

Ratio, percentages and simplifying expressions

About 80 minutes No calculator 77 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/further-maths-ratio-percentages-and-simplifying-expressions/

Date _____

A Do Now

The first questions are what today's lesson needs. The others bring back GCSE Higher topics.

- A1** Needed today [2 marks]

Share £360 in the ratio 2 : 3 : 7.
Work out the largest share.

A2 Needed today [2 marks]

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

Answer

Answer

- A3** GCSE Higher [2 marks]

Increase £80 by 15%. Then decrease the new amount by 15%. Work out the final amount.

A4 GCSE Higher [2 marks]

Simplify $\frac{12a^5b^2}{4a^2b}$.

Answer

Answer

B Example, then your turn

Level 2

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

A tray holds apples, bananas and oranges.
apples : bananas = 2 : 3 and bananas : oranges = 5 : 4. Work out the smallest possible number of pieces of fruit on the tray.

Hint Make the bananas the same number of parts in both ratios: the LCM of 3 and 5 is 15.

- B1** $x : y = 5 : 6$ and $y : z = 4 : 9$. [3 marks]
Work out $x : y : z$ in its simplest form. Hence write down $x : z$.

Answer $x : y : z = \dots : \dots : \dots$ $x : z = \dots : \dots$

EXAMPLE 2

$a : b = 4 : 3$. Write a in terms of b . Then work out $(a + 2b) : (3a - b)$ in its simplest form.

Hint Write $a = 4k$ and $b = 3k$ and put them into each bracket.

B2 $m : n = 2 : 5$. Write n in terms of m . Then work out $(3m + n) : (n - m)$ in its simplest form. [3 marks]

Answer $n = \dots\dots\dots$

EXAMPLE 3

In a sale every price is cut by 35%. A lamp costs £52 in the sale. Work out the price of the lamp before the sale.

Hint The sale price is 65% of the old price. Find 1% first.

B3 A train fare rises by 12.5% to £63. Work out the fare before the rise. [2 marks]

Answer

EXAMPLE 4

Simplify $3(4p - 5q) - 2(p - 3q) + q$. Then factorise your answer.

Hint The -2 multiplies both terms in its bracket, so $-2 \times -3q = +6q$.

B4 Simplify $4x(x + 3y) - 2y(5x - 4y) - 4x^2$. Then factorise your answer fully. [3 marks]

Answer

EXAMPLE 5

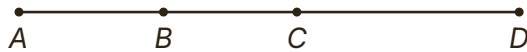
Simplify $\frac{8a^3b}{15c^2} \div \frac{4ab^3}{9c}$.

Hint Turn the second fraction upside down and multiply. Then cancel numbers and letters.

B5 Simplify fully $\frac{14x^2y^3}{9z} \div \frac{21xy}{12z^3}$. [3 marks]

Answer

- C1** $ABCD$ is a straight line. $AB = 6$ cm,
 $AC = 15$ cm and $AD = 27$ cm.



Not drawn accurately

- (a) Write the ratio
 4.5 km : 1350 m in its
simplest form. [2 marks]

Answer . . . : . . .

- (b) Work out $BC : CD$ in its
simplest form. [2 marks]

Answer . . . : . . .

Total for C1: 4 marks

- C3** Work out each of these. Give your
answers as fractions in their simplest
form.

- (a) $\frac{2}{3} + \frac{5}{6} \div \frac{5}{4}$ [2 marks]

Answer

- (b) $3\frac{3}{4} - 2\frac{2}{5}$ [2 marks]

Answer

Total for C3: 4 marks

- C2** Work out

- (a) $37\frac{1}{2}\%$ of £96 [1 mark]

Answer

- (b) £850 decreased by 14% [2 marks]

Answer

Total for C2: 3 marks

- C4** Work out each of these without a
calculator.

- (a) $7.2 - 0.46 \times 3.5$, giving your
answer to 2 significant
figures. [2 marks]

Answer

- (b) $0.24 \times 0.15 + 0.07$, giving
your answer to 1 significant
figure. [2 marks]

Answer

Total for C4: 4 marks

C5 Simplify

(a) $4a^3b^2 \times 3ab^4$ [1 mark]

Answer

(b) $\frac{18p^4q^2r}{24pq^5}$ [2 marks]

Answer

Total for C5: 3 marks

C6 Factorise or combine as asked.

(a) Factorise fully [2 marks]
 $14m^3n^2 - 21m^2n^3 + 7mn.$

Answer

(b) Write $\frac{3x}{4t} - \frac{y}{6t} + \frac{5z}{3t}$ as a [2 marks]
single fraction.

