Rearranging formulae when the required subject appears more than once

Starter

1. **(Review of last lesson)**

Make w the subject of: (a) $c = \sqrt{n - w}$ (b) $xy = 7 - 4z^5$

Working: (a)

	$c = \sqrt{n - w}$
Square both sides:	$c^2 = n - w$
Add w to make w positive:	$c^2 + w = n$
Subtract c^2 from both sides:	$w = n - c^2$

(b)

	$xy = 7 - 4z^5$
Add $4z^5$ to make z positive:	$xy + 4z^5 = 7$
Subtract xy from both sides:	$4z^5 = 7 - xy$
Divide both sides by 4:	$z^5 = \dfrac{7 - xy}{4}$
5th root both sides:	$z = \sqrt[5]{\dfrac{7 - xy}{4}}$

2. **(Review of previous material)** Factorise $xy + x$.

Working: $xy + x = x(y + 1)$ ***note the 1 in the bracket***

3. (a) Make x the subject of $5x = 2x + 4y$
(b) Using a similar first step to (a), make x the subject of $5x = ax + 4y$.

Working: (a)

	$5x = 2x + 4y$
Subtract $2x$ from both sides:	$3x = 4y$
Divide both sides by 3:	$x = \dfrac{4y}{3}$

(b)

	$5x = ax + 4y$
Subtract ax from both sides:	$5x - ax = 4y$
Factorise the LHS:	$x(5 - a) = 4y$
Divide both sides by $5 - a$:	$x = \dfrac{4y}{5 - a}$

E.g. 1 Make y the subject: (a) $ay + d = 3d + py$ (b) $my - c = e - ny$

Working: (a)

	$ay + d = 3d + py$
Subtract py from both sides:	$ay - py + d = 3d$
Subtract d from both sides:	$ay - py = 2d$
Factorise the LHS:	$y(a - p) = 2d$
Divide both sides by $a - p$:	$y = \dfrac{2d}{a - p}$

(b)

	$my - c = e - ny$
Add ny to both sides:	$my + ny - c = e$
Add c to both sides:	$my + ny = e + c$
Factorise the LHS:	$y(m + n) = e + c$

Divide both sides by $m+n$**:** $$y=\frac{e+c}{m+n}$$

E.g. 2 Make x the subject: (a) $a(x+2)=3(4-5x)$ (b) $5(x-p)=q(7+x)$

Working: (a)

	$a(x+2)=3(4-5x)$
Expand the brackets:	$ax+2a=12-15x$
Add $15x$ ***to both sides***:	$ax+15x+2a=12$
Subtract $2a$ ***from both sides***:	$ax+15x=12-2a$
Factorise the LHS:	$x(a+15)=12-2a$
	$x=\frac{12-2a}{a+15}$

(b)

	$5(x-p)=q(7+x)$
Expand the brackets:	$5x-5p=7q+qx$
Subtract qx ***from both sides***:	$5x-qx-5p=7q$
Add $5p$ ***to both sides***:	$5x-qx=7q+5p$
Factorise the LHS:	$x(5-q)=7q+5p$
	$x=\frac{7q+5p}{5-q}$

E.g. 3 Make y the subject: (a) $\frac{a-y}{b+y}=d$ (b) $\frac{2y+p}{q-y}=\frac{t}{3}$

Working: (a)

	$\frac{a-y}{b+y}=d$
Multiply both sides by $b+y$**:**	$a-y=d(b+y)$
Expand the brackets:	$a-y=bd+dy$
Add y ***to both sides***:	$a=bd+dy+y$
Subtract bd ***from both sides***:	$a-bd=dy+y$
Factorise the LHS:	$a-bd=y(d+1)$
Divide both sides by $d+1$**:**	$\frac{a-bd}{d+1}=y$
New subject on the LHS:	$y=\frac{a-bd}{d+1}$

(b)

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

Cross multiply:	$3(2y+p)=t(q-y)$
Expand the brackets:	$6y+3p=qt-ty$
Add ty ***to both sides***:	$6y+3p+ty=qt$
Subtract $3p$ ***from both sides***:	$6y+ty=qt-3p$
Factorise the LHS:	$y(6+t)=qt-3p$
Divide both sides by $6+t$**:**	$x=\frac{qt-3p}{6+t}$

Video: Solving equations with letters on both sides

Exercise

9-1 class textbook:	p169 M6.7 Qu 1-3, 4ace…, 5, 6, 7ace…, 8, 9
A*-G class textbook:	p162 E6.1 Qu 1-3, 4ace…, 5, 6, 7ace…, 8, 9
9-1 homework book:	p60 M6.7 Qu 1-10
A*-G homework book:	p46 E6.1 Qu 1-10