



1

a. Make x the subject of $y = x + 5$

b. Make x the subject of $y = 3x$

(2 marks)

a)

$$\begin{array}{rcl}
 y & = & x + 5 \\
 -5 & & -5 \\
 \hline
 y - 5 & = & x
 \end{array}$$

$$\boxed{x = y - 5}$$

b)

$$\begin{array}{rcl}
 y & = & 3x \\
 \div 3 & & \div 3 \\
 \hline
 \frac{y}{3} & = & x
 \end{array}$$

$$\boxed{x = \frac{y}{3}}$$

2

Make x the subject of the formula

$$y = 2x + 9$$

(2 marks)

Making x the subject means leaving x alone on one side. Apply the same inverse operation to both sides to keep the equality true

$$\begin{array}{rcl}
 y & = & 2x + 9 \\
 -9 & & -9 \\
 \hline
 y - 9 & = & 2x \\
 \div 2 & & \div 2 \\
 \hline
 x & = & \frac{y - 9}{2}
 \end{array}$$

$$\boxed{x = \frac{y - 9}{2}}$$

3 Chloe is making x the subject of the formula $y = 3x + 5$.

Here is her working.

Step 1: $y - 5 = 3x$

Step 2: $x = \frac{y}{3} - 5$

Explain the mistake Chloe has made.

(1 mark)

Step 1 is correct

$$y - 5 = 3x$$

To find x , the whole of the left-hand side must be divided by 3

$$\text{So } x = \frac{y - 5}{3}, \text{ not } \frac{y}{3} - 5$$

4 A plumber works out the cost of a job using this rule.

Cost in pounds = $15 + 8 \times \text{number of hours}$

a. Work out the cost of a job that takes 4 hours.

b. A job costs £79. Work out how many hours it took.

(3 marks)

a)

$$15 + 8 \times 4 = 15 + 32 = 47$$

£47

b)

$$\begin{array}{rcl} 79 & = & 15 + 8h \\ -15 & & \\ \hline 64 & = & 8h \\ \div 8 & & \\ \hline 8 & = & h \end{array}$$

8 hours

5 The formula $v = u + at$ gives the speed of an object after time t .

- Make t the subject of the formula.
- Find t when $v = 25$, $u = 7$ and $a = 3$.

(3 marks)

a)

$$\begin{array}{rcl} v & = & u + at \\ -u & & -u \\ \hline v - u & = & at \\ \div a & & \div a \\ \hline \frac{(v - u)}{a} & = & t \end{array}$$

$$t = \frac{(v - u)}{a}$$

b)

$$t = \frac{(25 - 7)}{3} = \frac{18}{3}$$

$$t = 6$$

6 Make a the subject of the formula

$$P = 3a + 2b$$

(2 marks)

$$\begin{array}{rcl} -2b & & -2b \\ P - 2b & = & 3a \\ \div 3 & & \div 3 \\ \hline a & = & \frac{P - 2b}{3} \end{array}$$

$$a = \frac{P - 2b}{3}$$

7 $F = 5v + 20$

- Work out the value of F when $v = 6$.
- Work out the value of v when $F = 95$.

(4 marks)

$$a) F = 5 \times 6 + 20 = 30 + 20 = 50$$

$$b) \text{ Substitute } F = 95: 95 = 5v + 20$$

b) Subtract 20

$$5v = 75, \text{ so } v = 15$$

Check

$$5 \times 15 + 20 = 95$$

8

Here is a rule: $y = 3x - 4$

Complete the table.

x	-1	5		
y			14	-10

(4 marks)

Forwards: put x into the rule

$$x = -1: 3 \times (-1) - 4 = -7$$

$$x = 5: 3 \times 5 - 4 = 11$$

Backwards: solve for x

$$\begin{array}{rcl}
 14 & = & 3x - 4 \\
 +4 & & +4 \\
 18 & = & 3x \\
 \div 3 & & \div 3 \\
 6 & = & x \\
 \\
 -10 & = & 3x - 4 \\
 +4 & & +4 \\
 -6 & = & 3x \\
 \div 3 & & \div 3 \\
 -2 & = & x
 \end{array}$$

$-7, 11, 6, -2$

9

Make k the subject of the formula

$$m = \frac{k}{5} - 2$$

(2 marks)

$$\begin{array}{rcl}
 +2 & m + 2 & = \frac{k}{5} \\
 \times 5 & k & = 5(m + 2) = 5m + 10
 \end{array}$$

$k = 5(m + 2)$

10

Make c the subject of the formula

$$a = 4(c + 2d)$$

(2 marks)

$$\begin{array}{rcl}
 \div 4 & \frac{a}{4} & = c + 2d \\
 -2d & c & = \frac{a}{4} - 2d
 \end{array}$$

Equivalently, expand first

$$a = 4c + 8d, \text{ so } c = \frac{a - 8d}{4}$$

$c = \frac{a}{4} - 2d$

11 $y = 5 + \sqrt{x}$

- Make x the subject of the formula.
- Find x when $y = 9$.

