

1. Arithmetic

- Integers

$$\begin{array}{l} i \times i = i \\ i \div i = i \end{array} \quad k \times q \rightarrow i$$

- 1,0,
- $2K \leftarrow 2(K) \leftarrow$ even if k is an integer
- Even = divisible by 2
- $2K \leftarrow 2 \times 1.5 = 3$
- $3K \leftarrow$ if k is an integer
- $2K \leftarrow$ if K is an integer
- $2m + 2n \rightarrow 2(m+n) \rightarrow m, n$ integer $\rightarrow 2m+2n$ integer
- $2m \leftarrow$ even , m integer / $2n \leftarrow$ even , n integer $\rightarrow$ even + even = even
- 30 – 288
- $30 - 25 = 5$ / $25 - 40 = 15 \leftarrow$ even +- odd , odd +- even = odd
- $2m+1, 2n \rightarrow 2m+1+2n \rightarrow 2m+2n+1$
- Odd+odd $\rightarrow 2m+1 + 2n+1 \rightarrow 2m+2n+2 \rightarrow$ even

Odd+odd = even

Odd+even = odd

Even + odd = odd

Even + even = even

K even , q odd

$K+Q+K \rightarrow$ odd

$3+K+Q \rightarrow$ even

Even * odd $\rightarrow 2[m * (2n+1)] \rightarrow 2[m*(2n+1)]$

Odd * even $\rightarrow 3*6 \rightarrow 2(3*3)$

$2*K \rightarrow 2[K]$

$$6 \rightarrow 2(3)$$

$$2m+2n \rightarrow 2(m+n)$$

$$6+8 \rightarrow 2(3+4)$$

$$6*8 \rightarrow 2(3*8)$$

$$(3*8)/2 \rightarrow = 24/2$$

$$2(3*8) \rightarrow 2*3*8$$

$$K(a+b) \rightarrow ka+kb$$

$$K(a*b) \rightarrow kab$$

$$K(ab+c) \rightarrow kab + kc$$

$$3(a+b) \rightarrow 3a+3b$$

$$3(a-b) \rightarrow 3a - 3b$$

$$3(ab+c-d) \rightarrow 3ab + 3c - 3d$$

$$3(ab) \rightarrow 3ab$$

$$3(6*8) \rightarrow 3*6*8$$

$$3*8 \rightarrow 2[3*4] \rightarrow \text{even}$$

$$2m*(2n+1) \rightarrow \text{หารสองลงตัวแน่นอน}$$

$$(2n+1)(2m) \rightarrow \text{หารสองลงตัวแน่นอน}$$

$$(2m)(2n) \rightarrow \text{หารสองได้แน่นอน}$$

$$(2n+1)(2m+1) \rightarrow \text{หารสองไม่ได้} /// \text{odd}$$

Odd*even $\rightarrow$ even

Even*odd $\rightarrow$ even

Even*even $\rightarrow$ even

Odd * odd $\rightarrow$ odd

Odd+-odd $\rightarrow$ even

Odd+-even $\rightarrow$ odd

Even+-even $\rightarrow$ even

Even + -odd $\rightarrow$ odd

K even

Q odd

$2K+Q = \text{odd}$

$(K)^2 + Q^2 = \text{odd}$

$3K+2Q = \text{even}+\text{even} = \text{even}$

$(K-Q)*7 = \text{odd}$

$(k-Q)*7 - 5 = \text{even}$

$0 = \text{even}$

$0/2 = 0$

0 หารได้ทุกตัว แต่ $0/0$ undefined $\leftarrow 0^0$ undefined

$K^0 = 1$ if K is not 0

$0^0 = \text{undefined}$

$x/x = 1 \leftarrow$ if x is not 0

$k^0 = 1$ // $0^0 = \text{undefined}$

$0/a = 0$ // $0/0 = \text{undefined}$

$k/0 = \text{undefined}$

$$a+0 = a \quad / \quad a-0 = a$$

