* higher SD =

1. higher spread of data
2. higher variability of data
3. lower consistency of data

Indices

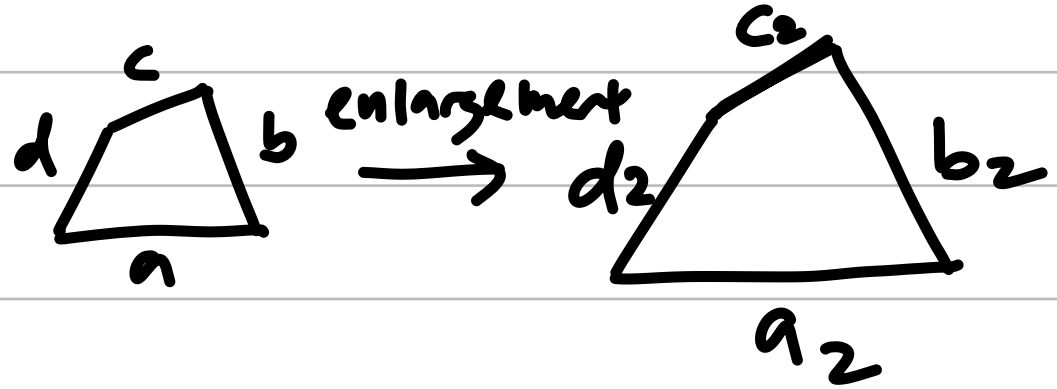
1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $(ab)^n = a^n b^n$
5. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
6. $a^0 = 1$
7. $a^{-n} = \frac{1}{a^n}$
8. $a^{\frac{1}{n}} = \sqrt[n]{a}$
9. $a^{\frac{m}{n}} = (\sqrt[n]{a})^m = \sqrt[n]{a^{mn}}$

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

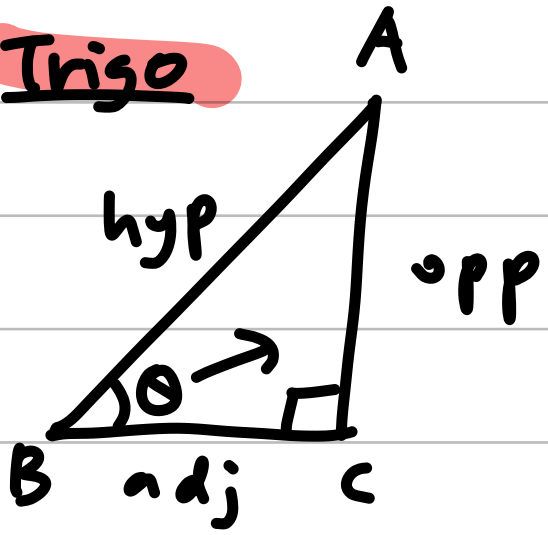
- A_n: total $ including interest
- P: principal
- r: interest
- n: time

Scale factor — Enlargement/reduction of a plane figure

$$\text{scale factor} = \frac{\text{enlarged/reduced length of a side}}{\text{original length}}$$



Trigo



$$\text{ToA} = \tan\theta = \frac{\text{opp}}{\text{adj}} \qquad \text{SoH} = \sin\theta = \frac{\text{opp}}{\text{hyp}}$$

$$\text{CAH} = \cos\theta = \frac{\text{adj}}{\text{hyp}}$$

when finding acute ∠s:

- $\sin(180^\circ - \theta) = \sin\theta$
  - ↳ e.g. find the value of $\sin 110^\circ$,

$$\sin 110^\circ = \sin(180 - 110)^\circ$$
$$= 0.940 \text{ (3s.f.)}$$

- $\cos(180^\circ - \theta) = -\cos\theta$

↳ e.g. find the value of $\cos 140^\circ$

$$\cos 140^\circ = -\cos(180 - 140)$$
$$= -0.766 \text{ (3s.f.)}$$

When finding obtuse ∠'s:

- $\sin\theta$ is positive & $\cos\theta$ is negative

e.g. it is given that $0°<\theta<180°$ find the values of $\cos\theta=-0.763$ & $\sin\theta=0.5$

