

Substitution



Substitution exists where there is a formula / generalisation / rule

write formulae down
substitute in number values
finally number crunch. (if required)

Area/
Perimeter

Number

Pythagoras

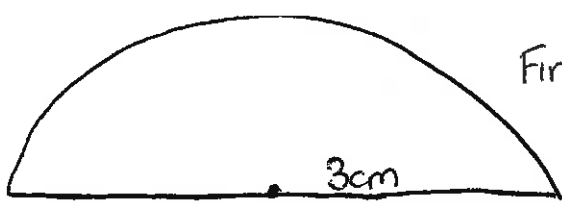
Equations of
Straight lines

Trigonometry

(reading information
from a graph and
the writing down
equation)

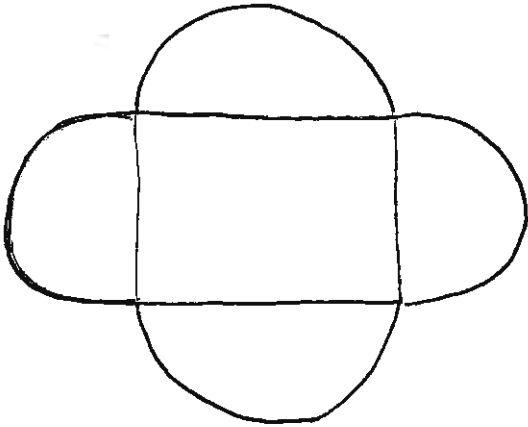
* This was strongly tied into
Science - speed and distance graphs

(students examples of the above)



Find perimeter

$$\begin{aligned} P &= \text{arc} + \text{---} \\ &= \frac{1}{2} \text{ of } c + b \\ &= \frac{1}{2} \times \pi \times d + b \\ &= \frac{1}{2} \times \pi \times 3 + 3 \\ &= 15.4 \text{ cm (1dp)} \end{aligned}$$



$$P = ()$$

$$\begin{aligned} &2 \times c \\ &2 \times \pi \times d \\ &2 \times \pi \times 5 \end{aligned}$$

$$= 31.4 \text{ cm (1dp)}$$

$$87.96 \div \pi = \cancel{27.92} 27.99852759$$

Algebra - everywhere

area/perimeter

4¹⁰ student's work


Algebra
- everywhere

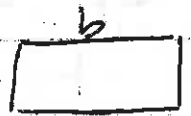
Thursday July 1~~7~~ / 2001

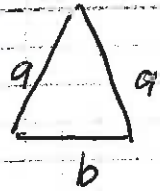
Perimeter.

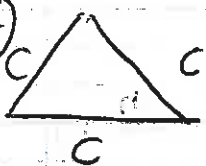
Level 5 packs 18/19

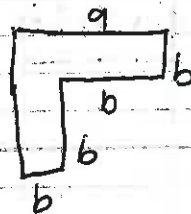
y-9 student's work.

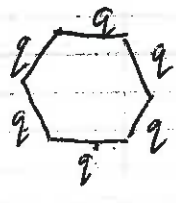
①  $= a + a + a + a = 4a \checkmark$

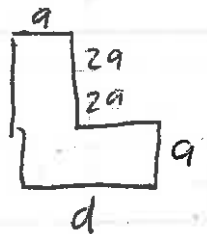
②  $= a + a + b + b = 2a + 2b \checkmark$

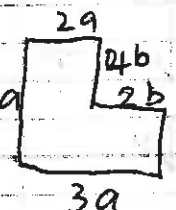
③  $a + a + b = 2a + b \checkmark$

④  $= c + c + c = 3c \checkmark$

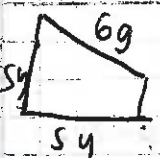
⑤  $a + a + b + b + b + b = 2a + 4b \checkmark$

⑥  $= 2 * a + a + a + a + a + a = 6a \checkmark$

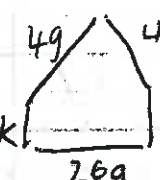
⑦  $= a + a + a + a + a + a = 6a + 2d \checkmark$

