UK 11+ EXAM FRACTIONS, DECIMALS & PERCENTAGES MASTERY WORKBOOK

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1. Understanding Fractions

A fraction represents a part of a whole. It consists of two parts:

- **Numerator** - the top number, showing how many parts we have
- **Denominator** - the bottom number, showing how many equal parts the whole is divided into

Example:

In the fraction $\frac{3}{4}$, we have 3 parts out of 4 equal parts.

Key Tip: The denominator tells us what type of fraction we're dealing with. For example, halves, thirds, quarters, fifths, etc.

Types of Fractions

- **Proper Fractions:** The numerator is smaller than the denominator (e.g., $\frac{2}{3}$)
- **Improper Fractions:** The numerator is equal to or larger than the denominator (e.g., $\frac{5}{3}$)
- **Mixed Numbers:** A whole number and a fraction combined (e.g., $2\frac{1}{3}$)

2. Equivalent Fractions and Simplifying

Equivalent fractions are fractions that represent the same value, even though they look different.

Example:

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$$

Finding Equivalent Fractions

To find equivalent fractions, multiply or divide both the numerator and denominator by the same number.

Worked Example:

Find three equivalent fractions for $\frac{2}{5}$

Step 1: Multiply by 2: $\frac{2\times2}{5\times2} = \frac{4}{10}$

Step 2: Multiply by 3: $\frac{2\times3}{5\times3} = \frac{6}{15}$

Step 3: Multiply by 4: $\frac{2\times4}{5\times4} = \frac{8}{20}$

Simplifying Fractions

To simplify a fraction, divide both the numerator and denominator by their highest common factor (HCF).

Worked Example:

Simplify $\frac{12}{18}$

Step 1: Find factors of 12: 1, 2, 3, 4, 6, 12

Step 2: Find factors of 18: 1, 2, 3, 6, 9, 18

Step 3: Find HCF: 6

Step 4: Divide: $\frac{12\div6}{18\div6} = \frac{2}{3}$

Practice Questions - Equivalent Fractions

1. Find two equivalent fractions for $\frac{3}{7}$
2. Simplify $\frac{15}{25}$
3. Are $\frac{4}{6}$ and $\frac{8}{12}$ equivalent?
4. Simplify $\frac{24}{36}$

3. Mixed Numbers and Improper Fractions

Mixed numbers and improper fractions are two ways to express the same value when dealing with amounts greater than one whole.

Converting Improper Fractions to Mixed Numbers

Worked Example:

Convert $\frac{11}{4}$ to a mixed number

Step 1: Divide the numerator by the denominator: 11 ÷ 4 = 2 remainder 3

Step 2: Write as mixed number: $2\frac{3}{4}$

Converting Mixed Numbers to Improper Fractions

Worked Example:

Convert $3\frac{2}{5}$ to an improper fraction

Step 1: Multiply whole number by denominator: 3 × 5 = 15

Step 2: Add the numerator: 15 + 2 = 17

Step 3: Write over original denominator: $\frac{17}{5}$

Practice Questions - Mixed Numbers

1. Convert $\frac{13}{3}$ to a mixed number

2. Convert $2\frac{4}{7}$ to an improper fraction

3. Convert $\frac{22}{6}$ to a mixed number in its simplest form

4. Understanding Decimals

Decimals are another way to represent fractions, especially those with denominators of 10, 100, 1000, etc.

Place Value in Decimals

Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths
H	T	U	.	t	h	th
1	2	3	.	4	5	6

In the number 123.456:

- 4 is in the tenths place = $\frac{4}{10}$
- 5 is in the hundredths place = $\frac{5}{100}$
- 6 is in the thousandths place = $\frac{6}{1000}$

5. Understanding Percentages

Percentages are fractions with a denominator of 100. The symbol % means "out of 100".

Example:

25% means 25 out of 100, which is $\frac{25}{100} = \frac{1}{4}$

Common Percentage Equivalents

Percentage	Fraction	Decimal
10%	1/10	0.1
20%	1/5	0.2
25%	1/4	0.25
50%	1/2	0.5

75%	3/4	0.75

6. Converting Between Fractions, Decimals, and Percentages

Fraction to Decimal

Divide the numerator by the denominator.