$\cos\theta=-0.763$

$\theta=\cos^{-1}(-0.763)$

Since $\sin\theta$ is positive, θ is either acute/obtuse

$\sin\theta=0.5$

$\theta=\sin^{-1}(0.5)$

$=30°$ ✗

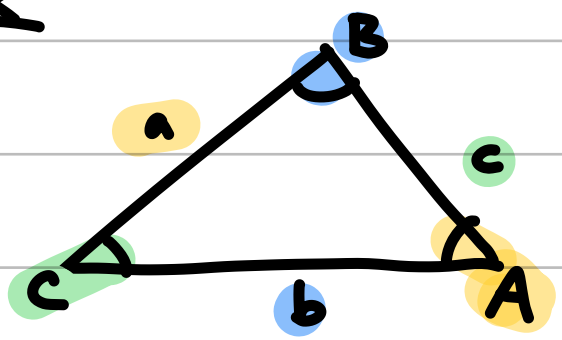
OR

$\theta=(180-30)°$

$=150°$ ✗

area non right ∠

$\Delta=\frac{1}{2}ab\sin C$



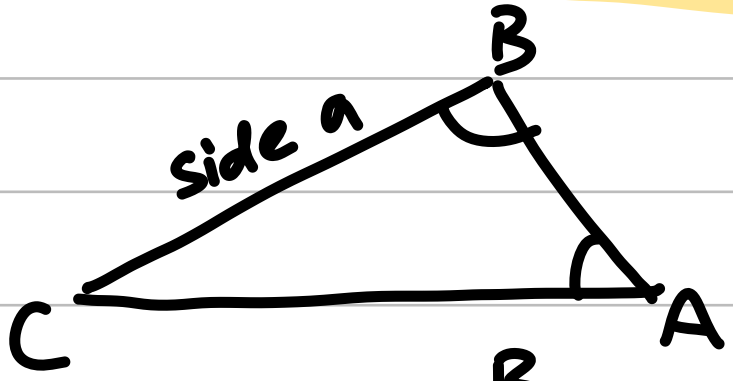
Sine rule

↳ used 2 find unknown sides/∠s if hv:

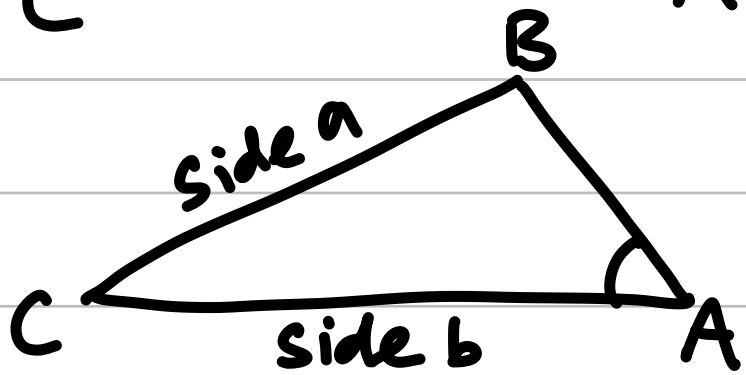
① one side + 2 ∠s

② 2 sides + 1 non-included ∠

①



②



$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ → finding unknown side

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin c}{c}$ → finding unknown ∠

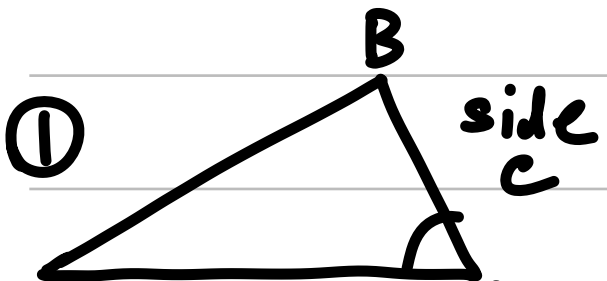
cosine rule → $c^2 = a^2 + b^2 - 2ab\cos C$