⑧  $= 3a + 2a + 3a = 8a$
 $4b + 2b + b = 7b$
 $= 8a + 7b \checkmark$

$= a + a + a + a + a + a = 6a + 2d \checkmark$

⑩  $= 6g + 2g = 8g$
 $5y + 5y = 10y$
 $8g + 10y \checkmark$

$\frac{26}{8}$
34

⑨  $= 4g + 4g = 8g + 2g = 10g$
 $2k + 2k = 4k$
 $= 34 + 4k \checkmark$

$$5. y = 4 - 3x$$

$$m = \frac{-3}{1}$$

$$c = 4$$

$$6. y = \frac{-1}{3}x + 2$$

$$m = \frac{-1}{3}$$

$$c = 2$$

$$7. y = \frac{-4x}{3} - 1$$

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

$$c = -1$$

$$8. y = 3x$$

$$m = \frac{3}{1}$$

$$c = 0$$

$$9. y = -2x$$

$$m = \frac{-2}{1}$$

$$c = 0$$

$$10. 6y - 3x = 18$$

$$+3x$$

$$+3x$$

$$6y = 18 + 3x$$

$$\div 6$$

$$\div 6 \quad \div 6$$

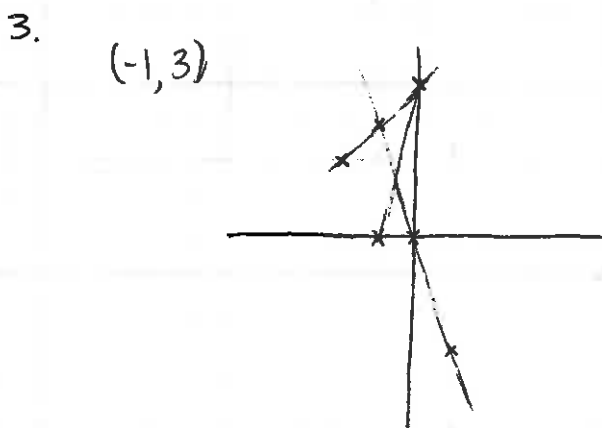
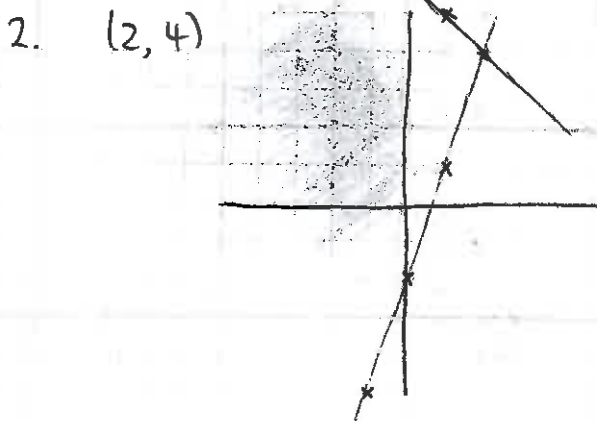
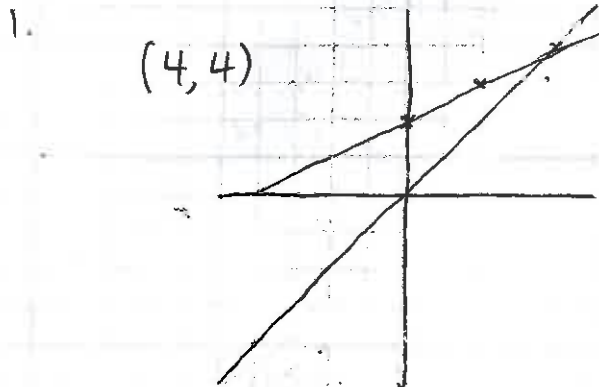
$$y = 3 + \frac{1}{2}x$$

$$m = \frac{1}{2}$$

$$c = 3$$

Algebra everywhere
→ eqns of straight
lines and graphing
yr 10 student's work.

Gamma page 298 ex 16.7



5.

$$y = y$$

$$x + 1 = -x + 3$$

$$\begin{array}{r} -1 \\ -1 \end{array}$$

$$x = -x + 2$$

$$\begin{array}{r} +x \\ +x \end{array}$$

$$\frac{2x}{2} = \frac{2}{2}$$

$$x = 1$$

$$\begin{array}{l} x = 1 \\ y = 2 \end{array}$$

$$(1, 2)$$

for 10 student's work

6.

$$y = y$$

$$5 - x = x - 3$$

$$\begin{array}{r} +3 \\ +3 \end{array}$$

$$8 - x = x$$

$$\begin{array}{r} +x \\ +x \end{array}$$

$$\frac{8}{2} = \frac{2x}{2} \quad y = 4 - 3$$

$$4 = x$$

$$x = 4 \quad (4, 1)$$

$$y = 1$$

7.

$$y = y$$

$$-2x = 4x + 6$$

$$\begin{array}{r} -4x \\ -4x \end{array}$$

$$\frac{-6x}{-6} = \frac{6}{-6} \quad y = 4x - 1 + 6$$

$$x = -1 \quad y = -4 + 6$$

$$y = 2$$

$$(-1, 2)$$

8.

$$y = y$$

$$10x - 11 = -9x + 8$$

$$\begin{array}{r} +9x \\ +9x \end{array}$$

$$19x - 11 = 8 \quad y = 10x - 11$$

$$\begin{array}{r} +11 \\ +11 \end{array} \quad y = 10 - 11$$

$$\frac{19x}{19} = \frac{19}{19} \quad y = -1$$

$$x = 1$$

$$(1, -1)$$

9.

$$2x + 7 = -x + 2$$

$$\begin{array}{r} +x \\ +x \end{array} \quad \begin{array}{r} +2 \\ +2 \end{array} \quad \begin{array}{r} 2x + 7 + 7 \\ 3x + 14 \\ 10.4 \end{array}$$

$$3x + 7 = 2$$

$$\begin{array}{r} -7 \\ -7 \end{array}$$

$$\frac{3x}{3} = \frac{-5}{3}$$

$$x = 1.7$$

Algebra - everywhere

intersection of 2 lines

- by graph - by algebra.

