Sec 1-2 Math notes

Thursday, 26 September 2024 7:27 AM

<u>Numbers</u>

- Natural numbers ->1, 2, 3, 4, 5,⋯⋯
- Whole numbers ->0, 1, 2, 3, 4,⋯⋯
- Prime numbers ->2, 3, 5, 7, 11, 13, 17, 19, 23,⋯⋯
- Rational numbers ->numbers that can be expressed in fraction including terminating (e.g. 0.2, 0.35, 0.6) and recurring decimals (e.g. 0.33333333⋯, 0.2133333333⋯, 0.213213213213213⋯)
- Integer ->numbers without fraction (0 is neutral)
- Find HCF ->take the power that is included in all numbers
- Find LCM ->take the power that is the high must most be from all the numbers
- Perfect square ->indices of prime factorisation must be multiples of 2
- Perfect cube ->indices of prime factorisation must b multiples of 3
- (—)(—)= +
- (+)(—)= —
- (—)(+)= —
- + = —
- — = +
- × = ÷
- ÷ = ×
- $X^2 = \pm\sqrt{}$
- $X^3 = \pm\sqrt{}$

<u>Rounding significant figures</u>

- All non 0 are significant
- All 0 in between digits are significant

<u>Expansion</u>

- (X + Y)(a + b)= Xa + Xb + Ya + Yb
- a (x + y)= ax + ay
- $*\frac{a}{3} = \frac{1}{3}a$
- #1 $(a+b)^2 = a^2 + 2ab + b^2$
- #2 $(a-b)^2 = a^2 - 2ab + b^2$
- #3 $(a+b)(a-b) = a^2 - b^2$

<u>Factorisation</u>

- Take out common factors *$-x - y = -(x+y)$
- four terms ->grouping *$(a-b) = -(b-a)$
- three terms ->cross method
- two terms ->#3 $(a+b)(a-b) = a^2 - b^2$

<u>Linear graph</u>

- straight line graph
- Linear functions: $y = mx + c$
- e.g. 1) y = 2x + 3   2) 3 = 2x + c   3) 3 = x + 3
- m = gradient = $\frac{y2-y1}{x2-x1}$
- c = y-intercept (where line cuts y-axis)
- m > 0 : positive
- m < 0 : negative
- Parallel lines have the same gradient

Horizontal line

- Gradient = 0
- Equation → y = constant

Vertical line

- Gradient = undefined
- Equation → x = constant

*cuts x-axis, sub y = 0
*cuts y-axis, sub x = 0

<u>Number pattern</u>

- Even number Tn = 2n
- Odd number Tn = 2n - 1
- Perfect square Tn = n^2
- Perfect cube Tn = n^3
- if add or subtract a number to get the next term
- *Tn = a + (n - 1)(d)
- a ->first term of the sequence
- d ->the consistent increase of decrease in the sequence

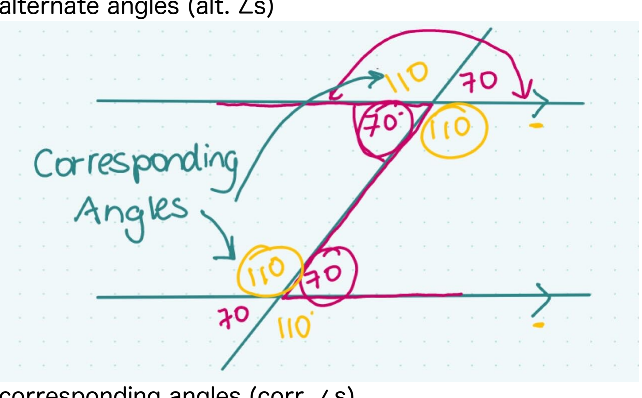
<u>Percentage</u>

- $x\% = \frac{x}{100}$
- x% of A ->$\frac{x}{100}$ × A
- to convert to % ->x × 100%
- express A as a percentage of B -> $\frac{a}{b}$ × 100%
- percentage change -> $\frac{increase\ or\ decrease}{original}$ × 100%
- increased by x percent ->(100 + x)%
- deceased by x percent ->(100 - x)%
- increase/decrease to x percent ->x%
- profit -> $\frac{profit}{selling\ price - cost\ price}$ × 100
- loss -> $\frac{loss}{cost\ price - selling\ price}$ × 100
- discount percentage -> $\frac{discount}{marked\ price}$ × 100%