↳ used 2 find unknown side/∠ if hv

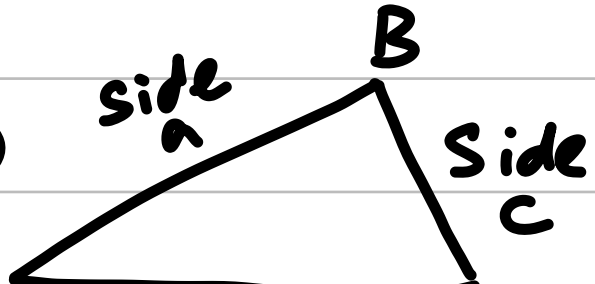
① 2 sides + 1 included ∠

② all 3 sides of △

①



②



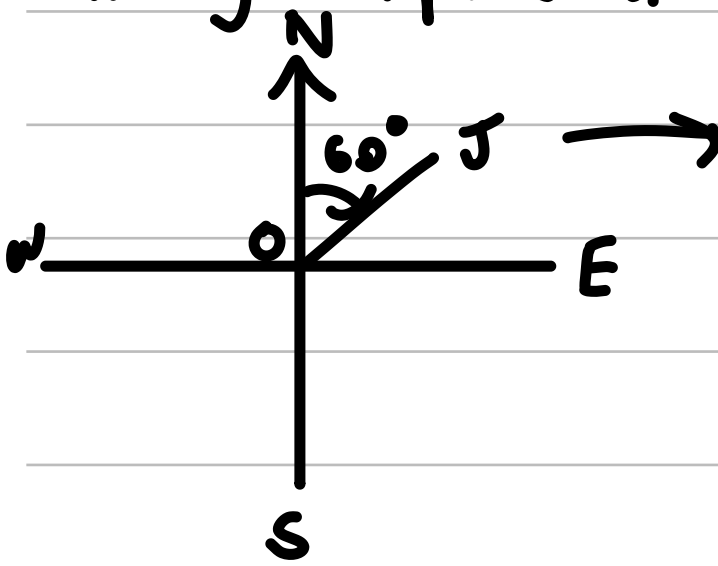
C side b A

C side b A

Bearings

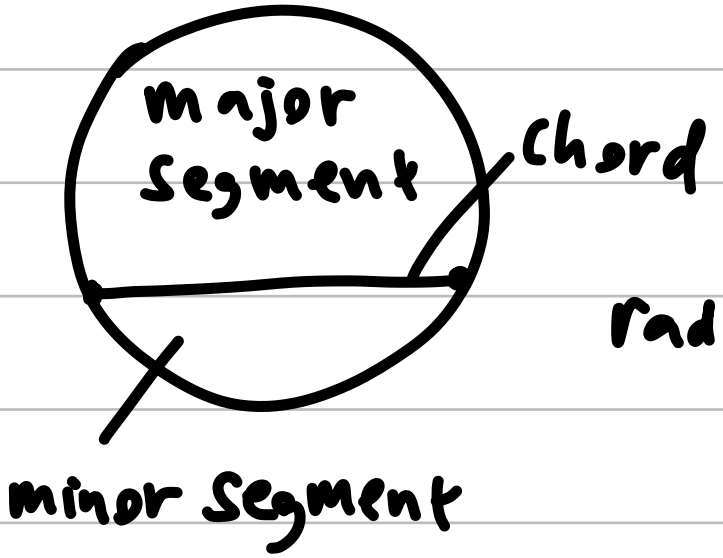
e.g. 040°/043.5°

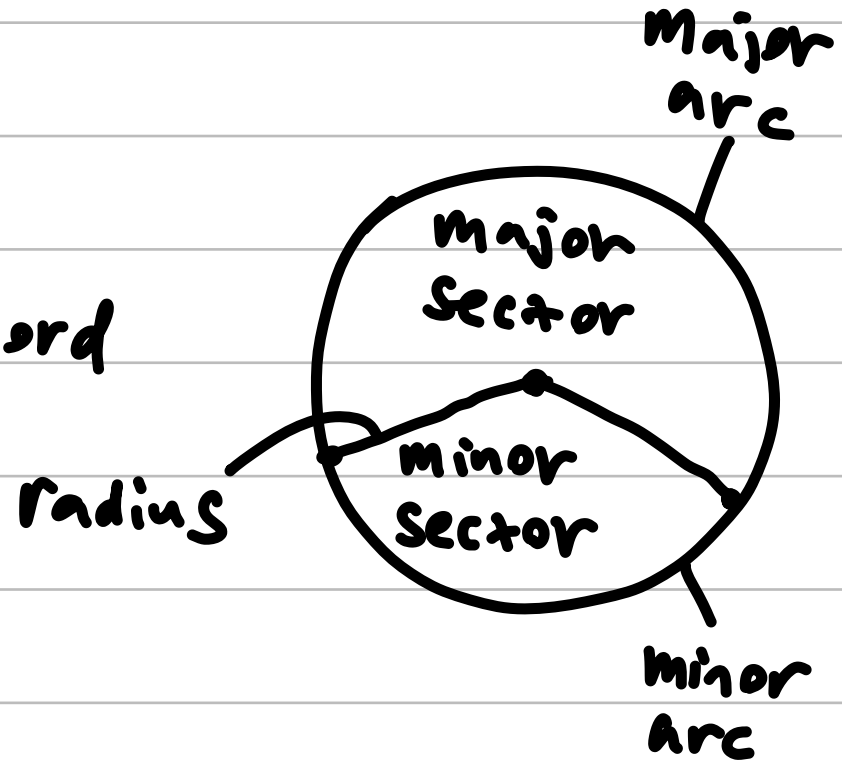
- always expressed as a 3 digit no.