Example:

$$\frac{3}{4} = 3 \div 4 = 0.75$$

Decimal to Fraction

Write the decimal as a fraction with a denominator of 10, 100, or 1000, then simplify.

Example:

$$0.6 = \frac{6}{10} = \frac{3}{5}$$

Fraction to Percentage

Convert to decimal first, then multiply by 100.

Example:

$$\frac{3}{5} = 3 \div 5 = 0.6 = 0.6 \times 100 = 60\%$$

Percentage to Fraction

Write as a fraction over 100, then simplify.

Example:

$35\% = \frac{35}{100} = \frac{7}{20}$

Practice Questions - Conversions

1. Convert $\frac{7}{8}$ to a decimal
2. Convert 0.45 to a fraction in its simplest form
3. Convert $\frac{2}{5}$ to a percentage
4. Convert 65% to a fraction in its simplest form

7. Ordering and Comparing

To compare fractions, decimals, and percentages, it's often easiest to convert them all to the same form.

Worked Example:

Order from smallest to largest: 0.7, 65%, $\frac{3}{4}$

Step 1: Convert all to percentages

0.7 = 70%

65% = 65%

$\frac{3}{4}$ = 75%

Step 2: Order: 65%, 70%, 75%

Step 3: Answer: 65%, 0.7, $\frac{3}{4}$

Strategy Tip: When comparing fractions with different denominators, find a common denominator or convert to decimals.

8. Adding and Subtracting Fractions

Same Denominators

When fractions have the same denominator, add or subtract the numerators and keep the denominator the same.

Example:

$$\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$$

Different Denominators

Find a common denominator first, then add or subtract.

Worked Example:

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

Step 1: Find common denominator (LCM of 3 and 4 = 12)

Step 2: Convert fractions: $\frac{1}{3} = \frac{4}{12}$ and $\frac{1}{4} = \frac{3}{12}$

Step 3: Add: $\frac{4}{12} + \frac{3}{12} = \frac{7}{12}$

Practice Questions - Adding/Subtracting Fractions

1. $\frac{2}{5} + \frac{1}{5} = ?$

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

3. $\frac{1}{2} + \frac{1}{6} = ?$

4. $\frac{5}{6} - \frac{1}{3} = ?$

9. Multiplying and Dividing Fractions

Multiplying Fractions

Multiply the numerators together and multiply the denominators together.

Example:

$$\frac{2}{3} \times \frac{4}{5} = \frac{2 \times 4}{3 \times 5} = \frac{8}{15}$$

Dividing Fractions

Multiply by the reciprocal (flip the second fraction).

Example:

$$\frac{3}{4} \div \frac{2}{5} = \frac{3}{4} \times \frac{5}{2} = \frac{15}{8} = 1\frac{7}{8}$$

Practice Questions - Multiplying/Dividing Fractions

1. $\frac{3}{5} \times \frac{2}{7} = ?$

2. $\frac{4}{9} \div \frac{2}{3} = ?$

3. $\frac{1}{2} \times \frac{3}{8} = ?$

10. Calculating Percentages of Amounts

To find a percentage of an amount, convert the percentage to a decimal and multiply.

Worked Example:

Find 25% of £80

Step 1: Convert percentage to decimal: 25% = 0.25

Step 2: Multiply: 0.25 × 80 = £20

Finding One Percentage from Another

Worked Example:

Find 15% of £60 using 10%

Step 1: Find 10% of £60: £60 ÷ 10 = £6

Step 2: Find 5% of £60: £6 ÷ 2 = £3

Step 3: Add: 10% + 5% = £6 + £3 = £9

Practice Questions - Percentage Calculations

1. Find 20% of £150
2. Find 35% of 240
3. Find 12.5% of £96
4. In a class of 30 students, 60% are boys. How many boys are there?

11. Finding Fractions of Quantities

To find a fraction of a quantity, divide by the denominator and multiply by the numerator.

Worked Example:

Find $\frac{3}{4}$ of £120

Step 1: Find $\frac{1}{4}$ of £120: £120 ÷ 4 = £30

Step 2: Find $\frac{3}{4}$: £30 × 3 = £90

Finding Unknown Quantities

Sometimes you know the fraction and need to find the whole amount.

Worked Example:

If $\frac{3}{5}$ of a number is 60, what is the number?

