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FUNCTIONAL SKILLS LEVEL 2 MATHS

MASTER COMPLETE COURSE GUIDE

Every Level 2 content statement, prerequisite refreshers, original examples and self-check practice

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How to use this volume

Every Level 2 content statement, prerequisite refreshers, original examples and self-check practice

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Use the whole set

The complete course teaches the shared content. Use the methods handbook for extra examples, diagnostics to repair a specific weakness, and problem solving before attempting the two practice assessments. Consult the comparison guide for the exact qualification route.

The shared qualification

Functional Skills mathematics at Level 2 is an England-regulated qualification with a Pass/Fail outcome. The national subject content is shared across awarding organisations. The assessment has 25% non-calculator marks and 75% calculator marks. The separate allocation to underpinning skills and problem solving is also 25:75; these are two different splits. [DFE, OFQ]

One result across both sections

There is a single overall Pass boundary for the assessment version or permitted pairing. Learners do not need separate passing scores in the calculator and non-calculator sections. No universal fixed percentage is guaranteed. [OFQ]

A practical study route

1. Attempt the self-check questions before reading each worked example. 2. Study the method and explain why it applies. 3. Try the repair retest in Volume 4 if the same mistake recurs. 4. Complete linked contexts in Volume 5. 5. Sit the Volume 6 assessments under timed conditions, then practise the official format for your awarding organisation.

Lower-level skills still matter

Level 2 builds on lower levels. Times tables, written arithmetic, fraction-of-quantity work, metric conversions, money, clocks, simple interest, area of rectangles, mean and range, tables, bars, line graphs and pie charts remain relevant. This guide refreshes them alongside the 28 Level 2 lessons.

Lesson references use the national Level 2 statement numbers (SoS). Formulae, tax rates and prices used in examples are teaching data.

Content map: statements 1-14

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01. Signed numbers and place value

NATIONAL CONTENT LINK: SoS 1 | Number

Write large numbers in groups of three digits. A digit represents its place value: in 2,407,050 the 4 represents 400,000. On a number line, values increase to the right, so -2 is greater than -9. For a change in temperature or balance, calculate final value minus starting value; crossing zero needs both distances.

Worked example

A freezer rises from -18°C to -7°C. Change = -7 - (-18) = 11°C. The temperature has increased. To order -3, 0.7, -0.8 and 2, place negatives first: -3, -0.8, 0.7, 2.

Check the reasoning

An increase must be positive. Sketch a number line when subtracting a negative number.

Your turn

1. Order -12, -2, 1.2, -1.2. 2. A balance changes from -£45 to £28. Find the increase.

Self-check answers

1. -12, -2, -1.2, 1.2. 2. 28 - (-45) = £73.

If this skill is insecure, use Diagnostic 01 in Volume 4 and revisit it after 48 hours.

02. Arithmetic, estimates and checking

NATIONAL CONTENT LINK: SoS 2 | Number

Use written column methods when mental calculation is unreliable. Align place values for addition and subtraction. For multiplication, split one factor into useful parts; for division, record the divisor, quotient and remainder. An estimate uses rounded inputs and is a check, not automatically the final answer. Use the inverse operation for a second check.

Worked example

A charity receives £246,875 and spends £187,960. Remaining = £58,915. An estimate is £250,000 - £190,000 = £60,000. Inverse check: 187,960 + 58,915 = 246,875.

Check the reasoning

If the exact answer differs by a factor of ten from the estimate, inspect place value before accepting it.

Your turn

1. Calculate 324 × 26. 2. Calculate 84,672 ÷ 24. Give a rough check for each.

Self-check answers

1. 324 × (20 + 6) = 6,480 + 1,944 = 8,424; about 300 × 30 = 9,000. 2. 3,528; about 84,000 ÷ 24 = 3,500.

If this skill is insecure, use Diagnostic 02 in Volume 4 and revisit it after 48 hours.

