

## Chapter-2

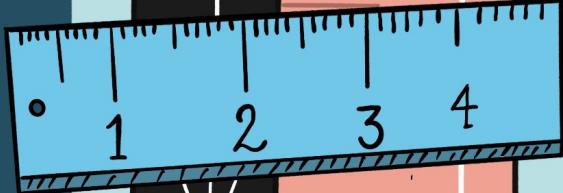
- .Writing expressions
- .Substitution
- .Simplifying expressions
- .Changing subjects
- .Expanding brackets
- .Indices

$$7^2 \times 7^3$$
$$(7 \times 7) \times (7 \times 7 \times 7)$$

$$3y = 12 - 2x$$

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

$$(x+5)(x-2) = x^2 - 2x + 5x - 10$$



## Forming Expressions

Question 1: Write an algebraic expression for each of the following

- (a) 4 more than c

$$4 + c$$

- (b) 2 lots of a

$$2a$$

- (c) 3 less than b

$$b - 3$$

- (d) m divided by 5

$$\frac{m}{5}$$

- (e) 7 multiplied by s

$$7s$$

- (f) w subtract 1

$$w - 1$$

- (g) e squared

$$e^2$$

- (h) y add 9

$$y + 9$$

- (i) m shared between 3

$$\frac{m}{3}$$

- (j) 10 times x

$$10x$$

- (k) k less than 8

$$8 - k$$

- (l) 12 less than g

$$g - 12$$

Question 2: Write an algebraic expression for each of the following

- (a) c add p

$$c + p$$

- (b) f minus m

$$f - m$$

(c) a times b

$$ab$$

(d) p divided by z

$$\frac{p}{z}$$

(e) b taken away from u

$$u - b$$

(f) k add n add r

$$k + n + r$$

(g) w less than c

$$c - w$$

(h) l multiplied by m

$$lm$$

(i) y multiplied by m multiplied by a

$$yma$$

Question 3: Write an algebraic expression for each of the following

(a) m multiplied by 2 and then add 3

$$2m + 3$$

(b) h divided by 4 and then add 7

$$\frac{h}{4} + 7$$

(c) p squared and then add 10

$$p^2 + 10$$

(d) t add 2 and then multiplied by 5

$$(t+2)5 = 5t + 10$$

(e) 9 times e and then add 1

$$9e + 1$$

(f) h divided by 3 then add 1

$$\frac{h}{3} + 1$$

(g) m subtract 6 and then divided by 3

$$\frac{m-6}{3}$$

(h) y squared and then multiplied by 4

$$4y^2$$

(i) k multiplied by 4 and then squared

$$(4k)^2$$

(j) a squared and then multiplied by b

$$a^2b$$

Question 4: An orange costs  $y$  pence, an apple costs  $z$  pence and a banana costs 17 pence.  
Write an expression for the total cost of:

(a) 3 oranges

$$3y$$

(b) 5 apples

$$5z$$

(c) 2 oranges and 3 apples

$$2y + 3z$$

(d) 2 apples and 1 banana

$$2z + 17$$

(e) m bananas

$$17m$$

(f) 3 oranges and 3 bananas

$$3y + 17(3) = 3y + 51$$

(g) 20 apples, 10 oranges and 2 bananas

$$20z + 10y + 17(2) = 20z + 10y + 34$$

(h) 4 oranges, 3 apples and n bananas

$$4y + 3z + 17n$$

Question 5: A taxi driver charges £m per mile.

Write an expression for the total cost of:

(a) A 2 mile journey

$$2m$$

(b) A 15 mile journey

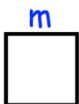
$$15m$$

(c) A journey of x miles

$$mx$$

Question 6: Write an expression for the perimeter of each shape below.

(a)



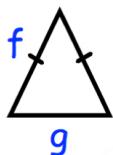
$$p = 4m$$

(b)



$$p = 2d + 2c$$

(c)



$$p = 2f + g$$

Question 7: Alan is  $y$  years old and has 8 sisters.

Write an expression for how old each sister is.

(a) Beth is 3 years older than Alan.

$$y + 3$$

(b) Clara is 2 years younger than Alan.

$$y - 3$$

(c) Donna is three times Alan's age.

$$3y$$

(d) Emma is half Alan's age.

$$\frac{y}{2}$$

(e) Fiona is two years younger than Donna.

$$3y - 2$$

(f) Georgia is twice Beth's age.

$$2(y + 3) = 2y + 6$$

(g) Hannah is 4 years older than Fiona.

$$3y - 2 + 4 = 3y + 2$$

(h) Isabelle is three times Clara's age.

$$3(y-3) = 3y-9$$

Question 8: Guy, Eric and Luke go Christmas shopping.

Write an expression for how much money each man has left after shopping.

(a) Guy had £20 and spends £y on presents.

$$20 - y$$

(b) Eric had £m and spends £12 on presents.

$$m - 12$$

(c) Luke had £a and spends £b on presents.

$$a - b$$

Question 9: A TV costs £x. A DVD player costs £45 less than the TV.

Write an expression for the total cost of the TV and DVD player.

$$\text{DVD} = x - 45$$

$$\begin{aligned}\text{Total} &= x + x - 45 \\ &= 2x - 45\end{aligned}$$

Question 10: A plumber charges £15 per hour plus a £y initial callout charge.

