

S3 (3.1) Changing the subject.notebook

September 22, 2017

Daily Practice 12.6.2017

Q1. A pair of shoes cost £84, they are reduced by 30% in the sale, how much are they now?

10% of 84 = £8.40
 30% of 84 = 8.40 x 3 = £25.20
 £84 - £25.20 = £58.80

Q2. Calculate the volume of a cylinder with radius 12cm and height 70cm

$V = \pi r^2 h = \pi \times 12^2 \times 70 = 31667.25 \text{ cm}^3$

Q3. $2\frac{2}{3} \div \frac{1}{5} = \frac{8}{3} \times \frac{5}{1} = \frac{40}{3} = 13\frac{1}{3}$

Q4. State the equation of the line joining (-3, 2) and (-2, 1)

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 2}{-2 - (-3)} = \frac{-1}{1} = -1$
 $y = mx + c$
 $2 = -1(-3) + c$
 $2 = 3 + c$
 $c = -1$
 $y = -x - 1$

Q5. State where the line $y = 3x - 6$ cuts the x and y axes.

x -axis $\Rightarrow y = 0$
 $3x - 6 = 0$
 $3x = 6$
 $x = 2$ (2, 0)

y -axis $\Rightarrow x = 0$
 $y = -6$
(0, -6)

Today we will be learning how to rearrange formula.

Changing the subject of Formulae

In a formula, the subject is always the letter that equals the formula. For example, in the formula $E = MC^2$, E is the subject.

Changing the subject means rearranging the formula to get it in terms of a different letter like M.

Remember opposite operations!

+	-
-	+
×	÷
÷	×
x^2	$\sqrt{\quad}$
\sqrt{a}	a^2
a^2	$\sqrt{\quad}$

Changing the subject

Examples:

Change the subject of each of the following to the letter in brackets:

i) $a + b = c$ (b)
 $-a \quad -a$
 $b = c - a$

ii) $\frac{h}{g} = d$ (g)
 $\times g \quad \times g$
 $h = gd$
 $\div d \quad \div d$
 $\frac{h}{d} = g$
 $g = \frac{h}{d}$

iii) $w = pr + t$ (r)
 $-t \quad -t$
 $w - t = pr$
 $\div p \quad \div p$
 $\frac{w-t}{p} = r$
 $r = \frac{w-t}{p}$

(iv) $w = 3y + 2$

1. Change the subject of each formula to x.

- | | | |
|-------------------|-------------------|-------------------|
| (a) $y = x + 3$ | (b) $y = x - 5$ | (c) $y = x + a$ |
| (d) $y = x - b$ | (e) $y = 3x$ | (f) $y = 10x$ |
| (g) $y = kx$ | (h) $y = ax$ | (i) $y = 3p + x$ |
| (j) $y = x - 5t$ | (k) $y = 2x + 1$ | (l) $y = 3x - 7$ |
| (m) $y = 7x + 4a$ | (n) $y = 3b + 4x$ | (o) $y = 8 + 10x$ |

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Solve the following equations

(a) $2x = 15$
 $\div 2 \quad \div 2$
 $x = 7.5$

(b) $3x - 1 = 14$
 $+1 \quad +1$
 $3x = 15$
 $\div 3 \quad \div 3$
 $x = 5$

(c) $8x + 3 = 6x - 7$
 $-6x \quad -6x$
 $2x + 3 = -7$
 $-3 \quad -3$
 $2x = -10$
 $\div 2 \quad \div 2$
 $x = -5$

(d) $2(x + 4) = 17$
 $2x + 8 = 17$
 $-8 \quad -8$
 $2x = 9$
 $\div 2 \quad \div 2$
 $x = 4.5$

(e) $\frac{1}{2}x + 2 = 20$
 $x + 4 = 40$
 $x = 36$

(f) $\frac{40}{x} + 5 = 25$
 $\frac{40}{x} = 20$
 $40 = 20x$
 $\div 20 \quad \div 20$
 $2 = x$

Today we will be continuing to learn how to change the subject of a formula.