03. Expressions and formula substitution

NATIONAL CONTENT LINK: SoS 3 | Number

A formula describes a relationship. Identify what each letter means and the unit of each input. Substitute using brackets, especially with negative values. Calculate powers before multiplying. A formula written in words works in the same way as one written in symbols. Do not confuse 3x, which means 3 × x, with x cubed.

Worked example

A hire charge is C = 18 + 7.5h, where h is hours. For 6 hours, C = 18 + 7.5 × 6 = £63. In T = $2x^2$ - 5, x = -3 gives T = 2 × $(-3)^2$ - 5 = 13.

Check the reasoning

After substitution, there should be no unexplained letters left. Ask whether the resulting unit fits the question.

Your turn

1. Find P = 4a + 3b when a = 2.5 and b = 6. 2. Cost = fixed fee + distance × rate. Use £12, 18 km and £0.80/km.

Self-check answers

1. P = 10 + 18 = 28. 2. 12 + 18 × 0.80 = £26.40.

If this skill is insecure, use Diagnostic 03 in Volume 4 and revisit it after 48 hours.

04. Fractions, decimals and percentages

NATIONAL CONTENT LINK: SoS 4 | Number

Divide numerator by denominator to convert a fraction to a decimal. Multiply a decimal by 100 to write a percentage. To convert a terminating decimal to a fraction, use place value and simplify. Learn common equivalents: 1/2 = 0.5 = 50%, 1/4 = 0.25 = 25%, 1/5 = 0.2 = 20%, 1/8 = 0.125 = 12.5%.

Worked example

Convert 3/8: 3 ÷ 8 = 0.375, so 37.5%. Convert 0.45: 45/100 = 9/20, so 45%. To compare 2/5, 0.38 and 41%, convert all to decimals: 0.40, 0.38, 0.41.

Check the reasoning

A percentage greater than 100% represents more than one whole. 125% = 1.25 = 5/4.

Your turn

1. Convert 7/20 to a decimal and percentage. 2. Write 0.625 as a simplified fraction.

Self-check answers

1. 0.35 and 35%. 2. 625/1000 = 5/8.

If this skill is insecure, use Diagnostic 04 in Volume 4 and revisit it after 48 hours.

05. Percentages of amounts and comparisons

NATIONAL CONTENT LINK: SoS 5 | Number

For p% of an amount, multiply by p/100. For a non-calculator method, build from 10%, 5% and 1%. To express one amount as a percentage of another, divide the part by the reference whole and multiply by 100. Identify the denominator from the wording rather than choosing the larger number automatically.

Worked example

Find 17.5% of £240: 10% = £24, 5% = £12, 2.5% = £6; total £42. A group has 18 learners, 12 of whom travel by bus. Bus percentage = 12/18 × 100 = 66.666...%, about 66.7%.

Check the reasoning

Part/whole must use matching units. Convert 250 g and 2 kg to the same unit before division.

Your turn

1. Find 6.5% of £800. 2. Express 45 minutes as a percentage of 3 hours.

Self-check answers

1. 800 × 0.065 = £52. 2. 45/180 × 100 = 25%.

If this skill is insecure, use Diagnostic 05 in Volume 4 and revisit it after 48 hours.

06. Percentage change and reverse percentages

NATIONAL CONTENT LINK: SoS 6 | Number

Percentage change = change/original × 100. Use the original amount as denominator. An increase of p% uses multiplier 1 + p/100; a decrease uses 1 - p/100. To find an original value, divide the final amount by the multiplier. A reverse percentage is not found by subtracting the same percentage from the new value.

Worked example

A price rises from £80 to £92: increase £12; 12/80 × 100 = 15%. A coat costs £68 after a 15% discount. It represents 85% of the original, so original = 68/0.85 = £80.

Check the reasoning

Reapply the percentage change to the recovered original. £80 × 0.85 = £68.

