

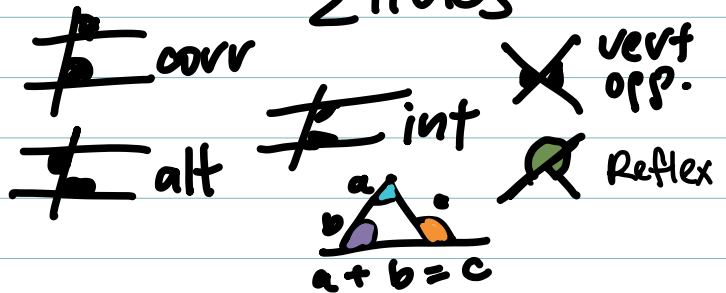
General Information

Proving Properties

- 1) Adj $\angle$ s on str. line
- 2) $\angle$ sum of Δ
- 3) Base $\angle$ of isos. Δ
- 4) $\angle$ sum of quad
- 5) $\angle$ s of equilat. Δ
- 6) int $\angle$ + $AB \parallel CD$
- 7) alt $\angle$ + $AB \parallel CD$
- 8) ext $\angle$ + $AB \parallel CD$
- 9) corr. $\angle$ + $AB \parallel CD$

Angles

Complementary $\angle = 90^\circ$
Supplementary $\angle = 180^\circ$
Transversal: Line Cutting
Through any
2 lines



Surface Area

Rectangle $A = B \times H$

Trapezium $A = \frac{1}{2}(a+b)h$

Cube $SA = 6a^2$

Cone $A = \pi r^2 + \pi r l$

Square $A = a^2$

Circle $A = \pi r^2$

Parallelogram $A = b \times h$

Rhombus $A = \frac{d_1 \times d_2}{2}$

Cuboid $SA = 2(lb + bh + hl)$

Sphere $SA = 4\pi r^2$

Half Sphere $SA = 3\pi r^2$

Pyramid $SA = \text{Base Area} + 3\Delta$

Cylinder $SA = 2\pi rh + 2\pi r^2$

Volume

Cube $V = a^3$
Cone $V = \frac{1}{3} \times \pi r^2 \times h$

Cuboid $V = \text{Base Area} \times h$

Sphere $V = \frac{4}{3} \pi r^3$

Half Sphere $V = \frac{2}{3} \pi r^3$

Pyramid $V = \frac{1}{3} \times \text{Base Area} \times h$

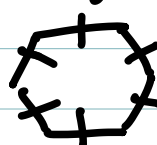
Cylinder $V = \pi r^2 h$

Polygon

Sides

- | | |
|----------|----------|
| 3: Tri | 8: Octa |
| 4: Quad | 9: Nona |
| 5: Penta | 10: Deca |
| 6: Hexa | |
| 7: Hepta | |

Regular Polygon



All sides + int $\angle$ s equal
sum of int $\angle$ = $180(n-2)$
sum of ext $\angle$ = 360°
n: no. of sides

Sec 1

Chap 01: Prime Factors, Sq root, Cube Root, HCF, LCM

Prime no. $\rightarrow$ exactly 2 diff factors ex: $14 = 1 \times 14$ $7 = 1 \times 7$

Composite no. $\rightarrow$ more than 2 ex: $6 = 2 \times 3 = 1 \times 6$

Whole no. $\rightarrow 0, 1, 2, 3 \dots$

Integers $\rightarrow \dots -1, 0, 1 \dots$

Rational (can write as $\frac{a}{b}$) $\rightarrow \frac{1}{2}, 0.1, -8.25, 0, \frac{22}{7}$

Irrational $\rightarrow \pi, \sqrt{3}, 1.4142 \dots$

Recurring Decimal $= \frac{1}{3} = 0.3333 \dots = 0.\bar{3}$

Commonly asked q's

1. 15×135 why even?

$$\begin{aligned} a: 15 \times 135 &= (3 \times 5) \times (3^3 \times 5) \\ &= 3^4 \times 5^2 \end{aligned}$$

Since both indexes are even, $\therefore$ perf sq

2. $15 \times 135 \times 9$ is perf cube, q ?

$$\begin{aligned} 15 \times 135 \times 9 &= 3^4 \times 5^2 \times 3^3 \times 5 \\ &= 3^7 \times 5^3 \end{aligned}$$

$q = 3^2 \times 5$ $\leftarrow$ make index multiple of 3

Chap 02: Integers, Rational & Real no.

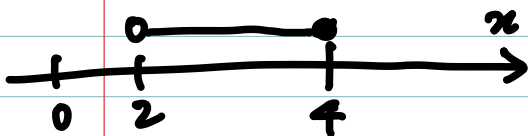
1) More than $>$

2) Less than $<$

3) More than/equal to $\geq$

4) Less than/equal to $\leq$

Number Lines



$$2 \leq x \leq 4$$

Chap 03: Approx & Est

Significant Fig Rules

1) All non-zero digits are sig.

- 2) All zeros b/w non-zero digits sig.
- 3) All zeros before non zero x sig. } Decimals
- 4) All zeros aft non zero sig
- 5) Zeros at end of whole no. may/not be sig

Chap 04: Algebra

term $2 - 3y$ ^{coeff} _{variable}

Linear expression $\Rightarrow$ 1 term & 1 constant
 $\hookrightarrow$ Can hv 2 variables
 $\hookrightarrow$ Can have 0 constants

~ Addition & Subtraction

~ Expansion & Factorisation

$$6(x-2) = 6x - 12$$

$$2x + 2y = 2(x+y)$$

Chap 05: Linear Eqns

~ Solving

~ Formulae

~ Fractional Linear Eqns

Chap 06: Linear Func & Graphs

$$y = mx + c$$

^{gradient} ^{y intercept}

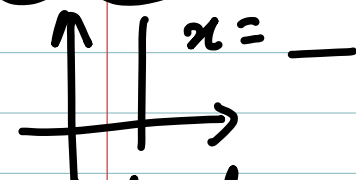
$$\text{gradient} = \frac{y_1 - y_2}{x_1 - x_2}$$

coords
 (x, y)

x			
y			

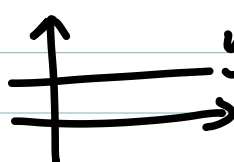
At least 3 points for straight line.

Vert line



gradient = undefined

Horizontal line



gradient = 0

Chap 07: Number Sequence

2, 5, 8, 11

↖
+3

$$T_1 = 2 \quad T_n = d(n) + T_0$$

$$T_2 = 5 = T_1 + \text{diff}(n-1)$$

no. before
1st term

only for
common diff

* Tips: look for squared/cubed no.
4 9 16 8 27

Chap 08: percentage

£: price

$$\cdot x\% = \frac{x}{100}$$

$$\cdot \% \text{ change} = \frac{\text{increase/decrease}}{\text{original}} \times 100\%$$

$$\cdot \text{Profit} = \text{selling } £ - \text{cost } £$$

$$\cdot \text{Loss} = \text{cost } £ - \text{selling } £$$

$$\cdot \text{Profit/Loss as \% of cost } £ = \frac{\text{profit/loss}}{\text{cost}} \times 100\%$$

$$\cdot \text{Discount} = \text{Marked } £ - \text{Sale } £$$

• GST

• Commission

Chap 09: Ratio & Rate

$$\begin{aligned} 6:2 & \div 2 \\ 3:1 & \div 1 \end{aligned}$$

involving 3 fractions

$$a:b \quad b:c$$

$$\frac{1}{2}:2 \quad 1:\frac{1}{3}$$

$$1:4 \quad 3:1$$

$$3:12 \quad 12:4$$

$$a:b:c$$

$$3:12:4$$

rate

$$\text{rate} = \frac{\quad}{\quad} \text{ per } \quad$$

$$\text{avg speed} = \frac{\text{Total distance}}{\text{Total time}}$$

$$I = \frac{PRT}{100}$$

time period
rate
principle value (starting value)

Commonly Asked An (Hire Purchase)

Q: Washing Machine is \$450. Man buys it on hire purchase. A down payment of 15%. the remaining to be paid in

monthly instalment over 2 years at simple interest rate of $10\frac{1}{3}\%$ per annum. Find:

a) Monthly Payment

b) Total amt paid

A: a) Down payment = $\frac{15}{100} \times 450 = 67.50$

Rem. amt to pay = $450 - 67.50 = 382.50$

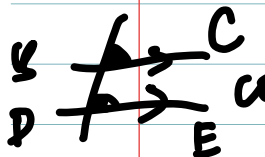
Am't needed to pay aft 2 years = $382.50 \times \frac{10}{100} \times 2 = 81.60$

Tot. amt to pay in monthly instalments = $\frac{382.50 + 81.60}{24} = 19.34$

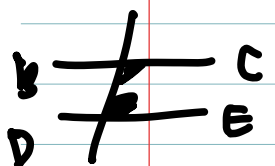
b) Total Amt = $81.60 + 450 = 531.60$.