Write an expression for the total cost of:

(a) A job lasting 3 hours

$$y + 3(15) = y + 45$$

(b) A job lasting 8 hours

$$y + 8(15) = y + 120$$

(c) A job lasting n hours

$$y + 15n$$

## Simplifying expression

Question 1: Simplify each of the following

(a)  $y + y + y + y$

**4y**

(b)  $w + w + w + w + w$

**5w**

(c)  $a + a + a + a + a + a$

**6a**

(d)  $s + s + s$

**3s**

(e)  $n + n$

**2n**

(f)  $g + g + g + g - g$

**3g**

(g)  $y + y + y + y - y - y$

**2y**

(h)  $p + p - p - p$

**0**

(i)  $3y + 2y$

**5y**

(j)  $4a + 3a$

**7a**

(k)  $9k + 5k$

**14k**

(l)  $7m + m$

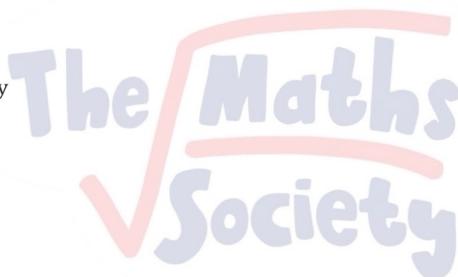
**8m**

(m)  $15c + 20c$

**35c**

(n)  $6w - 3w$

**3w**



(o)  $10y + 3y - 5y$

**$13y - 5y = 8y$**

(p)  $20t - 14t$

**$6t$**

(q)  $7x - 3x - x$

**$3x$**

(r)  $8k - 8k$

**$0$**

(s)  $7y - 2y + y$

**$6y$**

(t)  $5u - 4u$

**$u$**

(u)  $y^2 + y^2$

**$2y^2$**

(v)  $a^2 + a^2 + a$

**$2a^2 + a$**

(w)  $c^2 + c^2 + c^2 + c^2 + c^2$

**$5c^2$**

(x)  $7y^2 + 3y^2$

**$10y^2$**

(y)  $2w^2 + 4w^2 + 8w^2$

**$14w^2$**

(z)  $6y^2 - 2y^2 + 3y^2$

**$7y^2$**

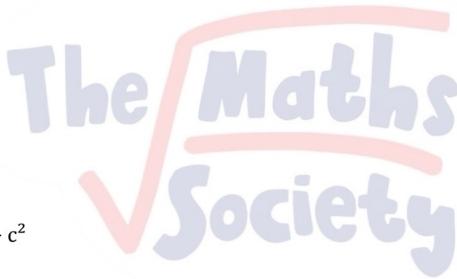
Question 2: Simplify the following expressions

