

Adding and Subtracting Fractions

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 (2 marks)

Work out. Give each answer in its simplest form.

(a) $\frac{4}{11} + \frac{5}{11}$

The denominators are the same (11).

So add the numerators: $4 + 5 = 9$

The denominator stays as 11.

Answer: $\frac{9}{11}$

Tip: Never add the denominators. The answer is 9 elevenths, not $\frac{9}{22}$.

(b) $\frac{1}{2} - \frac{1}{6}$

The denominators are different. Change halves into sixths.

$$\frac{1}{2} = \frac{3}{6} \text{ (multiply the top and bottom by 3)}$$

$$\frac{3}{6} - \frac{1}{6} = \frac{2}{6}$$

Simplify: divide the top and bottom by 2: $\frac{2}{6} = \frac{1}{3}$

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

2 (2 marks)

Work out $\frac{3}{5} + \frac{1}{4}$

Find a common denominator: 20 is in the 5 and the 4 times tables.

$$\frac{3}{5} = \frac{12}{20} \text{ (multiply the top and bottom by 4)}$$

$$\frac{1}{4} = \frac{5}{20} \text{ (multiply the top and bottom by 5)}$$

$$\text{Add the numerators: } \frac{12}{20} + \frac{5}{20} = \frac{17}{20}$$

Answer: $\frac{17}{20}$

Tip: When you change the denominator, multiply the numerator by the same number. $\frac{3}{5}$ becomes $\frac{12}{20}$, not $\frac{3}{20}$.

Marks: 1 mark for writing both fractions with a common denominator. 1 mark for $\frac{17}{20}$.

3 (2 marks)

Work out $\frac{5}{6} - \frac{3}{8}$

Find a common denominator: 24 is in the 6 and the 8 times tables.

$$\frac{5}{6} = \frac{20}{24} \text{ (multiply the top and bottom by 4)}$$

$$\frac{3}{8} = \frac{9}{24} \text{ (multiply the top and bottom by 3)}$$

$$\text{Subtract the numerators: } \frac{20}{24} - \frac{9}{24} = \frac{11}{24}$$

Answer: $\frac{11}{24}$

Marks: 1 mark for writing both fractions with a common denominator. 1 mark for $\frac{11}{24}$.

4 (3 marks)

Work out $1\frac{2}{3} + 2\frac{4}{5}$

Give your answer as a mixed number.

Add the whole numbers: $1 + 2 = 3$

Add the fractions using a common denominator of 15:

$$\frac{2}{3} = \frac{10}{15} \text{ and } \frac{4}{5} = \frac{12}{15}$$

$$\frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$$

Add the two parts: $3 + 1\frac{7}{15} = 4\frac{7}{15}$

(Or use improper fractions: $\frac{5}{3} + \frac{14}{5} = \frac{25}{15} + \frac{42}{15} = \frac{67}{15} = 4\frac{7}{15}$)

Answer: $4\frac{7}{15}$

Tip: The fractions add up to more than 1 ($\frac{22}{15}$). Change this to $1\frac{7}{15}$ and add the 1 to the whole number. $3\frac{22}{15}$ is not a proper mixed number.

Marks: 1 mark for changing to improper fractions or adding the whole numbers separately. 1 mark for using a common denominator of 15. 1 mark for $4\frac{7}{15}$.

5 (3 marks)

Show that $3\frac{1}{4} - 1\frac{2}{3} = 1\frac{7}{12}$

Change to improper fractions:

$$3\frac{1}{4} = \frac{3 \times 4 + 1}{4} = \frac{13}{4}$$

$$1\frac{2}{3} = \frac{1 \times 3 + 2}{3} = \frac{5}{3}$$

Common denominator 12:

$$\frac{13}{4} = \frac{39}{12} \text{ and } \frac{5}{3} = \frac{20}{12}$$

$$\frac{39}{12} - \frac{20}{12} = \frac{19}{12}$$

$$\frac{19}{12} = 1\frac{7}{12}, \text{ as required.}$$

Tip: Here $\frac{1}{4}$ is smaller than $\frac{2}{3}$, so subtracting the whole numbers and fractions separately goes wrong easily. Improper fractions are safer.

Marks: 1 mark for changing to improper fractions. 1 mark for using a common denominator, e.g. $\frac{39}{12} - \frac{20}{12}$. 1 mark for reaching $\frac{19}{12} = 1\frac{7}{12}$ with all working shown.

6 (3 marks)

Kofi has a length of ribbon.

He uses $\frac{2}{7}$ of the ribbon to wrap a present for his sister.