Chap 10 : Basic Geometry

 A B C are collinear
(lie on same line)

 corresponding $\angle$ s, $BC \parallel DE$

 alternate $\angle$ s, $BC \parallel DE$

 interior $\angle$ s, $BC \parallel DE$

$\nparallel$ parallel

$\angle$ acute $\angle$

$\angle$ obtuse $\angle$

$\angle$ adjacent $\angle$

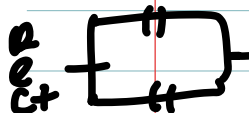
Chap 11 : Polygon & Geomet. Construction

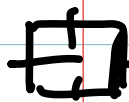
 equilateral

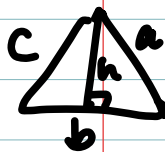
 isosceles

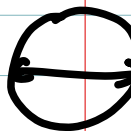
(in general info)

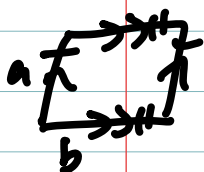
Chap 12: Perimeter & Area of Plane Fig

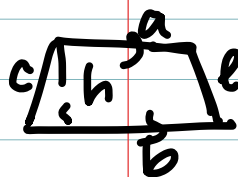
	$\frac{\text{Area}}{l \times b}$	$\frac{\text{Perimeter}}{2(l+b)}$
--	----------------------------------	-----------------------------------

	square l^2	$4l$
---	--------------	------

	$\frac{1}{2}bh$	$a+b+c$
--	-----------------	---------

	πr^2	$2\pi r$
---	-----------	----------

	bh	$2(a+b)$
---	------	----------

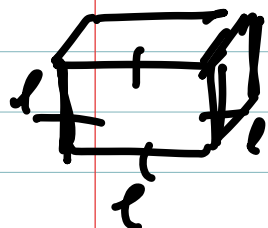
	$\frac{1}{2}(a+b)h$	$a+b+c+d$
--	---------------------	-----------

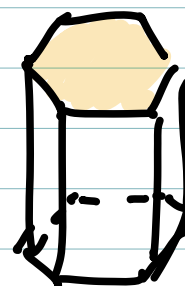
$1\text{m}^2 = 10000\text{cm}^2$
 $1\text{m} = 100\text{cm}$

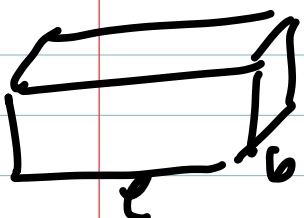
Chap 13: Volume & SA of Prisms & Cylinders

$1\text{ml} = 1\text{cm}^3$

$1\ell = 1000\text{ml} = 1000\text{cm}^3$

	$V = l^3$	$SA = 6l^2$
--	-----------	-------------

	$V = \text{Base Area} \times h$
---	---------------------------------

	$V = lbh$	$SA = 2(lb + lh + bh)$
--	-----------	------------------------

Chap 14: Statistics

① Frequency Table

ex:

Fruit	Apple	Pear
Number of students	4	10

② Bar Graph



Distributions

- Range
- Cluster
- Extreme Data
- Symmetry

③ Pie Chart



④ Pictogram

Bus  3

Car  

Sec 2

Chap 01: Linear Graphs & Simul. eqns

$$y = \underset{\text{gradient}}{m}x + \underset{\leftarrow y \text{ int.}}{c}$$

Simultaneous eqns.

① Elimination

↳ make 1 variable same

② Substitution

↳ find $x = _ / y = _$

presentation

label eqns : $5x + y$ — ①

show steps ① $\times 2$ / sub ① into ②

Chap 02: Linear Inequality

Recall $\rightarrow 4x \geq 22$
 $x \geq 8 \downarrow \div 4$



real life ex

at least 15cm $\rightarrow$ 15cm or more

at most 12y/o $\rightarrow$ 12y/o or less

Not more than 66 $\rightarrow$ 66 or less

Not less than 30 $\rightarrow$ 30 or more

Chap 03: Expansion/Factorisation

$$a(b+c) = ab+ac$$

$$(a+b)(c+d) = ac+ad+bc+bd$$

factorisation

	c	+d	} ① Multiplication Frame
a	ac	ad	
+b	bc	+bd	

$$\begin{aligned} & ac + ad + bc + bd \\ &= a(c+d) + b(c+d) \\ &= (a+b)(c+d) \end{aligned} \quad \left. \vphantom{\begin{aligned} & ac + ad + bc + bd \\ &= a(c+d) + b(c+d) \\ &= (a+b)(c+d) \end{aligned}} \right\} \text{② grouping}$$

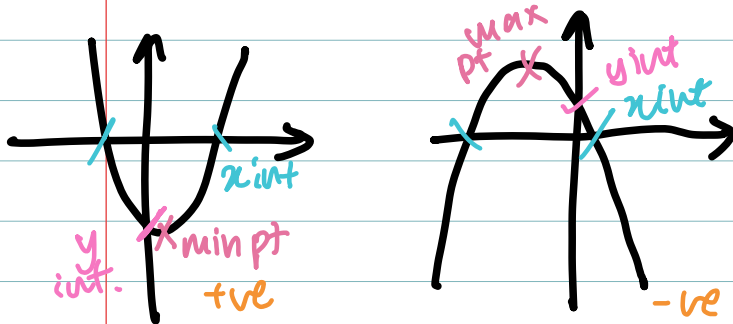
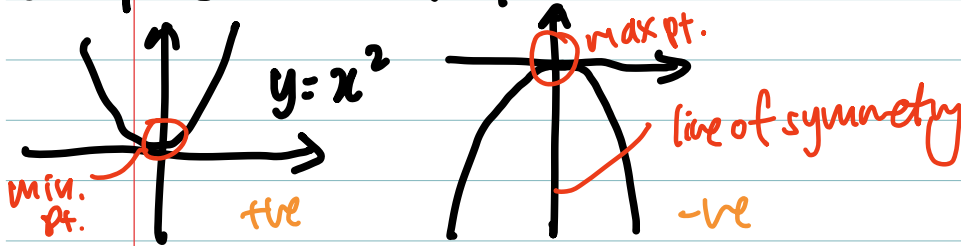
Chap 04: E/F w/ special identity

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$(a+b)(a-b) = a^2 - b^2$$

Chap 05: Quad eq^{ns} & circles



Chap 06: Algebraic formulae

$$\frac{A}{B} = \frac{A \times C}{B \times C} \quad \frac{A}{B} = \frac{A \div C}{B \div C}$$

$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d} = \frac{ac}{bd}$$

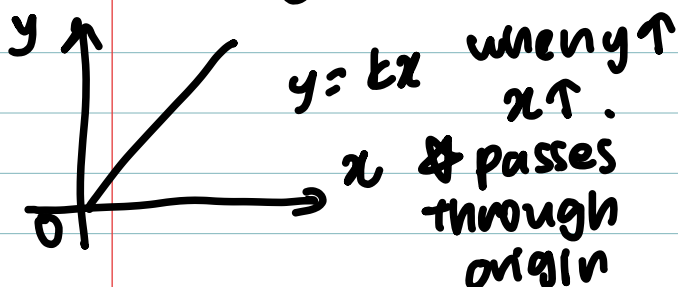
$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

- remove $\sqrt{\quad}$: square

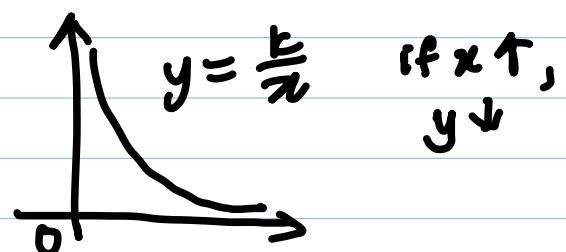
- remove $\sqrt[3]{\quad}$: cube

Chap 07: Direct & Inverse Proportion

direct: $y = kx$ constant



indirect: $y = \frac{k}{x}$ constant



commonly asked q^{ns}.

Q: 35 workers complete construction in 16 days. Before proj, boss tells company need to finish in 14 days. Assuming all workers work at the same rate, how many more workers needed

method 1

Since no. of workers & days are inversely proportional,

let x be no. of workers for 14 days

$$x(14) = 35(16)$$

$$14x = 560$$

$$x = 40$$

$\therefore$ no. of workers needed is

$$40 - 35 = 5.$$

method 2

let x be no. of days

let y be no. of workers

$$y = \frac{k}{x}$$

when $xy = 35$, $x = 16$

$$35 = \frac{k}{16}$$

$$k = 560$$

$$\therefore y = \frac{560}{x}$$

$$\text{when } x = 14, y = \frac{560}{14} = 40$$

$$\text{no. of workers needed} = 40 - 35 = 5$$

Q: F , force b/w 2 obj inversely propo to square of dist.
d. Dist b/w 2 obj red by 15%. Calculate
 $\therefore$ reduction in force b/w obj

$$F = \frac{k}{d^2} \quad k = Fd^2$$

$$\text{new dist} = d + \frac{15}{100}d = 1.15d$$

let new force be F_1

$$F_1 = \frac{k}{(1.15d)^2}$$

$$= \frac{Fd^2}{(1.15d)^2}$$

$$= \frac{(529)}{400}d^2$$

$$= \frac{400F}{529}$$

$$\% \text{ change} = \frac{\frac{400F}{529} - F}{F} \times 100\%$$

$$= -24.4\%$$

$$\% \text{ reduction} = 24.4\%$$

Chap 08: Congruency & Similarity

congruent $\rightarrow$ same shape & size ($\equiv$)

$$\triangle ABC \equiv \triangle EFG$$

$$\begin{array}{l} A \leftrightarrow E \\ B \leftrightarrow F \\ C \leftrightarrow G \end{array} \quad \left. \vphantom{\begin{array}{l} A \leftrightarrow E \\ B \leftrightarrow F \\ C \leftrightarrow G \end{array}} \right\} \begin{array}{l} \text{order} \\ \text{matters!} \end{array}$$

$$\text{scale factor of enlargement} = \frac{\text{side of larger } \triangle}{\text{side of smaller } \triangle}$$

$$\text{scale factor of reduction} = \frac{\text{side of smaller } \triangle}{\text{side of larger } \triangle}$$

similar $\rightarrow$ corr $\angle$ s equal, ratio of length of corr side equal

map actual

$$\begin{array}{l} 1\text{cm rep } 100\text{cm} \\ 1\text{m rep } 1000\text{m} \end{array}$$

* map actual

$$\begin{array}{l} 1\text{cm rep } 2\text{km} \\ (1\text{cm})^2 \text{ rep } (2\text{km})^2 \\ 1\text{cm}^2 \text{ rep } 4\text{km}^2 \end{array}$$

unit must be the same
no units in ratio

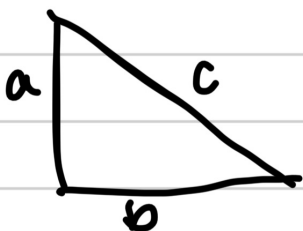
$$\begin{array}{l} \text{linear scale } \frac{\text{map}}{\text{actual}}: x \\ \text{Area scale } \frac{\text{map}}{\text{actual}}: x^2 \end{array}$$

no need to convert units if not necessary!