(a)  $4u - 6u$

**$-2u$**

(b)  $8w - 9w$

**$-w$**



(c)  $4a + 2a - 9a$

**-3a**

(d)  $2y - 9y$

**-7y**

(e)  $-3g - 2g$

**-5g**

(f)  $-4f + 9f$

**5f**

(g)  $-m - 7m$

**-8m**

(h)  $5y^2 - 7y^2$

**-2y<sup>2</sup>**

(i)  $6a^2 + 2a^2 - 9a^2$

**-a<sup>2</sup>**

(j)  $ab + ab + ab$

**3ab**

Question 3: Simplify the following expressions

(a)  $3a + 2b + 4a + b$

**7a + 3b**

(b)  $7y + 5y + 2h + 2h$

**12y + 4h**

(c)  $g + 8a + 2a + g$

**2g + 10a**

(d)  $7m + 7p + 8m + p + 2p$

**15m + 10p**

(e)  $9e + 2 + e + 2$

**10e + 4**

(f)  $4 + 3a + 2a + 8$

**12 + 5a**

(g)  $2y + 4 + 3y - 1$

**$5y + 3$**

(h)  $8 + 3w - w - 3$

**$5 + 2w$**

(i)  $5 - 4s - 2 + 10s$

**$3 + 6s$**

(j)  $3x + 6y + 5x - 2y$

**$8x + 4y$**

(k)  $6m - 2s + 11s + m$

**$7m + 9s$**

(l)  $2a + 3b - 2 + a + 3b + 4$

**$3a + 6b + 2$**

(m)  $3a - 2b + a - 5b$

**$4a - 7b$**

(n)  $2x - 2y - 6x + 5y$

**$-4x + 3y$**

(o)  $y - 4m - 3y - 5m$

**$-2y - 9m$**

(p)  $7p - 2q - q + 3r + 4r$

**$7p - 3q + 7r$**

(q)  $11c + 8d - 6c - 11d$

**$5c - 3d$**

Question 4: Simplify the following

(a)  $3y^2 + 4ab + 7y^2 + ab$

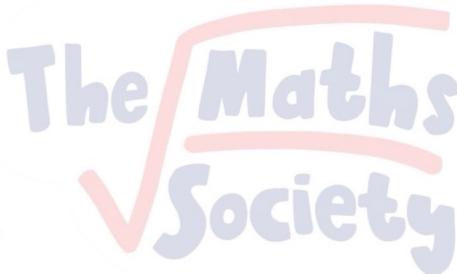
**$10y^2 + 5ab$**

(b)  $9x^2 - 2x - 11x^2 + 5x$

**$-2x^2 + 3x$**

(c)  $\cancel{7}ac - 3ab + 9ab - \cancel{7}ac$

**$6ab$**



Question 5: Expand and simplify the following

(a)  $2(y + 3) + 3(y + 1)$

$$\begin{array}{r} 2y+6+3y+3 \\ \hline 5y+9 \end{array}$$

(b)  $8(x + 2) + 3(x + 3)$

$$\begin{array}{r} 8x+16+3x+9 \\ \hline 11x+25 \end{array}$$

(c)  $4(x - 1) + 2(x + 3)$

$$\begin{array}{r} 4x-4+2x+6 \\ \hline 6x+2 \end{array}$$

(d)  $5x + 3 + 2(x + 9)$

$$\begin{array}{r} 5x+3+2x+18 \\ \hline 7x+21 \end{array}$$

(e)  $3(2y + 1) + 4(2y + 5)$

$$\begin{array}{r} 6y+3+8y+20 \\ \hline 14y+23 \end{array}$$

(f)  $5(2x + 3) + 2(3x + 1)$

$$\begin{array}{r} 10x+15+6x+2 \\ \hline 16x+17 \end{array}$$

(g)  $7(c + 2) + 3(c - 2)$

$$\begin{array}{r} 7c+14+3c-6 \\ \hline 10c+8 \end{array}$$

(h)  $5(2a + 7) + 2(9a - 4)$

$$\begin{array}{r} 10a+35+18a-8 \\ \hline 28a+27 \end{array}$$

(i)  $9(t + 3) + 3(2t - 11)$

$$\begin{array}{r} 9t+27+6t-33 \\ \hline 15t-6 \end{array}$$

(j)  $2(x - 4) + 5(x - 2)$

$$\begin{array}{r} 2x-8+5x-10 \\ \hline 7x-18 \end{array}$$

(k)  $6(y - 1) - 2(y + 3)$

$$\begin{array}{r} 6y-6-2y-3 \\ \hline 4y-9 \end{array}$$

(l)  $8(x + 2) - 3(x - 2)$

$$\begin{array}{r} 8x+16-3x+2 \\ \hline 5x+18 \end{array}$$

(m)  $5(2y - 3) + 3(y - 2)$

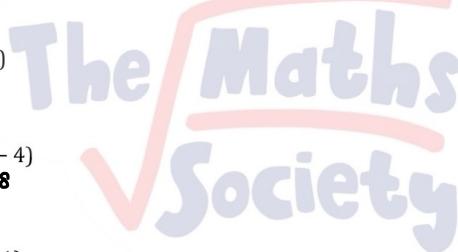
$$\begin{array}{r} 10y-15+3y-6 \\ \hline 13y-21 \end{array}$$

(n)  $2(4w - 5) - 2(w - 7)$

$$\begin{array}{r} 8w-10-2w+14 \\ \hline 6w+4 \end{array}$$

(o)  $5(3y + 7) - 3(2y - 5)$

$$\begin{array}{r} 15y+35-6y+15 = 9y+50 \end{array}$$



Question 6: Write down the perimeter of each shape below

(a)

$$P = 2x + 2(x+9) \\ = 2x + 2x + 18 \\ = 4x + 18$$

(b)

$$P = 2(3y) + 2(2x) \\ = 6y + 4x$$

(c)

$$P = 2(2x) + x \\ = 4x + x$$

Question 7: A square has a side length of  $3x$ .  
Find an expression for the perimeter of the square.

$$P = 4(3x) \\ = 12x$$

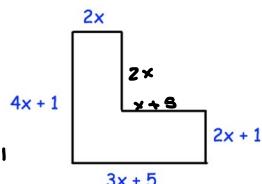
Question 8:  $6x + 7y + x - 8y = 7x - y$

Write down three other expressions that are equal to  $7x - y$

$$\begin{aligned} & 5x + 2x - 3y + 2y \\ & 8x - 9x - 9y + 8y \\ & 6x + x - 2y + y \end{aligned}$$

Question 9: Find an expression for the perimeter of this shape

$$\begin{aligned} 4x+1 - 2x - 1 &= 2x \\ 3x+5 - 2x &= x+5 \\ P &= 2x + 2x + x + 5 + 2x + 1 + 3x + 5 + 4x + 1 \\ &= 14x + 12 \end{aligned}$$



## Changing subject

Question 1: Make y the subject of each of the following

(a)  $y + w = c$

(b)  $y - p = m$

(c)  $m + y = s$

(d)  $y - 2g = n$

(e)  $3y = c$

(f)  $ay = w$

(g)  $\frac{y}{c} = w$

(h)  $\frac{y}{a} = 2c$

(i)  $a = y + p$

(j)  $c = y - k$

(k)  $y^2 = s$

(l)  $y^3 = x$

(m)  $\sqrt{y} = g$

(n)  $\pi y = c$

(o)  $n - y = t$

(p)  $ry = c$

(q)  $4\pi y = b$

(r)  $y + 7t = c + r$

(s)  $\frac{r}{y} = w$

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

(u)  $A = xy$

Write your answer here:

a)  $y + w = c$   
 $y = c - w$

b)  $y - p = m$   
 $y = m + p$

c)  $m + y = s$   
 $y = s - m$

d)  $y - 2g = n$   
 $y = n + 2g$

e)  $3y = c$   
 $y = \frac{c}{3}$

f)  $ay = w$   
 $y = \frac{w}{a}$

g)  $\frac{y}{c} = w$   
 $y = wc$

h)  $\frac{y}{a} = 2c$   
 $y = 2ac$

i)  $a = y + p$   
 $y = a - p$

j)  $c = y - k$   
 $c + k = y$

k)  $y^2 = s$   
 $y = \sqrt{s}$

l)  $y^3 = x$   
 $y = \sqrt[3]{x}$

m)  $\sqrt{y} = g$   
 $y = g^2$

n)  $\pi y = c$   
 $y = \frac{c}{\pi}$

o)  $n - y = t$   
 $n - t = y$

p)  $w = c$   
 $y = \frac{c}{r}$

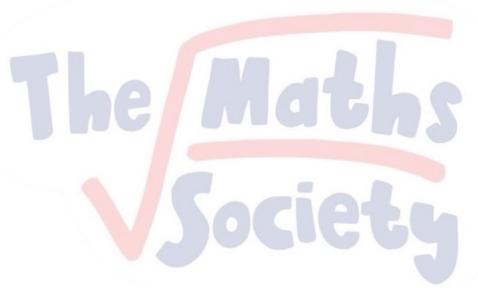
q)  $4\pi y = b$   
 $y = \frac{b}{4\pi}$

r)  $y + 7t = c + r$   
 $y = c + r - 7t$

s)  $\frac{r}{y} = w$   
 $\frac{r}{w} = y$

t)  $y^2 = k + x$   
 $y = \sqrt{k + x}$

u)  $A = xy$   
 $y = \frac{A}{x}$



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Question 2: Make x the subject of the following formulae