<u>Polygons</u>

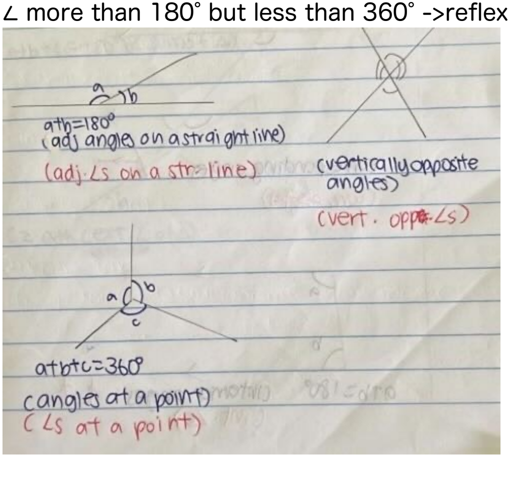
- triangle =180˚
- quadrilateral = 360˚
- Sum of angles in an n-sided polygon ->180(n - 2)
- One interior angle -> $n = \frac{(n-2)\times 180°}{n}$
- One exterior angle -> $\frac{360°}{n}$
- One interior angle + One exterior angle = 180˚
- Triangle: 3 sides, 180 degrees.
- Quadrilateral: 4 sides, 360 degrees.
- Pentagon: 5 sides, 540 degrees
- Hexagon: 6 sides, 720 degrees
- Heptagon: 7 sides, 900 degrees
- Octagon: 8 sides, 1080 degrees
- Nonagon: 9 sides, 1260 degrees
- Decagon: 10 sides, 1440 degrees
- 11 sides, 1620 degrees

<u>Triangles</u>

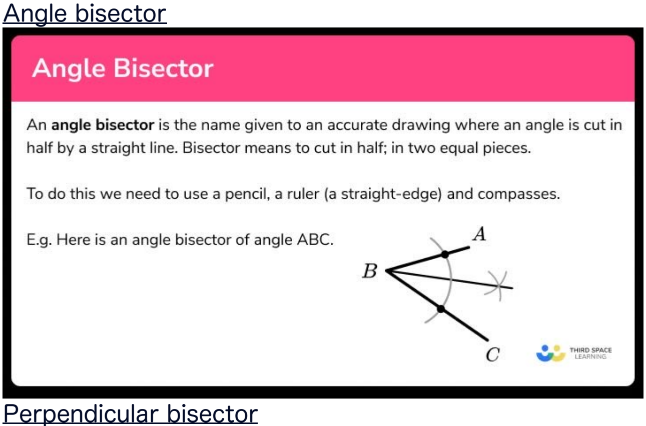
- 3 sides same ->equilateral
- 2 sides same ->isosceles
- alternate angles (alt. ∠s)
- 

- corresponding angles (corr. ∠s)
- a + b = 180˚ ->interior angles (int. ∠s)

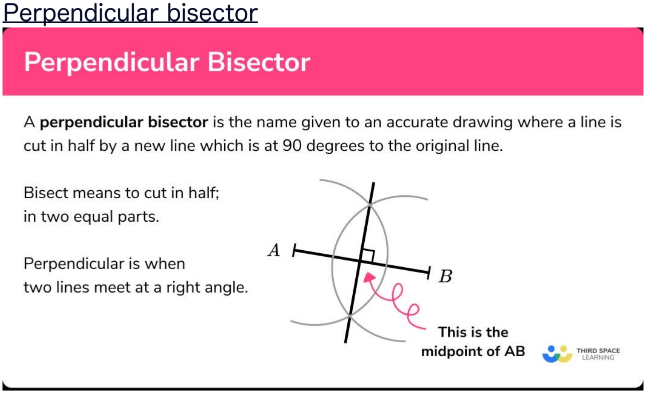
<u>Geometry</u>

- ∠ less than 90˚ ->acute angle
- ∠ ->right angle
- ∠ more than 90˚ but less than 180˚ ->obtuse angle
- ∠ more than 180˚ but less than 360˚ ->reflex angle
- 