Chap 09 Pythagoras Theorem

$$a^2 + b^2 = c^2$$

(hypotenuse)



proof

$$\begin{array}{ll} \text{LHS} = AB^2 & \text{RHS} = AC^2 + BC^2 \\ = 12^2 & = 8^2 + 10^2 \\ = 144 & = 164 \end{array}$$

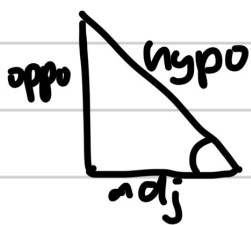
since LHS $\neq$ RHS, by the converse of pythagoras theorem, $\triangle ABC$ not

$\perp \triangle$

* Always put 'using pythagoras' theorem'

* If sq root, put $AB > 0$ if rejecting an ans.

Chap 10: Trigo Ratio



$$\sin = \frac{\text{oppo}}{\text{hypo}}$$

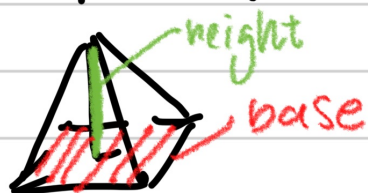
$$\tan = \frac{\text{oppo}}{\text{adj}}$$

$$\cos = \frac{\text{adj}}{\text{hypo}}$$

TOA CAH SOH

* Must be a **right $\triangle$**

Chap 11: Vol of sphere, cone, pyramids



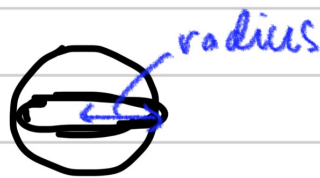
$$\text{vol} = \frac{1}{3} \times \text{BA} \times h$$

SA = Area of base + all lateral faces



$$\begin{aligned} \text{vol} &= \frac{1}{3} \times \text{BA} \times h \\ &= \frac{1}{3} \pi r^2 h \end{aligned}$$

$$\begin{aligned} \text{SA} &= \pi r^2 + \pi r l \end{aligned}$$



$$\begin{aligned} \text{vol} &= \frac{4}{3} \pi r^3 \end{aligned}$$

$$\text{SA} = 4\pi r^2$$

Chap 12: Probability

sample space = { }

single events

$$P(E) = \frac{\text{no. of favourable outcomes for event E}}{\text{tot. no. of poss. outcomes}}$$

ex: A card drawn from box of 7 cards prob. of drawing a 7?

$$\text{Ans: } P(\text{drawing a '7'}) = \frac{1}{7}$$

Prob of drawing perf sq? (1, 4)

$$P(\text{drawing perf sq}) = \frac{2}{7}$$

$$P(\text{Not E}) = 1 - P(E)$$

Chap 13: Statistical Diagram

① Dot diagrams

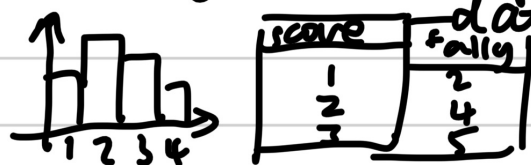
↳ constructing it

a) Range of value

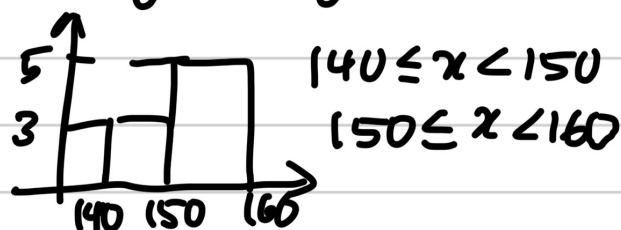
b) Horizontal line w/ equal interval

c) Plot w/ dots w/ equal spacing

② Histogram (ungrouped data)



④ Histogram (grouped data)



③ Stem & Leaf Diagram

14		2 4 7
15		1 1 2 3 4
16		0 1 1 2 3 5

key 14 | 2
means 142 cm.

commonly tested.

Chap 14: Average of Statistical Data

1) mean = $\frac{\text{sum of data values}}{\text{no. of data values}}$

mean of grouped data

Time	freq	mid value	fx
$15 < x \leq 20$	5	17.5	87.5
$20 < x \leq 25$	10	22.5	225

$$\text{mean} = \frac{\sum fx}{\sum f}$$

2) median

ex: 3 | 5 6 7 8 9

4 | 1 2 3 4 6

median position = $\frac{10+1}{2} = 5.5$

median = $\frac{39+41}{2} = 40$

3) mode

↳ highest freq

ALL ABOUT GRAPHS

Linear

(1) points (x, y)

(2) 2 points (x, y_1, x_2, y_2)

↳ gradient (m)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

↳ find eqⁿ of line connecting 2 pts

① Find m (gradient)

② $y = mx + c$ & sub or $y - y_1 = m(x - x_1)$

(3) length of line

$$= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

(4) Mid pt

$$= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

(5)  collinear = same gradient

Parallel

↳ same gradient

↳ y int diff

↳ don't intersect



Coincidence

① $x - 2y = 5$

② $5x - 10y = 28$

↳ lines overlap

↳ infinite solutions

Tools

① Parallel lines $\rightarrow m_1 = m_2$

② Perpendicular line $\rightarrow m_1 \times m_2 = -1$

③ gradient + 2 pts $\rightarrow$ equation

④ gradient $(m = \tan \theta)$

⑤ coords of pt $\rightarrow$ 2 intersecting lines

⑥ eqⁿ: $y - y_1 = m(x - x_1)$

⑦ Shoelace $\rightarrow \frac{1}{2} \begin{vmatrix} x_1 & x_2 & x_3 & \dots \\ y_1 & y_2 & y_3 & \dots \end{vmatrix}$

⑧ Mid Point

⑨ Distance

Sec 3

chap 01 : Quadratic & Fractional EQns.

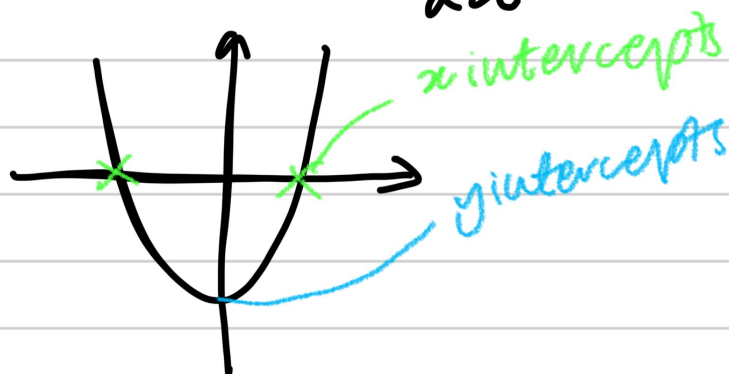
① Completely the square

$$x^2 + bx + c \longrightarrow \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$$

② using quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

* drawing of quadratic graphs need 7 or more points



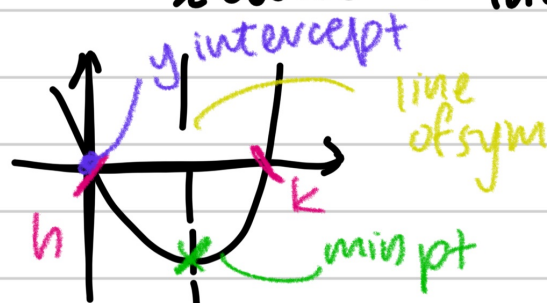
$$y = (x - h)(x - k)$$

- x int: h & k

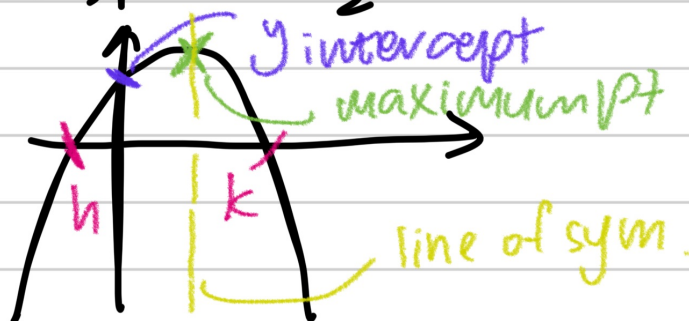
- eqⁿ of line of symmetry

$$x = \frac{h+k}{2}$$

- x coord of turning pt



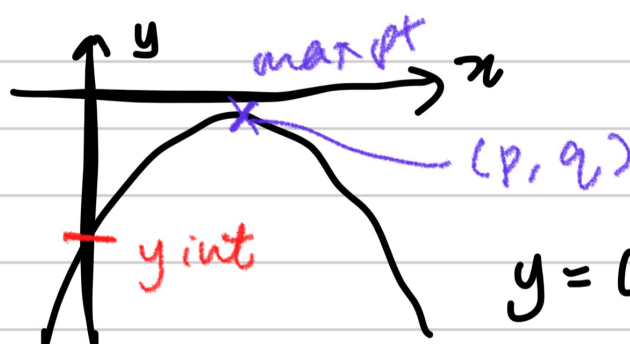
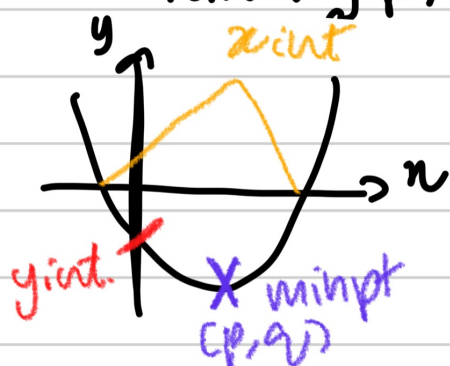
$$y = (x - h)(x - k)$$