(a)  $4x + c = w$

(b)  $dx - t = 8$

(c)  $x^2 + 3 = h$

(d)  $2x + 2y = P$

(e)  $s = x^2 - 3$

(f)  $y = xz + s$

(g)  $\frac{x}{n} + 2 = w$

(h)  $\frac{x}{6} - 5 = w$

(i)  $\frac{x+3}{c} = h$

(j)  $3y = 4x + 1$

(k)  $x^2 + a = v$

(l)  $x^3 - 4 = 5y$

(m)  $\frac{x+t}{m} = 2c$

(n)  $\frac{w+x}{u} = 3z$

(o)  $A = \pi x^2$

(p)  $A = \frac{1}{2}bx$

(q)  $V = abx$

(r)  $v^2 = u^2 + 2ax$

(s)  $\frac{a+b}{x} = r$

(t)  $\frac{5cx}{b} = a$

(u)  $\sqrt[3]{\frac{x}{k}} = w$

Write your answer here:

a)  $4x + c = w$   
 $4x = w - c$   
 $x = \frac{w-c}{4}$

b)  $dx - t = 8$   
 $dx = 8 + t$   
 $x = \frac{8+t}{d}$

c)  $x^2 + 3 = h$   
 $x^2 = h - 3$   
 $x = \sqrt{h-3}$

d)  $2x + 2y = P$   
 $2x = P - 2y$   
 $x = \frac{P-2y}{2}$

e)  $3 = x^2 - 3$   
 $\sqrt{3+3} = x$

f)  $y = x^2 + s$   
 $\frac{y-s}{2} = x$

g)  $\frac{x}{n} + 2 = w$   
 $\frac{x}{n} = w - 2$   
 $x = (w-2)n$

h)  $\frac{x}{6} - 5 = w$   
 $\frac{x}{6} = w + 5$   
 $x = 6w + 30$

i)  $\frac{x+3}{c} = h$   
 $x+3 = ch$   
 $x = ch - 3$

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

k)  $x^2 + a = v$   
 $x^2 = v - a$   
 $x = \sqrt{v-a}$

l)  $x^3 - 4 = 5y$   
 $x^3 = 5y + 4$   
 $x = \sqrt[3]{5y+4}$

m)  $\frac{x+t}{m} = 2c$   
 $x+t = 2cm$   
 $x = 2cm - t$

n)  $\frac{w+x}{u} = 3z$   
 $w+x = 3zu$   
 $x = 3zu - w$

o)  $A = \pi x^2$   
 $\frac{A}{\pi} = x^2$   
 $x = \sqrt{\frac{A}{\pi}}$

p)  $A = \frac{1}{2}bx$   
 $\frac{A}{\frac{1}{2}b} = x$

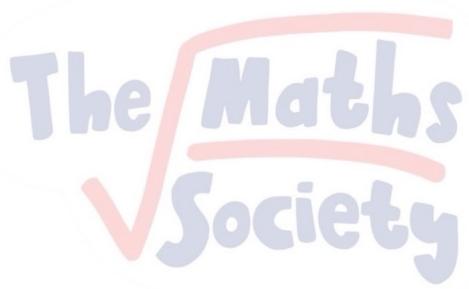
q)  $V = abx$   
 $x = \frac{V}{ab}$

r)  $v^2 = u^2 + 2ax$   
 $\frac{v^2-u^2}{2a} = x$

s)  $\frac{a+b}{x} = r$   
 $\frac{a+b}{r} = x$

t)  $\frac{5cx}{b} = a$   
 $5cx = ab$   
 $x = \frac{ab}{5c}$

u)  $\sqrt[3]{\frac{x}{k}} = w$   
 $\frac{x}{k} = w^3$   
 $x = kw^3$



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Question 3: Make c the subject of the following

(a)  $(a + c)^2 = t$

(b)  $v = u + ac$

(c)  $v = \pi c^2 h$

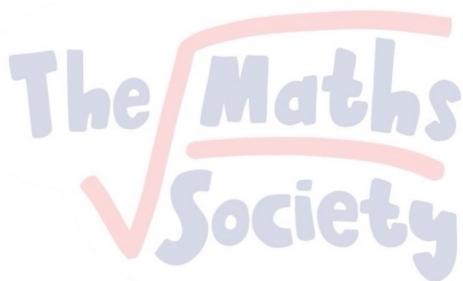
Write your answer here:

a)  $(a+c)^2 = t$   
 $a+c = \sqrt{t}$   
 $c = \sqrt{t} - a$

c)  $v = \pi c^2 h$   
 $\frac{v}{\pi h} = c^2$   
 $c = \sqrt{\frac{v}{\pi h}}$

b)  $v = u + ac$

$ac = v - u$   
 $c = \frac{v-u}{a}$



## Expanding Brackets

Question 1: Expand the following brackets

(a)  $5(y + 3)$   
 $5y + 15$

(b)  $4(a + 2)$   
 $4a + 8$

(c)  $8(w + 10)$   
 $8w + 80$

(d)  $3(x - 7)$   
 $3x - 21$

(e)  $9(s - 1)$   
 $9s - 9$

(f)  $2(8 - t)$   
 $16 - 2t$

(g)  $7(4 + h)$   
 $28 + 7h$

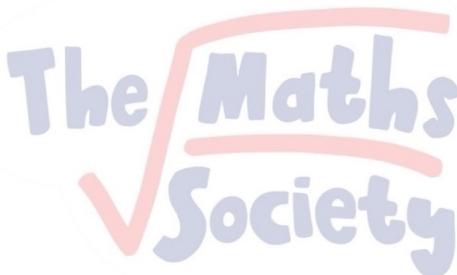
(h)  $10(a + 2b + 3c)$   
 $10a + 20b + 30c$