Make 'x' the Subject

$x + 4 = 10$
 $-4 \quad -4$
 $x = 6$

$x - 8 = 29$
 $x = 37$

$x - p = q$
 $x = q + p$

$x + r = d$
 $x = d - r$

Make 'x' the Subject

$2x = 10$
 $\div 2 \quad \div 2$
 $x = 5$

$5x = 30$
 $\div 5 \quad \div 5$
 $x = 6$

$3x = d$
 $\div 3 \quad \div 3$
 $x = \frac{d}{3}$

$rx = q$
 $\div r \quad \div r$
 $x = \frac{q}{r}$

Make 'x' the Subject

$2x + 3 = 19$
 $-3 \quad -3$
 $2x = 16$
 $\div 2 \quad \div 2$
 $x = 8$

$4x - 6 = 26$
 $+6 \quad +6$
 $4x = 32$
 $\div 4 \quad \div 4$
 $x = 8$

$kx - f = 13$
 $+f \quad +f$
 $kx = 13 + f$
 $\div k \quad \div k$
 $x = \frac{13 + f}{k}$

$5x + t = s$
 $-t \quad -t$
 $5x = s - t$
 $\div 5 \quad \div 5$
 $x = \frac{s - t}{5}$

Make 'x' the Subject

$33 = 5x - 2$
 $+2 \quad +2$
 $35 = 5x$
 $\div 5 \quad \div 5$
 $7 = x$

$27 = 6x + 9$
 $-9 \quad -9$
 $18 = 6x$
 $\div 6 \quad \div 6$
 $x = 3$

$u = 5x - s$
 $+s \quad +s$
 $u + s = 5x$
 $\div 5 \quad \div 5$
 $x = \frac{u + s}{5}$

$g = fx + m$
 $-m \quad -m$
 $g - m = fx$
 $\div f \quad \div f$
 $x = \frac{g - m}{f}$

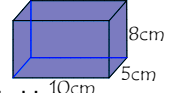
- (a) $y = ax + b$
- (b) $y = mx + c$
- (c) $t = sx - r$
- (d) $p = qx + 2r$
- (e) $m = fx - 3n$
- (f) $a = b + cx$
- (g) $k = h - mx$
- (h) $d = 3b + cx$
- (i) $g = kc - hx$

Daily Practice Non-Calc. 15.6.2017

Q1. Multiply out and simplify $3(2c + 1) + 4(3c - 8)$
 $6c + 3 + 12c - 32$

Q2. Find 17.5% of 800
 $800 \times 0.175 = 140$
 $18c - 29$

Q3. Solve $4(x - 5) = 2x + 6$
 $4x - 20 = 2x + 6$
 $2x - 20 = 6$
 $2x = 26$
 $x = 13$



Q4. Calculate the surface area of this cuboid
 $10 \times 5 \times 2 = 100 \text{cm}^2$
 $8 \times 10 \times 2 = 160 \text{cm}^2$
 $8 \times 5 \times 2 = 80 \text{cm}^2$
 $S.A = 100 + 160 + 80 = 340 \text{cm}^2$

Q5. Rearrange $y = mx + c$ so that m is the subject

$y - c = mx$
 $\frac{y - c}{x} = m$
 $m = \frac{y - c}{x}$

10. James lives in Balerno and has a dentist appointment in Edinburgh at 3.45pm. James will be travelling by bus. He has a 12-minute walk to the bus stop at Cockburn Crescent. The dentist is a 5-minute walk from the stop at Haymarket. Use the timetable below to work out the latest time he should leave for the bus. You must show all working! 3 marks

Balerno	Cockburn Crescent	0850	0900	0910	0920	0930	0940	0950	1000	1008	1016	23	33	43	53	03	13	1623
Juniper Green Post Office	Stateford Station	0904	0914	0923	0933	0943	0953	1003	1013	1021	1029	35	45	55	05	15	25	1635
Haymarket Dairy Road	Leopold Place	0916	0924	0933	0943	0953	1003	1013	1023	1031	1039	46	56	06	16	26	36	1646
Meadowbank House	Branstane	0926	0934	0943	0953	1003	1013	1023	1033	1041	1049	56	06	16	26	36	46	1656
Musselburgh Police Station	Wallyford PARK & RIDE	0944	0952	1001	1011	1021	1031	1041	1051	1059	1107	17	27	37	47	57	07	1717
Tranent Police Station	Tranent Windygould	0951	0959	1008	1018	1028	1038	1048	1058	1106	1114	24	34	44	54	04	14	1725
		1000	1008	1017	1027	1037	1047	1057	1107	1115	1123	33	43	53	03	13	23	1736
		1011	1019	1028	1038	1048	1058	1109	1119	1127	1135	45	55	05	15	25	35	1748
		1020	1028	1037	1047	1059	1109	1119	1129	1137	1145	55	05	15	25	35	45	1758
		1	1031	1	1050	1	1112	1	1132	1	1148	1	08	1	28	1	48	1
		1027	—	1044	—	1107	—	1127	—	1145	—	03	—	23	—	43	—	1806
		1032	—	1049	—	1112	—	1132	—	1150	—	08	—	28	—	48	—	1811

