

Transposition of Formulae - Lesson 5

Transposition of Formulae (All Types)

LI

- Transpose formulae.

SC

- +, -, \times and \div .
- Rearranging equations with fractions
- Powers and roots.

Transpose means to change position

In practice, 'transpose' (aka change the subject) means 'solve'.

Transposing a formula means you have
less formulae to remember

Example 1

Transpose $x + b = c$ for x .

$$x + b = c$$

$$-b \quad -b$$

$$x = c - b$$

Example 2

Transpose $y = 5x$ for x .

$$y = 5x$$

$$\begin{array}{ccc} 5x & = & y \\ \div 5 & & \div 5 \end{array}$$

$$x = \frac{y}{5}$$

Example 3

Transpose $C = 2\pi r$ for r .

$$C = 2\pi r$$

$$2\pi r = C$$

$$\div 2\pi \quad \div 2\pi$$

$$r = \frac{C}{2\pi}$$

Example 4

Transpose $y = 3x - 7$ for x .

$$y = 3x - 7$$

$$3x - 7 = y$$

$+7$ $+7$

$$3x = y + 7$$

$\div 3$ $\div 3$

$$x = \frac{y + 7}{3}$$

Example 5

Transpose $y = 2 - 6x$ for x .

$$y = 2 - 6x$$

$+6x$ $+6x$

$$y + 6x = 2$$

$-y$ $-y$

$$6x = 2 - y$$

$\div 6$ $\div 6$

$$x = \frac{2 - y}{6}$$

Example 6

Transpose $y = \frac{x}{3}$ for x .

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

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

x 3 x 3

$$x = 3y$$

Example 7

Transpose $y = \frac{5}{11} x$ for x .

$$y = \frac{5}{11} x$$

$$\frac{5}{11} x = y$$

$\times 11$ $\times 11$

$$5x = 11y$$

$\div 5$ $\div 5$

$$x = \frac{11}{5} y$$

Example 8

Transpose $f = \frac{4 - p}{g}$ for p .

$$f = \frac{4 - p}{g}$$

$\times g$ $\times g$

$$f g = 4 - p$$

$+ p$ $+ p$

$$f g + p = 4$$

$- f g$ $- f g$

$$p = 4 - f g$$

Example 9

Transpose $Q = \frac{k}{2} - \frac{p}{3}$ for k .

$$Q = \frac{k}{2} - \frac{p}{3}$$

(simplify fractions)

$$Q = \frac{3k - 2p}{6}$$

$\times 6$ $\times 6$

$$6Q = 3k - 2p$$

$+ 2p$ $+ 2p$

$$6Q + 2p = 3k$$

$$3k = 6Q + 2p$$

$\div 3$ $\div 3$

$$k = \frac{6Q + 2p}{3}$$

Example 10

Transpose $y = \frac{7}{w}$ for w .

$$y = \frac{7}{w}$$

x w x w

$$w y = 7$$

÷ y ÷ y

$$w = \frac{7}{y}$$

Example 11

Transpose $y = 4 + \frac{3}{x}$ for x .

$$y = 4 + \frac{3}{x}$$

- 4 - 4

$$y - 4 = \frac{3}{x}$$

x x x x

$$x(y - 4) = 3$$

÷ (y - 4) ÷ (y - 4)

$$x = \frac{3}{y - 4}$$

Example 12

Transpose $T = 5 - \frac{L}{G}$ for G .

$$T = 5 - \frac{L}{G}$$

-5 -5

$$T - 5 = -\frac{L}{G}$$

x (-1) x (-1)

$$5 - T = \frac{L}{G}$$

x G x G

$$G(5 - T) = L$$

÷ (5 - T) ÷ (5 - T)

$$G = \frac{L}{5 - T}$$

Example 13

Transpose $V = \frac{m}{A - 4}$ for A .

$$V = \frac{m}{A - 4}$$

$\times (A - 4)$ $\times (A - 4)$

$$V(A - 4) = m$$

$\div V$ $\div V$

$$A - 4 = \frac{m}{V}$$

$+ 4$ $+ 4$

$$A = \frac{m}{V} + 4$$

Example 14

Transpose $T = \sqrt{w}$ for w .

$$T = \sqrt{w}$$

$$\sqrt{w} = T$$

$(\)^2$ $(\)^2$

$$w = T^2$$

Example 15

Transpose $y = x^2$ for x .

$$y = x^2$$

$$\sqrt{\quad} \quad \sqrt{\quad}$$
$$x^2 = y$$

$$x = \sqrt{y}$$

Example 16

Transpose $A = \pi r^2$ for r .