$$a*1 = a \quad / \quad a/1 = a$$

$$a^1 = a$$

หารลงตัว $3K \leftarrow k \text{ integer} // 3K \text{ divisible by } 3$

$5k \leftarrow k \text{ integer} // 5k \text{ divisible by } 5$

$21(3m) \leftarrow m \text{ integer}$

$21*3m // 63m // m \text{ integer}$

$9 // 7 // 3 //$

$5m \rightarrow m \text{ is divisible by } 2$

$5m \rightarrow 5(2n) \rightarrow 5m \text{ divisible by } 10 (2*5)$

$3m \rightarrow m \text{ is divisible by } 3$

$3m \text{ divisible by } 9 (3*3)$

โดยอิงกับ **prime number**

$$(5^2 * 7^2) / 7^3$$

$$(7^3 * 5^2 * 2^4) / 10^3$$

$$10^3 \rightarrow (5*2)^3 \rightarrow 5^3 * 2^3$$

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- Positive/negative numbers
- Odd and even numbers
- Prime numbers (positive integer //
- 2,3,5,7,11,13,17, 19, 23,29, 31,37,41,43,47
- No even except 2
- No end with 0 or 5 except 5
- No sum of each digit divisible by 3 // 132 $\rightarrow 1+3+2 = 6$
- 1256 $\rightarrow 14 //$
- 1024 $\rightarrow 7$
- Factors and multiples
- GCD / GCF หรือ
- LCM หรือ

10/ 20 , 30

2, 3

GCD = 10

LCM $2*3*10$

10/ 20,30,40

2/2, 3 , 4

1, 3, 2

GCD = 10

LCM = $2*3*2*10 = 120$

Factors → prime factors

$$20 \rightarrow 2^2 * 5 // 2 * 2 * 5$$

$$30 \rightarrow 2 * 3 * 5$$

$$40 \rightarrow 2^3 * 5$$

$$50 \rightarrow 2 * 5^2$$

$$\text{GCD} \rightarrow \text{share} /// 20, 30, 40 \rightarrow 2 * 5 = 10$$

$$\text{LCM} \rightarrow 2^3 * 3 * 5 = 8 * 3 * 5 = 120$$

$$12, 40 \rightarrow 2^2 * 3, 2^3 * 5 \rightarrow 2^2 * 3, 2^3 * 5$$

$$\text{GCD} = 2^2$$

$$\text{LCM} \rightarrow 2^3 * 3 * 5 \rightarrow 8 * 15 \rightarrow 120$$

$$2 * 5 * 2^2 * 3 \rightarrow 12 * 10 \rightarrow 120$$

- Divisibility rules

$$6 \leftarrow 2, 3$$

$$132 \leftarrow \text{divisible by } 6$$

$$330 \leftarrow 12 // 2^2, 3$$

$$21 \leftarrow 3, 7$$

$$8 \leftarrow 2, 2, 2$$

$$10 \leftarrow 2, 5$$

$$20 \leftarrow 2^2, 5$$

- Remainders

- Remainder with conditions

- Fractions

- Decimals

- Percentages

- Ratios and proportions

- Powers and exponents

- Roots / radicals

- Absolute value

- Number properties

- Estimation and approximation

2. Algebra

- Algebraic expressions

- Simplifying expressions

- Factoring

- Linear equations

- Linear inequalities

- Systems of equations

- Quadratic equations

- Quadratic inequalities

- Exponents and roots
- Algebraic fractions
- Absolute-value equations/inequalities
- Sequences ///

2 4 6 8 , ____

3, 6, 9, 12 ,....

