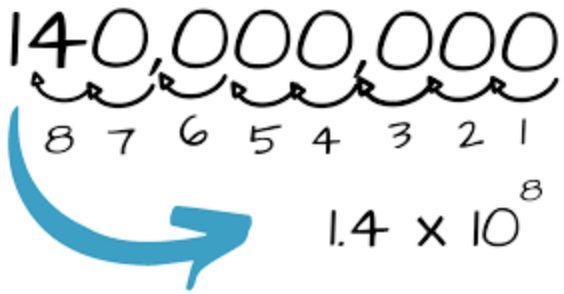
  For example: A number written as the product of a number between 1 and 10 AND a power of 10: 3,42 ×104 (This represents the number 3 420 000 – 3 million four hundred and twenty thousand)

- **Decimal form:** is a fraction written in a special form. Instead of writing 1/2, for example, you can express the fraction as the decimal 0.5.

## Worked examples:



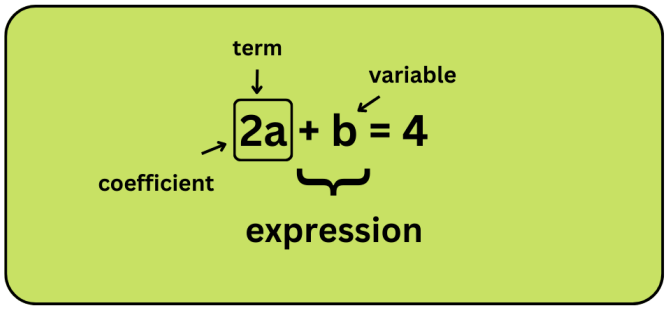



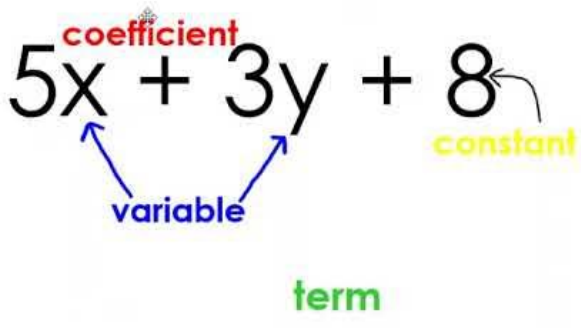



## Co-efficient, constant, terms:

- **Coefficient:** the number that appears next to the variable (the letter).
- **Constant:** the number that stands alone.
- **Terms:** a number, a variable, product of two or more variables or product of a number and a variable.

## Worked examples:



## Practice:

1. 7,990,000 = _____
2. 62,000 = _____
3. 779,600,000 = _____
4. 3,550,000 = _____

**Write down the coefficient, constant and how many terms there are for the following:**

1. **2a + 5**
2. **4 + 5d**
3. **5a + 4 + 2a + 7**

## Types of numbers:

**Non-real number:** Any number that doesn't belong to the set of real numbers. This includes numbers involving the square root of negative values or other expressions that result in non-real outcomes.

**Rational number:** Any number that can be expressed as a fraction of two integers, where the numerator is an integer and the denominator is a non-zero integer.

**Irrational number:** Any number that cannot be expressed as a fraction of two integers. Irrational numbers have non-repeating, non-terminating decimal representations.

## Worked Examples:

From the list: √25;  3/5;0,25; √7;√(-9); ∛(-8) write down all the numbers that are:

**Non-real, Rational, Irrational**

√25 (square root of 25): **Rational** (since it is a whole number).

3/5: Real, **Rational.**

0.25: Real, **Rational.**

√7 (square root of 7): Real, **Irrational** (because the square root of a non-square number is irrational).

√(-9) (square root of -9): **Non-real** (since you can't take the square root of a negative number and get a real result).

∛(-8) (cube root of -8): **Non-real** (since you can't take the cube root of a negative number and get a real result).

**Non-real numbers: √(-9), ∛(-8)**

**Rational numbers: √25, 3/5, 0.25**

**Irrational numbers: √7**

# Angles: straight lines, triangles and FUZ angles:

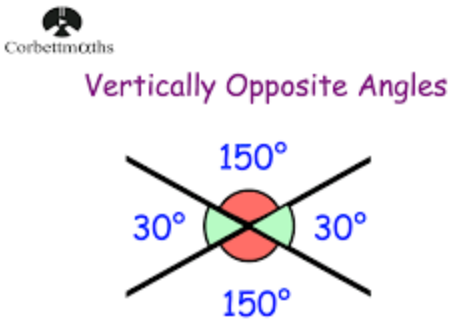
**Vertically opposite** angles are always equal.

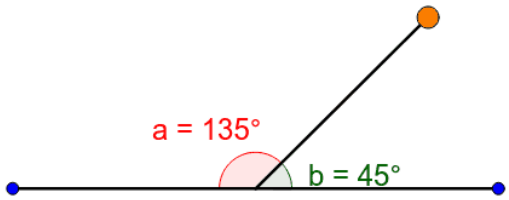
All **angles in a triangle** add up to 180 degrees.

All **angles on a straight line** add up to 180 degrees.

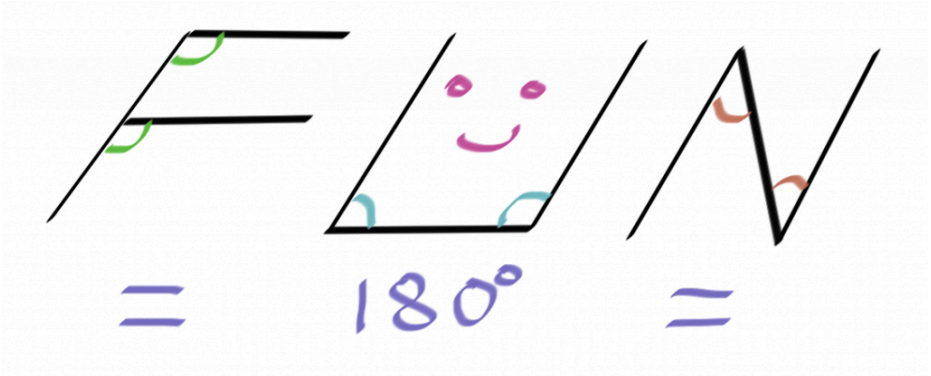
A **right angle** (small square) is equivalent to 90 degrees.

## Worked Examples:




Sum of a + b = 135°+ 45° = 180°



## Practice:

Find the unknown angles:

