Algebraic expressions

Worked solutions

KS3 Maths topic practice

This topic online

1 a. Simplify $5 \times 2m$

b. Simplify $n \times n \times n \times n$

c. Simplify $3c \times 4d$

(3 marks)

a) $5 \times 2m = 10m$

b) n multiplied by itself four times is n^4

c) Multiply the numbers

$3 \times 4 = 12$, then attach the letters: 12cd

2 Here are four pieces of algebra.

A: $3x + 2 = 11$ B: $A = lw$ C: $4y - 7$ D: $2(x + 3) \equiv 2x + 6$

Write down which one is

a. an expression

b. an equation

c. a formula

d. an identity

(2 marks)

a)

expression: no equals sign

C

b)

equation: true for one value ($x = 3$)

A

c)

formula: works out one quantity from others

B

d)

identity: true for every x, the $\equiv$ sign

D

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3 Simplify $6x + 3y - 2x + 5y$ (2 marks)

Like terms have exactly the same letters and powers. Combine x terms with x terms and y terms with y terms; an x and a y need not have the same value

Collect the x terms

$6x - 2x = 4x$

Collect the y terms

$3y + 5y = 8y$

The simplified expression is $4x + 8y$

$\boxed{4x + 8y}$

4 Simplify

a. $5a^2 + 3a - 2a^2 + 4a - 9$

b. $4xy - 7 + 2yx + 10$

(2 marks)

a)

a^2 terms: $5a^2 - 2a^2 = 3a^2$

a terms: $3a + 4a = 7a$

$\boxed{3a^2 + 7a - 9}$

b)

yx is the same as xy

$4xy + 2xy = 6xy$

$\boxed{6xy + 3}$

5 a. Expand $4(2x - 5)$

b. Factorise $6y + 15$

(2 marks)

a) 4 times $2x$ = $8x$ and 4 times $-5 = -20$, so $8x - 20$

b) The highest common factor of $6y$ and 15 is 3

$6y + 15 = 3(2y + 5)$

Factorising reverses expanding: divide every term by the common factor to find what belongs inside the bracket, then expand again to check

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6 a. Expand and simplify $3(2x + 5) - 2(x - 4)$

b. Expand $x(x + 7)$

(3 marks)

a)

$3(2x + 5) = 6x + 15$

$6x + 15 - 2x + 8$

$\boxed{4x + 23}$

b)

$x \times x = x^2$, $x \times 7 = 7x$

$\boxed{x^2 + 7x}$

7 a. Factorise $5x + 20$

b. Factorise $x^2 - 9x$

(2 marks)

a) The highest common factor of $5x$ and 20 is 5, so $5x + 20 = 5(x + 4)$

b) Both terms contain x, so $x^2 - 9x = x(x - 9)$

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8 The diagram shows a rectangle with sides $(x + 4)$ and $(x + 3)$.

It is split into four smaller rectangles.

a. Write down an expression for the area of each of the four smaller rectangles.

b. Hence expand and simplify $(x + 4)(x + 3)$

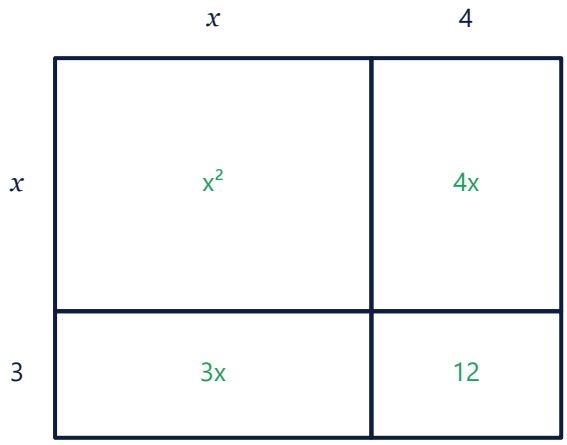

Diagram NOT accurately drawn

(3 marks)

a)

$x \times x = x^2$

$4 \times x = 4x$

$x \times 3 = 3x$

$4 \times 3 = 12$

$x^2, 4x, 3x, 12$

b)

$x^2 + 4x + 3x + 12$

collect $4x + 3x$

$x^2 + 7x + 12$

9 Expand and simplify $(x - 3)(x + 8)$

(2 marks)

$(x - 3)(x + 8) = x^2 + 8x - 3x - 24$

Collect like terms: $x^2 + 5x - 24$

$x^2 + 5x - 24$

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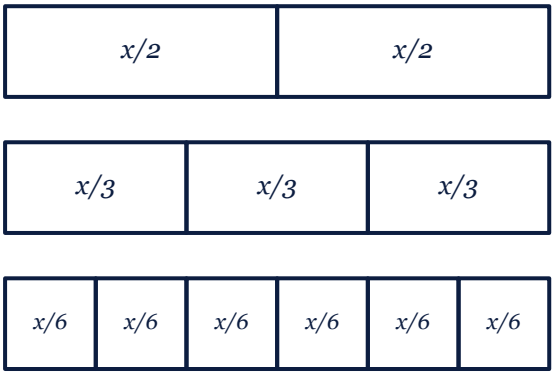
10 Each bar in the diagram has length x.

The top bar is split into halves, the middle bar into thirds and the bottom bar into sixths.

a. Use the diagram to write $\frac{x}{2}$ and $\frac{x}{3}$ in sixths.

b. Hence simplify $\frac{x}{2} + \frac{x}{3}$

c. Simplify $\frac{x}{2} - \frac{x}{3}$



(3 marks)

a)

one half covers 3 sixths

$$\frac{x}{2} = \frac{3x}{6}$$

one third covers 2 sixths

$$\frac{x}{3} = \frac{2x}{6}$$

b)

$$\frac{x}{2} + \frac{x}{3} = \frac{3x}{6} + \frac{2x}{6}$$

$$\boxed{\frac{5x}{6}}$$

c)

$$\frac{x}{2} - \frac{x}{3} = \frac{3x}{6} - \frac{2x}{6}$$

$$\boxed{\frac{x}{6}}$$

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11 Simplify fully

a. $\frac{6x}{9}$

b. $\frac{x}{3} + \frac{x}{4}$

c. $\frac{5y}{6} - \frac{y}{3}$

d. $\frac{2a}{3} \times \frac{9}{4a}$

(4 marks)

a)

divide top and bottom by 3

$$\boxed{\frac{2x}{3}}$$

b)

common denominator 12

$$\frac{x}{3} + \frac{x}{4} = \frac{4x}{12} + \frac{3x}{12}$$

$$\boxed{\frac{7x}{12}}$$

c)

$$\frac{5y}{6} - \frac{y}{3} = \frac{5y}{6} - \frac{2y}{6}$$

$$= \frac{3y}{6}$$

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

d)

$$\frac{2a}{3} \times \frac{9}{4a} = \frac{18a}{12a}$$

a cancels, then divide by 6

$$\boxed{\frac{3}{2}}$$

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12 a. Expand and simplify $(y - 3)(y - 8)$

b. Factorise fully $4a^2b + 6ab^2$

(4 marks)

a) $(y - 3)(y - 8) = y^2 - 8y - 3y + 24$

Collect like terms: $y^2 - 11y + 24$

b) The highest common factor of $4a^2b$ and $6ab^2$ is $2ab$

$4a^2b + 6ab^2 = 2ab(2a + 3b)$

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