Changing the Subject of a Formula - Worksheet

Skill

Group A - Linear formulae

Make x the subject:

1) $y = x + a$

2) $y = x - a$

3) $y = a + x$

4) $y = a - x$

5) $y = ax + b$

6) $y = ax - b$

7) $y = b + ax$

8) $y = b - ax$

9) $ax = bx + c$

10) $ax - c = bx + c$

11) $ax + c = bx - c$

12) $ax + b = cx + d$

Group B - Formulae involving powers and roots

Make x the subject:

1) $y = x^2$

2) $y = \sqrt{x}$

3) $y = ax^2$

4) $y = \sqrt{ax}$

5) $y = ax^2 + b$

6) $y = ax^2 - b$

7) $y = \sqrt{ax} + b$

8) $y = \sqrt{ax + b}$

9) $y = b + \sqrt{ax}$

10) $y = b - \sqrt{ax}$

11) $y = \sqrt{b + ax}$

12) $y = \sqrt{b - ax}$

Group C - Formulae involving fractions

Make x the subject:

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

2) $y = \frac{a}{x}$

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

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

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

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

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

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

9) $y = \frac{x^2}{a} + b$

10) $y = \frac{x^2+b}{a}$

11) $y = \sqrt{\frac{x}{a}}$

12) $y = \sqrt{\frac{x}{a}} + b$

Changing the Subject of a Formula - Worksheet

Applied

1) Show that $h = \frac{4+3j}{5-j}$ can be rearranged to $j = \frac{5h-4}{3+h}$

2) **(a)** The formula below is used to work out how much tax you pay.

$T = 0.2(E - 10\,600)$

T is the amount of tax you pay in pounds.
E is the amount of money you earn in pounds.

Rearrange the formula to make E the subject.

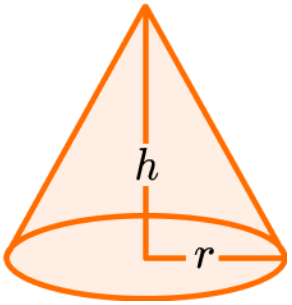
(b) Alison pays £5200 tax.

Work out the amount she earns.

3) Make x the subject of the formula $y(x + 3) = 2 + x$

4) Rearrange $5px + 4p = 1 + 2x$ to make p the subject.

5) The formula for the volume of a cone, Vcm^3, is $V = \frac{1}{3}\pi r^2 h$.



Given that the height of the cone is twice the radius, find r in terms of V.

Changing the Subject of a Formula - Exam Questions

1) **(a)** Make b the subject of $a = b + 5$

.....

(1)

(b) Work out the value of b when $a = 9$

.....

(2)

(3 marks)

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2) Rearrange the following equations to make x the subject.

(a) $5x = 8$

.....

(1)

(b) $3x = 2y$

.....

(1)

(c) $\frac{7}{x} = 3y$

.....

(1)

(d) $12 - x = b$

.....

(1)

(4 marks)

Changing the Subject of a Formula - Exam Questions

3) Make h the subject of the formula $4(g - h) = 5h - 4$

.....

(3 marks)

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4) Make d the subject of $e = \frac{d-4}{d+3}$

.....

(4 marks)

Changing the Subject of a Formula - Answers

	Question	Answer
	Skill Questions	
Group A	Make x the subject: **1)** $y = x + a$ **2)** $y = x - a$ **3)** $y = a + x$ **4)** $y = a - x$ **5)** $y = ax + b$ **6)** $y = ax - b$ **7)** $y = b + ax$ **8)** $y = b - ax$ **9)** $ax = bx + c$ **10)** $ax - c = bx + c$ **11)** $ax + c = bx - c$ **12)** $ax + b = cx + d$	 **1)** $x = y - a$ **2)** $x = y + a$ **3)** $x = y - a$ **4)** $x = a - y$ **5)** $x = \frac{y-b}{a}$ **6)** $x = \frac{y+b}{a}$ **7)** $x = \frac{y-b}{a}$ **8)** $x = \frac{b-y}{a}$ **9)** $x = \frac{c}{a-b}$ **10)** $x = \frac{2c}{a-b}$ **11)** $x = \frac{-2c}{a-b}$ or $x = \frac{2c}{b-a}$ **12)** $x = \frac{d-b}{a-c}$ or $x = \frac{b-d}{c-a}$

Changing the Subject of a Formula - Answers

Group B	Make x the subject:	
	1) $y = x^2$	**1)** $x = \sqrt{y}$
	2) $y = \sqrt{x}$	**2)** $x = y^2$
	3) $y = ax^2$	**3)** $x = \sqrt{\frac{y}{a}}$
	4) $y = \sqrt{ax}$	**4)** $x = \frac{y^2}{a}$
	5) $y = ax^2 + b$	**5)** $x = \sqrt{\frac{y-b}{a}}$
	6) $y = ax^2 - b$	**6)** $x = \sqrt{\frac{y+b}{a}}$
	7) $y = \sqrt{ax} + b$	**7)** $x = \frac{(y-b)^2}{a}$
	8) $y = \sqrt{ax + b}$	**8)** $x = \frac{y^2-b}{a}$
	9) $y = b + \sqrt{ax}$	**9)** $x = \frac{(y-b)^2}{a}$
	10) $y = b - \sqrt{ax}$	**10)** $x = \frac{(b-y)^2}{a}$
	11) $y = \sqrt{b + ax}$	**11)** $x = \frac{y^2-b}{a}$
	12) $y = \sqrt{b - ax}$	**12)** $x = \frac{b-y^2}{a}$

