Math & Science Note 01

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Last Updated Date: Oct 2020
Draft: 05

Part 1 (Basic Concepts)

CH 1 - Real No. vs. Unreal No.

1. Real No. - The type of number we normally use, such as 1, 2, 18.85, 0.1, 3/4, and -8 etc.
Positive or negative, large or small, whole numbers, decimal numbers and fractions are all Real Numbers.

2. Unreal No. - The type of number we can **NOT** easily work out or we only have a conceptual base, a good example is: Infinity (Symbol: ∞). Infinity means a very large number.... but how large ? One million (1,000,000; 10^6) ? One Billion (1,000,000,000; 10^9) or One Trillion (1,000,000,000,000; 10^{12}) ?

There are 3 other good examples:

a. $\sqrt{}(-9)$ (the square root of negative nine) and;
b. 1 ÷ 0 or 1/0 (one divided by zero or one over zero)
c. Tan 90^0

There are ways of dealing with unreal numbers, but we don't have to worry about that now.

CH 2 - Rational No. vs. Irrational No.

1. Rational No. - It can be written as a Ratio of two integers (i.e. a simple fraction), a good example is:

1/4 = 0.25 (Usually we only need 2 or 3 decimal points after the conversion)

2. Irrational No. is a real number that cannot be written as a simple fraction, there are 2 good examples:

a. 1/3 = 0.333333333.... (One over three, there is an **infinite** division loop)

b. 22/7 = 3.142857142857143… (This is the **π** value, it has an infinite **division** loop as well, as we can see the pattern repeats itself.

CH 3 - Two Stages / Opposite Meaning

In Mathematics or problem solving, very often it is a good idea to use the reverse logic. Here are some examples:

Computer System or Circuitry		
Switch	ON	OFF
Binary	1	0
Electric Charge	Positive	Negative
Flowchart	Start / Begin	Stop / End
Truth Table	TRUE	FALSE
English		
01	Yes	No
02	Affirmative	Negative
03	Agree	Disagree
04	Friend	Foe or Enemy
Mathematics		
01	Addition (+)	Subtraction (-)
02	Multiplication (x)	Division (÷)
03	Square (A^2)	Square Root ($\sqrt{}A$)
04	Exponential (e)	logarithmic function (log)
05	Odd No.	Even No.
06	Whole No.	Decimal / Fraction
07	Real No.	Unreal No.
08	Rational No.	Irrational No.
09	Expansion	Factorization
10	HCF (Highest Common Factor)	LCM (Lowest Common Multiple)
Direction or Geography		
01	Left	Right
02	Up	Down
03	East	West
04	North	South
05	Longitude	Latitude
06	Forward	Backward
07	Clockwise	Anti-clockwise

Math & Science Note 01

CH 4 - Common Algebra Rules

Rule No.	Rule	Description/ Example
01	A + B = B + A	For Addition, it does not matter about the orders.
02	A x B = B x A	For Multiplication, it does not matter about the orders.
03	If 1/A = B Therefore A = 1/B	We could inverse both LHS (Left Hand Side) and RHS (Right Hand Side) at the same time.
04	A unit x B unit AB **unit^2**	A good example is the area of a rectangle, if we have a rectangle with the following dimensions: L = 5m & W = 4m Area: 5m x 4m = **20m^2**
05	A unit ÷ B unit = C (w/o any unit or in different unit)	If A and B both have the same unit & the quotient does not have any unit or in a different unit. E.g.: We have 1,000 kg of goods and each truck carries 500Kg of goods only, how many trucks do we need ? E.g. 1,000 kg ÷ 500 kg = 2 trucks
06	A x (B + C) = AB + AC Or A x (B - C) = AB - AC	Simple expansion rules
07	(A + B) x (A + B) = A^2 + 2AB + B^2 Or (A - B) x (A - B) = A^2 - 2AB + B^2	Simple expansion rules, as you can see the middle nos. have same magnitude but in different signs.
08	(A + B) x (A - B) = A^2 - AB + AB - B^2 = A^2 - B^2	This is known as DOPS (Difference of Perfect Square), the middle nos. **have been cancelled** each other out.
09	A x B = AB	The product of 2 positive nos. will be a positive no.
10	- A x B = - AB	The product of 1 positive no. and 1 negative will be a negative no.
11	- A x (-B) = AB	The product of 2 negative nos. will be a positive no.
12	A + (-B) = A - B	When adding a negative no., it is just like dealing with a subtraction.
13	A + B and -A – B Same quantity or magnitude but different sign	They will have the same magnitude but in the different signs, if A = 12 and B = 8, we would have the following results: 12 + 8 = 20 & -12 - 8 = - 20

Math & Science Note 01

CH 4 - Common Algebra Rules

Rule No.	Rule	Description
14	2a + 4 + 10a - 5 = 2a + 10a + 4 - 5 = 12a - 1	Addition(s) or subtraction(s) could only be done for the same type or same unit.
15	$aX^2 + bX + c = 0$	General Quadratic equation
16	Percentage Form of One: 1 = 100%	1 could be expressed in 100%, because 1 could mean as whole or complete set.
17	Fraction Form of One: 1= 1/1, 2/2, 3/3, ... 1,000/1,000	1 could be expressed as 1/1, 2/2 and 10/10 etc. as long as the nominator is same as the denominator

CH 5 - Common Unit of Measurements

	Unit	Purpose
01	Kg or g	Weight
02	m, cm	Height or Length
03	m^3, cm^3	Volume
04	m^2, cm^2	Area or Total Surface Area
05	l (liter), ml (milliliter)	Volume (liquid)
06	dB (decibel)	Sound wave
07	Mw	Richter scale, to measure Earthquake
08	Second, Hour, Day, Year	Time
09	(°C Celsius), °F (Fahrenheit), K (Kelvin)	Temperature

CH 6 - Useful Prefix

	Name	Description
01	Kilo	1 Thousand ($10^{3)}$
02	Mega	1 Million ($10^{6)}$
03	Giga	1 Billion (10^9)
04	Tera	1 Trillion (10^{12})
05	Mini	1 Thousandth ($1/10^3$)
06	Micro	1 Millionth ($1/10^6$)
07	Nano	1 Billionth ($1/10^9$)
08	Pico	1 Trillionth ($1/10^{12}$)