

Rearranging formulae (including 2 steps, brackets and simple fractions)

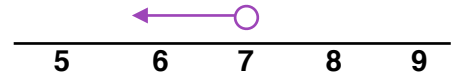
**Starter**

1. (Review of last lesson)

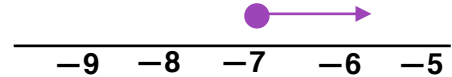
Solve the inequalities, expressing your answer in algebraic and diagrammatic form:

(a)  $4x - 3 < 25$                       (b)  $-3x + 4 \leq 25$

**Working:** (a)  $4x - 3 < 25$   
 $4x < 28$   
 $x < 7$



(b)  $-3x + 4 \leq 25$   
 $-3x \leq 21$   
 $x \geq -7$



2. Solve the inequality  $7 < 17 - 5x < 32$ .

**Working:**  $7 < 17 - 5x < 32$

$7 < 17 - 5x$	$17 - 5x < 32$	<i>2 separate inequalities solve separately</i>
$-10 < -5x$	$-5x < 15$	
$2 > x$	$x > -3$	
<i>Combine into 1 inequality:</i>		
$-3 < x < 2$		

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

(a)  $5x + y = z$                       (b)  $y = px - q$                       (c)  $a - b = b + cx$

**Working:** (a) *x is positive so we don't want to move it to the other side*  
*Addition before multiplication*  $5x + y = z$   
*Subtract y from both sides*  $5x = z - y$   
*Divide both sides by 5*  $x = \frac{z - y}{5}$

(b) *x is positive so we don't want to move it to the other side*  
*Subtraction before multiplication*  $y = px - q$   
*Subtract c from both sides*  $y + q = px$   
*Divide both sides by m*  $\frac{y + q}{p} = x$   
*New subject on the LHS*  $x = \frac{y + q}{c}$

(c) *x is positive so we don't want to move it to the other side*  
*Addition before multiplication*  $a - b = b + cx$   
*Subtract b from both sides*  $a - 2b = cx$   
*Divide both sides by c*  $\frac{a - 2b}{c} = x$   
*New subject on the LHS*  $x = \frac{a - 2b}{c}$

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

(a)  $\frac{x}{p} = q - r$

(b)  $\frac{x}{a} - 7 = b$

(c)  $q = \frac{x}{a} - p$

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

$$\frac{x}{p} = q - r$$

*Multiply both sides by  $p$*   $x = p(q - r)$

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

*Subtraction before division*  $\frac{x}{a} - 7 = b$

*Add 7 to both sides*  $\frac{x}{a} = b + 7$

*Multiply both sides by  $a$*   $x = a(b + 7)$

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

*Subtraction before division*  $q = \frac{x}{a} - p$

*Add  $p$  to both sides*  $q + p = \frac{x}{a}$

*Multiply both sides by  $a$*   $a(q + p) = x$

*New subject on the LHS*  $x = a(q + p)$

**N.B.** *Expand* brackets *before rearranging unless the new subject is in front of the bracket*

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

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

(b)  $a = t(4x + y)$

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

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

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

*$x$  is not in front of the brackets so expand*  $ax - ab = c$

*Subtraction before multiplication*

*Add  $ab$  from both sides*  $ax = c + ab$

*Divide both sides by  $a$*   $x = \frac{c + ab}{a}$

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

$$a = t(4x + y)$$

*$x$  is not in front of the brackets so expand*  $a = 4tx + ty$

*Addition before multiplication*

*Subtract  $ty$  to both sides*  $a - ty = 4tx$

*Divide both sides by  $4t$*   $x = \frac{a - ty}{4t}$

(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*  $x(a - b) = c$

*Divide both sides by  $a - b$*   $x = \frac{c}{a - b}$

**N.B.** When the new subject is negative, it is usually a good idea to *prioritise making it positive*

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

(a)  $a = b - cy$

(b)  $a^2 = b^2 - cy$

(c)  $a - 7y = b$

**Working:**

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

**Add  $cy$  to both sides**

**Subtraction before multiplication**

**Subtract  $a$  from both sides**

**Divide both sides by  $c$**

$$a = b - cy$$

$$a + cy = b$$

$$cy = b - a$$

$$y = \frac{b - a}{c}$$

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

**Add  $cy$  to both sides**

**Addition before multiplication**

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

**Divide both sides by  $c$**

$$a^2 = b^2 - cy$$

$$a^2 + cy = b^2$$

$$cy = b^2 - a^2$$

$$y = \frac{b^2 - a^2}{c}$$

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

**Add  $7y$  to both sides**

**Addition before multiplication**

**Subtract  $b$  from both sides**

**Divide both sides by  $7$**

**New subject on the LHS**

$$a - 7y = b$$

$$a = b + 7y$$

$$a - b = 7y$$

$$\frac{a - b}{7} = y$$

$$y = \frac{a - b}{7}$$

**Video:** [Video: Changing the subject of a formula](#)  
[Changing the subject involving brackets, fractions and powers](#)

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

### Exercise

9-1 class textbook:

p165 M6.5 Qu 6-13

A\*-G class textbook:

p157 M6.6 Qu 6-14

9-1 homework book:

p58 M6.5 Qu 1-10

A\*-G homework book:

p44 M6.6 Qu 1-10