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GCSE MATHEMATICS • NUMBER

Fractions

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Fractions worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Fractions worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 Common denominator 20: $\frac{8}{20} + \frac{5}{20} = \frac{13}{20}$

A2 $\frac{5}{6} \times \frac{3}{2} = \frac{15}{12} = \frac{5}{4}$ $1\frac{1}{4}$

A3 $\frac{17}{5} - \frac{5}{3} = \frac{51}{15} - \frac{25}{15} = \frac{26}{15}$ $1\frac{11}{15}$

HIGHER

A4 After day 1, $\frac{3}{5}$ remains. After day 2, $\frac{1}{4}$ of $\frac{3}{5} = \frac{3}{20}$ remains.

$\frac{3}{20}$ of the tank is 9 litres, so $\frac{1}{20}$ is 3 litres $3 \times 20 = 60$ litres Check: $60 \rightarrow 36 \rightarrow 9$

A5 Girls = $2k$, boys = k . After 6 boys join: $\frac{2k}{3k+6} = \frac{3}{5}$ $10k = 9k + 18$ $k = 18$

Girls = $2k = 36$ Check: 36 girls out of 54, then 36 out of 60 = $\frac{3}{5}$

A6 Multiply by 12: $4(x+4) - 3(x-2) = 24$ $4x + 16 - 3x + 6 = 24$ $x + 22 = 24$ $x = 2$

A7 Area = $\frac{1}{2} \times \text{base} \times \text{height}$, so height = $2 \times \text{area} \div \text{base}$

$2 \times \frac{15}{4} = \frac{15}{2}$ $\frac{15}{2} \div \frac{5}{2} = \frac{15}{2} \times \frac{2}{5} = \frac{30}{10} = 3$ cm



B**Fluency solutions**

One mark for each correct part unless stated. The notes in italics explain why each sequence was chosen.

FOUNDATION

B1 (a) $\frac{2}{3}$ (b) $\frac{7}{10}$ (c) $17 \times 3 = 51$, so $\frac{1}{3}$ (d) **cannot be simplified** 9 and 20 share no factors

Not every fraction simplifies, and 51 is not prime.

B2 (a) $2\frac{3}{4}$ (b) $4\frac{5}{6}$ (c) $3 \times 7 + 2 = 23$ $\frac{23}{7}$ (d) $5 \times 9 + 7 = 52$ $\frac{52}{9}$

B3 (a) **7** (b) $7 \times 3 = 21$ (c) $\frac{108}{5} = 21\frac{3}{5}$ (d) $36 \div 3 \times 5 = 60$

(b) builds on (a). In (c) the answer is not a whole number. In (d) the fraction is greater than 1, so the answer is greater than 36.

B4 (a) $\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$ (b) $\frac{3}{6} + \frac{4}{6} = \frac{7}{6} = 1\frac{1}{6}$ (c) $\frac{25}{30} - \frac{9}{30} = \frac{16}{30} = \frac{8}{15}$ (d) $\frac{9}{12} - \frac{10}{12} = -\frac{1}{12}$

Answers can be greater than 1 or negative. In (c) the lowest common denominator is 30, not 60.

B5 (a) $\frac{3}{10}$ (b) $\frac{12}{72} = \frac{1}{6}$ (c) $\frac{10}{3} = 3\frac{1}{3}$ (d) $\frac{6}{6} = 1$

In (d) the fractions are reciprocals. A number multiplied by its reciprocal is always 1.

B6 (a) $\frac{1}{4} \times \frac{2}{1} = \frac{1}{2}$ (b) $\frac{1}{2} \times \frac{4}{1} = 2$ (c) $6 \times \frac{4}{3} = 8$ (d) $\frac{3}{4} \times \frac{1}{6} = \frac{3}{24} = \frac{1}{8}$

Swapping the order in a division gives the reciprocal: $\frac{1}{2}$ and 2, then 8 and $\frac{1}{8}$.

B7 Common denominator 24: $\frac{12}{24}, \frac{9}{24}, \frac{10}{24}, \frac{8}{24}$ $\frac{1}{3}, \frac{3}{8}, \frac{5}{12}, \frac{1}{2}$

B8 (a) $\frac{15}{10} + \frac{26}{10} = \frac{41}{10} = 4\frac{1}{10}$ (b) $\frac{51}{12} - \frac{22}{12} = \frac{29}{12} = 2\frac{5}{12}$

(c) $\frac{40}{8} - \frac{19}{8} = \frac{21}{8} = 2\frac{5}{8}$ (d) $\frac{57}{18} - \frac{32}{18} = \frac{25}{18} = 1\frac{7}{18}$

B9 (a) $\frac{4}{3} \times \frac{11}{5} = \frac{44}{15} = 2\frac{14}{15}$ (b) $\frac{10}{3} \times \frac{6}{5} = 4$ (c) $\frac{9}{2} \times \frac{5}{6} = \frac{15}{4} = 3\frac{3}{4}$ (d) $\frac{21}{8} \times \frac{4}{7} = \frac{3}{2} = 1\frac{1}{2}$



B10 (a) $18 \div 2 \times 3 = 27$ (b) $45 \div 5 \times 8 = 72$ (c) $108 \div 9 \times 7 = 84$

In (c) the fraction is greater than 1, so the number is smaller than 108.