$2:51 \text{pm} \xrightarrow{12 \text{ mins}} 3:03 \text{pm} \xrightarrow{5 \text{ min}} 3:45 \text{pm}$

Today we will be continuing to learn how to change the subject of a formula.

Changing the subject - Straight Line

The gradient of a line can only be read from the equation if it is of the form $y = mx + c$.

Examples: State the gradient of the following lines

$y = mx + c$

(a) $3x - 2y + 5 = 0$
 $3x + 5 = 2y$
 $\div 2$
 $1.5x + 2.5 = y$
 $y = 1.5x + 2.5$
 $m = 1.5$

(b) $2x - y = 4$
 $-y = 4 - 2x$
 $2x - 4 = y$
 $y = 2x - 4$
 $m = 2$

(c) $3y + 5x = 7$
 $3y = 7 - 5x$
 $y = \frac{7}{3} - \frac{5}{3}x$
 $y = -\frac{5}{3}x + \frac{7}{3}$
 $m = -\frac{5}{3}$

$\frac{x}{2} = -6$
 $x = -12$

or
 $\frac{x}{2} + 2 = -4$
 $x + 4 = -8$
 $x = -12$

Make 'x' the Subject

$\frac{x}{5} - t = s$
 $x - 5t = 5s$
 $+5t + 5t$
 $x = 5s + 5t$

$\frac{x}{5} = t + s$
 $x = 5(t + s)$

$2x + y = q$
 $+ -y -y$
 $2x = q - y$
 $2x = t(q - y)$
 $x = \frac{t(q - y)}{2}$

$\frac{gx}{h} - p = 9y$
 $+p +p$
 $\frac{gx}{h} = 9y + p$
 $gx = h(9y + p)$
 $x = \frac{h(9y + p)}{g}$

Daily Practice 16.6.2017

Q1. Find 15% of 780 $780 \div 10 = 78$ $78 \times (15 \div 5) = 117$

Q2. Multiply out and simplify $2(3x + 4) - 8(x + 5)$
 $6x + 8 - 8x - 40$

Q3. Share £420 in the ratio 2:3
 $420 \div 5 = 84$ $84 \times 2 = 168$ $84 \times 3 = 252$ $168 : 252$

Q4. Factorise $3g^2h - 6g$ $3g(g-2)$

Q5. Find the median and range of -2, 3, 4, 5, 7, 8
 4.5
 $4.5 - 2 = 2.5$
 $8 - (-2) = 10$

Today we will be continuing to learn how to rearrange formulae.

Changing the subject

Examples: Change the subject of the formula to h

(i) $g = \frac{ah + 2p}{-2p}$
 $-2p \cdot g = ah + 2p$
 $-2pg = ah + 2p$
 $-2pg - 2p = ah$
 $-2p(g+1) = ah$
 $h = \frac{-2p(g+1)}{a}$

(ii) $t = \frac{3b+a}{b}$
 $bt = 3b+a$
 $bt - 3b = a$
 $b(t-3) = a$
 $t-3 = \frac{a}{b}$
 $t = \frac{a}{b} + 3$

(iii) $g = \frac{h-5}{t}$
 $gt = h-5$
 $gt + 5 = h$
 $h = gt + 5$

(iv) $s = \frac{5}{h} + t$
 $sh = 5 + th$
 $sh - th = 5$
 $h(s-t) = 5$
 $h = \frac{5}{s-t}$