$$y = -(x - h)(x - k)$$

$$y = \pm(x - p)^2 + q$$

- turning pt (p, q)



$$y = (x - p)^2 + q$$

Chapter simultaneous linear inequalities

ex Find range of values of x for which

$$3x \leq x+6 \quad \& \quad 2x+4 < 3x+6$$

$$3x \leq x+6$$

$$2x+4 < 3x+6$$

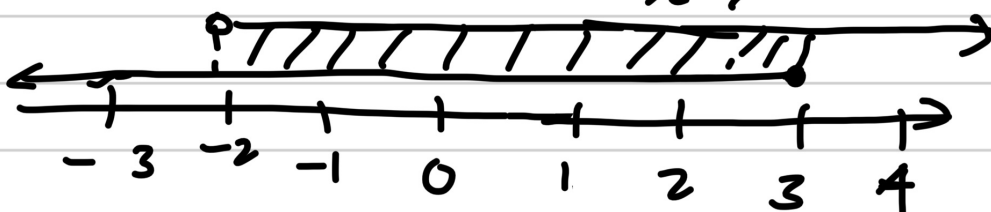
$$2x \leq 6$$

$$-x+4 < 6$$

$$x \leq 3$$

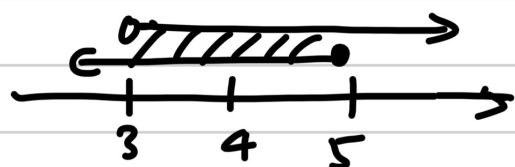
$$-x < 2$$

$$x > -2$$



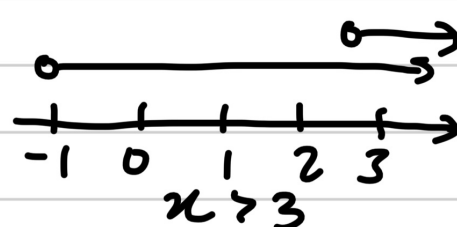
$$-2 < x \leq 3$$

① $x > 3$ & $x \leq 5$

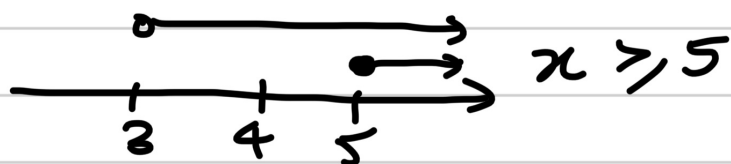


$$3 < x \leq 5$$

③ $x > 3$ & $x > -1$

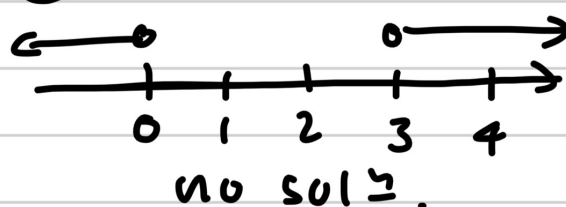


② $x > 3$ & $x \geq 5$



$$x \geq 5$$

④ $x > 3$ & $x < 0$



no soln.

To solve

$$2x+1 < x < 1-x \quad \leftarrow \text{solve separately}$$

①

②

$$2x+1 < x$$

&

$$x < 1-x$$

$$x < -1$$

$$2x < 1$$

$$x < \frac{1}{2}$$



$$\therefore x < -1$$

Chap 0 Indices

Law of indices

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $a^m b^m = (ab)^m$
5. $a^m \div a b^m = \left(\frac{a}{b}\right)^m$
6. Zero indices
 $\hookrightarrow a^0 = 1$
7. Negative indices
 $\hookrightarrow a^{-n} = \frac{1}{a^n}$
8. Rational indices
 $\hookrightarrow \sqrt[n]{a} = a^{\frac{1}{n}}$
 $\hookrightarrow \sqrt[n]{a^m} = a^{\frac{m}{n}}$

eqns involving indices

1) $5^n = 125$
 $5^n = 5^3$ $\hookrightarrow$ make base same

By comparing index
 $n = 3$

2) $9^{-2} \times 3^k = 1$
 $(3^2)^{-2} \times 3^k = 3^0$
 $3^{-4} \times 3^k = 3^0$
 $3^{-4+k} = 3^0$

By comparing index
 $-4 + k = 0$
 $k = 4$

Standard form

$$5400 = 5.4 \times 10^3$$

$\rightarrow$ has to be from 1-10

kilo (10^3)

milli (10^{-3})

mega (10^6)

micro (10^{-6})

giga (10^9)

centi (10^{-2})

tera (10^{12})

deci (10^{-1})

nano (10^{-9})

compound interest: $A = P \left(1 + \frac{r}{100}\right)^n$

simple interest: $I = \frac{Prt}{100}$

Possible Qns

- 1) Li Ting deposited \$15000 in an acc that pays 4.12% per annum compound interest. Find the total amt in the acc after 3yrs if interest is compounded monthly (a) & half yearly (b)

a) monthly

$$P = 15000$$

$$r = \frac{4.12}{100} \%$$

$$n = 3 \times 12 = 36$$

$$A = 15000 \left(1 + \frac{4.12}{100}\right)^{36}$$

$$= 16969.85$$

b) half yearly

$$P = 15000$$

$$r = \frac{4.12}{100} \%$$

$$n = 3 \times 2 = 6$$

$$A = 15000 \left(1 + \frac{4.12}{100}\right)^6$$

$$= 16952.19$$

2) Bernard borrowed a sum of money from the bank which charges a compound interest of 4.2% per annum, compounded quarterly. Given that Bernard had to pay \$96.60 in interest payments at the end of the 1st yr, find the orig. sum of \$ borrowed

Let P be the original sum borrowed

$$A = P + 96.60$$

$$r = \frac{4.2}{4} \% = 1.05\% \rightarrow \text{no. of times you compound}$$

$$n = \frac{12}{3} = 4 \rightarrow \text{no. of times/yr}$$

$$P + 96.60 = P \left(1 + \frac{1.05}{100} \right)^4$$

$$\left(1 + \frac{1.05}{100} \right)^4 P - P = 96.60$$

$$P \left[\left(1 + \frac{1.05}{100} \right)^4 - 1 \right] = 96.60$$

$$P = \frac{96.60}{\left(1 + \frac{1.05}{100} \right)^4 - 1} = 2264 \text{ (nearest \$)}$$

3) Joyce deposited \$ x in an acc that pays 2% compound interest per yr. Assuming that no withdrawal was made, find the value of x if she has \$36757.94 in the account at the end of 7 yrs

$$36757.94 = x \left(1 + \frac{2}{100} \right)^7$$

$$P = \$x$$

$$x = \frac{36757.94}{\left(1 + \frac{2}{100} \right)^7}$$

$$\text{int rate} = 2\%$$

$$\text{tot. amt} = 36757.94$$

$$= 32000.00 \text{ (2dp)}$$

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$\text{Joyce deposited } \$32000.00$$

Chap 04 Coord Geometry

① length of line $y_2 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

② gradient = $\frac{y_2 - y_1}{x_2 - x_1}$

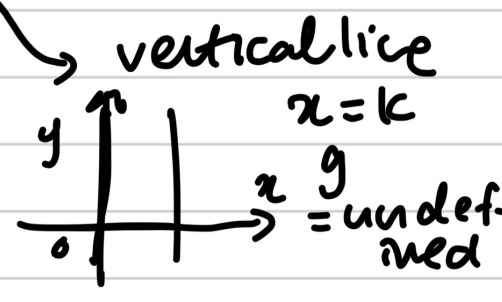
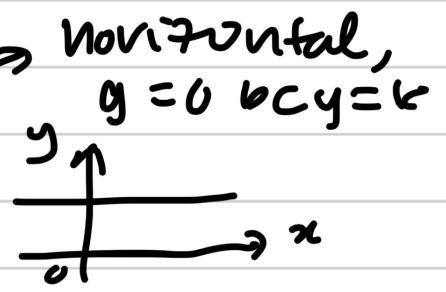
↪ +ve : / -ve : \

