



eClassroom

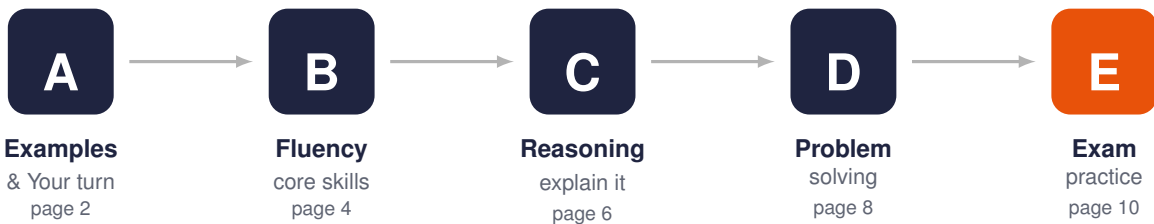
GCSE MATHEMATICS • ALGEBRA

Rearranging Formula

Worksheet

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

Free Rearranging Formula worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: make a letter the subject of a formula with one or two steps • rearrange formulae with brackets and fractions • spot and correct rearranging mistakes • *Higher*: powers and roots of the subject, the subject appearing twice, and the subject in a fraction.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER Higher only: formulae where the subject appears twice, or where a power or root of the subject appears. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	15
Higher marks	16	14	17	15
My score				

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A**Worked examples & Your turn**

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION*Everyone starts here***Worked example A1**

Make x the subject of $y = 4x + 9$

Undo the operations in reverse order: subtract 9, then divide by 4

$$y - 9 = 4x$$

$$x = \frac{y - 9}{4}$$

Your turn A1

Make q the subject of $p = 7q - 3$

Worked example A2

Make b the subject of $A = 3(b - 2)$

Divide by 3 first, then add 2

$$\frac{A}{3} = b - 2$$

$$b = \frac{A}{3} + 2$$

Your turn A2

Make n the subject of $T = 5(n + 4)$

Worked example A3

Make k the subject of $m = \frac{k + 5}{2}$

Multiply both sides by 2, then subtract 5

$$2m = k + 5$$

$$k = 2m - 5$$

Your turn A3

Make x the subject of $y = \frac{x}{3} - 4$



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HIGHER*Higher only: powers and roots of the subject, and the subject appearing twice***Worked example A4: a power of the subject**

Make v the subject of $E = \frac{1}{2}mv^2$, where $v > 0$

Get v^2 on its own, then take the square root.

$$2E = mv^2 \quad v^2 = \frac{2E}{m}$$

$$v = \sqrt{\frac{2E}{m}}$$

Your turn A4

Make r the subject of $A = 4\pi r^2$, where $r > 0$

Worked example A5: a root of the subject

Make q the subject of $p = 3\sqrt{q}$

Divide by 3, then square both sides.

$$\frac{p}{3} = \sqrt{q}$$

$$q = \frac{p^2}{9}$$

Your turn A5

Make h the subject of $d = \sqrt{\frac{h}{5}}$

Worked example A6: the subject appears twice

Make x the subject of $ax + b = cx + d$

Collect the x terms on one side, then factorise.

$$ax - cx = d - b \quad x(a - c) = d - b$$

$$x = \frac{d - b}{a - c}$$

Your turn A6

Make y the subject of $3y + k = ky - 2$

Worked example A7: the subject in a fraction

Make x the subject of $y = \frac{2x + 1}{x - 4}$

Multiply by $(x - 4)$, expand, collect x terms, factorise.

$$xy - 4y = 2x + 1 \quad x(y - 2) = 4y + 1$$

$$x = \frac{4y + 1}{y - 2}$$

Your turn A7

Make x the subject of $y = \frac{x - 3}{x + 5}$



B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION*Everyone starts here***B1** Make x the subject.

(a) $y = x + 5$

(b) $y = 5x$

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

(d) $y = 5 - x$

[4 marks]

B2 Make x the subject.

(a) $y = 2x + 3$

(b) $y = 2x - 3$

(c) $y = 3 - 2x$

(d) $y = \frac{x}{2} + 3$

[4 marks]

B3 Make x the subject.

(a) $y = 2(x + 3)$

(b) $y = \frac{x + 3}{2}$

(c) $y = \frac{2x + 3}{5}$

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

[4 marks]

B4 Make the letter in square brackets the subject.

(a) $v = u + at$ [a]

(b) $P = 2l + 2w$ [l]

(c) $S = 180(n - 2)$ [n]

(d) $A = \frac{1}{2}bh$ [b]

[4 marks]

B5 Make the letter in square brackets the subject.

(a) $A = lw$ [w]

(b) $V = lwh$ [h]

(c) $D = \frac{m}{V}$ [V]

[3 marks]

B6 Make the letter in square brackets the subject.

(a) $d = st$ [t]

(b) $I = \frac{PRT}{100}$ [R]

(c) $y = mx + c$ [m]

(d) $k = \frac{a - b}{c}$ [a]

[4 marks]



HIGHER*Higher tier only***B7** Make x the subject. In each case $x > 0$

(a) $y = x^2$

(b) $y = x^2 + 4$

(c) $y = 3x^2$

(d) $y = (x + 1)^2$

[4 marks]**B8** Make x the subject.

(a) $y = \sqrt{x}$

(b) $y = \sqrt{x + 2}$

(c) $y = 2\sqrt{x}$

(d) $y = \sqrt{\frac{x}{3}}$

[4 marks]**B9** Make x the subject.

