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GCSE MATHEMATICS • ALGEBRA

Rearranging Formula

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Rearranging Formula worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Rearranging Formula worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

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A**Your turn answers**

Compare each line of your working with the solution. Equivalent forms of an answer are also correct.

FOUNDATION**A1**

$p + 3 = 7q$

$q = \frac{p+3}{7}$

A2

$\frac{T}{5} = n + 4$

$n = \frac{T}{5} - 4$

A3

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

$x = 3(y + 4)$

HIGHER**A4**

$r^2 = \frac{A}{4\pi}$

$r = \sqrt{\frac{A}{4\pi}}$

A5

Square both sides: $d^2 = \frac{h}{5}$

$h = 5d^2$

A6

$3y - ky = -2 - k$

$y(3 - k) = -(k + 2)$

$y = \frac{k+2}{k-3}$

A7

$xy + 5y = x - 3$

$xy - x = -5y - 3$

$x(y - 1) = -(5y + 3)$

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

B**Fluency solutions**One mark for each correct part. Equivalent forms are also correct. The notes in *italics* explain why each sequence was chosen.**FOUNDATION****B1**

(a) $x = y - 5$

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

(c) $x = 5y$

(d) $x = 5 - y$



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B2 (a) $x = \frac{y-3}{2}$ (b) $x = \frac{y+3}{2}$ (c) $x = \frac{3-y}{2}$ (d) $x = 2(y-3)$

Undo in reverse order: in (d) subtract 3 before multiplying by 2

B3 (a) $x = \frac{y}{2} - 3$ (b) $x = 2y - 3$ (c) $x = \frac{5y-3}{2}$ (d) $x = \frac{y-1}{2} + 3$

B4 (a) $a = \frac{v-u}{t}$ (b) $l = \frac{P-2w}{2}$ (c) $n = \frac{S}{180} + 2$ (d) $b = \frac{2A}{h}$

B5 (a) $w = \frac{A}{l}$ (b) $h = \frac{V}{lw}$ (c) $DV = m: V = \frac{m}{D}$

B6 (a) $t = \frac{d}{s}$ (b) $R = \frac{100I}{PT}$ (c) $m = \frac{y-c}{x}$ (d) $a = ck + b$

HIGHER

B7 (a) $x = \sqrt{y}$ (b) $x = \sqrt{y-4}$ (c) $x = \sqrt{\frac{y}{3}}$ (d) $x = \sqrt{y} - 1$

Get the square on its own before taking the square root.

B8 (a) $x = y^2$ (b) $x = y^2 - 2$ (c) $x = \frac{y^2}{4}$ (d) $x = 3y^2$

B9 (a) $x(a-b) = c: x = \frac{c}{a-b}$ (b) $x(1+a) = 5: x = \frac{5}{1+a}$ (c) $px - qx = p: x = \frac{p}{p-q}$

(d) $xy - x = y + 2: x = \frac{y+2}{y-1}$ Collect the subject on one side, then factorise it out.

B10 (a) $xy + y = x, x(1-y) = y: x = \frac{y}{1-y}$ (b) $xy = x + 1: x = \frac{1}{y-1}$

(c) $xy + 4y = 3x - 2: x = \frac{4y+2}{3-y}$ (d) $xy - ay = x + a: x = \frac{a(y+1)}{y-1}$



C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 Ali divided before adding 1. Add 1 first: $y + 1 = 4x$

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

C2 Tom subtracted 2 instead of dividing by 2. $\frac{P}{2} = l + w$

$$l = \frac{P}{2} - w$$

C3 Try $x = 11$: then $y = \frac{11-5}{3} = 2$. Jo: $3 \times 2 + 5 = 11$, correct. Sam: $3(2+5) = 21$, wrong.

Jo is correct. Sam added 5 before multiplying by 3, but the 5 must be added after.

C4 (a) $r = \frac{C}{2\pi}$ (b) $\frac{31.4}{6.28} = 5$ cm

HIGHER

C5 Lily took the square root before subtracting 5. Subtract 5 first: $\pi r^2 = A - 5$

$$r = \sqrt{\frac{A-5}{\pi}}$$

C6 $c^2 = 9 + 16 = 25$, so $c = 5$, but Ben's formula gives $3 + 4 = 7$

A square root cannot be split over a sum:

$$c = \sqrt{a^2 + b^2}$$

C7 x still appears on the right-hand side, so it is not the subject.

$$ax - bx = 7 \quad x(a - b) = 7$$

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

C8 (a) $t = \frac{v-u}{a}$

(b) $s = \frac{1}{2}(u+v) \times \frac{v-u}{a} = \frac{(v+u)(v-u)}{2a} = \frac{v^2 - u^2}{2a}$ so $2as = v^2 - u^2$ and $v^2 = u^2 + 2as$

(c) $u^2 = v^2 - 2as$ $u = \sqrt{v^2 - 2as}$



D**Problem solving solutions**

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 (a) $P = 2l + 2w$, so $2w = P - 2l$ and $w = \frac{P}{2} - l$ as required

(b) $A = lw = l \left(\frac{P}{2} - l \right)$ $A = \frac{l(P - 2l)}{2}$

D2 (a) $z = 3(2x + 5) - 1$ $z = 6x + 14$ (b) $x = \frac{z - 14}{6}$

D3 $y = \frac{4x - 1}{3}$

Undo each step in reverse: multiply by 3, add 1, divide by 4

$x = \frac{3y + 1}{4}$

D4 (a) $n = \frac{S}{180} + 2$ (b) $S = 1000$ gives $n = \frac{1000}{180} + 2 = \frac{68}{9}$, about 7.6, which is not a whole number, so no polygon has this angle sum

HIGHER

D5 (a) $r^3 = \frac{3V}{4\pi}$ $r = \sqrt[3]{\frac{3V}{4\pi}}$ (b) $r^3 = \frac{3 \times 36\pi}{4\pi} = 27$ 3 cm

D6 (a) 40 hours at £ h is $40h$; x hours at £1.5 h is $1.5hx$ as required

(b) $T = h(40 + 1.5x)$ $h = \frac{T}{40 + 1.5x}$

D7 Square: $y^2 = \frac{x+a}{x-a}$ $y^2x - ay^2 = x + a$ $x(y^2 - 1) = a + ay^2$ $x = \frac{a(1+y^2)}{y^2 - 1}$



D8 (a) $xy - 3y = 3x + 1$ $x(y - 3) = 3y + 1$

$$x = \frac{3y + 1}{y - 3}$$

(b) The answer has exactly the same form as the original formula, with x and y swapped. The formula is its own inverse: applying it twice gets you back where you started.

(c) $xy + ky = 2x + 5$ gives $x = \frac{5 - ky}{y - 2}$. This has the same form as the original only when $-k = 2$

$$k = -2$$

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1 (a) $y + 7 = 3x$

M1

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

A1

(b) $m = 4p$

B1

E2 $v - u = at$

M1

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

A1

E3 $\frac{P}{2} = l + w$

M1

$$w = \frac{P}{2} - l$$

A1

E4 (a) $C - 45 = 30d$

M1

$$d = \frac{C - 45}{30}$$

A1

(b) $\frac{225 - 45}{30} = 6$ days

B1

E5 $2A = (a + b)h$

M1

$$\frac{2A}{h} = a + b$$

M1

$$a = \frac{2A}{h} - b$$

A1



E6 Kim divided before subtracting 2, so she divided only y by 5

C1

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

B1

HIGHER

E7 $y+5 = 2x^2$

M1

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

M1

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

A1

E8 $4t - at = y+3$

M1

$$t(4-a) = y+3$$

M1

$$t = \frac{y+3}{4-a}$$

A1

E9 $y(x-3) = x+2$

M1

$$xy - 3y = x+2, \text{ so } xy - x = 3y+2$$

M1

$$x(y-1) = 3y+2$$

M1

$$x = \frac{3y+2}{y-1}$$

A1

E10 (a) $\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{u-f}{uf}$

M1 M1

$$v = \frac{uf}{u-f}$$

A1

(b) $\frac{12 \times 8}{12-8} = \frac{96}{4} = 24$

B1

(c) When $u = f$ the denominator $u - f$ is 0, so v cannot be calculated: there is no image

C1