③ eqⁿ of line : $y - y_1 = m(x - x_1)$

eqⁿ of straight line

$y = mx + c$

special lines

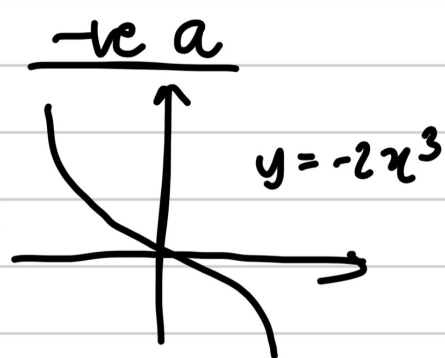
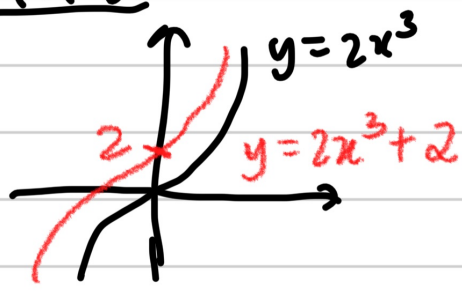


colinear lines

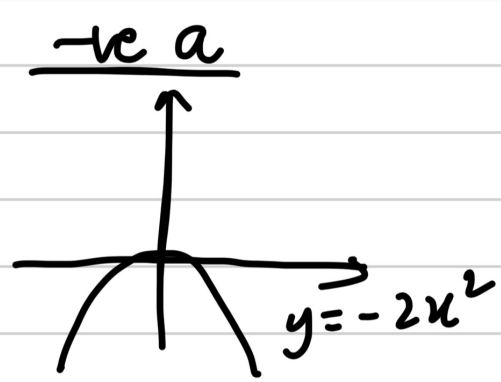
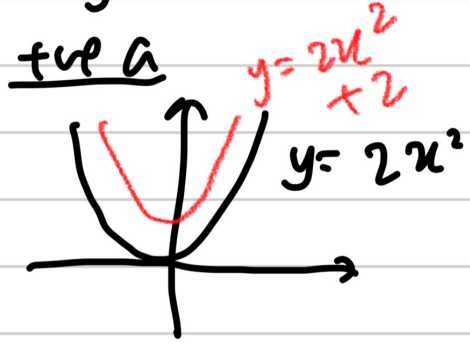
↪ have same gradient.

Chap 05 Graphs of Function & Graphical Solⁿ.

1) $y = ax^3$
+ve a



2) $y = ax^2$

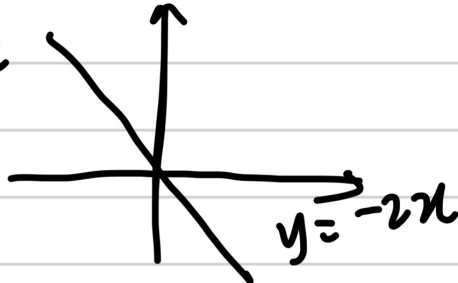


3) $y = ax$

+ve a



$y = 2x + 2$ -ve a

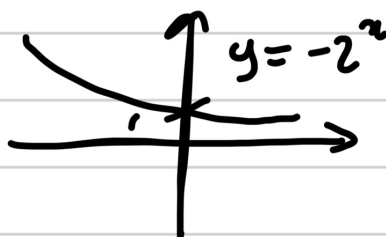


exponential

+ve

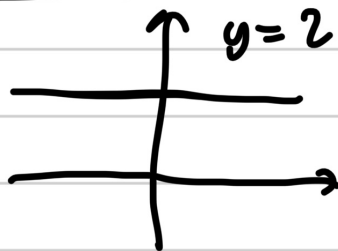


-ve



4) $y = a$

+ve a

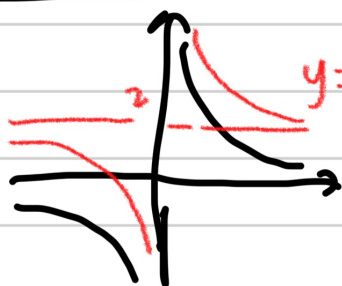


-ve a

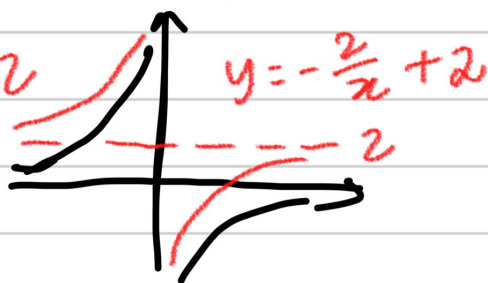


5) $y = ax^{-1}$ ($y = \frac{a}{x}$)

+ve a

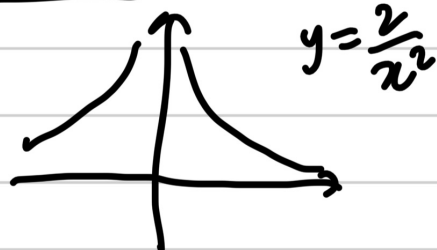


-ve a

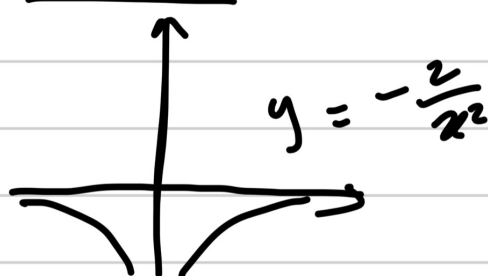


6) $y = ax^{-2}$ ($y = \frac{a}{x^2}$)

+ve a



-ve a



Chap 06 Further Trigo

① $\sin A = \sin (180 - A) \rightarrow \sin +ve$, $\angle$ obtuse/acute

② $\cos A = -\cos (180 - A) \rightarrow +ve = \text{acute}, -ve = \text{obtuse}$

Area of Δ

Area = $\frac{1}{2}$ (product of length of 2 sides) $\sin$ (included $\angle$)



$$Area = \frac{1}{2} bc \sin A$$

sine rule

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} \text{ or } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

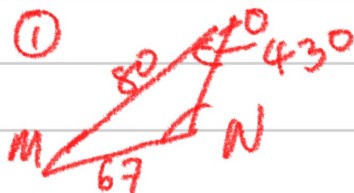
cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Δ For right Δ $\rightarrow$ TOA CAH SOH $\rightarrow$ Pythagoras' Theorem

on examples



$$\frac{\sin \angle ONM}{80} = \frac{\sin 43^\circ}{67}$$

$$\sin \angle ONM = 0.81433 \text{ (5sf)}$$

since $\sin \angle ONM$ is +ve,

$\angle ONM$ can be acute/obtuse $\angle$

$$\alpha = \sin^{-1}(0.81433)$$

$$= 54.521^\circ \text{ (3dp)}$$

$$\angle ONM = 54.5^\circ, 180^\circ - 54.521^\circ$$

$$= 54.5^\circ, 125.5^\circ$$

(rej), OM is the largest side
 $\angle ONM$ must be the largest $\angle$,
 $\therefore \angle ONM = 125.479^\circ$

$$\angle OMN = 180 - 125.479 - 43$$

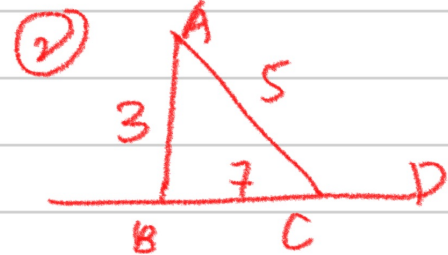
$$= 11.521 \text{ (3dp)}$$

using sine rule,

$$\frac{ON}{\sin 11.521} = \frac{67}{\sin 43}$$

$$ON = \frac{67}{\sin 43} \times \sin 11.521$$

$$= 19.6 \text{ m}$$



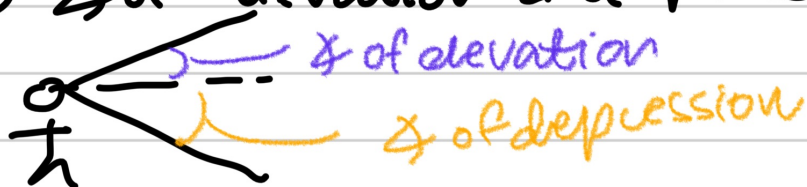
$$\begin{aligned}\sin \angle ACD &= \sin(180^\circ - \angle ACB) \\ &= \sin \angle ACB \\ &= \frac{3}{5}\end{aligned}$$

$$\begin{aligned}\tan \angle BAC &= \frac{4}{3} \\ &= 1\frac{1}{3}\end{aligned}$$

$$\begin{aligned}\cos \angle ACD &= -\cos(180^\circ - \angle ACB) \\ &= -\cos \angle ACB \\ &= -\frac{4}{5}\end{aligned}$$

Chap 07 Application of Trigu

① of elevation & depression



② Bearings

↳ clockwise direction

↳ if 2 digits, 08° or 1°

must add a 0 in front.

