Rearranging Formulae (Subject Appearing Twice)

Practice Worksheet (Problem Solving)

I Do

Make x the subject of

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

$x =$ .....

(Total for Question is 3 marks)

We Do

Make x the subject of

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

$x =$ .....

(Total for Question is 4 marks)

You Do 1

Make x the subject of

$$y = \frac{5x - 1}{x + 4}$$

$x =$ .....

(Total for Question is 4 marks)

You Do 2

Make t the subject of

$$p = \frac{4t - 3}{2t + 1}$$

$t =$ .....

(Total for Question is 4 marks)

You Do 3

Make m the subject of

$$k = \frac{7 - 2m}{3m - 5}$$

$m =$ .....

(Total for Question is 4 marks)

Challenge 1

Make x the subject of

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

Show all of your algebraic working clearly.

$x =$ .....

(Total for Question is 4 marks)

Challenge 2

Make x the subject of

$$w = \frac{ax + 3}{bx - c}$$

Show all of your algebraic working clearly.

$x =$ .....

(Total for Question is 4 marks)

Extreme Challenge

$$y = \frac{x^2 + 5}{2x^2 - 3} \qquad \text{where } x > 0$$

(a) Make x the subject of the formula.
You must show all of your algebraic working clearly.

$x =$ ..... *(4 marks)*

(b) Hence, find the exact value of x when $y = 5$.
Give your answer in its simplest surd form.

$x =$ ..... *(2 marks)*

(Total for Question is 6 marks)

Worked Answers

I Do

1. Multiply both sides by $(x-3)$: $y(x-3)=2x+5$.
2. Expand the bracket: $xy-3y=2x+5$.
3. Collect x terms on one side: $xy-2x=3y+5$.
4. Factorise out x: $x(y-2)=3y+5$.
5. Divide by $(y-2)$: $\mathbf{x=\dfrac{3y+5}{y-2}}$ *(or equivalently* $\mathbf{x=\dfrac{-3y-5}{2-y}}$*).*

We Do

$y(x-2)=3x+4 \implies xy-2y=3x+4$

$xy-3x=2y+4 \implies x(y-3)=2y+4 \implies \mathbf{x=\dfrac{2y+4}{y-3}}$.

You Do 1

$y(x+4)=5x-1 \implies xy+4y=5x-1$

$4y+1=5x-xy \implies 4y+1=x(5-y) \implies \mathbf{x=\dfrac{4y+1}{5-y}}$ *(or* $\mathbf{x=\dfrac{-4y-1}{y-5}}$*).*

You Do 2

$p(2t+1)=4t-3 \implies 2pt+p=4t-3$

$p+3=4t-2pt \implies p+3=t(4-2p) \implies \mathbf{t=\dfrac{p+3}{4-2p}}$ *(or* $\mathbf{t=\dfrac{-p-3}{2p-4}}$*).*

You Do 3

$k(3m-5)=7-2m \implies 3km-5k=7-2m$

$3km+2m=7+5k \implies m(3k+2)=7+5k \implies \mathbf{m=\dfrac{7+5k}{3k+2}}$.

Challenge 1

1. Square both sides to remove the square root:

$y^2 = \dfrac{3x+1}{x-4}$

2. Multiply both sides by $(x-4)$ and expand:

$y^2(x-4) = 3x+1 \implies xy^2 - 4y^2 = 3x+1$

3. Collect x terms on one side and factorise:

$xy^2 - 3x = 4y^2 + 1 \implies x(y^2-3) = 4y^2+1$

4. Divide by (y^2-3):

$\mathbf{x = \dfrac{4y^2+1}{y^2-3}}$.

Challenge 2

1. Multiply both sides by $(bx-c)$ and expand:

$w(bx-c) = ax+3 \implies bwx - cw = ax+3$

2. Collect x terms on one side and factorise:

$bwx - ax = cw+3 \implies x(bw-a) = cw+3$

3. Divide by $(bw-a)$:

$\mathbf{x = \dfrac{cw+3}{bw-a}}$ *(or* $\mathbf{x = \dfrac{-cw-3}{a-bw}}$*).*

Extreme Challenge

(a) 1. Multiply both sides by $(2x^2-3)$ and expand:

$y(2x^2-3) = x^2+5 \implies 2x^2y - 3y = x^2+5$

2. Collect x^2 terms on one side and factorise:

$2x^2y - x^2 = 3y+5 \implies x^2(2y-1) = 3y+5$

3. Divide by $(2y-1)$:

$x^2 = \dfrac{3y+5}{2y-1}$

4. Take the positive square root (since $x > 0$):

$\mathbf{x = \sqrt{\dfrac{3y+5}{2y-1}}}$.

(b) Substitute $y = 5$ into the rearranged formula:

$x = \sqrt{\dfrac{3(5)+5}{2(5)-1}} = \sqrt{\dfrac{20}{9}} = \dfrac{\sqrt{20}}{\sqrt{9}} = \dfrac{\sqrt{4\times5}}{3} = \mathbf{\dfrac{2\sqrt{5}}{3}}$.