



Rearranging formulae

About 70 minutes No calculator 61 marks

Date _____

A Do Now

The first questions are what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks]

Make x the subject of $y = \frac{x}{4} - 7$.

A2 Last lesson [2 marks]

Factorise $15x^2 + 7x - 2$.

Answer

Answer

- A3** From chapter 1 [2 marks]

Work out the coefficient of x^2 in the expansion of $(1 + 2x)^5$.

A4 From chapter 1 [2 marks]

Simplify $\frac{12}{\sqrt{3}} + \sqrt{27}$.

Answer

Answer

B Example, then your turn

Level 2

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

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

Hint Undo the steps in reverse order: the half and the m first, the square last.

- B1** Make r the subject of [2 marks]
 $V = \frac{1}{3}\pi r^2 h$, where $r > 0$.

Answer

EXAMPLE 2

Make l the subject of $T = 2\pi\sqrt{\frac{l}{g}}$.

Hint Get the square root on its own first. Then square both sides.

- B2** Make k the subject of [3 marks]
 $m = 4 - \sqrt{2k + 1}$.

Answer

EXAMPLE 3

Make x the subject of $a(x - 3) = b(x + 2)$.

Hint Expand both brackets. Collect every term in x on one side and everything else on the other. Then factorise out x .

B3 Make y the subject of [3 marks]
 $3(y - p) = py + 4$.

Answer

EXAMPLE 4

Make x the subject of $y = \frac{2x+3}{x-4}$.

Hint Multiply both sides by $x - 4$ to clear the fraction. Then it is the same as the last example.

B4 Make t the subject of [3 marks]
 $w = \frac{5-3t}{2t+1}$.

Answer

EXAMPLE 5

Make v the subject of $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$.

Hint Get $\frac{1}{v}$ on its own, write the other side as one fraction, then turn both sides upside down.

B5 Make b the subject of [3 marks]
 $\frac{2}{a} - \frac{3}{b} = c$.

Answer

c Practice

Level 2

C1 Make u the subject of $s = \frac{(u+v)t}{2}$. [2 marks]

Answer

C2 Make x the subject of [2 marks]
 $y = 5x^3 - 2$.

Answer

C3 Make x the subject of [3 marks]
 $x^2 + a^2 = (x + b)^2$.

Answer

C4 Make a the subject of $\sqrt{\frac{a}{a+1}} = k$. [3 marks]

Answer

- C5** Make x the subject of $y = \frac{x}{3} + \frac{x}{5}$. [2 marks] **C6** Make d the subject of $F = \frac{9g}{d^2}$, where $d > 0$. [2 marks]

Answer

Answer

D Exam-style questions

AQA exam style

- D1** Ali makes x the subject of $y = \sqrt{x^2 + 9}$. He writes " $y = x + 3$, so $x = y - 3$ ". [3 marks]

Explain the mistake Ali makes. Make x the subject of $y = \sqrt{x^2 + 9}$ correctly.

Answer

- D2** Make k the subject of $m = \frac{2k^3 + 5}{k^3 - 4}$. [5 marks]

Answer

- D3** $y = x^2 + 10x + 31$, where $x > -5$.

- (a) Show that $x^2 + 10x + 31 = (x + 5)^2 + 6$. [1 mark]

- (b) Hence make x the subject of $y = x^2 + 10x + 31$. [2 marks]

Answer

- (c) Work out the value of x when $y = 87$. [1 mark]

Answer

Total for D3: 4 marks

D4 Two pipes fill a tank. Pipe A alone takes p hours. Pipe B alone takes q hours. With both pipes on, the tank takes T hours to fill, where $\frac{1}{T} = \frac{1}{p} + \frac{1}{q}$.

(a) Make q the subject of the formula.

[3 marks]

Answer

(b) Pipe A alone takes 6 hours. Both pipes together take 4 hours. How long does pipe B take alone? [1 mark]

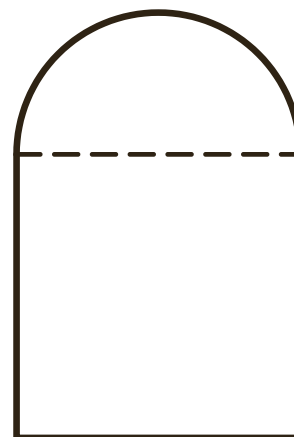
Answer hours

Total for D4: 4 marks

D5 The shape is a square of side x cm with a semicircle on its top side. The dashed side is not part of the outline.

(a) Show that the perimeter, P cm, of the shape is given by $P = 3x + \frac{1}{2}\pi x$. [2 marks]

(b) Make x the subject of $P = 3x + \frac{1}{2}\pi x$. Give your answer as a single fraction. [2 marks]



x cm

Answer

Total for D5: 4 marks

Not drawn accurately

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 Make x the subject of $y = \frac{x^2+1}{x^2-1}$. Hence find the values that y can never take. [5 marks]

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Treat x^2 as the subject first, the same way as $y = \frac{2x+3}{x-4}$. Then think about when a square root can be taken.
- Hint 2** $y(x^2 - 1) = x^2 + 1$, so $x^2(y - 1) = y + 1$ and $x^2 = \frac{y+1}{y-1}$.
- Hint 3** So $x = \pm\sqrt{\frac{y+1}{y-1}}$. This needs $\frac{y+1}{y-1} \geq 0$, which fails when $-1 < y < 1$; and $y = 1$ makes the bottom zero. So y can never take values with $-1 < y \leq 1$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can change the subject of a formula with powers and roots in it. ☐ ☐ ☐
- I can rearrange a formula where the subject appears more than once. ☐ ☐ ☐
- I can rearrange formulae with fractions and reciprocals. ☐ ☐ ☐
- I can rearrange a formula and then use it to work out a value. ☐ ☐ ☐