Fractions and mixed numbers

N2, N8 · Number · revision notes

Simplifying, ordering and converting fractions, and adding, subtracting, multiplying and dividing fractions and mixed numbers exactly. These questions are common on the non-calculator paper, both as straight calculations and inside word problems.

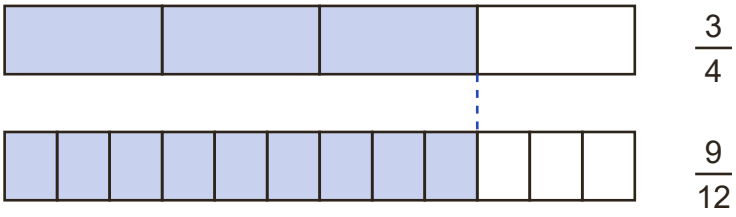
Key facts

- Add or subtract: common denominator first, then add or subtract the numerators
- $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$
- Fraction to decimal: numerator ÷ denominator
- 'of' means ×
- $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$
- Mixed to improper: $2\frac{3}{4} = \frac{2 \times 4 + 3}{4} = \frac{11}{4}$
- $\frac{1}{8}$ = 0.125 = 12.5%, $\frac{1}{5}$ = 0.2 = 20%, $\frac{1}{4}$ = 0.25 = 25%, $\frac{1}{3}$ = 0.333... ≈ 33.3%

Notes

Equivalent fractions and mixed numbers

- Multiply or divide the numerator (top) and denominator (bottom) by the same number to get an equivalent fraction: $\frac{3}{4} = \frac{9}{12}$



The same amount is shaded: $\frac{3}{4} = \frac{9}{12}$. Each quarter has been split into 3.

- Simplest form: divide the top and bottom by their HCF: $\frac{18}{24} = \frac{3}{4}$ (HCF 6).
- To order fractions, write them with a common denominator or change them to decimals.
- Improper fraction to mixed number: $\frac{17}{5} = 3\frac{2}{5}$ (5 goes into 17 three times, remainder 2).
- Mixed number to improper fraction:

$$\begin{aligned} & 2\frac{3}{4} \\ & = \frac{2 \times 4 + 3}{4} \\ & = \frac{11}{4} \end{aligned}$$

Fractions, decimals and percentages

- Fraction to decimal: divide the top by the bottom, e.g. with short division: $\frac{3}{8}$ = 3 ÷ 8 = 0.375.
- Decimal to fraction: use place value, then simplify: 0.35 = $\frac{35}{100} = \frac{7}{20}$
- Percentage to fraction: write it over 100, then simplify: 45% = $\frac{45}{100} = \frac{9}{20}$
- Learn: $\frac{1}{2}$ = 0.5, $\frac{1}{4}$ = 0.25, $\frac{3}{4}$ = 0.75, $\frac{1}{5}$ = 0.2, $\frac{1}{8}$ = 0.125, $\frac{1}{10}$ = 0.1, $\frac{1}{3}$ = 0.333...

Adding and subtracting

- Write the fractions with a common denominator (the LCM of the denominators keeps numbers small), then add or subtract the numerators only.

$$\begin{aligned}&\frac{5}{6}-\frac{3}{8}\\&=\frac{20}{24}-\frac{9}{24}\\&=\frac{11}{24}\end{aligned}$$

- Mixed numbers: change them to improper fractions:

$$\begin{aligned}&3\frac{1}{4}-1\frac{2}{3}\\&=\frac{13}{4}-\frac{5}{3}\\&=\frac{39}{12}-\frac{20}{12}\\&=\frac{19}{12}\\&=1\frac{7}{12}\end{aligned}$$

Multiplying and dividing

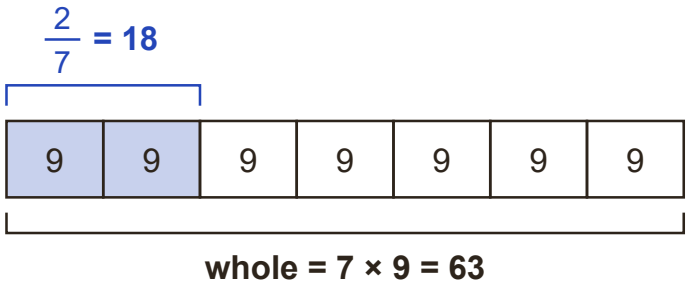
- Multiply: tops together, bottoms together: $\frac{2}{3} \times \frac{9}{10} = \frac{18}{30} = \frac{3}{5}$. Cancelling common factors first keeps the numbers small.
- Divide: keep the first fraction, change ÷ to ×, and flip the second fraction (use its reciprocal):

$$\begin{aligned} &\frac{3}{4} \div \frac{9}{10} \\ &= \frac{3}{4} \times \frac{10}{9} \\ &= \frac{30}{36} \\ &= \frac{5}{6} \end{aligned}$$

- Always change mixed numbers to improper fractions before multiplying or dividing:

$$\begin{aligned} &1\frac{1}{2} \times 2\frac{2}{3} \\ &= \frac{3}{2} \times \frac{8}{3} \\ &= \frac{24}{6} \\ &= 4 \end{aligned}$$

- Negative fractions use the same sign rules as integers: $-\frac{2}{3} \times \frac{3}{4} = -\frac{1}{2}$ and $\frac{1}{4} - \frac{2}{3} = -\frac{5}{12}$
- 'Of' means multiply: $\frac{3}{5}$ of 40 = 24.
- Whole from a part: if $\frac{2}{7}$ of a number is 18, then $\frac{1}{7}$ is 9 and the whole number is 63.