Answer

Total for C6: 4 marks

D Exam-style questions

AQA exam style

D1 Priya writes $4(2a - 3b) - 3(a - 2b) = 5a - 18b$. [3 marks]

Explain the mistake Priya has made. Simplify $4(2a - 3b) - 3(a - 2b)$ correctly.

Answer

D2 $x : y = 7 : 3$

(a) Circle the expression for x in terms of y . $\frac{3y}{7}$ $\frac{7y}{3}$ $7y - 3$ $\frac{7}{3y}$ [1 mark]

(b) Show that $(x + 2y) : (3x - 5y) = 13 : 6$ [2 marks]

(c) $y : z = 4 : 5$. Work out $x : z$ in its simplest form. [2 marks]

Answer $x : z = \dots : \dots$

Total for D2: 5 marks

- D3** The ratio of Ali's age to Ben's age is $7 : 4$. In 9 years' time the ratio of their ages will be $10 : 7$. Work out their ages now. Do not use trial and improvement. You must show your working. [4 marks]

Answer Ali Ben

- D4** The angles of this shape are all 90° or 270° . Four of its side lengths, in cm, are given in terms of x .

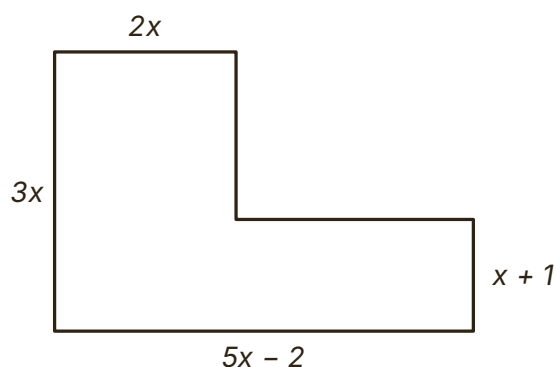
- (a) Work out the perimeter of the shape in terms of x . Give your answer in its simplest form. [2 marks]

Answer cm

- (b) Work out the area of the shape in terms of x . Give your answer in its simplest form. [3 marks]

Answer cm^2

Total for D4: 5 marks



Not drawn accurately

- D5** The price of a bike rises by 2% to £510.

- (a) Work out the price of the bike before the rise. [2 marks]

Answer

- (b) Later, the price of £510 is reduced by 20% in a sale. Work out the overall percentage change from the price before the rise. State whether it is an increase or a decrease. [3 marks]

Answer% increase / decrease

Total for D5: 5 marks

D6 A rectangle of card is $(4x + 6)$ cm long and $(2x + 4)$ cm wide. A square of side x cm is cut from each corner. The card that is left is the net of an open box.

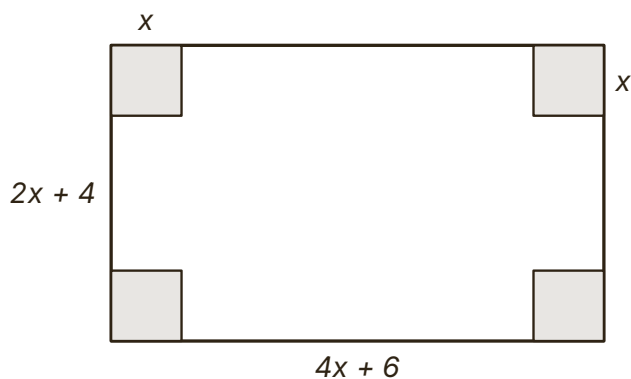
- (a) Work out the perimeter of the card that is left, in terms of x . [2 marks]

Answer cm

- (b) Work out the area of the card that is left, in terms of x . Give your answer in its simplest form. [2 marks]

Answer cm^2

- (c) Show that the volume of the box is $8x(x + 3) \text{ cm}^3$. [2 marks]



Not drawn accurately

Total for D6: 6 marks

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** $x : y = 3 : 2$ and $xy - y = 20$. Work out all the possible pairs of values of x and y . [5 marks]

Answer $x = \dots, y = \dots$ or $x = \dots, y = \dots$

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Write x and y as multiples of one letter, so the second equation has one unknown.
- Hint 2** $x = 3k$ and $y = 2k$ give $6k^2 - 2k = 20$, so $3k^2 - k - 10 = 0$.
- Hint 3** $(3k + 5)(k - 2) = 0$, so $k = 2$ or $k = -\frac{5}{3}$. Then $x = 3k$ and $y = 2k$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can combine two ratios and use a ratio given in letters. ☐ ☐ ☐

I can work out a percentage change, and the amount before a change. ☐ ☐ ☐

I can expand, simplify and factorise expressions, including with negative brackets. ☐ ☐ ☐

I can multiply, divide and add algebraic fractions. ☐ ☐ ☐