

GCSE MATHEMATICS - AQA AND PEARSON EDEXCEL

GCSE Maths revision handbook

A structured review of six core GCSE Mathematics areas. Methods are shown before questions so the handbook can support both independent revision and a tutor-led lesson.

Use the confirmed course

This handbook covers core ideas shared by AQA and Pearson Edexcel. Topic order, required practicals, tier content and equation sheets can differ. Always use the learner's current specification and teacher guidance as the final authority.

Inside this handbook

1	Number, fractions, indices and standard form
2	Algebra, equations, graphs and sequences
3	Ratio, proportion, percentages and rates
4	Geometry, trigonometry and measure
5	Probability and combined events
6	Statistics, sampling and interpretation

Each chapter gives the essential knowledge, a worked example and original exam-style practice. Complete the questions before using the answer section.

CHAPTER 1

Number, fractions, indices and standard form

Secure number work underpins algebra, ratio, geometry and statistics. Keep calculations exact until a question asks for rounding.

Coverage map

Integers and order of operations; factors and multiples; fractions, decimals and percentages; recurring decimals; index laws and surds; standard form; estimation and bounds.

Essential knowledge

- For fractions, use a common denominator for addition or subtraction; multiply numerators and denominators for multiplication; multiply by the reciprocal for division.
- Prime factorisation supports highest common factor, lowest common multiple and proof that a number is or is not a square.
- For the same non-zero base: $a^m \times a^n = a^{m+n}$, $a^m \div a^n = a^{m-n}$, and $(a^m)^n = a^{mn}$.
- Standard form is $A \times 10^n$, where $1 \leq A < 10$ and n is an integer.
- Use bounds from the stated degree of accuracy, not from the displayed number alone.

Worked example

Calculate $\frac{3}{4} + \frac{5}{6}$. The lowest common denominator is 12. Convert $\frac{3}{4}$ to $\frac{9}{12}$ and $\frac{5}{6}$ to $\frac{10}{12}$, giving $\frac{19}{12} = 1 \frac{7}{12}$.

Exam focus

Keep values exact for as long as possible, show every conversion and state inequalities correctly when using bounds.

Common mistake to avoid

Do not add denominators when adding fractions, and do not round an intermediate value unless the question tells you to.

CHAPTER 1 PRACTICE

Exam-style practice

1. Write 540 as a product of prime factors, then find the highest common factor of 540 and 756.

2. Calculate $(3.6 \times 10^5) \times (4 \times 10^{-3})$. Give the answer in standard form.

3. A length is 8.4 cm correct to the nearest 0.1 cm. State the lower and upper bounds.

CHAPTER 2

Algebra, equations, graphs and sequences

Algebra describes general relationships. Every transformation must preserve equality, and graph features should be linked back to the equation.

Coverage map

Algebraic notation; expanding and factorising; linear and quadratic equations; simultaneous equations; inequalities; sequences; straight-line and quadratic graphs; functions.

Essential knowledge

- Collect like terms only; expand by multiplying every term inside a bracket; factorise by taking out a common factor or reversing an expansion.
- Apply the same operation to both sides of an equation. For inequalities, reverse the sign when multiplying or dividing by a negative number.
- A straight line has equation $y = mx + c$, where m is the gradient and c is the y-intercept.
- For a quadratic $ax^2 + bx + c$, factorisation, completing the square or the quadratic formula may be appropriate.
- For an arithmetic sequence, the n th term is the common difference multiplied by n plus the adjustment needed to match the first term.

Worked example

Solve $3(2x - 5) = 4x + 7$. Expand to $6x - 15 = 4x + 7$. Subtract $4x$, then add 15: $2x = 22$, so $x = 11$. Substitution checks both sides equal 51.

Exam focus

Show transformations in order and use substitution to check an equation, sequence rule or coordinate.

Common mistake to avoid

Terms can be combined only when their variable parts match; changing one side of an equation alone destroys equality.

CHAPTER 2 PRACTICE

Exam-style practice

1. Simplify $4a(3a - 2) - 2a(a + 5)$.

2. Solve $x^2 - 7x + 10 = 0$.

3. The sequence is 11, 17, 23, 29, ... Find its n th term and determine whether 203 is in the sequence.

CHAPTER 3

Ratio, proportion, percentages and rates

Proportional reasoning connects multiplicative relationships, unit rates, percentages, similarity and real-world measures.

Coverage map

Ratio notation and sharing; scale factors; direct and inverse proportion; percentage change; reverse percentages; compound growth and decay; speed, density and pressure.