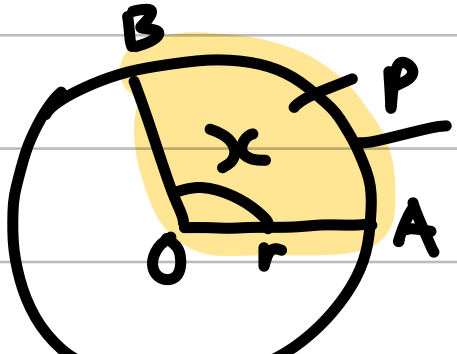


→ bearing of J frm O = 060°

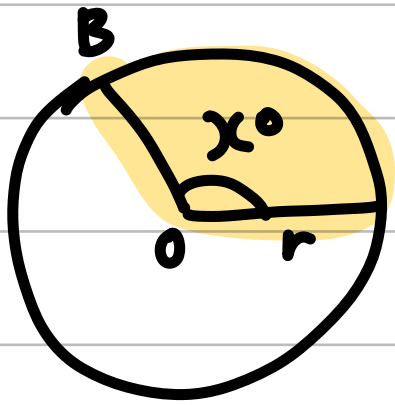
Arc lengths







- arc length $= \left(\frac{x}{360}\right)^\circ \times 2\pi r$



- sector area $= \left(\frac{x}{360}\right)^\circ \times \pi r^2$

$\theta = \frac{\text{arc length}}{r}$

(in radians)

- π rad $= 180^\circ$
- 1 rad $= \frac{180^\circ}{\pi}$
- $1^\circ = \frac{\pi}{180}$ rad

↓

e.g. express $\frac{5\pi}{6}$ rad into degrees

↳ 1 rad $= \frac{180^\circ}{\pi}$

$\frac{5\pi}{6}$ rad $= \frac{5\pi}{6} \times \frac{180^\circ}{\pi}$

$= 150^\circ$

* set calculator 2 rad mode b4 this

↓

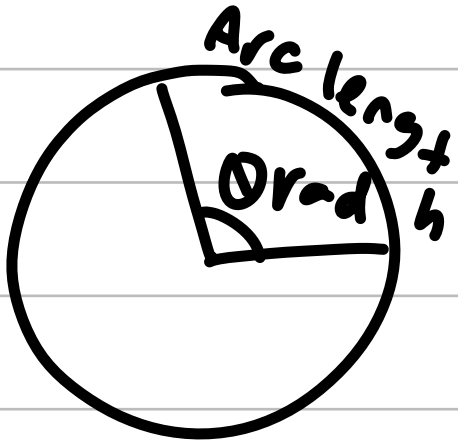
e.g. express 320° in rad

$1^\circ = \frac{\pi}{180}$ rad

$320^\circ = \frac{\pi}{180} \times 320^\circ$

$= 5.59$ rad

★ set calculator 2 degree mode b4 this



- Arc length (in rad) $= r\theta$

- sector area (in rad) $= \frac{1}{2}r^2\theta$

Data analysis

- range = largest value − smallest value (in a data set)

e.g. find the range of the following set of data

A: 16, 17, 18, 19, 20

range of A $= 20 - 16 = 4$

- range = largest end point − smallest end point of all intervals

(grped data set w class intervals)

e.g. the table shows da distribution of 50 tkbks

mass (x kg)	$300 < x \leq 500$	$500 < x \leq 700$	$700 < x \leq 900$	$900 < x \leq 1100$

frequency	8	17	22	3

find the range of the data

↳ (1100 − 300) kg = 800 kg ✗

- mean = avg = $\frac{\text{total values}}{\text{total no. values}}$

↓

e.g. find the mean of A: 1, 2, 3, 4, 5, 6

→ $\frac{1+2+3+4+5+6}{6} = 3.5$ ✗

- median = middle value in orderd data set

spliting data into 2 equal halves

↓

1. arrange data in ascending order
2. count no. values (n)
3. if n = odd, median = middle no.

$= \frac{n+1}{2}$

4. if n = even, take the 2 middle values

& ÷ by 2

e.g. find the median of da data showing no. hrs

9 students studied in a week: (odd version)

4, 2, 7, 5, 9, 3, 10, 6, 8 } step ①

2, 3, 4, 5, 6, 7, 8, 9, 10

no. values = 9 (odd) (n)

$\therefore \frac{n+1}{2} = \frac{9+1}{2} = 5 \rightarrow$ 5th value in set

5th value = 6 ✗

e.g. find the median of 9 hrs studying in a week = 4, 2, 7, 5, 9, 3, 10, 6, 8, 11 (even version)