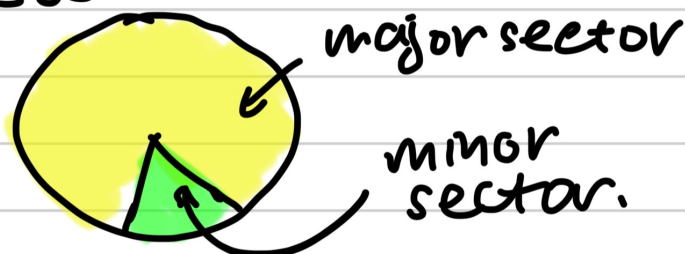
Chap 08 Arc Length, Sector Area, Radian Measure

① Arc length = $\frac{\theta}{360} \times 2\pi r$

② Area of sector = $\frac{\theta}{360} \times \pi r^2$

degree mode

③ Perimeter = $r + r + \frac{\theta}{360} \times 2\pi r$



$$2\pi \text{ radian} = 360^\circ$$

$$\pi \text{ radian} = 180^\circ$$

$$\frac{\pi}{2} \text{ radian} = 90^\circ$$

conversion b/w degree & radian

$$\text{① Arc length} = r\theta$$

$$\text{② Area of sector} = \frac{1}{2}r^2\theta$$

radian mode

Chap 9 Congruence & Similarity

congruency test

1) SSS

2) SAS

3) AAS

4) RHS $\rightarrow$ Right $\angle$, hypotenuse, side

S: Side

A: Angle

similarity test

1) AA

2) SSS

3) SAS

$$\hookrightarrow \frac{AB}{BC} = \frac{EF}{FC}$$

scale factor of enlargement > 1

scale factor of reduction < 1

$$\text{scale factor} = \frac{\text{final length}}{\text{orig length}}$$

Chap 10 Area & Vol. of Similar Fig & Solids

$$\text{① } \frac{A_2}{A_1} = \left(\frac{e_2}{e_1}\right)^2$$

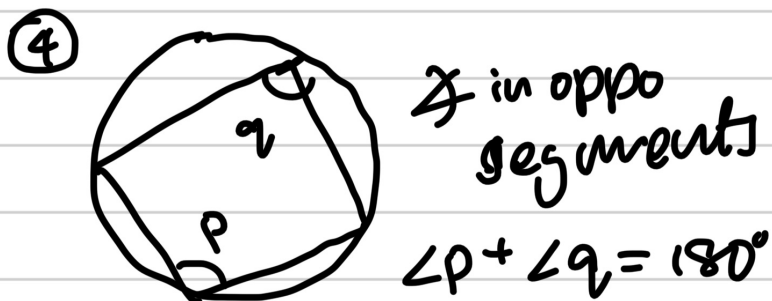
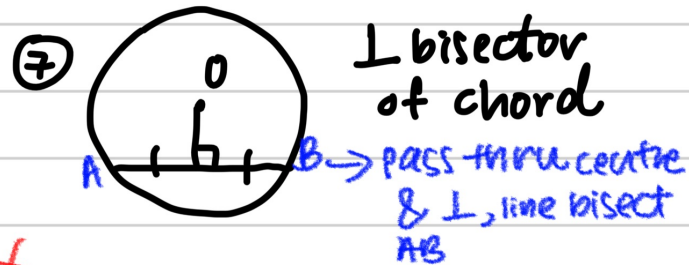
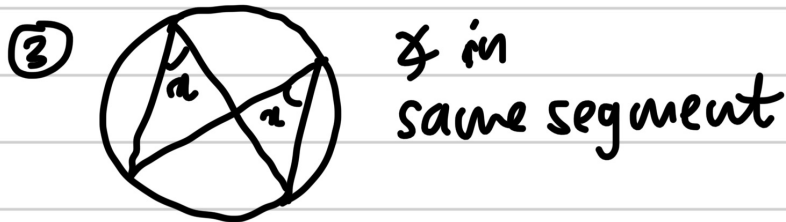
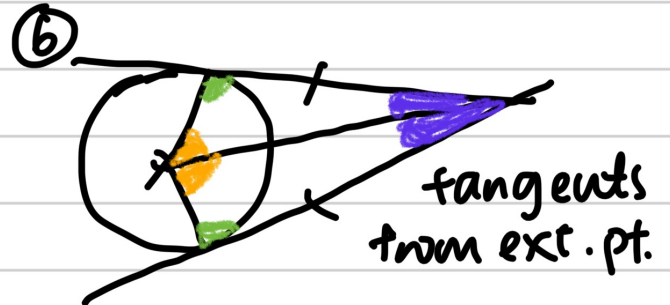
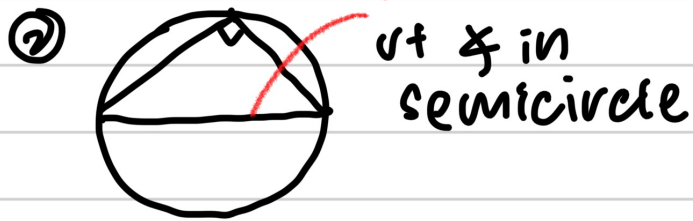
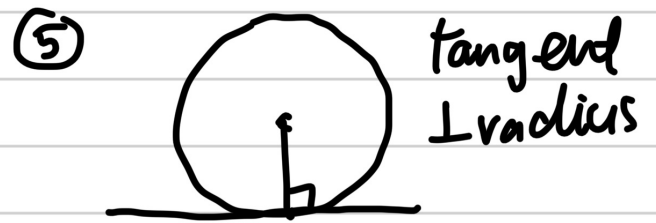
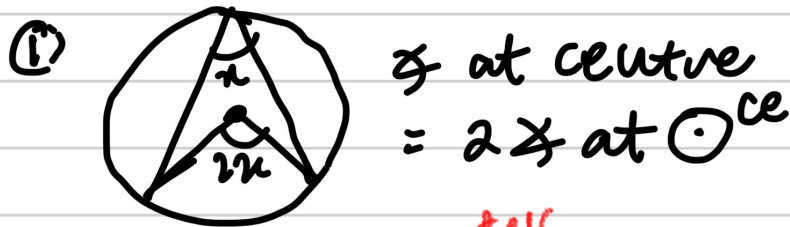
$$\text{② } \frac{A_2}{A_1} = \frac{b_2}{b_1}$$

$$\text{③ } \frac{V_2}{V_1} = \left(\frac{e_2}{e_1}\right)^3 \text{ and } \frac{m_2}{m_1} = \frac{V_2}{V_1}$$

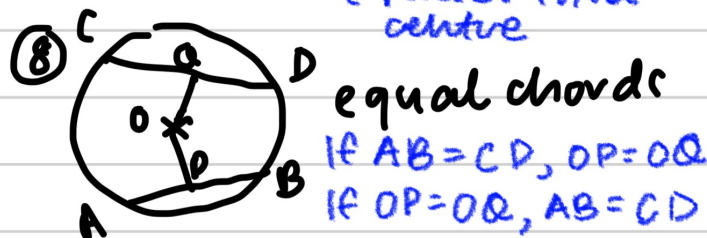
mass = m
volume = v



Chap II Geometrical Properties



$\rightarrow$ pass thru centre
& bisect, $\perp$ AB
 $\rightarrow$ bisect AB & $\perp$,
l passes thru
centre



Sec 4

chap 01: sets

notations

$\in$: element of

$\notin$: not an ele. of

$n(S)$: no. of ele in S

$\emptyset$: empty / null

$\mathcal{E}$: universal set

A' : prime, not in A

$\subset$: proper subset

$\subseteq$: subset

$\cup$: union

$\cap$: intersect

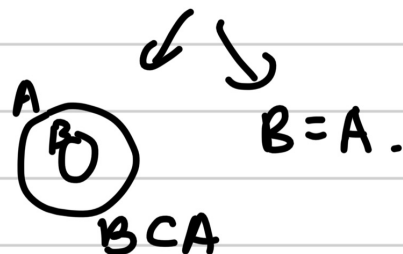
$\subset$ vs $\subseteq$

proper subset ($\subset$)

$\hookrightarrow B$ is a proper subset of A , every element of B is element of A & $B \neq A$

subset ($\subseteq$)

$\hookrightarrow$ can be less or equal to (B can be = to A)



describing sets :

1) words S is a set of...

2) list $S = \{ \dots \}$

3) Describe $S = \{ x : x \dots \}$

* $\emptyset$ is always a proper subset.

* $R\{\emptyset\}$ / $R = \{ \}$ $\leftarrow$ no ele. in R .

$\uparrow$ $\emptyset$ is an ele of R

Chap 02 Probability

$$P(E) = \frac{\text{no. of ele}}{\text{no. of ele in sample space}} = \frac{n(E)}{n(S)}$$

$$P(\text{not } E) = 1 - P(E)$$

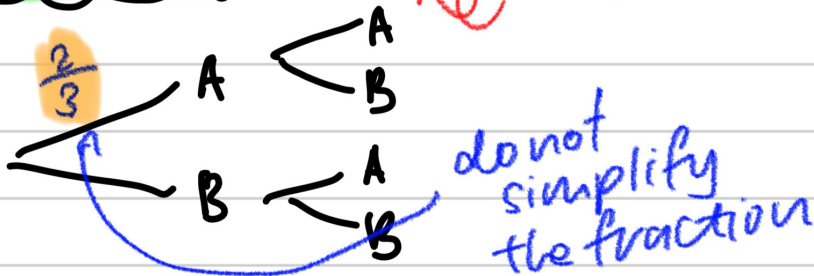
Probability diagrams

	H	T
H	(H, H)	(H, T)
T	(T, H)	(T, T)

or

+	1	2
1	2	3
2	3	4

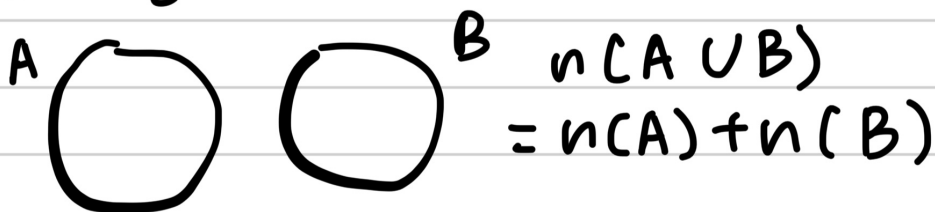
Tree diagram



* note if there is replacement or not.

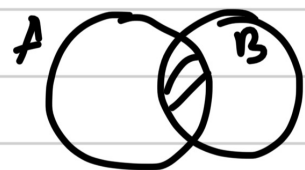
addition law

① disjoint sets



A & B X overlap
= mutually exclusive

② intersecting sets



$$n(A \cup B) \neq n(A) + n(B)$$

A & B overlap,
not mutually exclusive.