Essential knowledge

- To share in a ratio, add the parts, find the value of one part, then multiply.
- Direct proportion has $y = kx$ or, more generally, $y = kx^n$. In inverse proportion, one quantity increases as the other decreases.
- A multiplier of $1 + r$ represents an increase of r ; a multiplier of $1 - r$ represents a decrease.
- Compound change applies the multiplier repeatedly. Reverse percentages divide by the multiplier.
- Rate equations include speed = distance $\div$ time, density = mass $\div$ volume and pressure = force $\div$ area.

Worked example

After a 15% discount, a coat costs GBP 68. The multiplier is 0.85. Original price = $68 \div 0.85 = \text{GBP } 80$.

Exam focus

Identify the multiplier or unit rate before calculating, then attach the correct unit to the final answer.

Common mistake to avoid

A 20% decrease cannot be reversed by adding 20%; divide by the original multiplier instead.

CHAPTER 3 PRACTICE

Exam-style practice

1. Share GBP 420 in the ratio 3:4:5.

2. y is directly proportional to x^2 . When $x = 3$, $y = 45$. Find y when $x = 7$.

3. A car travels 156 km in 2 hours 24 minutes. Calculate its average speed in km/h.

CHAPTER 4

Geometry, trigonometry and measure

Draw and label the figure, identify known information, choose a theorem or formula, and include correct units.

Coverage map

Angle facts; constructions and bearings; congruence and similarity; Pythagoras; trigonometry; circles; perimeter, area and volume; transformations and vectors.

Essential knowledge

- Angles on a straight line total 180 degrees, around a point total 360 degrees, and vertically opposite angles are equal.
- Pythagoras applies only to right-angled triangles: $a^2 + b^2 = c^2$.
- For right-angled trigonometry, label opposite, adjacent and hypotenuse before choosing sine, cosine or tangent.
- Similar shapes have equal corresponding angles and proportional lengths; area scale factor is length factor squared and volume factor is cubed.
- Circle measures include circumference = $2 \pi r$ and area = πr^2 .

Worked example

A right-angled triangle has shorter sides 6 cm and 8 cm. The hypotenuse is $\sqrt{6^2 + 8^2} = \sqrt{100} = 10$ cm.

Exam focus

Draw and label a diagram, select the relationship that matches the known sides or angles, and retain full calculator precision until the end.

Common mistake to avoid

Check whether the question needs a length, area or volume: scale factors are k , k^2 and k^3 respectively.

CHAPTER 4 PRACTICE

Exam-style practice

1. A ladder 6.5 m long reaches 6 m up a wall. How far is its foot from the wall?

2. A sector has radius 9 cm and angle 80 degrees. Find its area in terms of π .

3. Two similar solids have length scale factor 3:5. The smaller volume is 216 cm^3 . Find the larger volume.

CHAPTER 5

Probability and combined events

Probability measures uncertainty on a scale from 0 to 1. Define the sample space carefully before calculating.

Coverage map

Probability scale; sample spaces; relative frequency; mutually exclusive events; independent events; tree diagrams; Venn diagrams; conditional probability.

Essential knowledge

- For equally likely outcomes, probability = favourable outcomes ÷ total outcomes.
- Probabilities for mutually exclusive exhaustive outcomes add to 1.
- For independent events, multiply probabilities along a tree branch and add the required branches.
- Without replacement, the denominator and possibly numerator change after the first selection.
- Relative frequency estimates probability from data; a larger sample is generally more reliable.

Worked example

A bag has 3 red and 5 blue counters. Two counters are drawn without replacement. $P(\text{two red}) = \frac{3}{8} \times \frac{2}{7} = \frac{6}{56} = \frac{3}{28}$.

Exam focus

Define the event carefully, include every outcome once and state whether probabilities should be added or multiplied.

Common mistake to avoid

Branches from the same point must total 1; replacement and no replacement produce different second-stage probabilities.

CHAPTER 5 PRACTICE

Exam-style practice

1. Two fair coins are tossed. Find the probability of getting exactly one head.

2. A box contains 4 green and 6 yellow counters. Two are taken without replacement. Find the probability that they are different colours.

3. A spinner lands on blue 84 times in 240 spins. Estimate how many blues to expect in 1,000 spins.

CHAPTER 6

Statistics, sampling and interpretation

Statistics is about evidence, not only calculations. State what a measure shows and recognise limits in the data or sampling method.

Coverage map

Averages and spread; frequency tables; grouped data; charts and diagrams; cumulative frequency; box plots; scatter graphs; sampling and bias.