Your turn

1. £150 falls to £126. Find the percentage decrease. 2. £252 includes a 20% increase. Find the starting amount.

Self-check answers

1. 24/150 × 100 = 16%. 2. 252/1.20 = £210.

If this skill is insecure, use Diagnostic 06 in Volume 4 and revisit it after 48 hours.

07. Ordering and calculating with fractions

NATIONAL CONTENT LINK: SoS 7 | Number

A proper fraction is less than one; an improper fraction has numerator at least as large as denominator. Convert mixed numbers to improper fractions before combining them. For addition or subtraction, use a common denominator. Equivalent fractions have both numerator and denominator scaled by the same factor. Simplify the answer and interpret it in context.

Worked example

2 1/4 - 5/6 = 9/4 - 5/6 = 27/12 - 10/12 = 17/12 = 1 5/12. To order 3/4 and 5/8, use eighths: 6/8 is greater than 5/8.

Check the reasoning

Do not add denominators. 1/2 + 1/2 is one whole, not 2/4.

Your turn

1. Calculate 1 2/3 + 3/4. 2. Calculate 2 1/2 - 7/8.

Self-check answers

1. 5/3 + 3/4 = 20/12 + 9/12 = 29/12 = 2 5/12. 2. 20/8 - 7/8 = 13/8 = 1 5/8.

If this skill is insecure, use Diagnostic 07 in Volume 4 and revisit it after 48 hours.

08. One amount as a fraction of another

NATIONAL CONTENT LINK: SoS 8 | Number

Write part/whole and simplify using a common factor. The reference whole is determined by the question. A fraction can exceed one when comparing an amount with a smaller reference amount. Convert units before forming the fraction. A ratio compares parts; a fraction of the total uses the sum of all parts as denominator.

Worked example

A 45-minute activity occupies part of a 2-hour session: 45/120 = 3/8. Red:blue beads = 3:5. Red beads are 3/(3+5) = 3/8 of all beads, not 3/5.

Check the reasoning

Name both numerator and denominator in words: time used divided by total time.

Your turn

1. Express 600 ml as a fraction of 1.5 litres. 2. A team has 9 adults and 6 children. What fraction are children?

Self-check answers

1. 600/1500 = 2/5. 2. 6/15 = 2/5.

If this skill is insecure, use Diagnostic 08 in Volume 4 and revisit it after 48 hours.

09. Decimal order, rounding and accuracy

NATIONAL CONTENT LINK: SoS 9 | Number

Append zeros to align decimal places when comparing: 0.7 = 0.700. Read the first unequal digit from left to right. To round, identify the last digit to keep and inspect the next digit. Keep full calculator precision until the final answer unless a context requires an earlier whole-item decision. Money normally needs two decimal places.

Worked example

Order 0.405, 0.45, 0.045: 0.045, 0.405, 0.450. Round 8.376 to 2 decimal places: 8.38. A requirement of 6.02 bags means buying 7 whole bags, even though nearest-integer rounding gives 6.

Check the reasoning

Rounding to a stated precision differs from rounding up for a purchase or rounding down for capacity.

Your turn

1. Round 14.995 to 2 decimal places. 2. Order 2.09, 2.9 and 2.109.

Self-check answers

1. 15.00. 2. 2.090, 2.109, 2.900.

If this skill is insecure, use Diagnostic 09 in Volume 4 and revisit it after 48 hours.

10. The four operations with decimals

NATIONAL CONTENT LINK: SoS 10 | Number

For addition and subtraction, align decimal points. For multiplication, calculate with whole numbers then restore the total number of decimal places. For division, multiply both numbers by the same power of ten until the divisor is a whole number. Decimal inputs may have up to three decimal places; the context controls the precision of the final answer.

Worked example

3.45 × 0.6: 345 × 6 = 2070; three decimal places gives 2.070 = 2.07. For 7.56 ÷ 0.12, multiply both by 100: 756 ÷ 12 = 63.