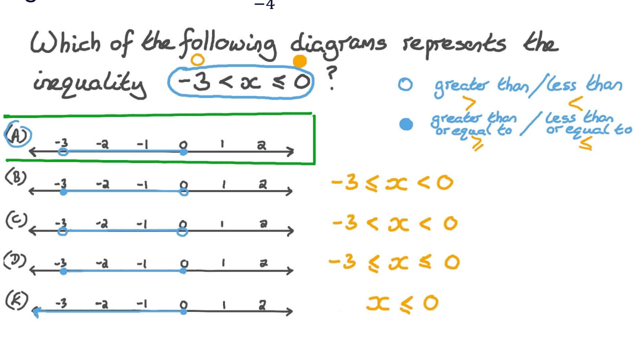
<u>Angle bisector</u>



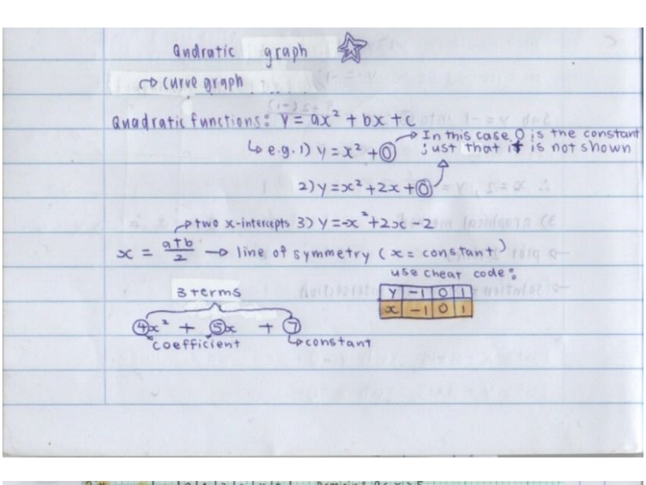
<u>Perpendicular bisector</u>

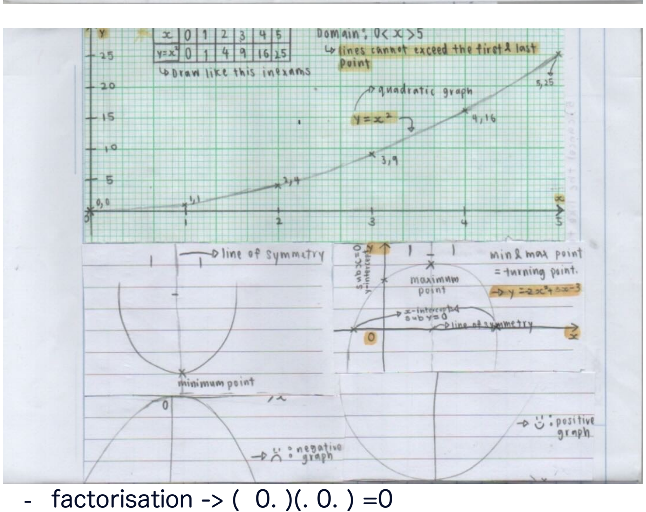


<u>Linear inequalities</u>

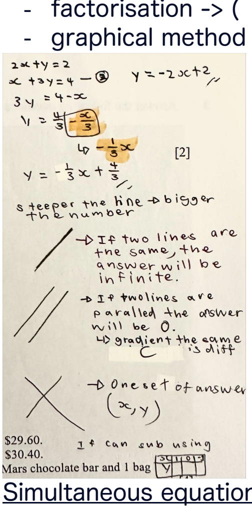
- when multiplying or dividing negative numbers ,flip the inequality sign
  e.g. -4x < 16 $x > \frac{16}{-4}$ x > -4
- 

<u>Quadratic graph</u>





- factorisation -> (0.)(. 0.) =0
- graphical method ->solution = x intercept



<u>Simultaneous equations</u>

1) elimination method
-> make one alphabet the same
-> if the same sign, subtract equations
-> if different sign, add equations
e.g $4x - 5y = 17$— (1)
$2x - 5y = 8$ — (2)
(1)-(2): (4x - 5y)-(2x - 5y)= 17 - 8
4x - 2x= 17 - 8
2x= 9
x= $\frac{9}{2} = 4.5$
sub x= 4.5 into (2): 2 (4.5) - 5y= 8
9 - 5y= 8
-5y= -1
y= $\frac{1}{5}$
x=4.5, y=$\frac{1}{5}$

2) substitution method
-> make one alphabet the subject
-> sub this alphabet into the other equations
e.g 3x - 2y= 8 —(1)
4x + 3y= 5 —(2)
From (1): 3x= 8 + 2y
x=$\frac{8+2y}{3}$ — (3)
Sub (3) into (2): 4 ($\frac{8+2y}{3}$) $+ 3y = 5$
$\frac{32+8y}{3} + 3y = 5$
32 + 8y + 9y= 15
17y= -17
y= -1
Sub y= -1 into (3): x=$\frac{8+2(-1)}{3}$
x= 2
x=2, y= -1

3) graphical method
-> plot two lines
-> solution=point of intersection

<u>Algebraic fraction</u>

1) for × and ÷, factorise both numerator
-> cancel out like terms
2) for + and -, factorise only the denominator, find LCM
-> finalise LCM

<u>Direct & Inverse Proportion</u>

1) direct proportion
Formula: y=kx *x=constant
e.g. If y is directly proportional to x
y = kx

2) inverse proportion
Formula: $y = \frac{k}{x}$
e.g. If y is inversely proportional to x
y = $\frac{k}{x}$

*Particular value an
1) Write: Let particular of ? be m
2) Sub the number and m in (add brackets)
3) Write ⋯ formula
4) When this value is doubled (x2), tripled (x3), quadrupled (x4)
Sub m into the place of ? and times by the an ask
5) cancel the like terms (get your ans)

e.g.1
y is directly proportional to the square of x and y=a for a particular value of x. Find an expression for y in terms of a, when this value of x is doubled.

Let particular value of x be m, y = a
$y=kx^2$
$(a)=k(m)^2$
$a=km^2$
$km^2=a$
k=$\frac{a}{m^2}$
∴y=$\frac{a}{m^2}x^2$
y=$\frac{a}{m^2}(2m)^2$
y=4a

e.g. 2
The frequency of a radio wave is inversely proportional to its wavelength W. Given that the frequency is 100 kHz at a certain wavelength, find the frequency when the wavelength is doubled.

Let the certain wavelength W be m, f = 100
$f = \frac{k}{w}$
$(100) = \frac{k}{m}$
$100 = \frac{k}{m}$
$100m = k$
$k = 100m$
$∴f = \frac{100m}{w}$
$f = 50kHz$