1. Make x the subject of each formula.

- (a) $y = \frac{3}{x}$
- (b) $d = \frac{c}{x}$
- (c) $m = \frac{y}{x}$
- (d) $s = \frac{a+2}{x}$
- (e) $w = \frac{z-1}{x}$
- (f) $a = \frac{b+c}{x}$
- (g) $a = \frac{x+8}{9}$
- (h) $k = \frac{x-5}{2}$
- (i) $p = \frac{3-x}{4}$
- (j) $y = \frac{2}{x} + 1$
- (k) $z = \frac{6}{x} - 7$
- (l) $h = \frac{m}{x} + k$

Pegasys

1. Make x the subject of each formula.

- (a) $y = \frac{3}{x}$
- (b) $d = \frac{c}{x}$
- (c) $m = \frac{y}{x}$
- (d) $s = \frac{a+2}{x}$
- (e) $w = \frac{z-1}{x}$
- (f) $a = \frac{b+c}{x}$
- (g) $a = \frac{x+8}{9}$
- (h) $k = \frac{x-5}{2}$
- (i) $p = \frac{3-x}{4}$
- (j) $y = \frac{2}{x} + 1$
- (k) $z = \frac{6}{x} - 7$
- (l) $h = \frac{m}{x} + k$

Make 'x' the Subject

$x^2 = 144$
 $x = \pm \sqrt{144} = \pm 12$

$x^2 = r$
 $x = \pm \sqrt{r}$

$2x^2 = 98$
 $x^2 = 49$
 $x = \pm \sqrt{49} = \pm 7$
 $rx^2 = t$

$x^2 = \frac{98}{2}$
 $x = \pm \sqrt{\frac{98}{2}}$

$x^2 = \frac{t}{r}$
 $x = \pm \sqrt{\frac{t}{r}}$

Pegasys

Daily Practice 19.6.2017

Q1. Round 182116 to 2 significant figures

→ 180 000

Q2. Calculate the volume of a cylinder with diameter 15cm and height 23cm.

$$V = \pi r^2 h = \pi \times 7.5^2 \times 23 = \underline{4064.4 \text{ cm}^3} \text{ (1.d.p.)}$$

Q3. Multiply out and simplify $7(2k + 2) - 3(k + 4)$

$$14k + 14 - 3k - 12$$

$$11k + 2$$

Q4. Rearrange the formula $h = gc + k$ such that 'c' is the subject

$$\begin{aligned} h - k &= gc \\ \frac{h - k}{g} &= c \end{aligned} \quad c = \frac{h - k}{g} \quad (h - k) \div g$$

Today we will be continuing to practise questions on changing the subject.

Make 'x' the Subject

$$x^2 + 6 = 35$$

$$x^2 = 29$$

$$x = \pm\sqrt{29}$$

$$2x^2 - b = 15$$

$$2x^2 = 15 + b$$

$$x^2 = \frac{15 + b}{2}$$

$$px^2 + m = n$$

$$px^2 = n - m$$

$$x^2 = \frac{n - m}{p}$$

$$rx^3 - u = 2s$$

$$rx^3 = 2s + u$$

$$x^3 = \frac{2s + u}{r}$$

$$x = \sqrt[3]{\frac{2s + u}{r}}$$

$$x = \sqrt{\frac{15 + b}{2}}$$

$$x = \sqrt{\frac{n - m}{p}}$$

$$x > 0$$

Make 'x' the Subject

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

$$\sqrt{x} = 2$$

$$x = 4$$

$$\sqrt{x - b} = c$$

$$\sqrt{x} = c + b$$

$$x = (c + b)^2$$

$$2\sqrt{x} + 5 = p$$

$$2\sqrt{x} = p - 5$$

$$\sqrt{x} = \frac{p - 5}{2}$$

$$x = \left(\frac{p - 5}{2}\right)^2$$

$$\frac{(p - 5)^2}{4}$$

$$7\sqrt{x} - t = 4r$$

Changing the subject (with square roots)

Examples: Rearrange the following so that 'a' is the subject

(i) $t = \sqrt{a} + 3$

$$t - 3 = \sqrt{a}$$

$$(t - 3)^2 = a$$

$$a = (t - 3)^2$$

(ii) $t = \frac{a^2}{b}$

$$bt = a^2$$

$$a = \sqrt{bt}$$

(iii) $r = 5a^2 + 3$

$$r - 3 = 5a^2$$

$$\frac{r - 3}{5} = a^2$$

$$\sqrt{\frac{r - 3}{5}} = a$$

$$a = \sqrt{\frac{r - 3}{5}}$$

(iv) $h = \sqrt{\frac{a}{b}}$

$$h^2 = \frac{a}{b}$$

$$h^2 b = a$$

$$a = h^2 b$$

Change the subject of each formula to k.

