1 Fractions

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EQUIVALENT & SIMPLIFYING

- **Equivalent:** multiply or divide **top and bottom by the same number**: $\frac{2}{3} = \frac{4}{6} = \frac{6}{9}$.
- **Simplify:** divide top and bottom by their **HCF** (cancel): $\frac{12}{18} = \frac{2}{3}$.

IMPROPER & MIXED NUMBERS

- **Improper** (top-heavy): $\frac{11}{4}$. **Mixed:** $2\frac{3}{4}$.
- **Mixed → improper:** (whole × denom + num) over denom: $2\frac{3}{4} = \frac{11}{4}$.
- **Improper → mixed:** divide: $\frac{11}{4} = 11 \div 4 = 2\frac{3}{4}$.

FRACTIONS OF AMOUNTS

Divide by the denominator, **multiply** by the numerator.

$\frac{1}{4}$ of 24 = 24÷4 = **6**

$\frac{7}{4}$ of 24 = (24÷4)×7 = **42**

ADDING & SUBTRACTING

Common denominator first, then add/subtract the **numerators** (keep the denominator).

$\frac{2}{3} + \frac{1}{4} = \frac{8}{12} + \frac{3}{12} = \mathbf{\frac{11}{12}}$

Mixed numbers: change to improper first, or add the wholes and parts separately.

MULTIPLYING

Multiply **straight across** (tops together, bottoms together), then simplify.

$\frac{2}{5} \times \frac{3}{4} = \frac{6}{20} = \mathbf{\frac{3}{10}}$

Mixed numbers → convert to improper first.

SQUARING & ROOTING

- Square / root the **top and bottom**: $(\frac{5}{8})^2 = \frac{25}{64}$.
- $\sqrt{\frac{16}{81}} = \frac{4}{9}$.

RECIPROCALS

- The **reciprocal** is the number you multiply by to make **1** — **flip** the fraction.
- Reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$; of 6 is $\frac{1}{6}$.

DIVIDING

Multiply by the reciprocal of the second fraction (flip it, then multiply).

$\frac{1}{5} \div \frac{1}{3} = \frac{1}{5} \times \frac{3}{1} = \mathbf{\frac{3}{5}}$

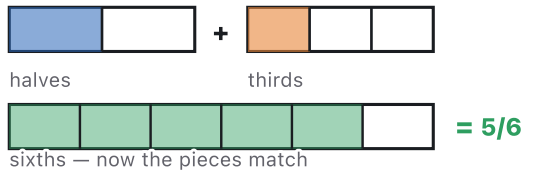
$2 \div \frac{1}{5} = 2 \times 5 = \mathbf{10}$

Mixed numbers → convert to improper first.

MIXED OPERATIONS

- Order of operations still applies: **brackets**, then **× ÷**, then **+ −**.
- $\frac{5}{7} + \frac{5}{3} \times \frac{3}{2}$ → do the multiply first.

WHY YOU NEED A COMMON DENOMINATOR



Different-sized pieces cannot be added — cut both into **sixths** first.

MORE PRACTICE

$\frac{3}{4} - \frac{1}{6} = \frac{9}{12} - \frac{2}{12} = \mathbf{\frac{7}{12}}$

$\frac{2}{3} \times \frac{9}{10} = \frac{18}{30} = \mathbf{\frac{3}{5}}$

$\frac{3}{8} \div \frac{3}{4} = \frac{3}{8} \times \frac{4}{3} = \mathbf{\frac{1}{2}}$

$\frac{2}{5}$ of 45 = **18**

⚠ COMMON EXAM MISTAKES (recurring errors flagged in examiners' reports)

- ✕ **Adding the denominators:** $\frac{1}{2} + \frac{1}{3} = \frac{2}{5}$ is **wrong** ($= \frac{5}{6}$). **Find a common denominator.**
- ✕ **Dividing:** forgetting to flip, or flipping the **first** fraction instead of the second.
- ✕ Not converting **mixed numbers to improper** before × or ÷.
- ✕ Reciprocal of a whole number: reciprocal of 5 is $\frac{1}{5}$, **not** 5.
- ✕ Leaving the answer **unsimplified**.

2 Decimals

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ADDING & SUBTRACTING

Line up the decimal points (place value columns). Fill empty places with zeros.

3.70 + 12.45 = **16.15**

8.30 – 2.75 = **5.55**

PLACE VALUE REMINDER

- More digits does **not** mean bigger: 0.5 is bigger than 0.45.
- Compare digit by digit from the **left**.

LINE UP THE POINTS

$$\begin{array}{r} 3.70 \\ +\ 12.45 \\ \hline 16.15 \\ {\scriptstyle 1\ \ \ \ \ } \end{array}$$

Points sit **directly under** each other — add a zero to fill the gap.

× AND ÷ BY 10, 100, 1000

- **×** moves digits **left**: 3.4 × 100 = 340.
- **÷** moves digits **right**: 3.4 ÷ 100 = 0.034.
- The digits move — the point stays put.

MULTIPLYING

Ignore the points, multiply as whole numbers, then put back the **total number of decimal places**.