Step 1: Find $\frac{1}{5}$ of the number: 60 ÷ 3 = 20

Step 2: Find the whole number: 20 × 5 = 100

Practice Questions - Fractions of Quantities

1. Find $\frac{2}{3}$ of £90

2. Find $\frac{5}{8}$ of 160

3. If $\frac{2}{7}$ of a number is 14, what is the number?

12. Real-World Applications

Fractions, decimals, and percentages appear frequently in everyday situations.

Shopping Example:

A jacket costs £80. It's reduced by 25% in a sale. What is the sale price?

Step 1: Find 25% of £80: $0.25 \times 80 = £20$

Step 2: Subtract from original price: £80 - £20 = £60

Recipe Example:

A recipe serves 4 people and needs $\frac{3}{4}$ cup of flour. How much flour for 6 people?

Step 1: Find flour per person: $\frac{3}{4} \div 4 = \frac{3}{16}$ cup

Step 2: Find flour for 6 people: $\frac{3}{16} \times 6 = \frac{18}{16} = 1\frac{1}{8}$ cups

Practice Questions - Real-World Applications

1. A book costs £12. VAT at 20% is added. What is the total cost?
2. In a school of 600 students, $\frac{3}{8}$ walk to school. How many students walk to school?
3. A pizza is cut into 8 slices. If 5 slices are eaten, what percentage is left?

13. Practice Test Questions

These questions are similar to those found in 11+ exams. Time yourself and try to complete them without a calculator.

Section A: Multiple Choice

1. What is 0.75 as a fraction in its simplest form?
   A) $\frac{75}{100}$ B) $\frac{3}{4}$ C) $\frac{15}{20}$ D) $\frac{6}{8}$

2. Which is the largest?
   A) 0.6 B) 65% C) $\frac{5}{8}$ D) 0.62

3. What is 15% of 240?
   A) 36 B) 32 C) 40 D) 35

4. $\frac{2}{3} + \frac{1}{6} = ?$
   A) $\frac{3}{9}$ B) $\frac{5}{6}$ C) $\frac{4}{6}$ D) $\frac{2}{6}$

Section B: Problem Solving

1. Sarah spends $\frac{2}{5}$ of her money on books and $\frac{1}{4}$ on clothes. What fraction of her money is left?

2. A class has 28 students. If 75% of them pass a test, how many students passed?

3. Convert $2\frac{3}{8}$ to an improper fraction.

4. A recipe needs 1.5 litres of water for 6 people. How much water is needed for 9 people?

5. If $\frac{3}{7}$ of a number is 21, what is $\frac{4}{7}$ of the same number?

14. Answer Key

Section 2 - Equivalent Fractions

1. $\frac{6}{14}$ and $\frac{9}{21}$ (examples)
2. $\frac{3}{5}$
3. Yes, both simplify to $\frac{2}{3}$
4. $\frac{2}{3}$

Section 3 - Mixed Numbers

1. $4\frac{1}{3}$
2. $\frac{18}{7}$
3. $3\frac{2}{3}$

Section 6 - Conversions

1. 0.875
2. $\frac{9}{20}$
3. 40%
4. $\frac{13}{20}$

Section 8 - Adding/Subtracting Fractions

1. $\frac{3}{5}$
2. $\frac{1}{2}$
3. $\frac{2}{3}$

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

Section 9 - Multiplying/Dividing Fractions

1. $\frac{6}{35}$
2. $\frac{2}{3}$
3. $\frac{3}{16}$

Section 10 - Percentage Calculations

1. £30
2. 84
3. £12
4. 18 boys

Section 11 - Fractions of Quantities

1. £60
2. 100
3. 49

Section 12 - Real-World Applications

1. £14.40
2. 225 students
3. 37.5%

Section 13A - Multiple Choice

1. B) $\frac{3}{4}$
2. B) 65%
3. A) 36
4. B) $\frac{5}{6}$

Section 13B - Problem Solving

1. $\frac{7}{20}$
2. 21 students
3. $\frac{19}{8}$
4. 2.25 litres
5. 28

Final Tips for Success:

- Learn the common fraction, decimal, and percentage equivalents by heart
- Practice mental calculations regularly
- Always check if your answer makes sense
- Show your working clearly in exams
- Remember to simplify fractions to their lowest terms