Chap 03 Statistical Data

Range

1, 2, 3, 4

$$\text{Range} = 4 - 1 = 3$$

* 25%, 50%, 75%

↳ use for continuous data (graph)

Interquartile & quartile range

6 | 21 | 22 | 23 | 25

Q_1 lower quartile

median

Q_3 upper quartile

$$\text{interquartile range} = Q_3 - Q_1$$

* use $\frac{n+1}{2}$ for discrete data

(40, 51, 57)

↳ To find median / IQR etc.

Percentiles

$$Q_1 = P_{25} \text{ (25th percentile)}$$

$$Q_2 = P_{50}$$

75% & below

$$Q_3 = P_{75} \leftarrow \frac{75}{100} \times [\text{tot. no.}]$$

commonly asked qz

Q: Why is it not poss to state the no. of men who did more than 8 pull ups?

no. of pull ups	freq
$x \geq 0$	230
$x \geq 8$	98
$x \geq 16$	27

A: freq table based on 'more than or equal to' freq. Since do not know the exact no. of men who did only more than 8 pull ups, not poss. to find no. of men that did more than 8 pull ups.

↳ state the evid!

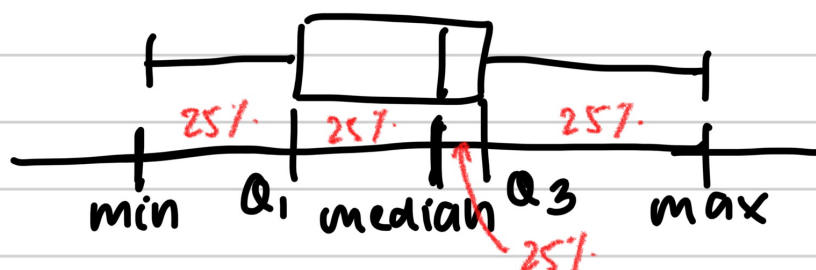
Consistency (median)

IQR: varied / consistent

mean / med: in general, on avg

→ (↑ IQR ↑, consistency ↓ (spread))

Box & Whiskers Plot



Standard deviation

$$SD = \sqrt{\frac{\sum fx^2}{\sum f} - (\bar{x})^2}$$
$$= \sqrt{\frac{\sum x^2}{n} - (\bar{x})^2}$$

Chap 04 Matrices

$$\begin{pmatrix} 1 & 1 \\ 14 & 3 \\ 5 & 2 \end{pmatrix} \begin{matrix} \text{row} & \text{column} \\ 3 \times 2 \end{matrix}$$

$[7] \neq 7$
matrix no.

→ square matrix: same no. of row & column

→ column matrix: 1 column

→ row matrix: 1 row

→ zero matrix: every ele is '0'

→ equal matrix: same order, corr. ele equal $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

matrix multiplication

$$\begin{pmatrix} 56 & 63 & 21 \\ 27 & 17 & 9 \end{pmatrix} \begin{pmatrix} 1.5 \\ 2 \\ 1.8 \end{pmatrix} = \begin{pmatrix} 247.8 \\ 90.7 \end{pmatrix}$$

Annotations: Red arrows show row 1 of the first matrix multiplying column 1 of the second matrix to get 247.8. Yellow arrows show row 2 of the first matrix multiplying column 1 of the second matrix to get 90.7. Labels '2x3' and '3x1' are under the matrices. A red arrow points to the result with the text 'must be same'.

addition / subtraction

$$\begin{pmatrix} 5 & 8 \\ 12 & 6 \end{pmatrix} + \begin{pmatrix} 0 & -3 \\ -4 & -\frac{7}{2} \end{pmatrix} = \begin{pmatrix} 5 & 5 \\ 8 & 9\frac{1}{2} \end{pmatrix}$$

2x2 2x2

$$\begin{pmatrix} -7 & 0 \\ 6 & 0 \end{pmatrix} - \begin{pmatrix} -7 \\ 6 \end{pmatrix} \neq$$

↑ not possible

scalar multiplication

$$2 \begin{pmatrix} 3 & 0 \\ 5 & 1 \end{pmatrix} + \begin{pmatrix} 10 & 8 \\ 9 & 2 \end{pmatrix}$$
$$= \begin{pmatrix} 6 & 0 \\ 10 & 2 \end{pmatrix} + \begin{pmatrix} 10 & 8 \\ 9 & 2 \end{pmatrix}$$
$$= \begin{pmatrix} 16 & 8 \\ 19 & 4 \end{pmatrix}$$

$$\begin{pmatrix} 56(1.5) + 63(2) + 1.8(21) \\ 27(1.5) + 17(2) + 9(1.8) \end{pmatrix}$$
$$= \begin{pmatrix} 247.8 \\ 90.7 \end{pmatrix}$$

2x1

Chap 05 Vectors

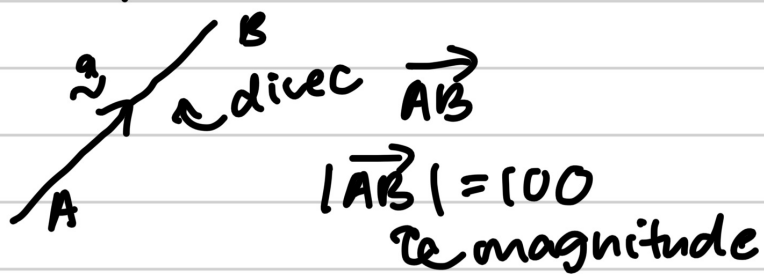
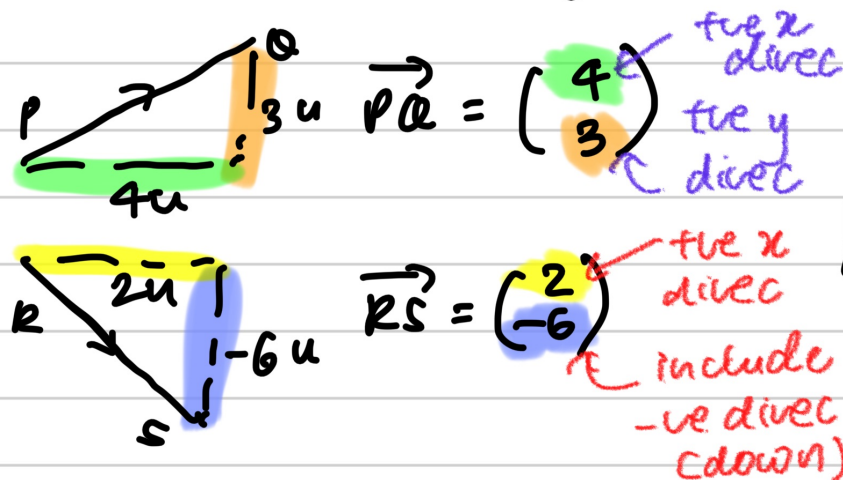


Diagram showing a vector $\vec{RS}$ from point R to point S. The vector has a horizontal component of $2u$ and a vertical component of $-6u$. The magnitude is calculated as $|\vec{RS}| = \sqrt{2^2 + (-6)^2}$.

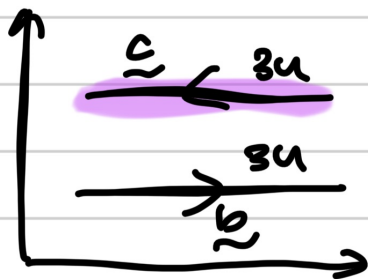


$$\begin{pmatrix} 2 \\ -6 \end{pmatrix} \neq \begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

downwards : -ve /
upwards : +ve
right : +ve /
left : -ve

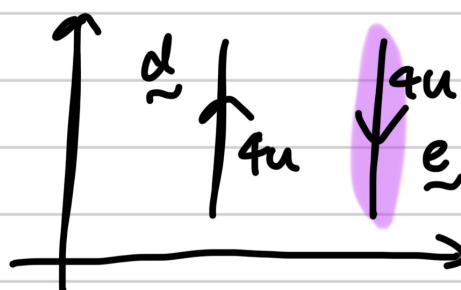
horizontal vector

$$\underline{b} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \quad \underline{c} = \begin{pmatrix} -3 \\ 0 \end{pmatrix}$$



vertical vector

$$\underline{d} = \begin{pmatrix} 0 \\ 4 \end{pmatrix} \quad \underline{e} = \begin{pmatrix} 0 \\ -4 \end{pmatrix}$$



equal vectors] rhombus / parallelogram

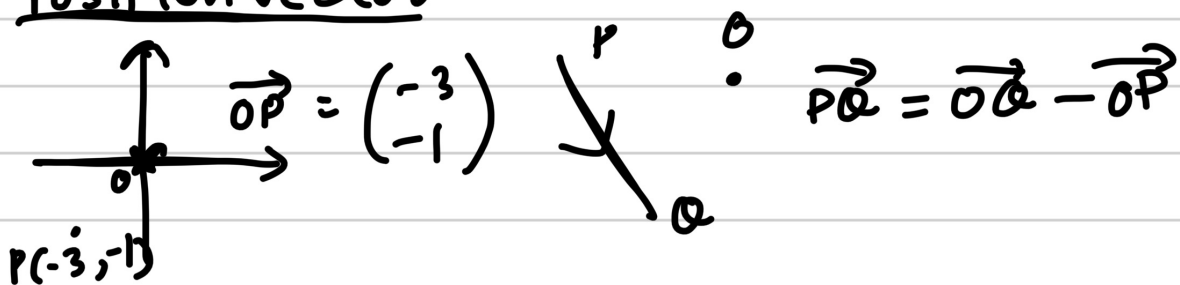
↳ same magnitude & direc

$$\underline{a} = \begin{pmatrix} a_1 \\ a_2 \end{pmatrix} \quad \underline{b} = \begin{pmatrix} b_1 \\ b_2 \end{pmatrix}$$

if $|\underline{a}| = |\underline{b}|$ then $a_1 = b_1$ & $a_2 = b_2$

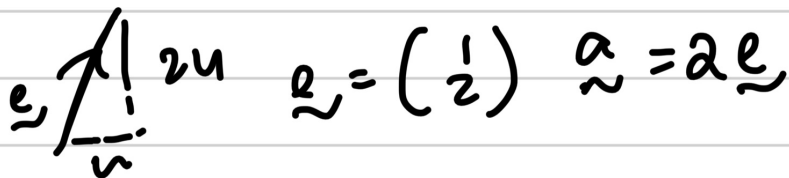
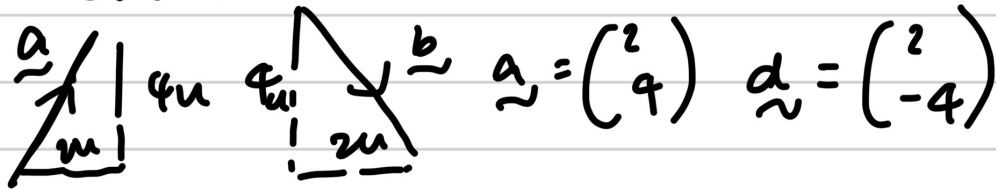
* magniequal but components may not be equal $\underline{a} \neq \underline{b}$