0.3 × 0.4: 3×4 = 12, **2 d.p.** → **0.12**

2.4 × 6 = **14.4** (1 d.p.)

RELATED CALCULATIONS

- Use a fact you know and adjust by powers of 10.
- If 24 × 3 = 72, then 2.4 × 3 = 7.2, 0.24 × 3 = 0.72, 24 × 0.3 = 7.2.

MULTIPLYING IN COLUMNS

$$\begin{array}{r} 3.24 \\ \times\ \ \ 6 \\ \hline 19.44 \end{array}$$

324 × 6 = 1944, and 3.24 has **2 d.p.**, so the answer has **2 d.p.**

MORE PRACTICE

0.7 × 0.8 = **0.56** 1.2 × 0.5 = **0.6**

9.6 ÷ 0.8 = **12** 7.2 ÷ 4 = **1.8**

DIVIDING

Make the divisor a whole number — multiply both numbers by 10, 100… then divide.

4.8 ÷ 0.6 = 48 ÷ 6 = **8**

6.5 ÷ 5 = **1.3**

KEEP THE POINT IN LINE

- When using short division, the decimal point in the answer sits **directly above** the point in the number.

ORDERING DECIMALS

- Give every number the **same number of decimal places**, then compare.
- 0.4, 0.35, 0.409 → 0.400, 0.350, 0.409 → **0.35, 0.4, 0.409**.

⚠ COMMON EXAM MISTAKES (recurring errors flagged in examiners' reports)

- ✕ **Misplacing the decimal point** in × and ÷ — the digits are right but the point is wrong.
- ✕ Not **lining up the points** when adding or subtracting.
- ✕ Removing the point to calculate and then **forgetting to put it back**.
- ✕ 0.3 × 0.4 = 1.2 — miscounting decimal places (it is 0.12).
- ✕ Thinking **more digits = bigger** — e.g. that 0.45 beats 0.5.

Revise it: line up a subtraction and a division from memory, then check.

3 Solving Linear Equations 1

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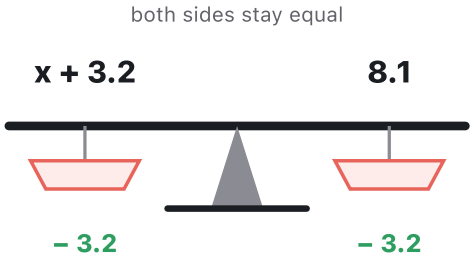
WHAT IS AN EQUATION?

- = means **"the same as"** — both sides **balance**.
- A **solution** is the value of the variable that makes it true: x = 6 solves 2x + 8 = 20 (since 2×6+8 = 20).

THE BALANCING METHOD

- **Whatever you do to one side, you must do to the other.**
- Undo with **inverse operations**: + ↔ − and × ↔ ÷.

BOTH SIDES STAY EQUAL



Take **3.2** off **both** pans and it still balances → **x = 4.9**

CHECK YOUR ANSWER

- **Substitute** your solution back in — both sides should be equal.
- x = 15 in 4x − 17: 4(15) − 17 = 43 ✓

ONE-STEP EQUATIONS

x + 3.2 = 8.1 (−3.2) → **x = 4.9**

2.3x = 12.88 (÷2.3) → **x = 5.6**

$\frac{x}{2.1} = 8.5$ (×2.1) → **x = 17.85**

TWO-STEP EQUATIONS

4x − 17 = 43

(+17) → 4x = 60 (÷4) → **x = 15**

Undo **+/− first**, then **×/÷** — reverse the order of operations.

FORMING & REVERSING

- Solving **reverses** how the expression was built.

BUILD **x** → ×4 → **4x** → −5 → **4x−5**

SOLVE **x** ← ÷4 ← **4x** ← +5 ← **4x−5**

Undo the **last** step first — work back along the arrows.

MORE PRACTICE

x − 9 = 21 → **x = 30**

7x = 91 → **x = 13**

5x + 8 = 43 → **x = 7**

$\frac{x}{4} - 6 = 2$ → **x = 32**

EQUATIONS WITH FRACTIONS

$\frac{x}{3} + 12 = 49$

(−12) → $\frac{x}{3} = 37$ (×3) → **x = 111**

$\frac{x+12}{3} = 49$ (×3) → x+12 = 147 → **x = 135**

WHEN X IS SUBTRACTED

17 − 4x = 43 (−17) → −4x = 26 (÷−4) → **x = −6.5**

⚠ COMMON EXAM MISTAKES (recurring errors flagged in examiners' reports)

- ✕ Doing the operation to **one side only** — you must do it to **both**.
- ✕ **Wrong inverse order:** dividing before adding the number back on a two-step equation.
- ✕ **Sign errors** when moving a term across the equals sign.
- ✕ For $\frac{x+12}{3}$, forgetting the whole numerator is over 3 — multiply **both sides** by 3 first.
- ✕ When the letter is **subtracted** (17 − 4x = 43), treating −4x as 4x and giving a positive answer — it should be x = −6.5.