(i)  $4(3y + 2)$   
 $12y + 8$

(j)  $5(2p - 1)$   
 $10p - 5$

(k)  $3(7a + 2)$   
 $21a + 6$

(l)  $9(2x - 5)$   
 $18x - 45$



Question 2: Expand the following brackets

(a)  $-2(w + 5)$

**$-2w - 10$**

(b)  $-3(c + 7)$

**$-3c - 21$**

(c)  $-8(c + 7)$

**$-8c - 56$**

(d)  $-10(y - 2)$

**$-10y + 20$**

(e)  $-7(g - 3)$

**$-7g + 21$**

(f)  $-4(2w + 3)$

**$-8w - 12$**

(g)  $-9(3w - 5)$

**$-27w + 45$**

(h)  $-9(5x - 1)$

**$-45x + 9$**

(i)  $-5(6 - c)$

**$-30 + 5c$**

(j)  $-6(4 + 3m)$

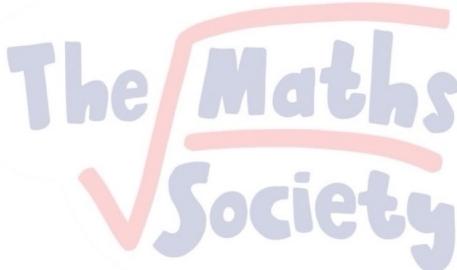
**$-24 - 18m$**

(k)  $-2(1 + 9c)$

**$-2 - 18c$**

(l)  $-5(8a - 7w)$

**$-40a + 35w$**



Question 3: Expand the following brackets

(a)  $a(c + 2)$   
 $ac + 2a$

(b)  $c(d - 3)$   
 $cd - 3c$

(c)  $a(b + c)$   
 $ab + ac$

(d)  $w(8 - y)$   
 $8w - wy$

(e)  $c(5 + a)$   
 $5c + ca$

(f)  $w(a - 9)$   
 $wa - 9w$

(g)  $y(s + t)$   
 $ys + yt$

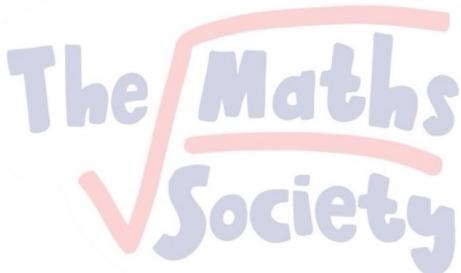
(h)  $2a(c - 3)$   
 $2ac - 6a$

(i)  $5x(y + 8)$   
 $5xy + 40$

(j)  $3a(2c + 9)$   
 $6ac + 27a$

(k)  $6g(2c - 1)$   
 $12gc - 6g$

(l)  $9k(2 + d)$   
 $18k + 9kd$



Question 4: Expand the following brackets

(a)  $a(a + 2)$

$a^2 + 2a$

(b)  $y(y - 5)$

$y^2 - 5y$

(c)  $w(a + w)$

$aw + w^2$

(d)  $c(9 - c)$

$9c - c^2$

(e)  $p(2p + 5)$

$2p^2 + 5p$

(f)  $2w(3w - 1)$

$6w^2 - 2w$

(g)  $9y(2y + 3)$

$18y^2 + 27y$

(h)  $4c(2a + 5c)$

$8ca + 20c^2$

(i)  $2u(3 - u)$

$6u - 2u^2$

(j)  $m(m^2 + 3)$

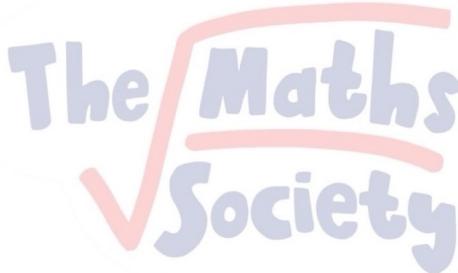
$m^3 + 3m$

(k)  $y(y^2 - 7)$

$y^3 - 7y$

(l)  $g^2(g - 8)$

$g^3 - 8g^2$



Question 5: Expand and simplify

(a)  $5(y + 3) + 2(y + 7)$

$$\begin{array}{r} 5y + 15 + 2y + 14 \\ \hline 7y + 29 \end{array}$$

(b)  $6(2w + 5) + 9(w + 2)$

$$\begin{array}{r} 12w + 30 + 9w + 18 \\ \hline 21w + 48 \end{array}$$

(c)  $3(y - 2) + 4(2y + 5)$

$$\begin{array}{r} 3y - 6 + 8y + 20 \\ \hline 11y + 14 \end{array}$$

(d)  $7(2g + 3) - 5(g + 2)$

$$\begin{array}{r} 14g + 21 - 5g - 10 \\ \hline 9g + 11 \end{array}$$

(e)  $6(x - 2) - 4(x - 8)$

$$\begin{array}{r} 6x - 12 - 4x + 32 \\ \hline 2x + 20 \end{array}$$

(f)  $2(3y - 8) - 5(2y - 1)$

$$\begin{array}{r} 6y - 18 - 10y + 5 \\ \hline -4y - 13 \end{array}$$

(g)  $8(5 + 2m) + 3(5 - 3m)$

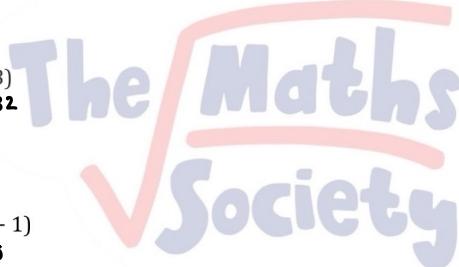
$$\begin{array}{r} 40 + 16m + 15 - 9m \\ \hline 55 + 7m \end{array}$$