Check the reasoning

Multiplying by a positive number below 1 reduces an amount. Dividing by a number below 1 increases it.

Your turn

1. 4.08 + 0.975. 2. 6.3 - 2.875. 3. 0.125 × 24. 4. 4.2 ÷ 0.35.

Self-check answers

1. 5.055. 2. 3.425. 3. 3. 4. 420 ÷ 35 = 12.

If this skill is insecure, use Diagnostic 10 in Volume 4 and revisit it after 48 hours.

11. Ratio, direct and inverse proportion

NATIONAL CONTENT LINK: SoS 11 | Number

Simplify a ratio by dividing all terms by the same number. To share a total, add the ratio parts, divide the total by this sum, then multiply by each part. In direct proportion, the same scale factor applies to both quantities. In inverse proportion, one increases as the other decreases while their product stays fixed. State assumptions such as equal working rates.

Worked example

Share £420 in ratio 3:4. Seven parts; one part £60; shares £180 and £240. Six identical pumps empty a tank in 8 hours. Four pumps take (6 × 8)/4 = 12 hours, assuming constant equal rates.

Check the reasoning

For fewer workers doing the same job, the time should increase, not decrease.

Your turn

1. A recipe uses 450 g for 6 portions. Find flour for 14 portions. 2. Eight workers take 15 days. How long for 10 equally productive workers?

Self-check answers

1. 450/6 × 14 = 1,050 g. 2. 8 × 15/10 = 12 days.

If this skill is insecure, use Diagnostic 11 in Volume 4 and revisit it after 48 hours.

12. Order of operations and indices

NATIONAL CONTENT LINK: SoS 12 | Number

Calculate brackets first, then indices, then multiplication and division from left to right, then addition and subtraction from left to right. Multiplication has no priority over division; their position decides. An index describes repeated multiplication: $3^2 = 3 \times 3$. Use brackets on a calculator so the intended order is preserved.

Worked example

$18 - 2 \times 3^2 = 18 - 2 \times 9 = 0$. $(18 - 2) \times 3^2 = 16 \times 9 = 144$. For $24 \div 6 \times 2$, work left to right: $4 \times 2 = 8$.

Check the reasoning

Write the next simplified line after each stage; this exposes accidental order changes.

Your turn

1. $5 + 3 \times 4^2$. 2. $(5 + 3) \times 4^2$. 3. $36 \div 3^2 + 7$.

Self-check answers

1. 53. 2. 128. 3. $36 \div 9 + 7 = 11$.

If this skill is insecure, use Diagnostic 12 in Volume 4 and revisit it after 48 hours.

13. Money, tax, budgets and compound interest

NATIONAL CONTENT LINK: SoS 13 | Measures, shape and space

Build a budget with income, each expense and the balance. Distinguish price before tax from price including tax. Repeated percentage growth acts on the updated amount, so compound interest uses a repeated multiplier. Simple interest uses the starting principal each time. Tax rates in teaching examples are supplied assumptions, not current financial advice.

Worked example

A £250 item has 20% tax added: 250 × 1.20 = £300. Savings of £800 grow at a stated 3% annually for 2 years: 800 × 1.03^2 = £848.72. Interest earned = £48.72, not £848.72.

Check the reasoning

Keep the original principal separate from the final balance. State whether the question asks for interest or total.

Your turn

1. £1,200 grows by 4% a year for 2 years. Find total and interest. 2. Income £1,640; costs £725, £238.50 and £410. Find the balance.

Self-check answers

1. 1200 × 1.04^2 = £1,297.92; interest £97.92. 2. Costs £1,373.50; balance £266.50.

If this skill is insecure, use Diagnostic 13 in Volume 4 and revisit it after 48 hours.

14. Units, conversion factors and graphs

NATIONAL CONTENT LINK: SoS 14 | Measures, shape and space

Use the supplied conversion factor rather than a remembered approximation when one is given. Track units as you multiply or divide. Within metric units, 1 km = 1,000 m; 1 kg = 1,000 g; 1 litre = 1,000 ml. Length factors must be squared for area and cubed for volume. A conversion graph maps one unit to another; read its axes and interval sizes.