Position vector



Negative vector

↳ same magn, oppo
direc



Parallel Vector

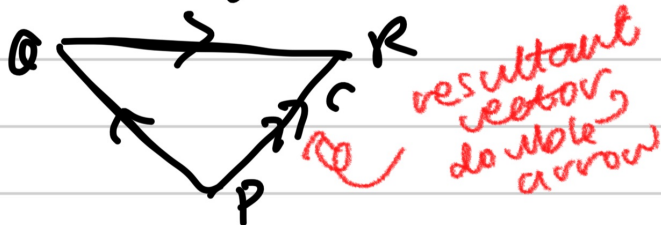
↳ same / oppo direc

$$|\vec{a} + \vec{b}| \neq |\vec{a}| + |\vec{b}|$$

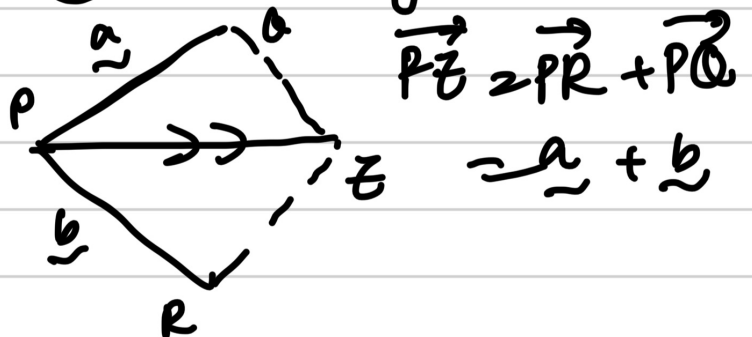
$$|\vec{a} - \vec{b}| \neq |\vec{a}| - |\vec{b}|$$

vector Addition

① Triangle Law

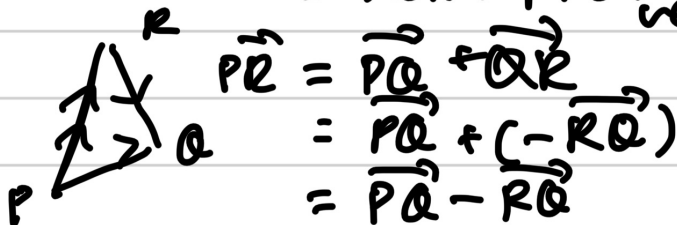
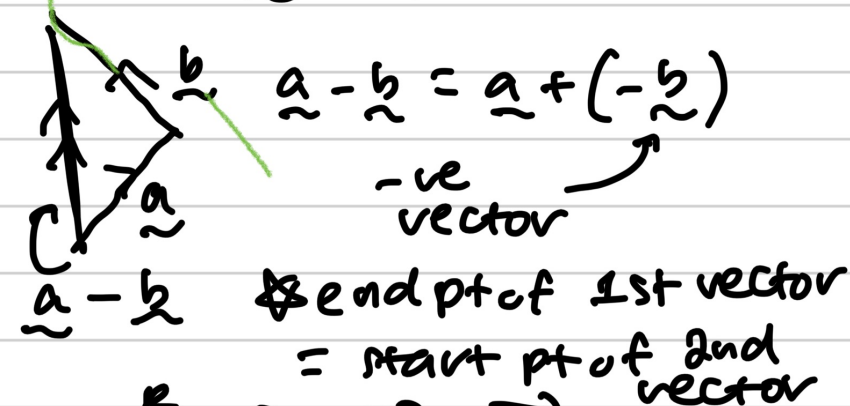


② Parallelogram Law

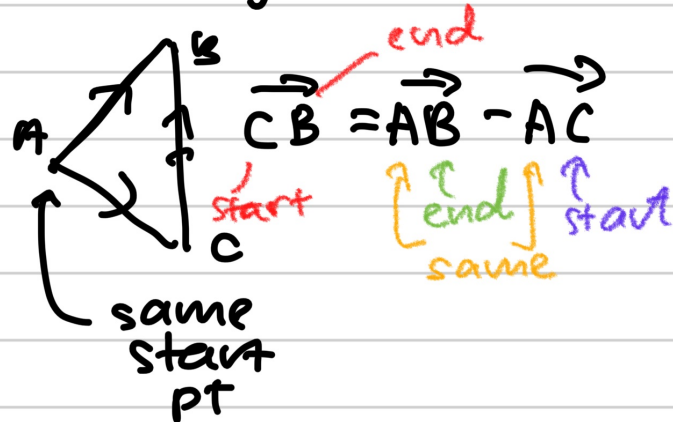


Vector subtraction

① Add -ve vector



② Triangle Law



Zero Vector

Zero vector is directionless

$$a + (-a) = 0 = (-a) + a$$

$$\text{ex } \begin{pmatrix} 8 \\ -1 \end{pmatrix} + \begin{pmatrix} -8 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

Scalar multiples of vector

equal vec: same mag & dir

-ve vec: same mag, oppo dir

// vec: diff mag, same dir

Showing // vectors

$$\text{ex } \begin{pmatrix} 6 \\ -9 \end{pmatrix} = 3 \begin{pmatrix} 2 \\ -3 \end{pmatrix}$$

$$\text{since } \begin{pmatrix} 6 \\ -9 \end{pmatrix} = 3 \begin{pmatrix} 2 \\ -3 \end{pmatrix}$$

$\begin{pmatrix} 6 \\ -9 \end{pmatrix}$ & $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ are // vectors

$$\underline{a} = k \underline{b}$$

$$\begin{pmatrix} 14 \\ 18 \end{pmatrix}, \begin{pmatrix} -7 \\ 9 \end{pmatrix}$$

$$\begin{pmatrix} 14 \\ 18 \end{pmatrix} = k \begin{pmatrix} -7 \\ 9 \end{pmatrix}$$

$$\begin{pmatrix} 14 \\ 18 \end{pmatrix} = \begin{pmatrix} -7k \\ 9k \end{pmatrix}$$

$$k = 2, k = -2$$

since no constant k such that

$$\begin{pmatrix} 14 \\ 18 \end{pmatrix} = k \begin{pmatrix} -7 \\ 9 \end{pmatrix}$$

$$\begin{pmatrix} 14 \\ 18 \end{pmatrix} \text{ \& } \begin{pmatrix} -7 \\ 9 \end{pmatrix}$$

are X // vectors

Proving that O, P, X collinear

$$1. \text{ proof } \vec{OP} = k \vec{OX}, \vec{OX} // \vec{OP}$$

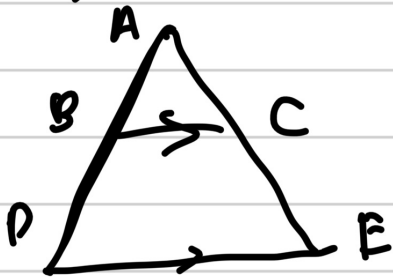
2. common pt is O, $\therefore$ O & P & X collinear

Finding Area in Vectors

A) Similar $\triangle$

B) Same $\perp$ height

A) Similar $\triangle$



Since $\triangle ABC$ & $\triangle ADE$ are similar

$$\begin{aligned}\frac{\text{Area } \triangle ABC}{\text{Area } \triangle ADE} &= \left(\frac{AB}{AD}\right)^2 \\ &= \left(\frac{AC}{AE}\right)^2 \\ &= \left(\frac{BC}{DE}\right)^2\end{aligned}$$

$$\therefore \frac{AB}{AD} = \frac{AC}{AE} = \frac{BC}{DE} \quad / \quad \frac{AB}{BD} = \frac{AC}{CE}$$

B) Same $\perp$ height



$$\frac{\text{Area } \triangle PQR}{\text{Area } \triangle PRS} = \frac{\frac{1}{2} \times QR \times h}{\frac{1}{2} \times RS \times h} = \frac{QR}{RS}$$

$$\frac{\text{Area } \triangle PQR}{\text{Area } \triangle PQS} = \frac{\frac{1}{2} \times QR \times h}{\frac{1}{2} \times QS \times h} = \frac{QR}{QS}$$

$$\frac{\text{Area } \triangle PRS}{\text{Area } \triangle PQS} = \frac{\frac{1}{2} \times RS \times h}{\frac{1}{2} \times QS \times h} = \frac{RS}{QS}$$