2, 3, 4, 5, 6, 7, 8, 9, 10, 11 (step ①)

no. values = 10 (even) (n)

6 & 7 middle values $\therefore$ median $= \frac{6+7}{2}$

$= 6.5$ ✗

- mode → no. that occurs most often

- Cumulative frequency diagrams

Consider the distribution of daily wages of 45 workers

Daily wages ($x)	frequency
$100 < x \leq 105$	4
$105 < x \leq 110$	10
$110 < x \leq 115$	22
$115 < x \leq 120$	9

Daily wages ($x)	Cumulative frequency
$x \leq 100$	0
$x \leq 105$	4
$x \leq 110$	14
$x \leq 115$	36
$x \leq 120$	45

+4
+10
+22
+9

- interquartile range = upper − lower quartile

e.g. 16, 17, 18, 19, 20, 21, 22, 23, 23, 24, 40

↳ ① list in ascending order

② find median = 21 (Q2)

③ lower quartile = middle value of left side of median − Q1

④ upper quartile = middle value of right side of median - Q3

④ Q3 − Q1 = interquartile range

16, 17, 18, 19, 20, 21, 22, 23, 23, 24, 40

(18, 19, 20 = Q1; 21 = Q2; 22, 23, 23, 24, 40 = Q3)

∴ 23 − 18 = 5 ✗

Percentiles

Q1 - lower quartile = 25 %

Q2 - median = 50 %

Q3 - upper quartile = 75 %

Standard deviation (SD)

- greater spread of data frm mean = larger SD
- smaller spread of of this ↑ = smaller SD

$\bar{x}$ → mean

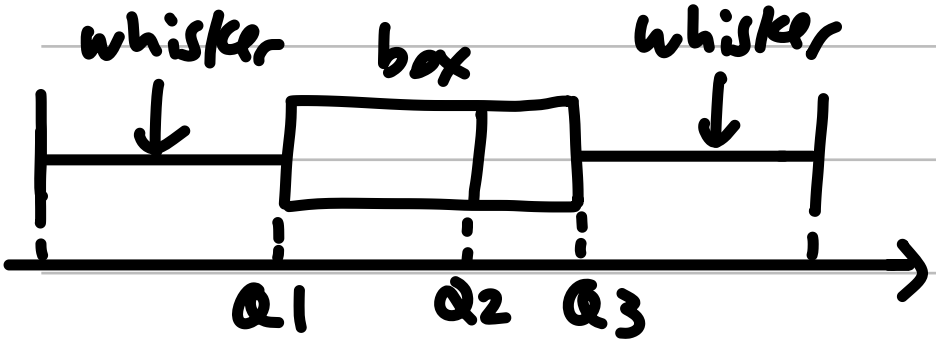
Σx → sum of x (all the no.s)

$\bar{0}x \rightarrow SD$

- Calculator method : (fx-975GX)

1. menu setup
2. no. 3 (statistics) } fm inside this
3. press no. 1 → 1-variable
(turn on frequency : press shift, menu setup press down, 2 : statistics)
4. 2 get ans : press OPTN, 3 : 1-variable 3 calculations

box & whisker plot



Congruence & Similarity

↳ Same shape & size (5 tests)

↗ Same shape diff size (3 tests)

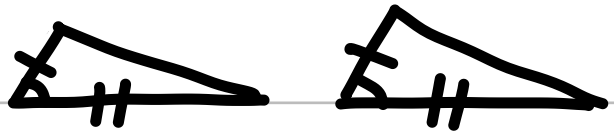
↓

↳ s equal &

Sides proportional

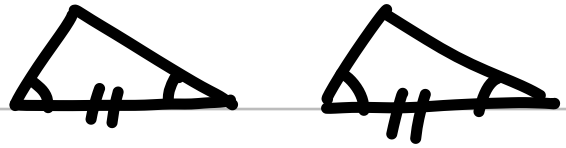
congruence tests:

1. SSS – all 3 sides of △ equal
2. SAS – 2 sides + 1 ∠ equal another △

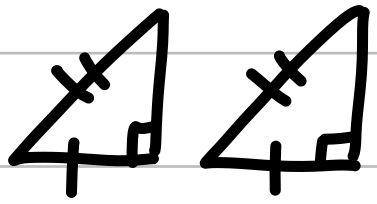


3. AAS – 2 ∠s + 1 non-included side =

4. ASA – 2 ∠s + 1 included side



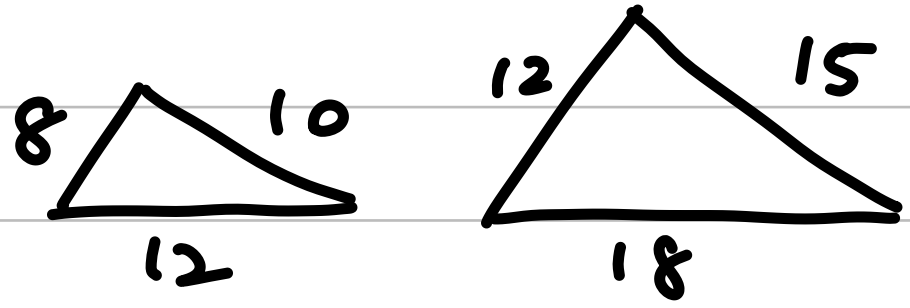
5. RHS – hyp + 1 side = another △



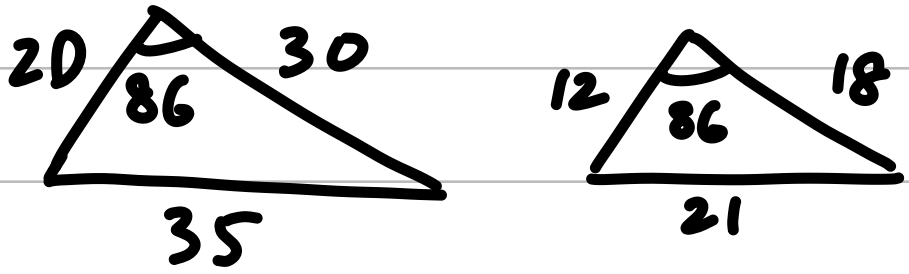
Similarity tests

1. AA – 2 ∠s = another △

2. SSS – all 3 sides of △ proportional 2 another △



3. SAS – 2 sides proportional 2 another △ & included ∠s equal



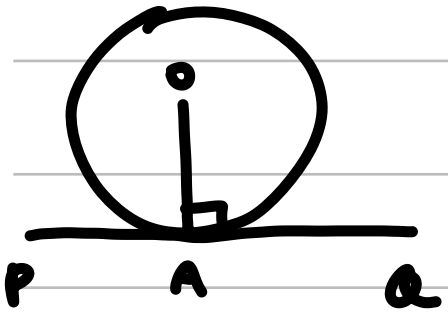
- ratio of areas = $\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$

volume (V1) volume (V^2)