Worked example

Using 1 mile = 1.6 km, 18 miles = 28.8 km and 48 km = 30 miles. Since 1 m = 100 cm, 1 m^2 = 10,000 cm^2. A straight conversion graph through (0,0) and (10 miles,16 km) gives 5 miles = 8 km.

Check the reasoning

Changing to a smaller unit makes the numerical value larger. Check the direction before pressing equals.

Your turn

1. Using 1 gallon = 4.5 litres, convert 27 litres to gallons. 2. Convert 2.4 m^2 to cm^2. 3. Convert 0.008 m^3 to litres.

Self-check answers

1. 27/4.5 = 6 gallons. 2. 24,000 cm^2. 3. 8 litres, since 1 m^3 = 1,000 litres.

If this skill is insecure, use Diagnostic 14 in Volume 4 and revisit it after 48 hours.

15. Compound measures, time and pay

NATIONAL CONTENT LINK: SoS 15 | Measures, shape and space

A compound measure combines quantities. Speed = distance/time; density = mass/volume; hourly pay = earnings/hours. Convert time to the unit required by the rate: 1 hour 30 minutes = 1.5 hours, not 1.30 hours. For overtime, calculate ordinary and enhanced-rate earnings separately. Read timetables by counting to the next hour and then the remaining minutes.

Worked example

A van travels 126 km in 1 hour 45 minutes. Time = 1.75 h; average speed = 126/1.75 = 72 km/h. A worker earns £12/h for 8 h and time-and-a-half for 2 h: 8 × 12 + 2 × 18 = £132.

Check the reasoning

State the rate unit. A speed in km/h cannot use a time in minutes without conversion.

Your turn

1. A block has mass 540 g and volume 200 cm³. Find density. 2. Find travel time for 150 km at 60 km/h. 3. Find time from 22:45 to 01:20 next day.

Self-check answers

1. 2.7 g/cm³. 2. 150/60 = 2.5 h = 2 h 30 min. 3. 2 h 35 min.

If this skill is insecure, use Diagnostic 15 in Volume 4 and revisit it after 48 hours.

16. Perimeter, area and composite shapes

NATIONAL CONTENT LINK: SoS 16 | Measures, shape and space

Perimeter measures the outside boundary; area measures the surface enclosed. Rectangle area = length × width. Triangle area = base × perpendicular height/2. Circle area = πr^2; circumference = $2\pi r$ or πd. For a composite shape, split into non-overlapping parts or subtract a missing part. Find unlabelled lengths before adding the perimeter.

Worked example

An L-shaped floor is an 8 m by 6 m rectangle with a 3 m by 2 m corner removed. Area = 48 - 6 = 42 m^2. Its boundary is 8 + 4 + 3 + 2 + 5 + 6 = 28 m. A radius-2 m circle has area $4\pi \approx 12.57$ m^2.

Check the reasoning

Diameter is twice radius. Use squared units for area and ordinary length units for perimeter.

Your turn

1. Find the area of a triangle with base 9 cm and perpendicular height 4 cm. 2. Find circumference and area for diameter 10 cm, to 2 decimal places.

Self-check answers

1. 9 × 4/2 = 18 cm^2. 2. C = 10π = 31.42 cm; A = 25π = 78.54 cm^2.

If this skill is insecure, use Diagnostic 16 in Volume 4 and revisit it after 48 hours.

17. Volume and surface area

NATIONAL CONTENT LINK: SoS 17 | Measures, shape and space

Volume measures space inside a solid. Surface area totals the exposed faces. A cuboid has volume lwh and surface area 2(lw + lh + wh). A cylinder has volume $\pi r^2 h$; a closed cylinder has surface area $2\pi r^2 + 2\pi rh$. An open-top cylinder has only one circular end. Read whether internal or external dimensions are supplied and which faces count.

