Chapter 1 Quadratic Equations

1.1

- Quad expression = ax^2+bx+c

Ways to solve quad equations

- factoring (Y2)
- completing the square
- Quad formula

1.1 *

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

follow sign; always −

Completing square

- make $a=1$
- put in completed square form
- put x on one side, other values on other side
- square root both sides
- solve ☺

example

$$(x+p)^2-q=0$$
$$(x+p)^2=q$$
$$x+p=\pm\sqrt{q}$$
$$x=\pm\sqrt{q}-p$$

1.2

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

discriminant b^2-4ac

Quadratic formula

- Sub in a, b, c values
- find x ☺

Sketching Quad graphs

- 2 forms $(x-p)(x-q)$ factor form
  $(x-h)^2+k$ vertex form

* 5 things to find
  - shape $a>0, \cup$ $a<, \cap$
  - x-intercept
  - y-intercept
  - line of symmetry
  - turning point

* vertex form

$y = -(x-h)^2+k$

- shape + or − (+ ∪, − ∩)
- turning point h, k
- y-intercept: sub $x=0$
- x-intercepts: sub $y=0$

example

$y = 2(x+4)^2-3$ ∪

swap sign! keep sign

turning point = $-4, -3$

factor form

$y = -(x-p)(x-q)$

- shape: + or − (+ ∪, − ∩)
- x-intercepts: p and q
- y-intercept: pq (sub $x=0$)
- line of symmetry: $\frac{p+q}{2}$ (turning point x)
- turning point: sub line of symm to find y of turning point

1.4 fractional equations

- Denominators cannot be 0, so solutions of x cannot make denominator 0. Check them in workings!

example

$$\frac{1}{x+4} = 0$$

Denominators cannot be 0

$x+4 \neq 0$

$x \neq -4$

Chapter 2 Linear Inequalities

Inequality Signs (Y2)

- $>$ greater than
- $\geqslant$ greater than or equal to
- $<$ less than
- $\leqslant$ less than or equal to

2.2

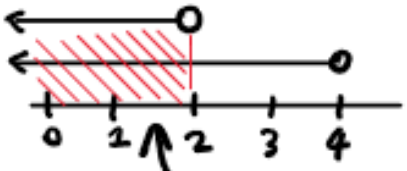
- Solve **simultaneous inequalities** like normal ones

e.g. $2x+3<5$

$x-7>13$

Solved cases

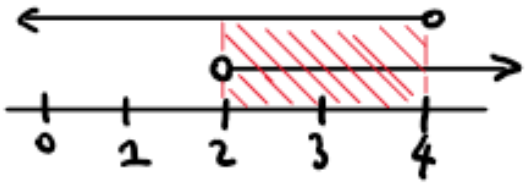
1. $x<2$ and $x<4$



answer is where they **overlap**

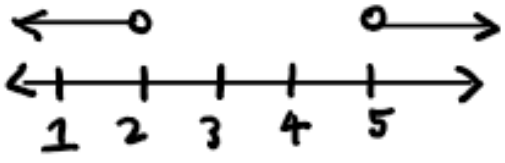
$x<2$

2. $x<4$ and $2<x$



$2<x<4$

3. $2<x$ and $x>4$



x has no solutions

Chapter 3 Indices

3.1 - 3.4

Laws of Indices

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

   $a^{-n} = \frac{1}{a^n}$
8. $a^{\frac{1}{n}} = \sqrt[n]{a}$

   $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$
9. if $a^x = a^y$, $x = y$

Terms

Base a

Power n a^n ↖ index notation

3.5 Standard form

$a \times 10^n$ is standard form

e.g. 3.69×10^6

$1.5 \times 10^8 = 1.50000000.$ (8 moves of d.p.)

$1.5 \times 10^{-3} = 0.0015$ (3 moves of d.p.)

