



1

a. Write each of these in the correct algebraic way.

(i) $a \times 4 \times b$ (ii) $m \div 3$ (iii) $y \times y \times 5$

b. Simplify $5p + 3q - 2p + q$

(3 marks)

a)

Number first, no $\times$ signs

(i) $4ab$

(ii) $\frac{m}{3}$

(iii) $5y^2$

b)

$$5p - 2p = 3p$$

$$3q + q = 4q$$

$$3p + 4q$$

2

Here are four lines of algebra.

A $3x + 2$ B $v = u + at$ C $4x - 1 = 11$ D $2(x + 3) \equiv 2x + 6$

a. Which one is an expression?

b. Which one is a formula?

c. Which one is an identity?

d. Write $\equiv$ in the box if the two sides are identical, or $\neq$ if they are not.

(i) $5(n - 2)$ $5n - 10$ (ii) $n^2 + n^2$ n^4 (iii) $3y + 2y$ $5y$

(4 marks)

a)

No equals sign

b)

Links different quantities

c)

True for every value of x

d)

(i) $5n - 10 = 5n - 10$

(ii) $n^2 + n^2 = 2n^2$

(iii) $3y + 2y = 5y$

3

- a. Simplify $t^3 \times t^4$
 b. Simplify $12h^5 \div 3h^2$
 c. Simplify $5u + 3v - 2u + 7v$

(4 marks)

a) When multiplying powers of the same letter, add the indices: $3 + 4 = 7$, so t^7

b) Divide the numbers

$12 \div 3 = 4$. Subtract the indices: $5 - 2 = 3$. Answer $4h^3$

c) Collect the u terms

$5u - 2u = 3u$. Collect the v terms: $3v + 7v = 10v$. Answer $3u + 10v$

The original fraction has h in its denominator, so h must not be zero

4

- a. Work out the value of $2a - 3b$ when $a = -1$ and $b = 4$.
 b. Work out the value of $4a^2 + b$ when $a = -3$ and $b = -7$.

(4 marks)

a) $2 \times (-1) =$

b) $a^2 = (-3) \times (-3) = 9$, so $4a^2 = 36$

b) $36 + (-7) = 29$

5

a. The perimeter of a rectangle is given by the formula $P = 2(l + w)$ Work out P when $l = 7.5$ and $w = 4$ b. Work out the value of $3(x - 2)^2$ when $x = 5$ c. Work out the value of $a^2 + 2ab$ when $a = -3$ and $b = 4$

(4 marks)

a)

$$P = 2(7.5 + 4)$$

$$P = 2 \times 11.5$$

$$P = 23$$

23

b)

Brackets, then the power

$$3(5 - 2)^2 = 3 \times 3^2$$

$$= 3 \times 9$$

$$= 27$$

27

c)

$$(-3)^2 + 2 \times (-3) \times 4 = 9 + (-24)$$

$$= -$$

-

6

a. In science, the distance s metres travelled by a cart is given by

$$s = ut + \frac{1}{2}at^2$$

Work out s when $u = 3$, $t = 4$ and $a = 2.5$ b. To change a temperature from $^{\circ}\text{C}$ to $^{\circ}\text{F}$ you can use $F = \frac{9C}{5} + 32$ Ruby's thermometer reads 25°C . Change this temperature to $^{\circ}\text{F}$.

(3 marks)

a)

$$s = 3 \times 4 + \frac{1}{2} \times 2.5 \times 4^2$$

$$s = 12 + \frac{1}{2} \times 2.5 \times 16$$

$$s = 12 + 20$$

$$s = 32$$

32 m

b)

$$F = \frac{9 \times 25}{5} + 32$$

$$F = \frac{225}{5} + 32$$

$$F = 45 + 32$$

$$F = 77$$

77 $^{\circ}\text{F}$

7

a. Expand and simplify $3(x + 2) + 2(x - 5)$ b. Solve $5(x - 3) = 20$

(4 marks)

$$a) 3(x + 2) = 3x + 6 \text{ and } 2(x - 5) = 2x - 10$$

$$3x + 6 + 2x - 10 = 5x - 4$$

b) Divide both sides by 5

$$\begin{array}{rcl} x - 3 & = & 4 \\ +3 & & +3 \\ \hline x & = & 7 \end{array}$$

Check

$$5(7 - 3) = 20$$

8

- a. Write down the highest common factor of $6x^2y$ and $9xy$
 b. Factorise $8a - 12$
 c. Factorise fully $10x^2y + 15xy^2$