(a) $ax = bx + c$

(b) $x + ax = 5$

(c) $p(x - 1) = qx$

(d) $xy - 2 = x + y$

[4 marks]**B10** Make x the subject.

(a) $y = \frac{x}{x + 1}$

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

(c) $y = \frac{3x - 2}{x + 4}$

(d) $y = \frac{x + a}{x - a}$

[4 marks]

C**Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Ali makes x the subject of $y = 4x - 1$ and writes $x = \frac{y}{4} + 1$

Explain Ali's mistake, and write the correct answer.

[2 marks]

- C2** Tom makes l the subject of $P = 2(l + w)$ and writes $l = P - 2 - w$

Explain Tom's mistake, and write the correct answer.

[2 marks]

- C3** Jo and Sam each make x the subject of $y = \frac{x - 5}{3}$

Jo writes $x = 3y + 5$ Sam writes $x = 3(y + 5)$

Who is correct? Use a value of x to check, and explain Sam's mistake.

[3 marks]

- C4** The circumference of a circle is $C = 2\pi r$

(a) Make r the subject. (b) Find the radius of a circle with circumference 31.4 cm. Use $\pi = 3.14$

[3 marks]



HIGHER*Higher tier only*

- C5** Lily makes r the subject of $A = \pi r^2 + 5$ and writes $r = \sqrt{\frac{A}{\pi}} + 5$

Explain Lily's mistake, and write the correct answer.

[3 marks]

- C6** Ben makes c the subject of $c^2 = a^2 + b^2$ and writes $c = a + b$

Use $a = 3$ and $b = 4$ to show that Ben is wrong, and write the correct formula for c (with $c > 0$).

[3 marks]

- C7** Mia is asked to make x the subject of $ax - 2 = bx + 5$

She writes $x = \frac{bx + 7}{a}$

Explain why x is not yet the subject, and make x the subject correctly.

[3 marks]

- C8** Two formulae for motion with constant acceleration are $v = u + at$ and $s = \frac{1}{2}(u + v)t$

(a) Make t the subject of $v = u + at$

(b) Substitute your answer into the second formula to show that $v^2 = u^2 + 2as$

(c) Hence make u the subject of $v^2 = u^2 + 2as$, where $u > 0$

[5 marks]



D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

D1 A rectangle has length l and width w . Its perimeter is P .

(a) Show that $w = \frac{P}{2} - l$

(b) Hence write a formula for the area A of the rectangle in terms of P and l only.

[3 marks]

D2 $y = 2x + 5$ and $z = 3y - 1$

(a) Write a formula for z in terms of x . (b) Make x the subject of your formula.

[4 marks]

D3 Start with x . Multiply by 4, then subtract 1, then divide by 3. The result is y .

Write a formula for y in terms of x , and then make x the subject.

[3 marks]

D4 The sum of the interior angles of a polygon with n sides is $S = 180(n - 2)$

(a) Make n the subject. (b) Explain how your formula shows that no polygon has an angle sum of 1000°

[3 marks]



HIGHER*Higher tier only*

D5 The volume of a sphere is $V = \frac{4}{3}\pi r^3$

(a) Make r the subject. (b) A sphere has volume $36\pi \text{ cm}^3$. Find its radius. [4 marks]

D6 A worker is paid $\pounds h$ an hour for 40 hours, and $\pounds 1.5h$ an hour for each hour of overtime. In a week with x hours of overtime, the total pay is $\pounds T$.

(a) Show that $T = 40h + 1.5hx$ (b) Make h the subject. [4 marks]

D7 Make x the subject of $y = \sqrt{\frac{x+a}{x-a}}$

[4 marks]

D8 (a) Make x the subject of $y = \frac{3x+1}{x-3}$

(b) What do you notice about your answer? Explain what this means.

(c) Find the value of k for which $y = \frac{2x+5}{x+k}$ has the same property. [5 marks]



E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION*Foundation and Higher crossover*

E1 (a) Make x the subject of $y = 3x - 7$

.....
(2)

(b) Make m the subject of $p = \frac{m}{4}$

.....
(1)

(Total for Question E1 is 3 marks)

E2 Make t the subject of $v = u + at$

.....
(Total for Question E2 is 2 marks)

E3 Make w the subject of $P = 2(l + w)$

.....
(Total for Question E3 is 2 marks)

E4 The cost, C pounds, of hiring a van for d days is $C = 45 + 30d$

(a) Make d the subject of the formula.

.....
(2)

(b) Kim paid £225. For how many days did she hire the van?

.....
(1)

(Total for Question E4 is 3 marks)



- E5** The area of a trapezium is $A = \frac{1}{2}(a+b)h$

Make a the subject of the formula.

.....
(Total for Question E5 is 3 marks)

- E6** Kim makes x the subject of $y = 5x + 2$ and writes $x = \frac{y}{5} - 2$

Explain Kim's mistake, and write the correct answer.

.....
(Total for Question E6 is 2 marks)

HIGHER

Higher tier only

- E7** Make x the subject of $y = 2x^2 - 5$, where $x > 0$

.....
(Total for Question E7 is 3 marks)

- E8** Make t the subject of $4t - y = at + 3$

.....
(Total for Question E8 is 3 marks)

- E9** Make x the subject of $y = \frac{x+2}{x-3}$

.....
(Total for Question E9 is 4 marks)



E10 The lens formula is $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

(a) Make v the subject of the formula.

.....
(3)

(b) Find v when $u = 12$ and $f = 8$

.....
(1)

(c) Explain what your formula shows happens to v when $u = f$

(1)

(Total for Question E10 is 5 marks)

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