

GCSE MATHS

Rearranging formulae

Worked Solutions

Q1

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$$5x = y - 8$$

$$x = \frac{y - 8}{5}$$

Subtract eight from both sides.

Divide the whole of $y - 8$ by five.

Q2

*

$$at = v - u$$

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

Subtract u from both sides.

Divide by a .

Q3

*

$$2r = P - 2s$$

$$r = \frac{P - 2s}{2}$$

Subtract $2s$ from both sides.

Divide by two.

Q4

*

$$bx = a - y$$

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

Add bx and subtract y on both sides.

Divide by b .

Q5

*

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

$$m = 3(p + q)$$

Add q to both sides.

Multiply the entire right-hand side by three.

Q6

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

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

Divide by four before undoing the subtraction.

Add three.

Q7

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$$5y = 3x - 7$$

$$3x = 5y + 7$$

$$x = \frac{5y + 7}{3}$$

Multiply both sides by five.

Add seven.

Divide by three.

Q8

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$$F - 32 = \frac{9}{5}C$$

$$C = \frac{5}{9}(F - 32)$$

Subtract 32 before undoing the multiplication.

Multiply by five ninths.

Q9

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$$2s = (u + v)t$$

$$t = \frac{2s}{u + v}$$

Multiply by two.

Divide by the whole factor $u + v$.

Q10

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$$y - d = a(bx - c)$$

$$\frac{y - d}{a} = bx - c$$

$$bx = \frac{y - d}{a} + c$$

$$x = \frac{y - d + ac}{ab}$$

Subtract d .

Divide by a .

Add c .

Write over one denominator and divide by b .

Q11

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$$x^2 = y - 9$$

$$x = \sqrt{y - 9}$$

Subtract nine.

Take the positive square root because $x > 0$.

Q12

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$$3x^2 = y + 5$$

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

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

Add five.

Divide by three.

Take the positive square root of the whole fraction.

Q13

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$$y^2 = 2x + 7$$

$$2x = y^2 - 7$$

$$x = \frac{y^2 - 7}{2}$$

The original square root makes $y \geq 0$. Square both sides.

Subtract seven.

Divide by two.

Q14

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$$3V = 4\pi r^3$$

$$r^3 = \frac{3V}{4\pi}$$

$$r = \sqrt[3]{\frac{3V}{4\pi}}$$

Multiply by three.

Divide by 4π .

Take the cube root of the whole fraction.

Q15

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$$y - c = a\sqrt{x + b}$$

$$\frac{y - c}{a} = \sqrt{x + b}$$

$$\left(\frac{y - c}{a}\right)^2 = x + b$$

$$x = \left(\frac{y - c}{a}\right)^2 - b$$

Subtract c .

Divide by $a > 0$; the original equation implies $y \geq c$.

Square the whole left-hand side.

Subtract b .

Q16

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

$$x = \frac{y}{a + b}$$

Factor out x from both terms.

Divide by $a + b$.

Q17

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$$y - b = ax - cx$$

Subtract b .

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

Factor out x .

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

Divide by $a - c$.

Q18

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$$6y = 3ax + 2bx$$

Multiply every term by six.

$$6y = x(3a + 2b)$$

Factor out x .

$$x = \frac{6y}{3a + 2b}$$

Divide by the whole factor $3a + 2b$.

Q19

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$$ax + ab = cx - cd$$

Expand both brackets.

$$ab + cd = cx - ax$$

Collect x terms on the right and other terms on the left.

$$ab + cd = x(c - a)$$

Factor out x .

$$x = \frac{ab + cd}{c - a}$$

Divide by $c - a$.

Q20

**

$$2mx - 3m = nx + 4n$$

Expand both brackets.

$$2mx - nx = 3m + 4n$$

Collect x terms on the left.

$$x(2m - n) = 3m + 4n$$

Factor out x .

$$x = \frac{3m + 4n}{2m - n}$$

Divide by the whole factor $2m - n$.

Q21

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$$y(x + 2) = 5$$

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

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

Multiply both sides by $x + 2$.

Divide by y .

Subtract two. The first form is shorter; the second is a single fraction.

Q22

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$$y(bx + c) = a$$

$$bxy + cy = a$$

$$bxy = a - cy$$

$$x = \frac{a - cy}{by}$$

Multiply by $bx + c$.

Expand the bracket.

Subtract cy .

Divide by by .

Q23

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

$$yx - 2y = x + 3$$

$$yx - x = 2y + 3$$

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

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

Multiply by $x - 2$.

Expand.

Collect x terms on the left.

Factor out x .

Divide by $y - 1$.

Q24

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$$y(2x + 5) = 3x - 4$$

$$2xy + 5y = 3x - 4$$

$$4 + 5y = 3x - 2xy$$

$$4 + 5y = x(3 - 2y)$$

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

Multiply by $2x + 5$.

Expand.

Put all x terms on the right.

Factor out x .

Divide by $3 - 2y$.

Q25

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$\frac{1}{v} = \frac{u - f}{fu}$$

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

Subtract $1/u$.

Use the common denominator fu .

Take the reciprocal of both sides.

Q26

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$$10y = 2(2x + 3) - 5(x - 1)$$

$$10y = 4x + 6 - 5x + 5$$

$$10y = 11 - x$$

$$x = 11 - 10y$$

Multiply every term by ten.

Expand; subtracting $5(x - 1)$ gives $-5x + 5$.

Collect like terms.

Add x and subtract $10y$.

Q27

$$y(x^2 - 4) = 2x^2 + 3$$

$$yx^2 - 2x^2 = 4y + 3$$

$$x^2(y - 2) = 4y + 3$$

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

$$x = \sqrt{\frac{4y + 3}{y - 2}}$$

Multiply by $x^2 - 4$.

Expand and collect all x^2 terms on the left.

Factor out x^2 .

Divide by $y - 2$.

Take the positive square root because $x > 0$.

Q28

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$$S - 2\pi r^2 = 2\pi r h$$

$$h = \frac{S - 2\pi r^2}{2\pi r}$$

Subtract the area of the two circular ends.

Divide by $2\pi r$; both terms in the numerator are divided.

Q29

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

The original equation implies $y \geq 0$. Square both sides.

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

Multiply by $x-1$.

$$y^2x - x = y^2 + 3$$

Expand and collect x terms.

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

Factor out x .

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

Divide by $y^2 - 1$.

Q30

$$t_1 = \frac{d}{u}$$

Let each distance be d . Time equals distance divided by speed.

$$t_2 = \frac{d}{v}$$

$$a = \frac{2d}{d/u + d/v}$$

Average speed is total distance divided by total time.

$$a = \frac{2uv}{u+v}$$

Use a common denominator in the total time, then cancel d .

$$a(u+v) = 2uv$$

Multiply by $u+v$.

$$au + av = 2uv$$

Expand.

$$au = 2uv - av$$

Subtract av to gather the v terms.

$$au = v(2u - a)$$

Factor out v .

$$v = \frac{au}{2u - a}$$

Divide by $2u - a$. The condition $a < 2u$ makes this positive.