

Adding and Subtracting Fractions

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (3 marks)

Work out. Give each answer in its simplest form.

(a) $\frac{2}{7} + \frac{3}{7}$

The denominators are the same (7).

So add the numerators: $2 + 3 = 5$

The denominator stays as 7.

Answer: $\frac{5}{7}$

Tip: Never add the denominators. $\frac{2}{7} + \frac{3}{7}$ is 5 sevenths, not $\frac{5}{14}$.

(b) $\frac{5}{9} - \frac{2}{9}$

The denominators are the same (9).

So subtract the numerators: $5 - 2 = 3$

$$\frac{5}{9} - \frac{2}{9} = \frac{3}{9}$$

Simplify: divide the top and bottom by 3: $\frac{3}{9} = \frac{1}{3}$

Answer: $\frac{1}{3}$

(c) $\frac{3}{10} + \frac{1}{5}$

The denominators are different. Change fifths into tenths.

$$\frac{1}{5} = \frac{2}{10} \text{ (multiply the top and bottom by 2)}$$

$$\frac{3}{10} + \frac{2}{10} = \frac{5}{10}$$

$$\text{Simplify: } \frac{5}{10} = \frac{1}{2}$$

Answer: $\frac{1}{2}$

2 (2 marks)

Work out $\frac{1}{3} + \frac{2}{5}$

Find a common denominator: 15 is in the 3 and the 5 times tables.

$$\frac{1}{3} = \frac{5}{15} \text{ (multiply the top and bottom by 5)}$$

$$\frac{2}{5} = \frac{6}{15} \text{ (multiply the top and bottom by 3)}$$

$$\text{Add the numerators: } \frac{5}{15} + \frac{6}{15} = \frac{11}{15}$$

Answer: $\frac{11}{15}$

Tip: When you change the denominator, multiply the numerator by the same number. $\frac{2}{5}$ becomes $\frac{6}{15}$, not $\frac{2}{15}$.

Marks: 1 mark for writing both fractions with a common denominator. 1 mark for $\frac{11}{15}$.

3 (2 marks)

Work out $\frac{3}{4} - \frac{1}{6}$

Find a common denominator: 12 is in the 4 and the 6 times tables.

$$\frac{3}{4} = \frac{9}{12} \text{ (multiply the top and bottom by 3)}$$

$$\frac{1}{6} = \frac{2}{12} \text{ (multiply the top and bottom by 2)}$$

Subtract the numerators: $\frac{9}{12} - \frac{2}{12} = \frac{7}{12}$

Answer: $\frac{7}{12}$

Tip: Do not subtract the tops and the bottoms separately ($\frac{3-1}{4-6}$). Get a common denominator first.

Marks: 1 mark for writing both fractions with a common denominator. 1 mark for $\frac{7}{12}$.

4 (1 mark)

Circle the answer to $\frac{1}{2} + \frac{1}{4}$

Options: $\frac{2}{6}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{1}{8}$

$$\frac{1}{2} = \frac{2}{4}$$

$$\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$$

($\frac{2}{6}$ comes from wrongly adding the tops and the bottoms.)

Answer: $\frac{3}{4}$

5 (3 marks)

Work out $2\frac{1}{3} + 1\frac{3}{4}$

Give your answer as a mixed number.

Change the mixed numbers to improper fractions:

$$2\frac{1}{3} = \frac{2 \times 3 + 1}{3} = \frac{7}{3}$$

$$1\frac{3}{4} = \frac{1 \times 4 + 3}{4} = \frac{7}{4}$$

Use a common denominator of 12:

$$\frac{7}{3} = \frac{28}{12} \text{ and } \frac{7}{4} = \frac{21}{12}$$

Add: $\frac{28}{12} + \frac{21}{12} = \frac{49}{12}$

Change back to a mixed number: $49 \div 12 = 4$ remainder 1

So the answer is $4\frac{1}{12}$

Answer: $4\frac{1}{12}$

Tip: The question asks for a mixed number, so do not leave the answer as $\frac{49}{12}$.

Marks: 1 mark for changing to improper fractions (or adding the whole numbers separately). 1 mark for using a common denominator, e.g. $\frac{28}{12}$ and $\frac{21}{12}$. 1 mark for $4\frac{1}{12}$.