Original Amount

algebra everywhere

- number

y.r. 10 student work.

eg. The price of food has gone up by 12% over the last year. If your food bill is now ~~\$20~~ \$210, what was it last year?

$$\begin{array}{ccc} 2010 & \xrightarrow{12\% \text{ higher}} & 2011 \\ \text{food} & \times 1.12 = & \text{food} \end{array}$$

$$\boxed{f} \times 1.12 = \$210$$

$$\div 1.12 \qquad \div 1.12$$

$$\boxed{f} = \$187.50$$

check! - add 12% back on. do you get \$210?

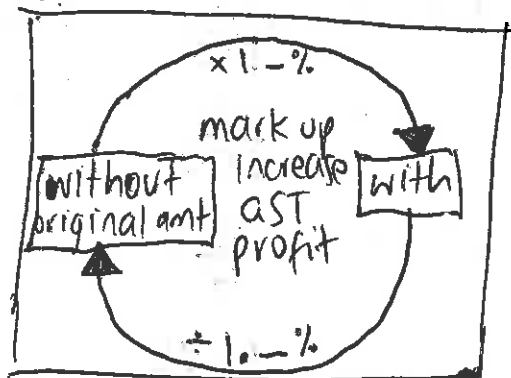
eg. A shop is having a sale by removing the GST. If the tag says \$69, how much would you pay in the sale?

$$\text{price with out GST} \times 1.15 = \text{price with GST}$$

$$\boxed{P} \times 1.15 = \$69$$

$$\div 1.15 \qquad \div 1.15$$

$$\boxed{P} = \$60$$



60% of the class have blue eyes.
 There are 20 students with blue eyes.
 How many in the class altogether?

60% ~~of~~ the class has to equal 20.

$$60 \div 100 \times \text{letter} = 20$$

$$\frac{60}{100} \times C = 20$$

$$\times \frac{3}{5} \Rightarrow \frac{3}{5} \times \frac{6}{10} \times \frac{3}{5} C = 20$$

~~$$\frac{3}{5} C = 20$$~~

~~$$\div \frac{3}{5} \quad \div \frac{3}{5}$$~~

~~$$C = 20 \quad \div \frac{3}{5}$$~~

$$C = 33.\bar{3}$$

$$\Rightarrow 34$$

34 students in the class.

algebra everywhere
 - number

4 x 10 student's work.

~~Multiplying~~

Increasing / decreasing by a %
 (profit) (discount)
 (markup)
 (GST)

eg With training you have increased your running time of 35 mins by 15%.
 How long can you run for now?

method 1.

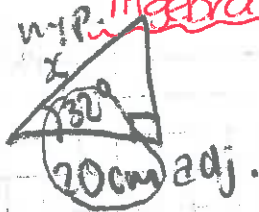
$$10\% \text{ of } 35 = 3.50$$

$$5\% \text{ of } 35 = 1.75$$

$$\underline{5.25}$$

$$\text{total} = 35 + 5.25 = 40.25 \text{ minutes}$$

or 40 mins 25 sec.



adj. Trig
hyp.

$$\cos A = \frac{\text{adj}}{\text{hyp}}$$

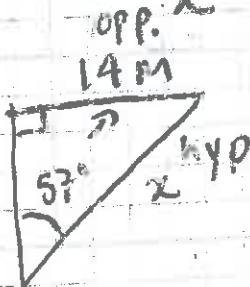
$$\cos 32^\circ = \frac{20}{x}$$

x x x x

$$\cos 32^\circ \times x = 20$$

$$\div \cos 32^\circ \quad \div \cos 32^\circ$$

$$x = 23.6 \text{ cm (1dp)}$$



opp. Trig
hyp

$$\sin A = \frac{\text{opp}}{\text{hyp}}$$

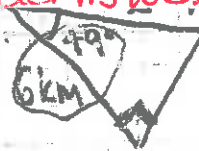
$$\sin 57^\circ = \frac{14}{x}$$

x x x x

$$\sin 57^\circ \times x = 14$$

$$\div \sin 57^\circ \quad \div \sin 57^\circ$$

$$x = 16.7 \text{ m (1dp)}$$



adj. Trig
hyp.

$$\cos A = \frac{\text{adj}}{\text{hyp}}$$

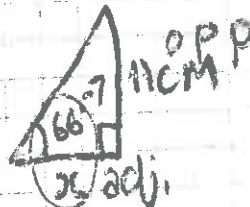
$$\cos 49^\circ = \frac{6}{x}$$

x x x x

$$\cos 49^\circ \times x = 6$$

$$\div \cos 49^\circ \quad \div \cos 49^\circ$$

$$x = 9.1 \text{ km (1dp)}$$



opp. Trig
adj.

$$\tan A = \frac{\text{opp}}{\text{adj}}$$

$$\tan 66^\circ = \frac{11}{x}$$

x x x x

$$\tan 66^\circ \times x = 11$$

$$\div \tan 66^\circ \quad \div \tan 66^\circ$$

$$x = 4.9 \text{ cm (1dp)}$$