$$\frac{v_1}{v_2} = \left(\frac{l_1}{l_2}\right)^3$$

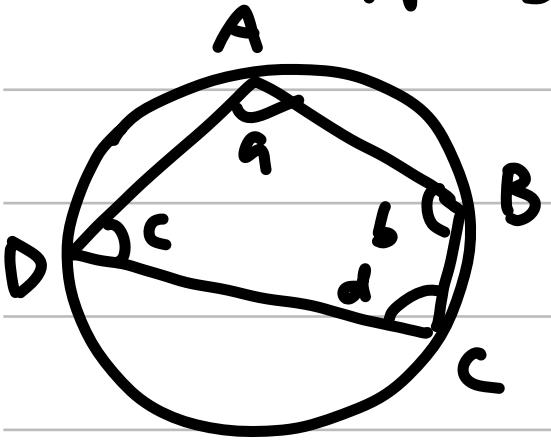
Circle properties – 8

1. tangent ⊥ radius



→ PQ ⊥ OA, whr PQ tangent 2 circle at A

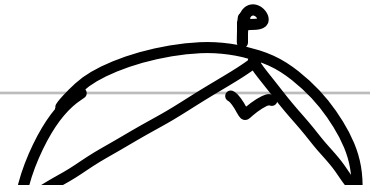
2. ∠s in opp segments r supplementary

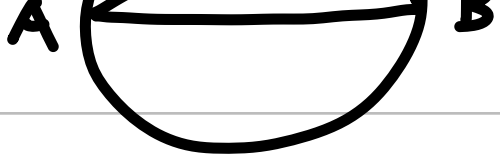


$\angle DAB + \angle DCB = 180°$

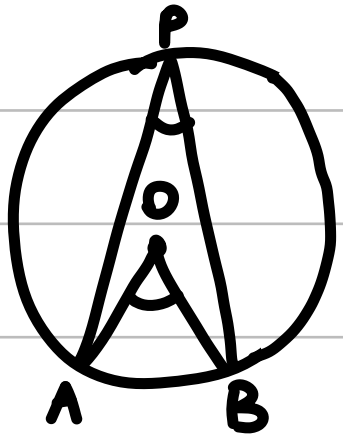
$\angle ABC + \angle ADC = 180°$

3. ∠s in ⌓ = 90°



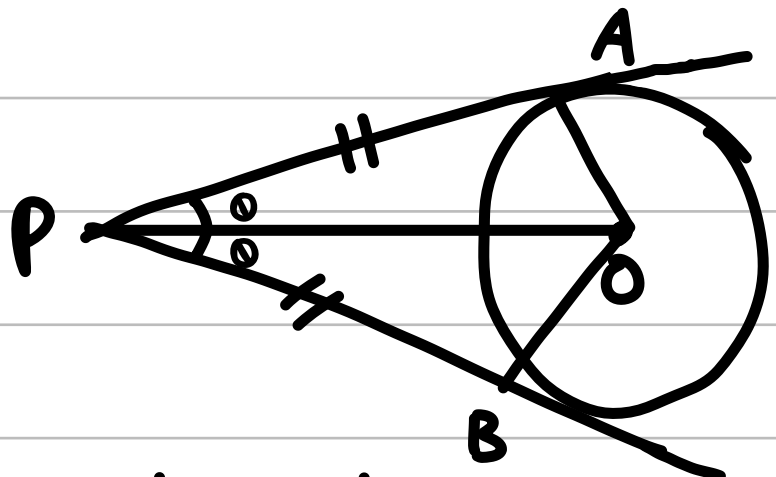


4. ∠ at centre 2x ∠ at circumference



$\angle AOB = 2 \times \angle APB$

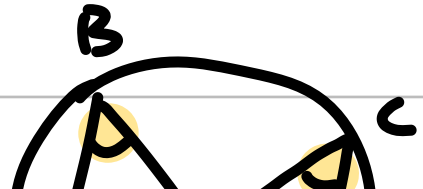
5. tangent frm ext. point



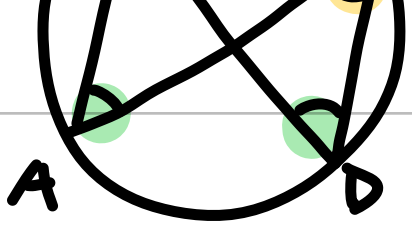
PA = PB whr PA & PB r tangents 2 OA n B

$\angle APO = \angle BPO$

6. ∠s in same segment

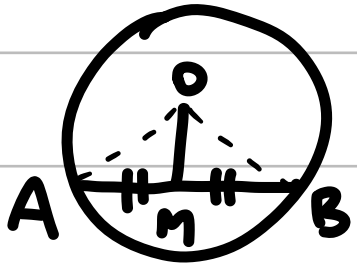


$\angle ABD = \angle ACD$



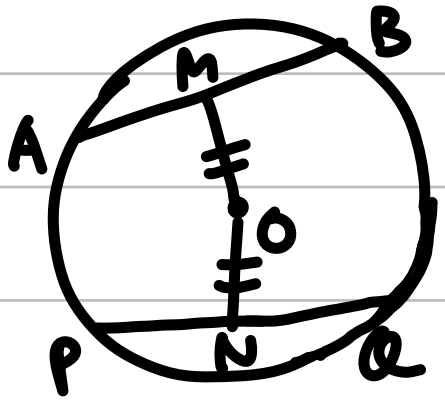
$\angle BAC = \angle BDC$

7. pependicular bisector of chord



OM pependicular 2 AB ∴
AM = MB

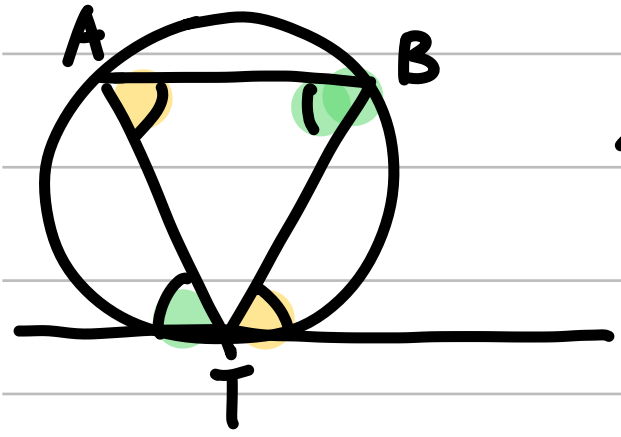
8. Equal chords



AB = PQ

OM = ON

9. tangent chord theorem / alt. seg. theorem



∠ between tangent & TB
$= \angle TAB$

converting units

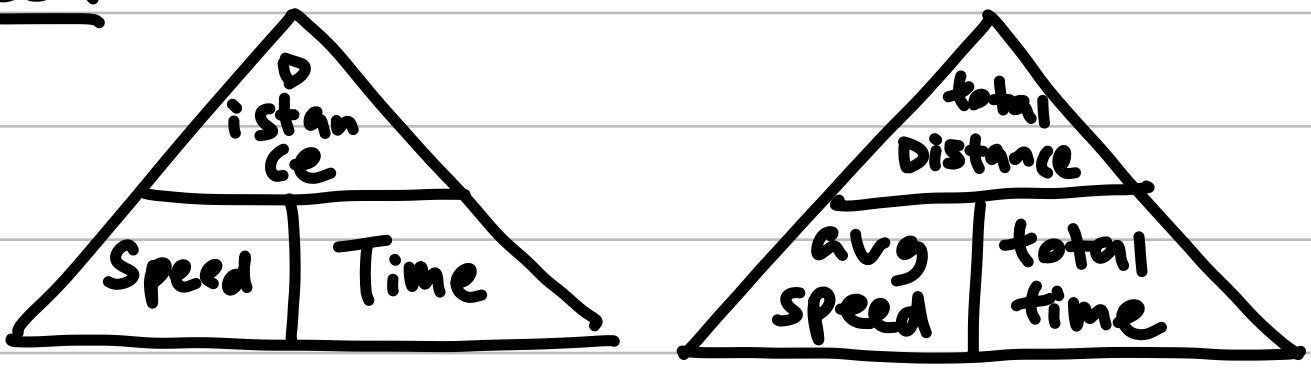
$1\ m/s = 3.6\ km/h$

e.g. convert 100 km/h into m/s

$100\ km/h = \frac{100\,000\ m}{3600\ s}$ (1 km = 1000 m) (1 hr = 3600 s)

$= 27.8\ m/s$ (3 s.f.)

speed



algebraic identities

expansion

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $a^2 - b^2 = (a+b)(a-b)$

quadratic equation

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