Changing the Subject of a Formula - Answers

Group C	Make x the subject:	
	1) $y = \frac{x}{a}$	**1)** $x = ay$
	2) $y = \frac{a}{x}$	**2)** $x = \frac{a}{y}$
	3) $y = \frac{x}{a} + b$	**3)** $x = a(y - b)$
	4) $y = \frac{x}{a} - b$	**4)** $x = a(y + b)$
	5) $y = \frac{a}{x} + b$	**5)** $x = \frac{a}{y-b}$
	6) $y = \frac{a}{x} - b$	**6)** $x = \frac{a}{y+b}$
	7) $y = \frac{x+b}{a}$	**7)** $x = ay - b$
	8) $y = \frac{a+b}{x}$	**8)** $x = \frac{a+b}{y}$
	9) $y = \frac{x^2}{a} + b$	**9)** $x = \sqrt{a(y - b)}$
	10) $y = \frac{x^2+b}{a}$	**10)** $x = \sqrt{ay - b}$
	11) $y = \sqrt{\frac{x}{a}}$	**11)** $x = ay^2$
	12) $y = \sqrt{\frac{x}{a}} + b$	**12)** $x = a(y - b)^2$

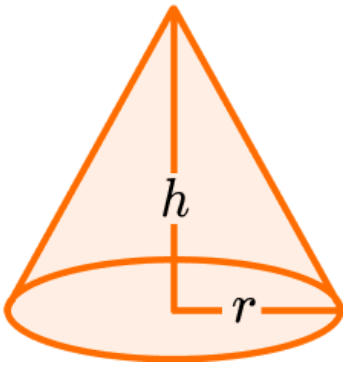
Changing the Subject of a Formula - Answers

	Question	Answer
	Applied Questions	
1)	Show that $h = \frac{4+3j}{5-j}$ can be rearranged to $j = \frac{5h-4}{3+h}$	$h = \frac{4+3j}{5-j}$ $h(5 - j) = 4 + 3j$ $5h - hj = 4 + 3j$ $5h - 4 = 3j + hj$ $5h - 4 = j(3 + h)$ $j = \frac{5h-4}{3+h}$
2)	The formula below is used to work out how much tax you pay. $T = 0.2(E - 10\,600)$ T is the amount of tax you pay in pounds. E is the amount of money you earn in pounds. **a)** Rearrange the formula to make E the subject. **b)** Alison pays £5200 tax. Work out the amount she earns.	**a)** $E = \frac{T}{0.2} + 10\,600$ **oe** **b)** $E = \frac{5200}{0.2} + 10\,600$ $E = £36\,600$
3)	Make x the subject of the formula $y(x + 3) = 2 + x$	$y(x + 3) = 2 + x$ $xy + 3y = 2 + x$ $xy - x = 2 - 3y$ $x(y - 1) = 2 - 3y$ $x = \frac{2-3y}{y-1}$
4)	Rearrange $5px + 4p = 1 + 2x$ to make p the subject.	$5px + 4p = 1 + 2x$ $p(5x + 4) = 1 + 2x$ $p = \frac{1+2x}{5x+4}$

Changing the Subject of a Formula - Answers

5)

The formula for the volume of a cone, $V\ cm^3$, is $V = \frac{1}{3}\pi r^2 h$.



Given that the height of the cone is twice the radius, find r in terms of V.

$V = \frac{1}{3}\pi r^2 h,\ h = 2r$

$V = \frac{1}{3}\pi r^2 \times 2r$

$V = \frac{2}{3}\pi r^3$

$3V = 2\pi r^3$

$\frac{3V}{2\pi} = r^3$

$r^3 = \frac{3V}{2\pi}$

$r = \sqrt[3]{\frac{3V}{2\pi}}$

Changing the Subject of a Formula - Mark Scheme

	Question	Answer	
	Exam Questions		
1) (a)	Make b the subject of $a = b + 5$	**(a)** $b = a - 5$	**(1)**
(b)	Work out the value of b when $a = 9$	**(b)** $b = 9 - 5$ $b = 4$	**(1)** **(1)**
2) (a)	Rearrange the following equations to make x the subject. $5x = 8$	**(a)** $x = \frac{8}{5}$	**(1)**
(b)	$3x = 2y$	**(b)** $x = \frac{2y}{3}$ or $x = \frac{2}{3}y$	**(1)**
(c)	$\frac{7}{x} = 3y$	**(c)** $x = \frac{7}{3y}$	**(1)**
(d)	$12 - x = b$	**(d)** $x = 12 - b$	**(1)**
3)	Make h the subject of the formula $4(g - h) = 5h - 4$	$4g - 4h = 5h - 4$ $4g + 4 = 5h + 4h$ **or** $4g + 4 = 9h$ $h = \frac{4g+4}{9}$ **oe**	**(1)** **(1)** **(1)**

Changing the Subject of a Formula - Mark Scheme

4)	Make d the subject of $e = \frac{d-4}{d+3}$	$e(d + 3) = d - 4$ $de + 3e = d - 4$ **or** $de - d = -4 - 3e$ $d(e - 1) = -4 - 3e$ $d = \frac{-4-3e}{e-1}$ **oe** **Alternatively:** $e(d + 3) = d - 4$ $de + 3e = d - 4$ **or** $3e + 4 = d - de$ $3e + 4 = d(1 - e)$ $d = \frac{3e+4}{1-e}$	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**