He uses $\frac{1}{3}$ of the ribbon to wrap a present for his brother.

Kofi says, "I have more than $\frac{1}{3}$ of the ribbon left."

Is Kofi correct?

You must show your working.

The whole ribbon is 1.

$$\text{Fraction used: } \frac{2}{7} + \frac{1}{3} = \frac{6}{21} + \frac{7}{21} = \frac{13}{21}$$

$$\text{Fraction left: } \frac{21}{21} - \frac{13}{21} = \frac{8}{21}$$

$$\text{Write } \frac{1}{3} \text{ with the same denominator: } \frac{1}{3} = \frac{7}{21}$$

$$\frac{8}{21} \text{ is more than } \frac{7}{21}$$

Answer: Yes, Kofi is correct: $\frac{8}{21}$ is left and $\frac{8}{21} > \frac{7}{21} = \frac{1}{3}$

Tip: To compare $\frac{8}{21}$ with $\frac{1}{3}$, write them over the same denominator. Just writing "yes" with no fractions scores nothing.

Marks: 1 mark for $\frac{2}{7} + \frac{1}{3}$ with a common denominator (or $\frac{13}{21}$). 1 mark for $\frac{8}{21}$ left. 1 mark for comparing with $\frac{1}{3} = \frac{7}{21}$ and saying yes.

7 (2 marks)

Work out $\frac{7}{10} - \frac{1}{4} + \frac{1}{2}$

Common denominator: 20 is in the 10, 4 and 2 times tables.

$$\frac{7}{10} = \frac{14}{20}, \quad \frac{1}{4} = \frac{5}{20}, \quad \frac{1}{2} = \frac{10}{20}$$

Work from left to right: $14 - 5 + 10 = 19$

So the answer is $\frac{19}{20}$

Answer: $\frac{19}{20}$

Marks: 1 mark for all three fractions with a common denominator. 1 mark for $\frac{19}{20}$.

8 (1 mark)

Lily works out $\frac{3}{4} - \frac{1}{2} = \frac{2}{2} = 1$

Explain what Lily has done wrong.

Lily subtracted the numerators ($3 - 1 = 2$) and subtracted the denominators ($4 - 2 = 2$).

You must use a common denominator instead:

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

Answer: She subtracted the numerators and the denominators; answer $\frac{1}{4}$

9 (3 marks)

A jug holds $2\frac{1}{2}$ litres of juice.

Sam pours out $\frac{3}{4}$ litre and then $1\frac{1}{3}$ litres.

How much juice is left in the jug?

Change the mixed numbers to improper fractions:

$$2\frac{1}{2} = \frac{5}{2} \text{ and } 1\frac{1}{3} = \frac{4}{3}$$

$$\text{Juice left: } \frac{5}{2} - \frac{3}{4} - \frac{4}{3}$$

$$\text{Common denominator 12: } \frac{30}{12} - \frac{9}{12} - \frac{16}{12}$$

$$30 - 9 - 16 = 5$$

$$\text{So } \frac{5}{12} \text{ litre is left.}$$

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

Marks: 1 mark for a correct first step, e.g. $\frac{3}{4} + 1\frac{1}{3}$ or using a common denominator of 12. 1 mark for a complete method, e.g. $\frac{30}{12} - \frac{9}{12} - \frac{16}{12}$. 1 mark for $\frac{5}{12}$.

10 (4 marks)

Some people take part in a fun run.

$\frac{3}{8}$ of the runners are children.

$\frac{1}{3}$ of the runners are women.

The rest of the runners are men.

There are 70 men in the fun run.

Work out the total number of runners in the fun run.

$$\text{Children and women together: } \frac{3}{8} + \frac{1}{3} = \frac{9}{24} + \frac{8}{24} = \frac{17}{24}$$

$$\text{Fraction who are men: } \frac{24}{24} - \frac{17}{24} = \frac{7}{24}$$

$$\text{So } \frac{7}{24} \text{ of the runners is 70 runners.}$$

$$\frac{1}{24} \text{ of the runners is } 70 \div 7 = 10 \text{ runners.}$$

All the runners ($\frac{24}{24}$): $24 \times 10 = 240$

Answer: 240 runners

Tip: 70 is only the number of men, not the total. Work out what fraction of the runners the men are, then scale up to the whole.

Marks: 1 mark for $\frac{3}{8} + \frac{1}{3} (= \frac{17}{24})$. 1 mark for $\frac{7}{24}$. 1 mark for $70 \div 7 (= 10)$. 1 mark for 240.