e.g. Solve $3x^2 - 2x - 8 = 0$

$3x^2 - 2x - 8 = 0$

$(3x + 4)(x - 2) = 0$

$3x + 4 = 0$ or $x - 2 = 0$

$3x = -4$ or $x = 2$ ✗

$x = -\frac{4}{3}$

$x = -1\frac{1}{3}$ ✗

Set language & notation

- elements = objects in a set
- empty set = $\emptyset$ / $\{\}$ aka null set
- infinite set = all uncountable no. elements
- finite set = contains countable no. elements
- $\in$ = element of
  - ↳ $a \in \mathbb{Q}$ → a element of $\mathbb{Q}$
- $\notin$ = not element of
- $n(O)$ = no. of elements in a set
  - ↳ e.g. $n(\mathbb{Q})$ = no. elements in set $\mathbb{Q}$

- equal sets = when 2 sets contain same elements
  - e.g. $A = \{1,2,3\}$ $B = \{3,2,1\}$

subset ($\subseteq$) vs proper subset ($\subset$)

e.g. all elements in A = B

whether its $A = \{1,2\}$ or $A = \{1,2,3\}$

$B = \{1,2,3\}$

$\therefore A \subseteq B$

e.g. every element of A is in B but A not equal to b

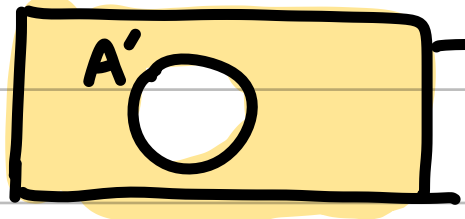
in $A = \{1,2\} \rightarrow A \subset B$

in $A = \{1,2,3\}$ A not $\subset$ B

basically elements in A can only b apart of B but elements in B can't b apart in A

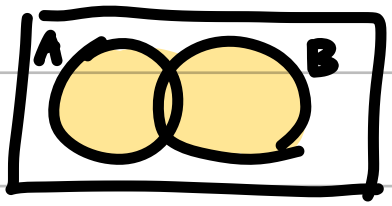
Complement = outside

e.g. A'



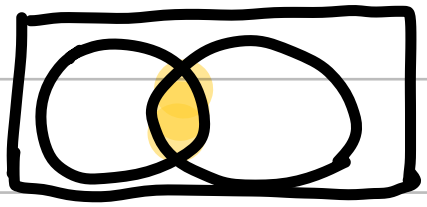
A' = everything outside A shaded

union = everyt tgt

e.g. $A \cup B$ 

= A & B r shaded

intersection = only the part that meets

e.g. $A \cap B$ 
= in between A & B shaded

Simple Interest : $I = \frac{PRT}{100}$

I ↙ interest

P: principal

R: rate of interest per yr

T: time (no. yrs)