(3 marks)

a)

$$\begin{array}{rcl}
 y & = & 5 + \sqrt{x} \\
 -5 & & \\
 y - 5 & = & \sqrt{x} \\
 \text{square} & & \\
 (y - 5)^2 & = & x \\
 \text{square} & &
 \end{array}$$

$$x = (y - 5)^2$$

b)

$$x = (9 - 5)^2 = 4^2$$

$$x = 16$$

12 Make x the subject of the formula

$$y = \frac{3x - 5}{2}$$

(2 marks)

$$\begin{array}{rcl}
 \times 2 & & \\
 2y & = & 3x - 5 \\
 +5 & & \\
 2y + 5 & = & 3x \\
 \div 3 & & \\
 x & = & \frac{2y + 5}{3}
 \end{array}$$

$$x = \frac{2y + 5}{3}$$

13 Make g the subject of the formula

$$h = 5 + \frac{3}{g}$$

(3 marks)

$$\begin{array}{rcl}
 -5 & & \\
 h - 5 & = & \frac{3}{g} \\
 \times g & & \\
 g(h - 5) & = & 3 \\
 \div (h - 5) & & \\
 g & = & \frac{3}{h - 5}
 \end{array}$$

The original formula requires $g \neq 0$. Its rearranged form requires $h \neq 5$; division by zero is undefined

$$g = \frac{3}{h - 5}$$

14

$$v = u + at$$

- a. Work out the value of v when $u = 7$, $a = 9.8$ and $t = 5$.
 b. Work out the value of t when $v = 87$, $u = 12$ and $a = 5$.

(4 marks)

$$a) v = 7 + 9.8 \times 5 = 7 + 49 = 56$$

b) Substitute

$$87 = 12 + 5t$$

b) Subtract 12

$$5t = 75, \text{ so } t = 15$$

Check

$$12 + 5 \times 15 = 87$$

15

$$m = 3n - 2p$$

- a. Work out the value of m when $n = -5$ and $p = 4$.
 b. Work out the value of n when $m = 19$ and $p = -2$.

(4 marks)

$$a) m = 3 \times (-5) - 2 \times 4 = -15 - 8 = -23$$

b) Substitute

$$19 = 3n - 2 \times (-2) = 3n + 4$$

b) Subtract 4

$$3n = 15, \text{ so } n = 5$$

Check

$$3 \times 5 - 2 \times (-2) = 15 + 4 = 19$$

16

$$Q = 5p - 3r$$

Work out the value of r when $Q = 5$ and $p = -2$.

(3 marks)

$$\begin{array}{rcl}
 5 & = & 5(-2) - 3r \\
 5 & = & -10 - 3r \\
 +10 & & \\
 15 & = & -3r \\
 \div(-3) & & \\
 -5 & = & r
 \end{array}$$

$$r = -5$$

17

The formula $F = \frac{9C}{5} + 32$ converts a temperature in degrees Celsius (C) to degrees Fahrenheit (F).

Make C the subject of the formula.

(3 marks)

$$\begin{array}{rcl}
 F & = & \frac{9C}{5} + 32 \\
 -32 & & \\
 F - 32 & = & \frac{9C}{5} \\
 \times 5 & & \\
 5(F - 32) & = & 9C \\
 \div 9 & & \\
 \frac{5(F - 32)}{9} & = & C \\
 \boxed{C = \frac{5(F - 32)}{9}}
 \end{array}$$

18

a. Expand $3x(2x - 5)$

b. Factorise fully $20a^2b - 8ab$

c. Make x the subject of $y = 4x - 7$

(6 marks)

a) $3x$ times $2x = 6x^2$ and $3x$ times $-5 = -15x$, so $6x^2 - 15x$

b) The highest common factor of $20a^2b$ and $8ab$ is $4ab$

$$20a^2b - 8ab = 4ab(5a - 2)$$

c) Add 7 to both sides

$$\begin{array}{rcl}
 y + 7 & = & 4x \\
 \div 4 & & \\
 x & = & \frac{y + 7}{4}
 \end{array}$$