HIGHER

B11 (a) $\frac{2}{3} \times \frac{3}{4} = \frac{1}{2}$ (b) $\frac{3}{5} \times \frac{2}{3} = \frac{2}{5}$ (c) $\frac{3}{4} \times \frac{1}{6} = \frac{1}{8}$

B12 (a) $\times 6: 2x + x = 30$ $x = 10$ (b) $\times 4: 2x + 2 = x + 5$ $x = 3$ (c) $\times 20: 8x - 5x = 60$ $x = 20$
 (d) $\times 6: 2(x - 1) + (x + 2) = 12$ $3x = 12$ $x = 4$

B13 (a) $\frac{3a}{6} + \frac{2a}{6} = \frac{5a}{6}$ (b) $\frac{5}{x}$ (c) $\frac{2}{2x} + \frac{1}{2x} = \frac{3}{2x}$ (d) $\frac{3x}{12} - \frac{2(x-1)}{12} = \frac{3x-2x+2}{12} = \frac{x+2}{12}$

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 $\frac{7}{9} = \frac{28}{36}$ $\frac{3}{4} = \frac{27}{36}$ $\frac{28}{36} > \frac{27}{36}$ $\frac{7}{9}$ is greater

C2 Tom added the numerators and added the denominators. He needs a common denominator first. $\frac{4}{12} + \frac{3}{12} = \frac{7}{12}$

C3 $\frac{2}{3}$ of 12 = 8 squares $8 - 3 = 5$ more squares

C4 Less than $\frac{3}{4}$ $\frac{5}{6}$ is less than 1, and multiplying by a number less than 1 makes the answer smaller.

C5 $\frac{1}{2} \div \frac{1}{3} = \frac{3}{2}$ $\frac{1}{3} \div \frac{1}{2} = \frac{2}{3}$ **No.** The order does not matter when multiplying, but it does when dividing.



C6 (a) She multiplied the whole numbers and the fractions separately. This misses out $2 \times \frac{1}{3}$ and $\frac{1}{2} \times 3$.

(b) $\frac{5}{2} \times \frac{10}{3} = \frac{50}{6} = \frac{25}{3} = 8\frac{1}{3}$

HIGHER

C7 $\frac{3}{7} = \frac{27}{63}$ and $\frac{4}{9} = \frac{28}{63}$. There is no whole number between 27 and 28, so double: $\frac{54}{126}$ and $\frac{56}{126}$ $\frac{55}{126}$

Other answers are possible, for example $\frac{7}{16}$.

C8 Sometimes true. Dividing by a number less than 1 makes the answer bigger: $\frac{1}{2} \div \frac{1}{4} = 2$, which is greater than $\frac{1}{2}$.

Dividing by a number greater than 1 makes it smaller: $\frac{1}{2} \div \frac{3}{2} = \frac{1}{3}$, which is less than $\frac{1}{2}$. (If $q = 1$ the answer equals p .)

C9 (a) $\frac{1}{n} - \frac{1}{n+1} = \frac{n+1}{n(n+1)} - \frac{n}{n(n+1)} = \frac{1}{n(n+1)}$ as required

(b) The denominators are 1×2 , 2×3 , 3×4 , 4×5 , 5×6 , so by (a) the sum is

$$\left(1 - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \left(\frac{1}{4} - \frac{1}{5}\right) + \left(\frac{1}{5} - \frac{1}{6}\right) = 1 - \frac{1}{6} = \frac{5}{6}$$

C10 $\frac{a+1}{b+1} - \frac{a}{b} = \frac{b(a+1) - a(b+1)}{b(b+1)} = \frac{b-a}{b(b+1)}$

Since $a < b$, the numerator is positive, and the denominator is positive. The difference is positive.

proved

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 $6 \div \frac{3}{4} = 6 \times \frac{4}{3} = 8$ 8 bottles



D2 30 biscuits is $\frac{30}{12} = \frac{5}{2}$ times as many. $\frac{2}{3} \times \frac{5}{2} = \frac{10}{6} = \frac{5}{3} = 1\frac{2}{3}$ cups