(4 marks)

a)

HCF of 6 and 9 = 3

Both have x and y

$$\boxed{3xy}$$

b)

HCF of 8 and 12 = 4

$$8a \div 4 = 2a, 12 \div 4 = 3$$

$$\boxed{4(2a - 3)}$$

c)

HCF = $5xy$

$$10x^2y \div 5xy = 2x$$

$$15xy^2 \div 5xy = 3y$$

$$\boxed{5xy(2x + 3y)}$$

9

- a. Expand and simplify $(x + 9)(x - 2)$
 b. Factorise $x^2 - 3x - 28$

(4 marks)

$$a) (x + 9)(x - 2) = x^2 - 2x + 9x - 18 = x^2 + 7x - 18$$

b) Find two numbers that multiply to -28 and add to -3 : they are -7 and 4

$$b) x^2 - 3x - 28 = (x - 7)(x + 4)$$

10

A rectangular garden is $(x + 4)$ metres long and $(x + 1)$ metres wide.

- Write an expression for the perimeter of the garden. Give your answer in its simplest form.
- Show that the area of the garden is $(x^2 + 5x + 4) \text{ m}^2$.
- Work out the area of the garden when $x = 6$

(4 marks)

a)

$$P = 2(x + 4) + 2(x + 1)$$

$$P = 2x + 8 + 2x + 2$$

$$P = 4x + 10$$

$$\boxed{4x + 10}$$

b)

$$A = (x + 4)(x + 1)$$

$$A = x^2 + x + 4x + 4$$

$$A = x^2 + 5x + 4$$

$$\boxed{x^2 + 5x + 4}$$

c)

$$A = 6^2 + 5 \times 6 + 4$$

$$A = 36 + 30 + 4$$

$$A = 70$$

Check: $10 \times 7 = 70$

$$\boxed{70 \text{ m}^2}$$

11

a. Simplify $t^8 \div t^3$ b. Simplify $(k^4)^5$ c. Simplify $\frac{12x^6y^3}{4x^2y}$

(3 marks)

a) Subtract the indices

$$t^{(8-3)} = t^5$$

b) Multiply the indices

$$k^{(4 \times 5)} = k^{20}$$

c) Divide the numbers

$$12 \div 4 = 3. \text{ Subtract indices: } x^{(6-2)} = x^4 \text{ and } y^{(3-1)} = y^2, \\ \text{giving } 3x^4y^2$$

Keep the original restriction: t , x and y must be non-zero wherever they occur in a denominator or with a negative power

EXTENSION QUESTIONS

12

a. Simplify $4a^2b \times 3ab^3$ b. Simplify $20p^5q^2 \div 4p^2q$ c. Expand and simplify $(3x + 2)(2x - 5)$

(4 marks)

a)

$$4 \times 3 = 12$$

$$a^2 \times a = a^3, b \times b^3 = b^4$$

$$12a^3b^4$$

b)

$$20 \div 4 = 5$$

$$p^5 \div p^2 = p^3, q^2 \div q = q$$

$$5p^3q$$

c)

$$(3x + 2)(2x - 5) = 6x^2 - 15x + 4x - 10 \\ = 6x^2 - 11x - 10$$

$$6x^2 - 11x - 10$$

13 Expand and simplify $(x + 2)(x + 3)(x + 4)$

(3 marks)

Expand the first two brackets

$$(x + 2)(x + 3) = x^2 + 5x + 6$$

Multiply the result by the third bracket: $(x^2 + 5x + 6)(x + 4)$

$$x^3 + 4x^2 + 5x^2 + 20x + 6x + 24$$

Collect like terms: $x^3 + 9x^2 + 26x + 24$

$$x^3 + 9x^2 + 26x + 24$$

14 Solve $2x^2 + 5x - 12 = 0$

(3 marks)

Look for two numbers that multiply to $2 \times (-12) = -24$ and add to 5: they are 8 and -3

Split the middle term

$$2x^2 + 8x - 3x - 12 = 2x(x + 4) - 3(x + 4) = (2x - 3)(x + 4)$$

Set each factor to zero

$$2x - 3 = 0 \text{ gives } x = \frac{3}{2}, \text{ and } x + 4 = 0 \text{ gives } x = -4$$

Check $x =$

$$x = \frac{3}{2}, x = -4$$