Bar model: 2 parts are 18, so 1 part is 9 and 7 parts are 63.

How to answer each type of question

M = method mark, A = answer mark, B = a mark on its own, P = a process mark.

Add or subtract mixed numbers (non-calculator)

3 marks | Grade 4

1. Change the mixed numbers to improper fractions.
2. Find a common denominator and write the equivalent fractions.
3. Add or subtract the numerators; keep the denominator.
4. Simplify, and give a mixed number if the question asks for one.

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

Give your answer as a mixed number.

Model answer.

$\frac{13}{5} + \frac{7}{4}$ (M1 for both improper fractions)

$= \frac{52}{20} + \frac{35}{20}$ (M1 for a correct common denominator)

$= \frac{87}{20}$

$= 4\frac{7}{20}$ (A1)

Show that: multiply or divide mixed numbers

3 marks | Grade 5

1. Change each mixed number to an improper fraction.
2. To divide, keep the first fraction, change ÷ to × and flip the second.
3. Multiply, then simplify, writing every step to reach the given answer.

Example. Show that $1\frac{7}{8} \div 2\frac{1}{4} = \frac{5}{6}$

Model answer.

$\frac{15}{8} \div \frac{9}{4}$ (M1 for both improper fractions)

$= \frac{15}{8} \times \frac{4}{9}$ (M1 for multiplying by the reciprocal)

$= \frac{60}{72} = \frac{5}{6}$ (A1 for a complete, correct method)

Fraction problem in context

3 to 4 marks | Grade 4

1. Find the first fraction of the amount.
2. Work out what is left before taking the next fraction, if the question says 'of the rest' or 'of what is left'.
3. Label each value so you don't lose track, and answer the question with units.

Example. Priya has £240. She spends $\frac{3}{8}$ of it on a coat. She then spends $\frac{2}{5}$ of the money she has left on shoes.
How much money does Priya have left?

Model answer.

Coat: 240 ÷ 8 × 3 = £90, so £150 is left (P1)
Shoes: 150 ÷ 5 × 2 = £60 (P1)
Left: 150 − 60 = £90 (A1)

Order fractions, decimals and percentages

2 marks | Grade 3

1. Change every number to a decimal (or all to percentages).
2. Compare them, lining up the decimal points.
3. Write the numbers in their original form, in the order asked for (check whether it says smallest or largest first).

Example. Write these numbers in order of size. Start with the smallest number.
0.62, $\frac{5}{8}$, 61%, $\frac{3}{5}$

Model answer.

$\frac{5}{8}$ = 0.625, 61% = 0.61, $\frac{3}{5}$ = 0.6 (M1 for at least two converted to the same form)
$\frac{3}{5}$, 61%, 0.62, $\frac{5}{8}$ (A1)

Don't lose marks

- Adding the denominators: $\frac{1}{3} + \frac{1}{4}$ is $\frac{7}{12}$, not $\frac{2}{7}$
- Multiplying mixed numbers without converting: $2\frac{1}{2} \times 3\frac{1}{2}$ is $\frac{35}{4} = 8\frac{3}{4}$, not $6\frac{1}{4}$
- Flipping the wrong fraction when dividing: only the second fraction is turned upside down.
- Not simplifying when the question asks for the simplest form, or giving an improper fraction when it asks for a mixed number.
- Taking a fraction of the original amount when the question says 'of the money left'.

More tips

Memory tricks

- Dividing fractions: Keep, Change, Flip (keep the first, change ÷ to ×, flip the second).
- Cancel before you multiply: in $\frac{4}{9} \times \frac{15}{8}$, cancel 4 with 8 and 15 with 9 to get $\frac{1}{3} \times \frac{5}{2} = \frac{5}{6}$
- Sense check: multiplying by a proper fraction makes a number smaller; dividing by a proper fraction makes it bigger.
- On the calculator paper, the fraction key gives exact answers, and the S⇔D key (on many calculators) switches between fraction and decimal.

Exam technique

- On the non-calculator paper, show every stage: the improper fractions, the common denominator, then the answer. The method marks come from these lines.
- In 'show that' questions, write every step; just writing the given answer earns nothing.
- In multi-step problems, say what each number is, e.g. 'left after coat = £150'.
- Check your final answer is in the form asked for: simplest form, mixed number or decimal.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 1

Simplify a fraction

Divide the top and bottom by a common factor, e.g. $\frac{18}{24} = \frac{3}{4}$

Grade 2

Find a fraction of an amount

Divide by the denominator, then multiply by the numerator: $\frac{3}{5}$ of 40 = 40 ÷ 5 × 3 = 24.

Grade 3

Convert fractions, decimals and percentages

E.g. $\frac{3}{8}$ = 3 ÷ 8 = 0.375 = 37.5%.

Grade 3

Add and subtract fractions

Use a common denominator:

$$\begin{aligned} &\frac{2}{3} + \frac{1}{4} \\ &= \frac{8}{12} + \frac{3}{12} \\ &= \frac{11}{12} \end{aligned}$$

Grade 4

Multiply and divide fractions

Multiply tops and bottoms; to divide, multiply by the reciprocal of the second fraction.

Grade 5

Calculate with mixed numbers

Change mixed numbers to improper fractions first, e.g. $2\frac{1}{3} = \frac{7}{3}$, then add, subtract, multiply or divide.

Grade 5

Solve multi-step fraction problems

E.g. find a fraction of what is left, or find the whole amount from a fraction of it.

Free notes, Full packs, practice papers and mock exams at chhetriacademy.com. Written for this site; not taken from past papers. Stuck? 1-to-1 tutoring with a free 30-minute trial lesson.