

Rearranging formulae (powers and more fractions)

Starter

Inequalities example

1. **(Review of previous material)** Rearrange the formulae to make x the subject:

(a) $\frac{a - x}{f} = 2f$

(b) $\frac{M(x + B)}{B} = T$

Working: (a)

Multiply both sides by f :
 x needs to be positive:
Subtract $2f^2$ from both sides:
New subject on the LHS:

$$\begin{aligned} \frac{a - x}{f} &= 2f \\ a - x &= 2f^2 \\ a &= 2f^2 + x \\ a - 2f^2 &= x \\ x &= a - 2f^2 \end{aligned}$$

(b)

Multiply both sides by B :
Expand the brackets:
Subtract BM from both sides:
Divide both sides by M :

$$\begin{aligned} \frac{M(x + B)}{B} &= T \\ M(x + B) &= BT \\ Mx + BM &= BT \\ Mx &= BT - BM \\ x &= \frac{BT - BM}{M} \end{aligned}$$

2. Rearrange $\frac{2a}{x} + 3c = 5d$ to make x the subject.

Working:

Subtract $3c$ from both sides:
 x needs to be in the denominator so multiply by x :
Since x is in front of the bracket, do not expand.
Divide both sides by $5d - 3c$:
New subject on the LHS:

$$\begin{aligned} \frac{2a}{x} + 3c &= 5d \\ \frac{2a}{x} &= 5d - 3c \\ \frac{x}{2a} &= \frac{1}{x(5d - 3c)} \\ \frac{2a}{5d - 3c} &= b \\ b &= \frac{2a}{5d - 3c} \end{aligned}$$

E.g. 1 Make w the subject: (a) $x = 1 + \sqrt{w}$

(b) $y = \frac{\sqrt{w - 4}}{3}$

Working: (a)

Subtract 1 from both sides:
Square both sides:
New subject on the LHS:

$$\begin{aligned} x &= 1 + \sqrt{w} \\ x - 1 &= \sqrt{w} \\ (x - 1)^2 &= w \\ w &= (x - 1)^2 \end{aligned}$$

(b) $y = \frac{\sqrt{w-4}}{3}$

Multiply both sides by 3: $3y = \sqrt{w-4}$
Square both sides: $(3y)^2 = w-4$
 $9y^2 = w-4$
Add 4 to both sides: $9y^2 + 4 = w$
New subject on the LHS: $w = 9y^2 + 4$

E.g. 2 Make w the subject: (a) $y + 2 = a - \sqrt{w}$

Working: (a)

Add \sqrt{w} to make w positive:
Subtract y and 2 from both sides:
Square both sides:

(b) $a = \sqrt{9-5w}$

$y + 2 = a - \sqrt{w}$
 $y + 2 + \sqrt{w} = a$
 $\sqrt{w} = a - y - 2$
 $w = (a - y - 2)^2$

(b)

Square both sides:
Add $5w$ to make w positive:
Subtract a^2 from both sides:
Divide both sides by 5:

$a = \sqrt{9-5w}$
 $a^2 = 9-5w$
 $a^2 + 5w = 9$
 $5w = 9 - a^2$
 $w = \frac{9 - a^2}{5}$

The opposite operation of squaring is square rooting.

E.g. 3 Make z the subject: (a) $u = (z + 5)^2$

Working: (a)

Square root both sides:
Subtract 5 from both sides:
New subject on the LHS:

(b) $x = 1 + z^2$

$u = (z + 5)^2$
 $\sqrt{u} = z + 5$
 $\sqrt{u} - 5 = z$
 $z = \sqrt{u} - 5$

(b)

Subtract 1 from both sides:
Square root both sides:
New subject on the LHS:

$x = 1 + z^2$
 $x - 1 = z^2$
 $\sqrt{x-1} = z$
 $z = \sqrt{x-1}$

E.g. 4 Make z the subject: (a) $2t = 3 - z^3$

Working: (a)

Add z^3 to make z positive:
Subtract $2t$ from both sides:
Cube root both sides:

(b) $g = 4 - (2z + 3)^6$

$2t = 3 - z^3$
 $2t + z^3 = 3$
 $z^3 = 3 - 2t$
 $z = \sqrt[3]{3 - 2t}$

(b)

Add $(2z + 3)^6$ to make z positive:

Subtract g from both sides:

6th root both sides:

Subtract 3 from both sides:

Divide both sides by 2:

$$\begin{aligned}g &= 4 - (2z + 3)^6 \\g + (2z + 3)^6 &= 4 \\(2z + 3)^6 &= 4 - g \\2z + 3 &= \sqrt[6]{4 - g} \\2z &= \sqrt[6]{4 - g} - 3 \\z &= \frac{\sqrt[6]{4 - g} - 3}{2}\end{aligned}$$

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

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

Exercise

9-1 class textbook: p167 M6.6 Qu 1, 2ace..., 3, 4ace..., 5, 6ace..., 7-10

A*-G class textbook: p160 M6.7 Qu 1, 2ace..., 3, 4ace..., 5, 6ace..., 7-10

9-1 homework book: p59 M6.6 Qu 1-10

A*-G homework book: p45 M6.7 Qu 1-10

Summary

Dealing powers (or **I**ndices) is the "**I**" part of **SADMIB** so is one of the last operations to be dealt with.

N.B. The opposite operation of square rooting is squaring etc.
The opposite operation of cubing is cube rooting etc.