

## Rearranging Formulae

### Starter

1. (Review of last lesson)

Expand and simplify: (a)  $(5x - 1)(2x - 3)$  (b)  $(6 - n)(2n + 1)$

**Working:** (a)  $(5x - 1)(2x - 3) = 10x^2 - 15x - 2x + 3$   
 $= 10x^2 - 17x + 3$

(b)  $(6 - n)(2n + 1) = 12n + 6 - 2n^2 - n$   
 $= 6 + 11n - 2n^2$

2. What is the difference between an equation and a formula?

**Working:** Equation — one unknown and some numbers. See examples above.

Formula — a relationship connecting two or more quantities (at least two letters and some numbers). **E.g.**  $C = 3m + 10$ ,  $v = u + at$ ,  $V = IR$

**E.g. 1** Rearrange the formula to make  $x$  the subject:

(a)  $3x - p = q$  (b)  $y = mx + c$  (c)  $s - t = t + kx$

**Working:** (a)  *$x$  is positive so we don't want to move it to the other side*  
*Subtraction before multiplication*  $3x - p = q$   
*Add  $q$  to both sides*  $3x = q + p$   
*Divide both sides by 3*  $x = \frac{q + p}{3}$

(b)  *$x$  is positive so we don't want to move it to the other side*  
*Addition before multiplication*  $y = mx + c$   
*Subtract  $c$  from both sides*  $y - c = mx$   
*Divide both sides by  $m$*   $\frac{y - c}{m} = x$   
*Swap the formula over*  $x = \frac{y - c}{m}$

(c)  *$x$  is positive so we don't want to move it to the other side*  
*Addition before multiplication*  $s - t = t + kx$   
*Subtract  $t$  from both sides*  $s - 2t = kx$   
*Divide both sides by  $k$*   $\frac{s - 2t}{k} = x$   
 $x = \frac{s - 2t}{k}$

**E.g. 2** Rearrange the formula to make  $x$  the subject:

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

(b)  $\frac{x}{s} + 1 = t$

(c)  $a = \frac{x}{m} + n$

**Working:** (a)  *$x$  is positive so we don't want to move it to the other side*

$$\frac{x}{c} = a + b$$

*Multiply both sides by  $c$*   $x = c(a + b)$

(b)  *$x$  is positive so we don't want to move it to the other side*

*Addition before division*

$$\frac{x}{s} + 1 = t$$

*Subtract 1 from both sides*

$$\frac{x}{s} = t - 1$$

*Multiply both sides by  $s$*

$$x = s(t - 1)$$

(c)  *$x$  is positive so we don't want to move it to the other side*

*Addition before division*

$$a = \frac{x}{m} + n$$

*Subtract  $n$  from both sides*

$$a - n = \frac{x}{m}$$

*Multiply both sides by  $m$*

$$m(a - n) = x$$

*Swap the formula over*

$$x = m(a - n)$$

**E.g. 3** Rearrange the formula to make  $x$  the subject of the formula:

(a)  $s(x + a) = b$

(b)  $z = p(3x - y)$

(c)  $x(c + d) = e$

**Working:** (a)  *$x$  is positive so we don't want to move it to the other side*

$$s(x + a) = b$$

*$x$  is not in front of the brackets so expand*  $sx + as = b$

*Addition before multiplication*

*Subtract  $as$  from both sides*

$$sx = b - as$$

*Divide both sides by  $s$*

$$x = \frac{b - as}{s}$$

(b)  *$x$  is positive so we don't want to move it to the other side*

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

*$x$  is not in front of the brackets so expand*

$$z = 3px - py$$

*Subtraction before multiplication*

*Add  $py$  to both sides*

$$z + py = 3px$$

*Divide both sides by  $3p$*

$$x = \frac{z + py}{3p}$$

(c)  *$x$  is positive so we don't want to move it to the other side*

*$x$  is in front of brackets so do not expand*

$$x(c + d) = e$$

*Divide both sides by  $c + d$*

$$x = \frac{e}{c + d}$$

**E.g. 4** Rearrange the formula to make  $y$  the subject of the formula:

(a)  $e = u - gy$

(b)  $w^2 = u^2 - ay$

(c)  $t - 5y = b$

**Working:**

(a)  $y$  is negative so we need to move it to the other side

**Add  $gy$  to both sides**

**Addition before multiplication**

**Subtract  $e$  from both sides**

**Divide both sides by  $g$**

$$e = u - gy$$
$$e + gy = u$$

$$gy = u - e$$
$$y = \frac{u - e}{g}$$

(b)  $y$  is negative so we need to move it to the other side

**Add  $ay$  to both sides**

**Addition before multiplication**

**Subtract  $w^2$  from both sides**

**Divide both sides by  $a$**

$$w^2 = u^2 - ay$$
$$w^2 + ay = u^2$$

$$ay = u^2 - w^2$$
$$y = \frac{u^2 - w^2}{a}$$

(c)  $y$  is negative so we need to move it to the other side

**Add  $5y$  to both sides**

**Addition before multiplication**

**Subtract  $b$  from both sides**

**Divide both sides by  $5$**

**Swap the formula over**

$$t - 5y = b$$
$$t = b + 5y$$

$$t - b = 5y$$
$$\frac{t - b}{5} = y$$
$$y = \frac{t - b}{5}$$

**Video:**

[Changing the subject of a formula](#)

[Solutions to Starter and E.g.s](#)

**Exercise**

p23 Ex 12.6 Qu 1ace..., 2-10