Arithmetic sequence เพิ่มขึ้นหรือลดเท่าๆเดิมไปเรื่อยๆ

$$T_n = T_k + (n-k) d$$

$$\text{Term 1} = 20$$

$$D = 3$$

$$\text{Term 5} = ?$$

$$T_5 = 20 + (4) \cdot 3 = 32$$

$$T_7 = 20 + (6) \cdot 3 = 38$$

$$\text{Term 1} = 7$$

$$D = -2$$

$$\text{Term 10} = ?$$

$$T_{10} = 7 + (9)(-2) = 7 - 18 = -11$$

$$300 - 400 = -100$$

$$238 - 300 = -62$$

น้อยลบมาก คือ มากลบน้อยได้ลบไปข้างหน้า

$$T_n = T_k + (n-k) d$$

$$\text{Term 1} = 5$$

$$D = 7$$

$$\text{Term 9} = ?$$

$$T_9 = 5 + (8)7 = 61$$

$$\text{Term 3} = 7$$

$$D = 4$$

$$\text{Term 11} = ?$$

$$T_{11} = 7 + (4)*4 = 23$$

Sum of arithmetic sequence

$$(n/2) (\text{first} + \text{last})$$

$$2, 4, 6, 8, 10 \leftarrow \text{sum} ?$$

$$n/2(\text{first} + \text{last}) \leftarrow 5/2 (2+10) = 30$$

สูตรแรกใช้ได้กว้างกว่า แต่ยากกว่า เพราะต้องรู้ค่าตัวแรกและตัวสุดท้ายที่แน่นอน และ จำนวนที่ถูกต้องถึงจะหาได้

$$10 \ 8 \ 6 \ 4 \ 2 \ 0 \ -2 \ -4$$

$$(8/2) (10-4) = 4 * 6 = 24$$

เราสามารถใส่สูตรหา **term** ในการหาได้ว่า เทอมสุดท้ายคือค่าอะไร

$$\text{Term 1} = 7$$

$$D = 3$$

$$\text{Term 1} + \text{Term 10} = ?$$

$$7 + (9)*3 = 34$$

$$(n/2)(\text{first} + \text{last}) = (10/2) (7+34) = 5 * 41 = 205 \text{ Ans}$$

Sum of consecutive start with 1

1,2,3,4,5,... n

$$(n/2)(n+1)$$

1,2,3,4,5,..., 10

สูตรที่สอง ใช้ง่ายกว่า เพราะเราใช้ n โดยตรงเลย ไม่ต้องนับ แต่จะมีข้อจำกัด เพราะใช้ได้แค่เฉพาะที่เริ่มจาก 1 และเพิ่มทีละ 1 เท่านั้น

หาจำนวนเทอม find n

$$(last - first)/d + 1$$

$$First\ term = 10$$

$$Last\ term = 100$$

$$D = 5$$

$$(100-10)/5 + 1 = 19\ terms$$

$$19/2 (10+100) Ans$$

$$20, 21, 22, \dots 50$$

$$(50-20)+1 = 31$$

$$D = 1\ \text{ก็ละตัวหารไว้ในฐานที่เข้าใจได้}$$

- Functions

$$F(x) = x+5$$

$$F(3) = 3+5 = 8$$

$$A \# B = A^2 + B \leftarrow \text{assign}$$

$$4 \# 3 = 4^2 + 3 = 19$$

$$1 \# 2 = 1^2 + 2 = 3$$

$$4 \# 3 - 5 \# 4 = ? \quad 19 - (25+4) \rightarrow 19 - 29 = -10$$

- Coordinate relationships
- Translating word problems into equations

3. Word Problems

- Rates // speed
- Work problems // work
- Distance / speed / time
- Mixtures //
- **Percent change**
- Profit and loss
- Interest //
- **Ratios**
- **Proportions**
- Averages /// total / n = average

$$20,000, 30,000, 50,000 \rightarrow (20k + 30k + 50k) / 3$$

- Weighted averages //

$$20,000 \cdot 3$$

50,000 2

100,000 1

Average ///

$3 \times 20,000 + 2 \times 50,000 + 100,000 / 3 + 2 + 1 \leftarrow \text{weighted average}$

- **Sets / overlapping groups // venn**
- Counting-based word problems
- Age problems
- Consecutive integers
- General equations from word problems

4. Statistics

- Mean
- Median
- Mode
- Range
- Weighted average
- Standard deviation (SD)
- Data distribution

5. Probability & Combinatorics

- Basic probability
- Probability of multiple events
- Independent/dependent events
- Conditional probability
- Counting principle
- Permutations

- Combinations
- Binomial Distribution
- Basic set/Venn-diagram probability