$$A = \pi r^2$$

$$\pi r^2 = A$$

$\div \pi$ $\div \pi$

$$r^2 = \frac{A}{\pi}$$

$\sqrt{\quad}$ $\sqrt{\quad}$

$$r = \sqrt{\frac{A}{\pi}}$$

Example 17

Transpose $S = \frac{\sqrt{WH}}{20}$ for H .

$$S = \frac{\sqrt{WH}}{20}$$

$$\frac{\sqrt{WH}}{20} = S$$

$\times 20$ $\times 20$

$$\sqrt{WH} = 20S$$

$(\)^2$ $(\)^2$

$$WH = 400S^2$$

$\div W$ $\div W$

$$H = \frac{400S^2}{W}$$

Questions

1 Make x the subject of the following formulae.

a $x + 2 = p$

b $x + t = w$

c $x - 5 = q$

d $10 + x = a$

e $f - x = 4$

f $mn - x = k$

2 Make x the subject of the following formulae.

a $y = 2x$

b $y = -4x$

c $y = 3x + 2$

d $y + 5x = 4$

e $y - 7x = 3$

f $y = -5x + 1$

g $a + bx = c$

h $1 - pqr x = m$

i $m + 3nx = 7p$

3 For each of the following maths and science formulae, change the subject of the formula to the letter in brackets.

a $d = vt$ (t)

b $W = mg$ (m)

c $V = IR$ (R)

d $V = lbh$ (b)

e $F = ma$ (a)

f $E = mgh$ (m)

g $Q = It$ (I)

h $l = Nhf$ (h)

i $v = u + at$ (t)

Answers

1 a $x = p - 2$	2 a $x = \frac{y}{2}$	3 a $t = \frac{d}{v}$
b $x = w - t$	b $x = -\frac{y}{4}$	b $m = \frac{w}{g}$
c $x = q + 5$	c $x = \frac{y-2}{3}$	c $R = \frac{V}{I}$
d $x = a - 10$	d $x = \frac{4-y}{5}$	d $b = \frac{V}{lh}$
e $x = f - 4$	e $x = \frac{y-3}{7}$	e $a = \frac{F}{m}$
f $x = mn - k$	f $x = \frac{1-y}{5}$	f $m = \frac{E}{gh}$
	g $x = \frac{c-a}{b}$	g $I = \frac{Q}{t}$
	h $x = \frac{1-m}{pqr}$	h $h = \frac{l}{Nf}$
	i $x = \frac{7p-m}{3n}$	i $t = \frac{v-u}{a}$

Questions

Make x the subject of the following formulae.

a $y = \frac{x}{4}$

b $y = \frac{x}{5}$

c $y = \frac{3x}{7}$

d $y = \frac{2x}{3}$

e $y = \frac{1}{6}x$

f $y = \frac{4}{5}x$

g $y = \frac{x+3}{8}$

h $y = \frac{x+1}{4}$

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

j $y = \frac{3x+5}{4}$

k $y = \frac{5x-1}{3}$

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

Answers

a $x = 4y$

b $x = 5y$

c $x = \frac{7y}{3}$

d $x = \frac{3y}{2}$

e $x = 6y$

f $x = \frac{5y}{4}$

g $x = 8y - 3$

h $x = 4y - 1$

i $x = 2y + 3$

j $x = \frac{4y-5}{3}$

k $x = \frac{3y+1}{5}$

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

Questions

Make x the subject of the following formulae.

a $y = \frac{1}{x}$

b $y = \frac{8}{x}$

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

d $y = \frac{2}{x-1}$

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

f $y = \frac{7}{1-6x}$

Answers

a $x = \frac{1}{y}$

b $x = \frac{8}{y}$

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

d $x = \frac{2}{y} + 1$

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

f $x = \frac{1}{6} - \frac{7}{6y}$

Questions

Make x the subject of the following formulae.

a $y = x^2$

b $y = 4x^2$

c $y = \frac{2}{3}x^2$

d $y = \frac{3}{5}x^2$

e $y = \sqrt{x}$

f $y = 3\sqrt{x}$

g $y = \frac{1}{2}\sqrt{x}$

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

i $y = 5x^2 + 2$

j $y = 6 - x^2$

k $y = \frac{3}{5}x^2 + 4$

l $y = 2\sqrt{x-3}$

Answers

a $x = \sqrt{y}$

b $x = \frac{\sqrt{y}}{2}$

c $x = \sqrt{\frac{3y}{2}}$

d $x = \sqrt{\frac{5y}{3}}$

e $x = y^2$

f $x = \frac{y^2}{9}$

g $x = 4y^2$

h $x = y^2 - 5$

i $x = \sqrt{\frac{y-2}{5}}$

j $x = \sqrt{6-y}$

k $x = \sqrt{\frac{5y-20}{3}}$

l $x = \frac{y^2}{4} + 3$