6 (3 marks)

Work out $3\frac{1}{5} - 1\frac{1}{2}$

Change the mixed numbers to improper fractions:

$$3\frac{1}{5} = \frac{3 \times 5 + 1}{5} = \frac{16}{5}$$

$$1\frac{1}{2} = \frac{1 \times 2 + 1}{2} = \frac{3}{2}$$

Use a common denominator of 10:

$$\frac{16}{5} = \frac{32}{10} \text{ and } \frac{3}{2} = \frac{15}{10}$$

Subtract: $\frac{32}{10} - \frac{15}{10} = \frac{17}{10}$

As a mixed number: $1\frac{7}{10}$

Answer: $1\frac{7}{10}$

Tip: If you subtract the whole numbers and the fractions separately, be careful: $\frac{1}{5} - \frac{1}{2}$ is negative. Changing to improper fractions avoids this.

Marks: 1 mark for changing to improper fractions. 1 mark for using a common denominator, e.g. $\frac{32}{10} - \frac{15}{10}$. 1 mark for $1\frac{7}{10}$ (or $\frac{17}{10}$).

7 (1 mark)

Write down two different fractions, each with a numerator of 1, whose difference is $\frac{1}{12}$

Fractions with a numerator of 1 are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \dots$

Try neighbouring ones: $\frac{1}{3} - \frac{1}{4} = \frac{4}{12} - \frac{3}{12} = \frac{1}{12}$ ✓

So $\frac{1}{3}$ and $\frac{1}{4}$ work.

Another answer is $\frac{1}{6}$ and $\frac{1}{12}$, because $\frac{2}{12} - \frac{1}{12} = \frac{1}{12}$.

Answer: e.g. $\frac{1}{3}$ and $\frac{1}{4}$

Tip: Check your pair by writing both fractions over a common denominator of 12.

8 (3 marks)

Anna plants flowers in $\frac{1}{4}$ of her garden.

She plants vegetables in $\frac{1}{3}$ of her garden.

The rest is lawn.

What fraction of the garden is left for lawn?

First add the fractions used for flowers and vegetables.

Common denominator 12: $\frac{1}{4} = \frac{3}{12}$ and $\frac{1}{3} = \frac{4}{12}$

$$\frac{3}{12} + \frac{4}{12} = \frac{7}{12}$$

The whole garden is 1, which is $\frac{12}{12}$.

Lawn: $\frac{12}{12} - \frac{7}{12} = \frac{5}{12}$

Answer: $\frac{5}{12}$

Tip: "The rest" means take away from the whole, and the whole is 1 (or $\frac{12}{12}$).

Marks: 1 mark for $\frac{1}{4} + \frac{1}{3}$ (or $\frac{7}{12}$). 1 mark for taking this away from 1. 1 mark for $\frac{5}{12}$.

9 (1 mark)

Dev works out $\frac{1}{5} + \frac{2}{3} = \frac{3}{8}$

What mistake has Dev made?

Dev added the numerators ($1 + 2 = 3$) and added the denominators ($5 + 3 = 8$).

You must use a common denominator instead:

$$\frac{1}{5} + \frac{2}{3} = \frac{3}{15} + \frac{10}{15} = \frac{13}{15}$$

Answer: He added the numerators and added the denominators; the answer is $\frac{13}{15}$

10 (2 marks)

Work out the missing fraction.

$$\frac{2}{3} + \boxed{} = \frac{9}{10}$$

The missing fraction is the difference: $\frac{9}{10} - \frac{2}{3}$

Common denominator 30:

$$\frac{9}{10} = \frac{27}{30} \text{ and } \frac{2}{3} = \frac{20}{30}$$

$$\frac{27}{30} - \frac{20}{30} = \frac{7}{30}$$

$$\text{Check: } \frac{20}{30} + \frac{7}{30} = \frac{27}{30} = \frac{9}{10} \checkmark$$

Answer: $\frac{7}{30}$

Marks: 1 mark for $\frac{9}{10} - \frac{2}{3}$ with a common denominator. 1 mark for $\frac{7}{30}$.

11 (3 marks)

A water tank holds 240 litres when it is full.

The tank is $\frac{5}{6}$ full.

Water equal to $\frac{3}{8}$ of the **full** tank is then used.

How many litres of water are left in the tank?

Fraction of the tank left: $\frac{5}{6} - \frac{3}{8}$

Common denominator 24: $\frac{20}{24} - \frac{9}{24} = \frac{11}{24}$

$\frac{1}{24}$ of 240 litres: $240 \div 24 = 10$

$\frac{11}{24}$ of 240 litres: $11 \times 10 = 110$

Or: $\frac{5}{6}$ of 240 = 200 litres, $\frac{3}{8}$ of 240 = 90 litres, $200 - 90 = 110$ litres

Answer: 110 litres

Marks: 1 mark for $\frac{5}{6} - \frac{3}{8}$ or $\frac{11}{24}$ (or 200 and 90). 1 mark for $\frac{11}{24} \times 240$ (or $200 - 90$). 1 mark for 110.