Move ← if exponent is positive

Move → if exponent is negative

Prefixes

10^{-12}	trillionth	pico	p
10^{-9}	billionth	nano	n
10^{-6}	millionth	micro	μ
10^{-3}	thousanth	mili	m
10^{-2}	hundredth	centi	c
10^{-1}	tenth	deci	d
10^{0}	one		
10^{3}	thousand	kilo	k
10^{6}	million	mega	b
10^{9}	billion	giga	G
10^{12}	trillion	tera	t

3.6 Intrest

Simple Intrest

$$\text{Intrest gained} = \text{Principal} \times \text{Rate} \times \text{Time}$$

$$I = PRT$$

Compound intrest

$$\text{Total Money} = \text{Principal} \times \left(1 + \text{Rate}\right)^{\text{Time}}$$

$$M = P(1+R)^{T}$$

R is in %

- Compounded yearly or twice yearly

example

4% compounded twice yearly

=

2% every 6 months, for x years

Chapter 4 ines

4.1 Gradient

Formulas

4.1 • **gradient** $\frac{y_2 - y_1}{x_2 - x_1}$

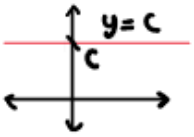
Cases

- —— 0
- ／ 1
- | undefined

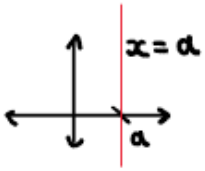
4.3 • **length** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ pythagoreas 

4.2 Equation of line

$y = mx + c$ gradient – intercept form



$y = c$ for all values of x



$x = a$ for all values of y

Chapter 5 Cubic & Exponential Graphs

5.1, 5.2,

Types of graphs

power

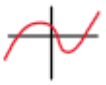
5

$y = ax^0$ 

$y = ax^1$ 

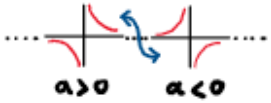
$y = ax^2$ 

$y = ax^3$ 

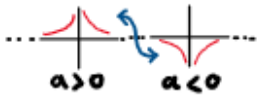
$y = ax^3 + bx^2 + cx + d$ 

fractional

2

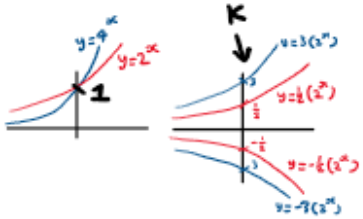
$y = \frac{a}{x}$ 

flip on x-axis

$y = \frac{a}{x^2}$ 

expo

1

$y = ka^x$ 

$k > 0$

$k < 0$

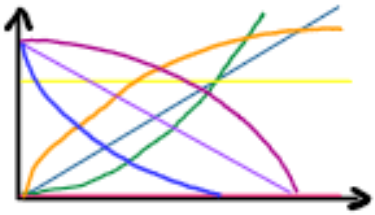
change a k

5.3

- **Tangent** line that touches curve at 1 point
  can be used to find instantaneous gradient

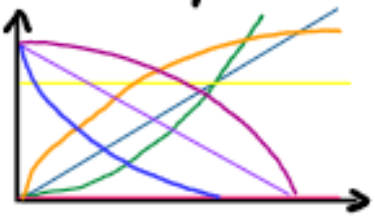
5.5

Distance Time



velocity

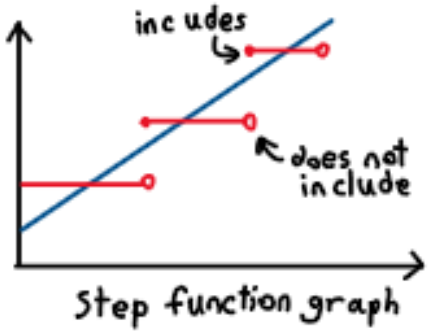
Velocity Time



acceleration

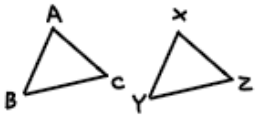
gradient velocity → gradient acceleration

area ← area displacement



Step function graph

- **Congruence** Same size, same angles
- **Similarity** different size, same angles



Sides are equal

Congruence

$AB = XY$
$BC = YZ$
$CA = ZA$
$\therefore \triangle ABC \equiv \triangle XYZ$ (SSS)

SSS Side Side Side

$\angle ABC = \angle XYZ$
$AB = XY$
$BC = YZ$
$\therefore \triangle ABC \equiv \triangle XYZ$ (SAS)

SAS Side Angle Side
$\angle$ must be included

$\angle ABC = \angle XYZ$
$\angle CAB = \angle ZXY$
$BC = YZ$
$\therefore \triangle ABC \equiv \triangle XYZ$ (AAS)

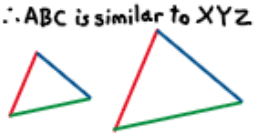
AAS Angle Angle Side
$\angle$ can be anywhere