(a) $y = \sqrt{k}$

(b) $x = \sqrt{k}$

(c) $m = \sqrt{k}$

(d) $a = \sqrt{\frac{k}{b}}$

(e) $c = \sqrt{\frac{k}{d}}$

(f) $h = \sqrt{\frac{k}{g}}$

(g) $s = \sqrt{\frac{l}{k}}$

(h) $q = \sqrt{\frac{p}{k}}$

(i) $w = \sqrt{\frac{z}{k}}$

(j) $r = k^2$

(k) $ab = k^2$

(l) $\frac{p}{q} = k^2$

(m) $y = x + k^2$

(n) $c = k^2 - d$

(o) $x = 3k^2 - 1$

Change the subject of each formula to k .

- (a) $y = \sqrt{k}$ (b) $x = \sqrt{k}$ (c) $m = \sqrt{k}$
- (d) $a = \sqrt{\frac{k}{b}}$ (e) $c = \sqrt{\frac{k}{d}}$ (f) $h = \sqrt{\frac{k}{g}}$
- (g) $s = \sqrt{\frac{t}{k}}$ (h) $q = \sqrt{\frac{p}{k}}$ (i) $w = \sqrt{\frac{z}{k}}$
- (j) $r = k^2$ (k) $ab = k^2$ (l) $\frac{p}{q} = k^2$
- (m) $y = x + k^2$ (n) $c = k^2 - d$ (o) $x = 3k^2 - 1$

Today we will be continuing to learn how to change the subject of a formula.

Daily Practice 21.6.2017

Q1. Round 0.0008762 to 3 significant figures

$\rightarrow 0.000876$

Q2. Find 18% of 900 $900 \div 100 \times 18 = 162$

Q3. Multiply out and simplify $7(2c + 3) - 5(c + 5)$

$14c + 21 - 5c - 25$

$9c - 4$

Q4. Rearrange the formula $h + 2g = p$ such that g is the subject

$2g = p - h$

$g = \frac{p-h}{2}$

Q5. Calculate the volume of a cylinder with diameter 6cm and height 23cm

$V = \pi r^2 h$

$V = \pi \times 3^2 \times 23$

$V = 207\pi = 650.3 \text{ cm}^3$ (1 d.p)

Today we will be continuing to practise questions on changing the subject.

Examples: Make 't' the subject of the formula

(i) $g = vt^2 + 4$

$g - 4 = vt^2$

$\frac{g-4}{v} = t^2$

$\sqrt{\frac{g-4}{v}} = t$

$t = \sqrt{\frac{g-4}{v}}$

(ii)

$y = \sqrt{\frac{3t-h}{p}}$

$y^2 = \frac{3t-h}{p}$

$py^2 = 3t-h$

$py^2 + h = 3t$

$\frac{py^2 + h}{3} = t$

$t = \frac{py^2 + h}{3}$

(a) Express $y = 4x + c$ in terms of x .

(b) Express $P = 3(2a - 4d)$ in terms of a .

(b) Express $H = ax^2 + m$ in terms of x .

(d) Express $M = \frac{4uw}{v}$ in terms of w .

(e) Express $P = \frac{1}{2}ac + d$ in terms of a .

(f) Express $T = u + \frac{v}{w}$ in terms of v .

(g) Express $D = \frac{m}{n} - p$ in terms of n .

(h) Express $G = \sqrt{u + v^2}$ in terms of v .

Daily Practice _____ 22.6.2017

Q1. $-9 + 8 + 13$

Q2. Rearrange the formula $y = mx + c$ such that x is the subject

Q3. Find the cost of a jumper that was £30 and marked 15% off in the sale

Q4. 91×2000

Q5. $1\frac{1}{3} - \frac{2}{5}$