(h)  $4(w + 7) - 2(2w + 1)$

$$\begin{array}{r} 4w + 28 - 4w - 2 \\ \hline 26 \end{array}$$

(i)  $9(1 + 2y) + 3(3 - y)$

$$\begin{array}{r} 9 + 18y + 9 - 3y \\ \hline 18 + 15y \end{array}$$



Question 6: Expand and simplify

(a)  $w(w+5) + w(w+7)$   
 $w^2 + 5w + w^2 + 7w$   
 $2w^2 + 12w$

(b)  $2g(4g+3) + g(g-7)$   
 $8g^2 + 6g + g^2 - 7g$   
 $9g^2 - 5$

(c)  $n(n-4) - n(5-n)$   
 $n^2 - 4n - 5n + n^2$   
 $2n - 9n$

(d)  $2e(4e+3) - 3e(e-5)$   
 $8e^2 + 6e - 3e^2 + 15e$   
 $5e^2 + 21e$

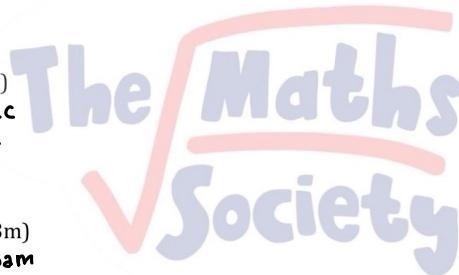
(e)  $a(3+c) + c(a+2)$   
 $3a + ac + ac + 2c$   
 $3a + 2ac + 2c$

(f)  $m(a+7) - a(4-3m)$   
 $7m + 7m - 4a + 3am$   
 $4am + 7m - 4a$

(g)  $8c(8-3a) + 3(4-c)$   
 $64c - 24ac + 12 - 3c$   
 $61c - 24ac + 12$

(h)  $5y(3y+z) - 2y(4y-3z)$   
 $15y^2 + 5yz - 8y^2 + 6yz$   
 $7y^2 + 11yz$

(i)  $4c(3c - c^2) - 2c^2(4-5c)$   
 $12c^2 - 4c^3 - 8c^2 + 10c^3$   
 $4c^2 + 6c^3$



Question 1: Expand and simplify

(a)  $(w + 4)(w + 2)$

$$\begin{array}{r} w^2 + 2w + 4w + 8 \\ \hline w^2 + 6w + 8 \end{array}$$

(b)  $(y + 1)(y + 2)$

$$\begin{array}{r} y^2 + 2y + y + 2 \\ \hline y^2 + 3y + 2 \end{array}$$

(c)  $(c + 2)(c + 5)$

$$\begin{array}{r} c^2 + 5c + 2c + 10 \\ \hline c^2 + 7c + 10 \end{array}$$

(d)  $(x + 6)(x + 7)$

$$\begin{array}{r} x^2 + 7x + 6x + 42 \\ \hline x^2 + 13x + 42 \end{array}$$

(e)  $(a + 5)(a - 3)$

$$\begin{array}{r} a^2 - 3a + 5a - 15 \\ \hline a^2 + 2a - 15 \end{array}$$

(f)  $(g + 7)(g - 4)$

$$\begin{array}{r} g^2 - 4g + 7g - 28 \\ \hline g^2 + 3g - 28 \end{array}$$

(g)  $(s - 4)(s + 5)$

$$\begin{array}{r} s^2 + 5s - 4s - 20 \\ \hline s^2 + s - 20 \end{array}$$

(h)  $(x + 1)(x - 3)$

$$\begin{array}{r} x^2 - 3x + x - 3 \\ \hline x^2 - 2x - 3 \end{array}$$

(i)  $(p - 3)(p - 2)$

$$\begin{array}{r} p^2 - 2p - 3p + 6 \\ \hline p^2 - 5p + 6 \end{array}$$

(j)  $(y - 4)(y - 4)$

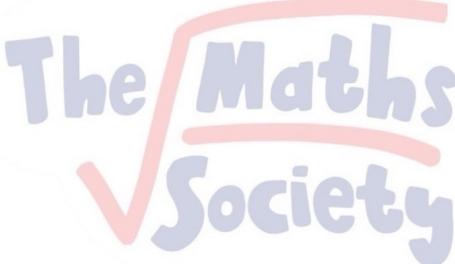
$$\begin{array}{r} y^2 - 4y - 4y + 16 \\ \hline y^2 - 8y + 16 \end{array}$$

(k)  $(k - 5)(k - 6)$

$$\begin{array}{r} k^2 - 6k - 5k + 30 \\ \hline k^2 - 11k + 30 \end{array}$$

(l)  $(v + 4)(v + 3)$

$$\begin{array}{r} v^2 + 3v + 4v + 12 \\ \hline v^2 + 7v + 12 \end{array}$$



Question 2: Expand and simplify

(a)  $(8 + x)(2 + x)$

$$\begin{array}{r} 16 + 8x + 2x + x^2 \\ 16 + 10x + x^2 \end{array}$$

(b)  $(9 + y)(4 - y)$

$$\begin{array}{r} 36 - 9y + 4y - y^2 \\ 36 - 5y - y^2 \end{array}$$

(c)  $(1 + y)(3 + y)$

$$\begin{array}{r} 3 + y + 3y + y^2 \\ 3 + 4y + y^2 \end{array}$$

(d)  $(10 - t)(4 - t)$

$$\begin{array}{r} 40 - 10t - 4t + t^2 \\ 40 - 14t + t^2 \end{array}$$

(e)  $(4 - w)(w + 2)$

$$\begin{array}{r} 4w + 8 - w^2 - 2w \\ 2w + 8 - w^2 \end{array}$$

(f)  $(6 - x)(x - 4)$

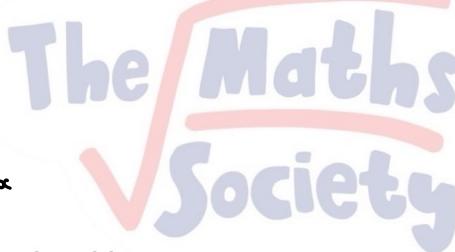
$$\begin{array}{r} 6x - 24 - x^2 + 4x \\ 10x - 24 - x^2 \end{array}$$