Essential knowledge

- Mean uses every value; median is the middle; mode is most frequent; range measures spread.
- For grouped data, the mean is an estimate because class midpoints represent all values in an interval.
- Cumulative-frequency graphs estimate medians, quartiles and interquartile range.
- Correlation does not prove causation; a third variable may affect both quantities.
- A representative sample should reduce selection bias and be large enough for the intended conclusion.

Worked example

For 4, 6, 6, 9, 15: mean = $\frac{40}{5} = 8$, median = 6, mode = 6 and range = $15 - 4 = 11$.

Exam focus

Quote relevant values when comparing distributions and distinguish association from causation.

Common mistake to avoid

The midpoint method gives an estimate for grouped data because the exact values within each class are unknown.

CHAPTER 6 PRACTICE

Exam-style practice

1. The mean of six values is 12. Five values are 7, 9, 11, 14 and 16. Find the sixth value.

2. A grouped table has intervals 0-10, 10-20 and 20-30 with frequencies 3, 8 and 5. Estimate the mean.

3. A survey about school lunches asks only students waiting in the canteen. Explain one likely bias and suggest an improvement.

ANSWERS AND WORKED METHODS

Check the reasoning as well as the final answer

Award credit only for a method that answers the question asked. Where a response is unclear, return to the matching chapter and correct it before trying a fresh question.

Chapter 1: Number, fractions, indices and standard form

1. $540 = 2^2 \times 3^3 \times 5$ and $756 = 2^2 \times 3^3 \times 7$. The shared factors are $2^2 \times 3^3$, so the HCF is 108.
2. Multiply the numbers and powers separately: $3.6 \times 4 = 14.4$ and $10^5 \times 10^{-3} = 10^2$. Therefore $14.4 \times 10^2 = 1.44 \times 10^3$.
3. Half of 0.1 is 0.05. The interval is $8.35 \text{ cm} \leq \text{length} < 8.45 \text{ cm}$. The upper bound is excluded because it would round to 8.5 cm.

Chapter 2: Algebra, equations, graphs and sequences

1. Expand first: $12a^2 - 8a - 2a^2 - 10a = 10a^2 - 18a$.
2. Find two numbers with product 10 and sum -7: -5 and -2. Thus $(x - 5)(x - 2) = 0$, so $x = 5$ or $x = 2$.
3. The common difference is 6, so begin with $6n$. At $n = 1$ this gives 6, which needs 5 added: $6n + 5$. Solve $6n + 5 = 203$ to get $n = 33$, an integer, so 203 is the 33rd term.

Chapter 3: Ratio, proportion, percentages and rates

1. There are 12 parts, so one part is GBP 35. The shares are GBP 105, GBP 140 and GBP 175.
2. Use $y = kx^2$. Since $45 = 9k$, $k = 5$. When $x = 7$, $y = 5 \times 49 = 245$.
3. 24 minutes is $\frac{24}{60} = 0.4$ hours, so total time is 2.4 hours. Speed = $156 \div 2.4 = 65$ km/h.

Chapter 4: Geometry, trigonometry and measure

1. Let the horizontal distance be x . Then $x^2 + 6^2 = 6.5^2$, so $x^2 = 42.25 - 36 = 6.25$ and $x = 2.5$ m.
2. Sector area = $\frac{80}{360} \times \pi \times 9^2 = \frac{1}{4.5} \times 81\pi = 18\pi$ cm².
3. The volume scale factor is $(\frac{5}{3})^3 = \frac{125}{27}$. Larger volume = $216 \times \frac{125}{27} = 8 \times 125 = 1000$ cm³.

Chapter 5: Probability and combined events

1. The equally likely outcomes are HH, HT, TH and TT. Exactly one head occurs in HT or TH, so the probability is $\frac{2}{4} = \frac{1}{2}$.
2. Green then yellow gives $\frac{4}{10} \times \frac{6}{9} = \frac{24}{90}$. Yellow then green gives $\frac{6}{10} \times \frac{4}{9} = \frac{24}{90}$. Total = $\frac{48}{90} = \frac{8}{15}$.
3. Relative frequency = $\frac{84}{240} = 0.35$. Expected blues = $0.35 \times 1000 = 350$.

Chapter 6: Statistics, sampling and interpretation

1. The total of six values is $6 \times 12 = 72$. The five known values total 57, so the missing value is 15.
2. Use midpoints 5, 15 and 25. Estimated total = $3 \times 5 + 8 \times 15 + 5 \times 25 = 260$. Total frequency = 16, so estimated mean = $\frac{260}{16} = 16.25$.
3. Students in the canteen may use or value school lunches more than students elsewhere, so the sample is not representative. Use a random or stratified sample from the whole school.