$\angle ABC = \angle XYZ = 90^\circ$
$AB = XY$
$CA = ZX$
$\therefore \triangle ABC \equiv \triangle XYZ$ (RHS)

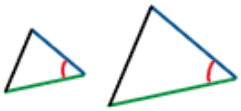
RHS Right $\angle$ Hypo Side

Similarity

$\frac{AB}{XY} = \frac{BC}{YZ} = \frac{CA}{ZX}$
$\therefore ABC$ is similar to XYZ

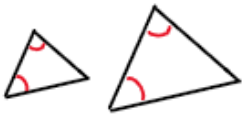


$AB = XY$
$BC = YZ$
$\angle ABC = \angle XYZ$
$\therefore ABC$ is similar to XYZ



AA Angle Angle

$\angle ABC = \angle XYZ$
$\angle CAB = \angle ZXY$
$\therefore ABC$ is similar to XYZ



Ratios of sides are same

Angle Tests

Vert. Opp. $\angle$s

$\angle = \angle$

Corr. $\angle$s

$\angle = \angle$

Alt $\angle$s

$\angle = \angle$

Int $\angle$s

$\angle = \angle$

Adj. $\angle$s on str. line $= 180^\circ$

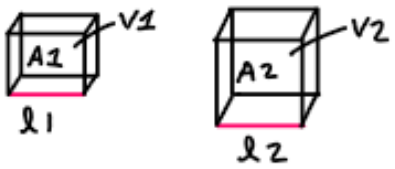
$\angle$ sum of $\triangle = 180^\circ$

base $\angle$ of isos. $\triangle$

$\angle = \angle$

Area and Volume ratios

For similar solids only



$\frac{A1}{A2} = \left(\frac{l1}{l2}\right)^2$ $\quad$ r Area = r length^2

$\frac{V1}{V2} = \left(\frac{l1}{l2}\right)^3$ $\quad$ r Volume = r length^3

$\frac{V1}{V2} = \left(\sqrt{\frac{A1}{A2}}\right)^3$

or

$\left(\frac{V1}{V2}\right)^3 = \left(\frac{A1}{A2}\right)^2$

r Volume = r Area$^{\frac{3}{2}}$

Chapter 7: Trigonometry

- Can use Amath notes

Quadrants

2	1
3	4

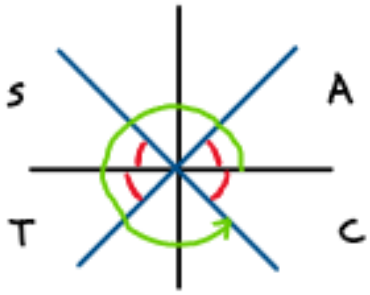
sin SOH
Cos CAH
Tan TOA

ASTC diagram

Which one will be positive value?

A all S sin T tan C cos

↑ because of '−' distances & trig ratios



Area of △

- area $= \frac{1}{2}ab\sin C$

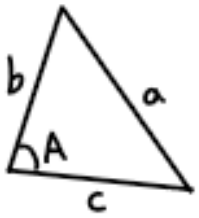
↑ must be included ∠

- when $C = 90$, it becomes $\frac{1}{2}bh$!

Sin & Cos rule

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

cos rule $a^2 = b^2 + c^2 - 2bc\cos A$
(pythagoreas)

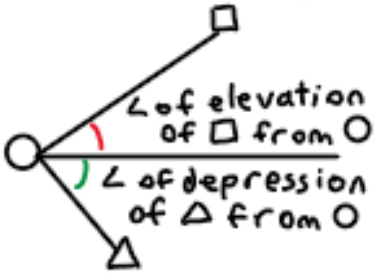


Chapter 8: Further trig

Bearing

- 3 digits e.g. 020°, 148.5°
- measured clockwise from north

Elevation & Depression

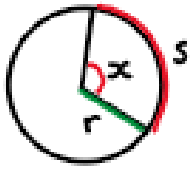


Chapter 9: Arc, Sector, Radian

Radian

$x_{rad} = \frac{s}{r}$

π rad $= 180^{\circ}$



Arc length

$\frac{x}{360} \times \pi d$

degree

% of circumfrence

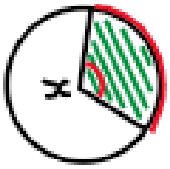
$r\theta$

radian

Area of Sector

$\frac{x}{360} \times \pi r^2$

degree



% of area

$\frac{1}{2}\theta r^2$

radian