(g)  $(2 - r)(8 - r)$

$$\begin{array}{r} 16 - 2r - 8r + r^2 \\ 16 - 10r + r^2 \end{array}$$

(h)  $(x + 2)(8 - x)$

$$\begin{array}{r} 8x - x^2 + 16 - 2x \\ 6x - x^2 + 16 \end{array}$$



Question 3: Expand and simplify

(a)  $(y + 2)(y - 2)$

$$\begin{array}{r} y - 2y + 2y - 4 \\ y - 4 \end{array}$$

(b)  $(w + 7)(w - 7)$

$$\begin{array}{r} w^2 + 7w - 7w - 49 \\ w^2 - 49 \end{array}$$

(c)  $(a + 1)(a - 1)$

$$\begin{array}{r} a^2 + a - a - 1 \\ a^2 - 1 \end{array}$$

(d)  $(x - 10)(x + 10)$

$$\begin{array}{r} x^2 + 10x - 10x - 100 \\ x^2 - 100 \end{array}$$

(e)  $(g - 8)(g + 8)$

$$\begin{array}{r} g^2 - 8g + 8g - 64 \\ g^2 - 64 \end{array}$$

(f)  $(6 - x)(6 + x)$

$$\begin{array}{r} 36 + 6x - 6x - x^2 \\ 36 - x^2 \end{array}$$

(g)  $(4 - r)(4 + r)$

$$\begin{array}{r} 16 + 4r - 4r - r^2 \\ \hline 16 - r^2 \end{array}$$

(h)  $(11 + y)(11 - y)$

$$\begin{array}{r} 121 + 11y + 11y - y^2 \\ \hline 121 - y^2 \end{array}$$

Question 4: Expand and simplify

(a)  $(2c + 1)(2c + 3)$

$$\begin{array}{r} 4c^2 + 6c + 2c + 3 \\ \hline 4c^2 + 8c + 3 \end{array}$$

(b)  $(5x + 1)(2x + 5)$

$$\begin{array}{r} 10x^2 + 25x + 2x + 5 \\ \hline 10x^2 + 27x + 5 \end{array}$$

(c)  $(3w + 2)(w + 1)$

$$\begin{array}{r} 3w^2 + 3w + 2w + 2 \\ \hline 3w^2 + 5w + 2 \end{array}$$

(d)  $(3p + 2)(2p - 1)$

$$\begin{array}{r} 6p^2 - 3p + 4p - 2 \\ \hline 6p^2 + p - 2 \end{array}$$

(e)  $(5g - 4)(g + 1)$

$$\begin{array}{r} 5g^2 + 5g - 4g - 4 \\ \hline 5g^2 + g - 4 \end{array}$$

(f)  $(2a - 3)(4a + 7)$

$$\begin{array}{r} 8a^2 + 14a - 12a - 21 \\ \hline 8a^2 + 2a - 21 \end{array}$$

(g)  $(4r - 5)(2r - 3)$

$$\begin{array}{r} 8r^2 - 12r - 10r + 15 \\ \hline 8r^2 - 22r + 15 \end{array}$$

(h)  $(2y - 3)(9y - 1)$

$$\begin{array}{r} 18y^2 - 2y - 27y + 3 \\ \hline 18y^2 - 29y + 3 \end{array}$$

(i)  $(5k - 4)(2k - 1)$

$$\begin{array}{r} 10k^2 - 5k - 8k + 4 \\ \hline 10k^2 - 13k + 4 \end{array}$$

(j)  $(2n + 3)(2n + 5)$

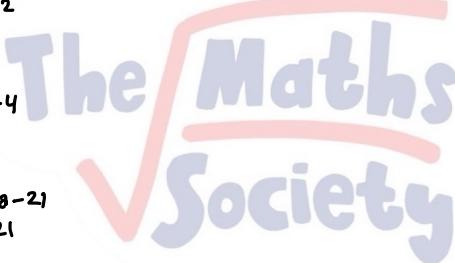
$$\begin{array}{r} 4n^2 + 10n + 6n + 15 \\ \hline 4n^2 + 16n + 15 \end{array}$$

(k)  $(3b + 4)(2b + 9)$

$$\begin{array}{r} 6b^2 + 27b + 8b + 36 \\ \hline 6b^2 + 35b + 36 \end{array}$$

(l)  $(2z - 9)(6z - 5)$

$$\begin{array}{r} 12z^2 - 10z - 54z + 45 \\ \hline 12z^2 - 64z + 45 \end{array}$$



Question 5: Expand and simplify

(a)  $(a + 2)^2$   
 $= a^2 + 4a + 4$

(b)  $(x + 7)^2$   
 $x^2 + 14x + 49$

(c)  $(z - 9)^2$   
 $z^2 - 18z + 81$

(d)  $(p + 1)^2$   
 $p^2 + 2p + 1$

(e)  $(c - 5)^2$   
 $c^2 - 10c + 25$

(f)  $(k + 4)^2$   
 $k^2 + 8k + 16$

(g)  $(y - 3)^2$   
 $y^2 - 6y + 9$

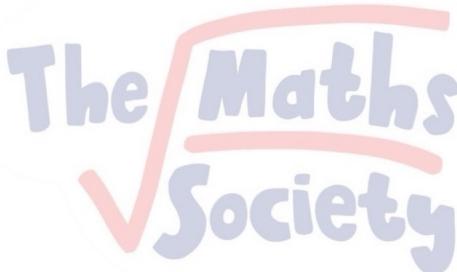
(h)  $(10 + r)^2$   
 $100 + 20r + r^2$

(i)  $(3g + 2)^2$   
 $9g^2 + 12g + 4$

(j)  $(2b - 1)^2$   
 $4b^2 - 4b + 1$

(k)  $(3m - 5)^2$   
 $9m^2 - 30m + 25$

(l)  $(2v + 9)^2$   
 $4v^2 + 36v + 81$



Question 6: Expand and simplify

(a)  $(a + 2)(a + 3) + (a + 4)(a + 1)$

$$\begin{aligned} & a^2 + 3a + 2a + 6 + a^2 + a + 4a + 4 \\ & 2a^2 + 10a + 10 \end{aligned}$$

(b)  $(2w + 3)(w - 1) + (w - 3)(w - 2)$

$$\begin{aligned} & 2w^2 - 2w + 3w - 3 + w^2 - 2w - 3w + 6 \\ & 3w^2 - 4w + 3 \end{aligned}$$

