

SENIOR TWO LESSON NOTES:

①

TOPIC ALGEBRA

SUB TOPIC SUBSTITUTION IN FORMULAE

A formula is an equation in which letters represent quantities. e.g. the area A , of a triangle of base length b and height h is given by the formula:

$$A = \frac{1}{2}bh$$

NOTE Many (formulae)

EX. 1 Given that $A = \frac{1}{2}bh$ find A if $b = 3.2\text{cm}$

and $h = 5\text{cm}$

$$A = \frac{1}{2}bh$$

$$A = ? \quad b = 3.2\text{cm} \quad h = 5\text{cm}$$

Substitute $b = 3.2\text{cm}$ and $h = 5\text{cm}$ in the formula.

$$\text{So } A = \frac{1}{2} \times 3.2 \times 5 \text{ cm}^2$$

$$\therefore A = 8 \text{ cm}^2$$

EX. 2. The formula $F = \frac{9C}{5} + 32$

Look for

(a) F when $C = 40$

$$F = \frac{9 \times 40}{5} + 32$$

$$= 72 + 32$$

$$= 104$$

(b) C when $F = 100$

$$F = \frac{9C}{5} + 32$$

$$100 = \frac{9C}{5} + 32$$

$$5 \times 100 = \frac{9C \times 5}{5} + 32 \times 5$$

$$500 = 9C + 160$$

$$500 - 160 = 9C$$

$$\frac{340}{9} = \frac{9C}{9} \quad C = 37\frac{7}{9}$$

ex 3. given that $h = 10t - 10t - t^2$
find h when $t = 5$.

$$\begin{aligned} h &= 10t - 10t - t^2 \\ &= 10(5) - 10(5) - (5^2) \\ &= 50 - 50 - 25 \\ h &= -25 \end{aligned}$$

ex. 4. $T = 2\pi \sqrt{\frac{L}{g}}$ work out T when $L = 3\frac{1}{7}$

$$L = 98 \text{ and } g = 32$$

$$\begin{aligned} T &= 2 \times 3\frac{1}{7} \sqrt{\frac{98}{32}} \\ &= 2 \times \frac{22}{7} \sqrt{3.0625} \\ &= \frac{44}{7} \times 1.75 \\ &= \frac{77}{7} \end{aligned}$$

$$\therefore T = 11$$

ex. 5. if $x = 2$ $y = -4$ $z = 5$

evaluate $\frac{(x+y)^2}{2(y-z)}$

$$= \frac{(2 + (-4))^2}{2(-4 - 5)}$$

$$= \frac{-2^2}{2(-9)}$$

$$= \frac{4}{-18}$$

$$= -\frac{2}{9}$$

EX. 6. The area of a square is given by

$$A = S^2$$

Determine S when $A = 64$

$$\Rightarrow A = S^2$$

$$64 = S^2$$

$$\sqrt{64} = \sqrt{S^2}$$

$$8 = S$$

Note $\sqrt{64} = \pm 8$ but we take the positive 8 (+8) coz we don't have a negative length (side)

ACTIVITY

- $V = u + at$ find the value of V
when $u = 6$ $a = 3$ and $t = 10$
- If $R = \frac{100I}{PT}$ and $P = 50$, $R = 10$, $T = 2$
Determine I
- Work out S when $u = 50$ $t = 15$ $a = 16$
given that $S = ut + \frac{1}{2}at^2$
- Given the formula $v^2 = u^2 + 2as$
Calculate the value of s if $a = 8$ $u = 14$
and $v = 30$
- $\frac{1}{u} + \frac{1}{r} = \frac{1}{f}$. Find r if $u = 10$ and $f = 8$
- Given $d = 5\sqrt{\frac{h}{2}}$ look for d if $h = 72$.

Change of Subject of formulae

Solve the equation for the letter which is to become the subject (make that letter the subject or Express that letter in terms of the other letters in question)

Ex. 1 Make m the subject of the formula $y = mx + c$

$$y = mx + c$$

Take c to the LHS of the equation

$$y - c = mx$$

Divide both sides by x

$$\frac{y - c}{x} = \frac{mx}{x}$$

$$\frac{y - c}{x} = m$$

$$\therefore m = \frac{y - c}{x}$$

Or $y = mx + c$

$$-mx = c - y$$

$$\frac{-mx}{-x} = \frac{c - y}{-x}$$

$$\therefore m = \frac{c - y}{-x} \quad m = \frac{c}{-x} - \frac{y}{-x}$$

$$m = -\frac{c}{x} + \frac{y}{x}$$

or $m = \frac{-c + y}{x}$

or $m = \frac{y - c}{x}$

ex. 2. make P the subject of the formula.

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

Multiply both sides by 100 or cross multiply

$$100 \times I = \frac{PRt}{100} \times 100$$

$$100I = PRt$$

Divide both sides by Rt

$$\frac{100I}{Rt} = \frac{PRt}{Rt}$$

$$\frac{100I}{Rt} = P \quad \therefore P = \frac{100I}{Rt}$$

ex. 3. Express x in terms of a and b given that $a = b(1-x)$

$$a = b(1-x)$$

clear brackets

$$a = b - bx$$

Rearrange to give terms in x on one side of the equation

$$bx = b - a$$

divide both sides by b

$$\frac{bx}{b} = \frac{b-a}{b}$$

$$\therefore x = \frac{b-a}{b}$$

ex. 4 make y the subject of $3y - 6x = py$

$$3y - 6x = py$$

Collect like terms

$$3y - py = 6x$$

factorise y (common factor)

$$y(3-p) = 6x$$

Divide both sides by 3-p

$$y \frac{(3-p)}{3-p} = \frac{6x}{3-p}$$

so $y = \frac{6x}{3-p}$

EX. 5 Express x in terms of a, and b from the equation

$$b = \frac{2xa}{3x-a}$$

multiply both sides by 3x-a or cross multiply

$$b(3x-a) = 2xa$$

Remove brackets

$$3bx - ab = 2xa$$

$$3bx - 2xa = ab$$

factorise x (common factor)

$$x(3b - 2a) = ab$$

divide both sides by 3b-2a

$$x \frac{(3b-2a)}{3b-2a} = \frac{ab}{3b-2a}$$

$$x = \frac{ab}{3b-2a}$$

ACTIVITY

1. Make the letter in the brackets the subject

(a) $C = 2\pi r$ (r)

(d) $\frac{a}{x} + b = c$ (x)

(b) $2b + c = 13$ (b)

(c) $C = \frac{5}{9}(F - 32)$ (F)

(e) $y = \frac{m+k}{m-k}$ (k)