D3 (a) $\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{3}{10} \text{ m}^2$ (b) $2 \times \left(\frac{15}{20} + \frac{8}{20}\right) = 2 \times \frac{23}{20} = \frac{23}{10} = 2\frac{3}{10} \text{ m}$

D4 Monday: $240 \div 3 = 80$, leaving 160 Tuesday: $160 \div 4 = 40$ Left: $160 - 40 = 120$ pages

D5 $\frac{3}{5}$ of his money is £42, so $\frac{1}{5}$ is £14 $14 \times 5 = \text{£}70$

D6 (a) $\frac{9}{2} \div \frac{5}{8} = \frac{9}{2} \times \frac{8}{5} = \frac{72}{10} = 7.2$ 7 pieces

(b) $7 \times \frac{5}{8} = \frac{35}{8}$ $\frac{36}{8} - \frac{35}{8} = \frac{1}{8} \text{ m}$

HIGHER

D7 After Monday $\frac{2}{3}$ is left. After Tuesday $\frac{2}{5}$ of $\frac{2}{3} = \frac{4}{15}$ is left.

$\frac{4}{15}$ of the book is 48 pages, so $\frac{1}{15}$ is 12 pages $12 \times 15 = 180$ pages

D8 Ben: $35 \div 5 \times 6 = \text{£}42$ Ali: $42 \div 3 \times 4 = \text{£}56$

D9 Width = $\frac{27}{8} \div \frac{9}{4} = \frac{27}{8} \times \frac{4}{9} = \frac{108}{72} = \frac{3}{2} \text{ m}$

Perimeter = $2 \times \left(\frac{9}{4} + \frac{6}{4}\right) = 2 \times \frac{15}{4} = \frac{15}{2} = 7\frac{1}{2} \text{ m}$

D10 $P(\text{blue}) = 1 - \frac{1}{4} - \frac{2}{5} = \frac{20}{20} - \frac{5}{20} - \frac{8}{20} = \frac{7}{20}$

$\frac{7}{20}$ of the counters is 21, so $\frac{1}{20}$ is 3 and there are 60 counters. Red = $\frac{1}{4} \times 60 = 15$

D11 Let the numerator be n . The fraction is $\frac{n}{n+5}$ $\frac{n+3}{n+8} = \frac{3}{4}$ $4n + 12 = 3n + 24$ $n = 12$

$\frac{12}{17}$



E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION*Foundation and Higher crossover*

- E1** (a) $\frac{3}{5}$ B1
- (b) $3\frac{2}{5}$ B1
- (c) $56 \div 8 = 7$ M1
 $7 \times 3 = 21$ A1
-
- E2** (a) $\frac{10}{15} + \frac{3}{15}$ M1
 $\frac{13}{15}$ A1
- (b) $\frac{10}{12} - \frac{9}{12}$ M1
 $\frac{1}{12}$ A1
-
- E3** Common denominator 30: $\frac{20}{30}, \frac{18}{30}, \frac{21}{30}, \frac{22}{30}$ M1
 $\frac{3}{5}, \frac{2}{3}, \frac{7}{10}, \frac{11}{15}$ A1
-
- E4** Rent: $180 \div 3 = £60$, leaving £120 P1
Food: $120 \div 8 \times 3 = £45$ P1
 $120 - 45$ P1
£75 A1
-
- E5** $\frac{9}{4} \times \frac{8}{5}$ M1
 $= \frac{72}{20}$ M1
 $= \frac{18}{5} = 3\frac{3}{5}$ A1



E6 $\frac{10}{3} \div \frac{5}{2}$ M1

$= \frac{10}{3} \times \frac{2}{5} = \frac{20}{15}$ M1

$= \frac{4}{3} = 1\frac{1}{3}$ as required A1

HIGHER

E7 $\frac{3}{8}$ of the adults is 45, so $\frac{1}{8}$ is 15 P1

Adults = 120 A1

$\frac{2}{5}$ of the people is 120, so $\frac{1}{5}$ is 60 P1

Total = 300 people A1

E8 Multiply by 12: $3(3x+1) - 4(x-2) = 36$ M1

$9x+3-4x+8=36$ M1

$5x=25$ x = 5 A1

E9 $160 \div 8 = 20$ Boys = 60, girls = 100 P1

Boys kayaking: $60 \div 12 \times 7 = 35$ P1

Girls: climbing is 3 times kayaking, so kayaking is 1 part out of 4 P1

$100 \div 4 = 25$ P1

$35 + 25 =$ 60 students A1

E10 Red = $3k$, blue = $4k$, total = $7k$ P1

$\frac{3k+12}{7k+12} = \frac{1}{2}$ P1

$6k+24=7k+12$ $k=12$ P1

Blue = $4k =$ 48 A1