(c)  $(x + 9)(3x + 4) - (x + 3)(x - 1)$

$$\begin{aligned} & 3x^2 + 4x + 27x + 36 - (x^2 - x + 3x - 3) \\ & = 3x^2 + 31x + 36 - x^2 + x - 3x + 3 \\ & = 2x^2 + 29x + 39 \end{aligned}$$

(d)  $2(x + 1)(x + 4) - (x + 1)(x + 2)$

$$\begin{aligned} & (2x^2 + 2)(x+4) - (x^2 - 2x - x - 2) \\ & 2x^3 + 8x^2 + 2x + 8 - x^2 - 3x - 2 \\ & 2x^3 + 7x^2 - x + 6 \end{aligned}$$

(e)  $(x + 4)^2 + (x + 1)^2$

$$\begin{aligned} & x^2 + 8x + 16 + x^2 + 2x + 1 \\ & 2x^2 + 10x + 17 \end{aligned}$$

(f)  $(2x + 1)^2 - (x - 5)^2$

$$\begin{aligned} & 4x^2 + 4x + 1 - (x^2 - 10x + 25) \\ & 4x^2 + 4x + 1 - x^2 + 10x - 25 \\ & 3x^2 + 14x - 24 \end{aligned}$$

# Indices

Question 1: Write as a single power of m.

(a)  $m^2 \times m^3 = m^5$

(b)  $m^3 \times m^3 = m^6$

(c)  $m^6 \times m^2 = m^8$

(d)  $m^7 \times m^3 = m^{10}$

(e)  $m^6 \times m^8 = m^{14}$

(f)  $m^2 \times m = m^3$

(g)  $m \times m^3 = m^4$

(h)  $m^7 \times m^8 = m^{15}$

(i)  $m^9 \times m^2 = m^{11}$

(j)  $m \times m^8 = m^9$

(k)  $m^6 \times m^5 = m^{30}$

(l)  $m^2 \times m^2 \times m^2 \times m^2 = m^8$

Question 2: Write as a single power of n.

(a)  $n^5 \div n^2 = n^3$

(b)  $n^8 \div n^3 = n^5$

(c)  $n^9 \div n^2 = n^7$

(d)  $n^7 \div n^5 = n^2$

(e)  $n^3 \div n = n^2$

(f)  $n^8 \div n = n^7$

(g)  $n^7 \div n^4 = n^3$

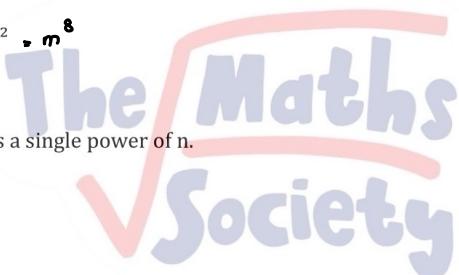
(h)  $n^9 \div n^3 = n^6$

(i)  $n^4 \div n^8 = n^{-4}$

(j)  $n \div n^3 = n^{-2}$

(k)  $n^{45} \div n^5 = n^{40}$

(l)  $n^3 \div n^3 = n^0 = 1$



Question 3: Write as a single power of a.

(a)  $\frac{a^5}{a^2} = a^3$

(b)  $\frac{a^9}{a^3} = a^6$

(c)  $\frac{a^{10}}{a^2} = a^8$

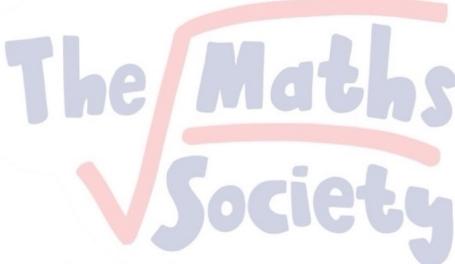
(d)  $\frac{a^7}{a} = a^6$

(e)  $\frac{a^{14}}{a^7} = a^7$

(f)  $\frac{a^4}{a^4} = a^0 = 1$

(g)  $\frac{a^3}{a^4} = a^{-1}$

(h)  $\frac{a^5}{a^9} = a^{-4}$



Question 4: Write as a single power of y.

(a)  $(y^5)^2 = y^{10}$

(b)  $(y^3)^2 = y^6$

(c)  $(y^4)^3 = y^{12}$

(d)  $(y^5)^4 = y^{20}$

(e)  $(y^3)^6 = y^{18}$

(f)  $(y^7)^3 = y^{21}$

(g)  $(y^6)^6 = y^{36}$

(h)  $(y^9)^2 = y^{18}$

(i)  $(y^4)^8 = y^{32}$

(j)  $(y^3)^{-5} = y^{-15}$

(k)  $(y^{-5})^2 = y^{-10}$

Question 5: Write as a single power of y.

(a)  $y^7 \times y^3 = y^{10}$

(b)  $y^9 \div y^7 = y^2$

(c)  $y^6 \div y^2 = y^4$

(d)  $(y^3)^5 = y^{15}$

(e)  $y^7 \div y = y^6$

(f)  $y^3 \div y^7 = y^{-4}$

(g)  $(y^9)^5 = y^{45}$

(h)  $y^6 \times y^7 = y^{13}$

(i)  $y^6 \times y^5 \times y^2 = y^{13}$

(j)  $y^8 \times y \times y^3 = y^{12}$

(k)  $\frac{y^8}{y^5} = y^3$

Question 6: Write as a single power of x.

(a)  $(2x^3)^2 = 2x^6$

(b)  $(5x^6)^2 = 5x^{12}$

(c)  $(5x^5)^3 = 5x^{15}$

(d)  $(2x^3)^4 = 2x^{12}$

(e)  $(7x^5)^2 = 7x^{10}$

(f)  $(4x^7)^3 = 4x^{21}$

(g)  $(2x^6)^6 = 2x^{36}$

(h)  $(10x^9)^3 = 10x^{27}$

(i)  $(3x^4)^4 = 3x^{16}$