Worked example

A cylinder has r = 3 cm and h = 10 cm. Volume = $90\pi \approx 282.74$ cm³. Closed surface area = $18\pi + 60\pi = 78\pi \approx 245.04$ cm². An open-top version has area $69\pi \approx 216.77$ cm².

Check the reasoning

Volume needs cubic units; surface area needs square units. For capacity, 1 cm³ = 1 ml.

Your turn

1. Find volume and surface area of a 4 × 3 × 2 cm cuboid. 2. Find the capacity of a radius-5 cm, height-12 cm cylinder, to the nearest ml.

Self-check answers

1. V = 24 cm³; SA = 2(12 + 8 + 6) = 52 cm². 2. $300\pi = 942.477...$ cm³, so 942 ml.

If this skill is insecure, use Diagnostic 17 in Volume 4 and revisit it after 48 hours.

18. Scale drawings and maps

NATIONAL CONTENT LINK: SoS 18 | Measures, shape and space

A scale of 1:n means one length unit on the drawing represents n of the same unit in reality. Actual length = drawing length × n. Drawing length = actual length/n. Convert the actual dimensions into the drawing unit first. To create a plan, choose a scale that fits, draw accurately, label dimensions and state the scale.

Worked example

A 1:200 plan shows a wall 6.5 cm long. Actual = 6.5 × 200 = 1,300 cm = 13 m. A real 9 m wall on the same plan is 900/200 = 4.5 cm. Check by multiplying 4.5 cm by 200.

Check the reasoning

Printing or displaying a diagram at a different size changes a measured scale drawing. Use stated dimensions unless correct print size is assured.

Your turn

1. On a 1:50 plan a room is 8 cm by 6 cm. Find its actual dimensions. 2. At 1:100, draw a 5 m by 3 m rectangle on squared paper.

Self-check answers

1. 4 m by 3 m. 2. Draw 5 cm by 3 cm, label scale 1:100 and the real dimensions.

If this skill is insecure, use Diagnostic 18 in Volume 4 and revisit it after 48 hours.

19. Coordinates in all four quadrants

NATIONAL CONTENT LINK: SoS 19 | Measures, shape and space

A coordinate pair is written (x,y). Move horizontally from the origin by x, then vertically by y. A negative x goes left; a negative y goes down. Label axes and use consistent intervals. To find a horizontal or vertical distance, subtract the relevant coordinates and take the positive size. Points on an axis have one coordinate equal to zero.

Worked example

A(-3,2), B(4,2), C(4,-2) are three vertices of a rectangle. The fourth is D(-3,-2). Horizontal length = 4 - (-3) = 7 units; height = 2 - (-2) = 4 units; area = 28 square units.

Check the reasoning

For a horizontal side the y values match; for a vertical side the x values match.

Your turn

1. Plot P(-2,-3), Q(3,-3), R(3,1). Give the fourth vertex of the rectangle. 2. Find its perimeter.

Self-check answers

1. S(-2,1). 2. Width 5, height 4; perimeter 18 units.

If this skill is insecure, use Diagnostic 19 in Volume 4 and revisit it after 48 hours.

20. Nets and other 2-D representations

NATIONAL CONTENT LINK: SoS 20 | Measures, shape and space

A net is a flat arrangement that folds to make a solid. Faces must connect along suitable edges without overlapping when folded. A plan looks from above; an elevation looks straight from a specified side or the front. A drawing of a solid may show depth with sloping lines, but those lines are not automatically actual measurements.

Worked example

A closed cuboid 4 cm by 3 cm by 2 cm needs two 4 × 3 faces, two 4 × 2 faces and two 3 × 2 faces in its net. A cylinder net has two circles and a rectangle whose width equals the circumference, 2πr, and whose height equals h.

Check the reasoning

Count faces before judging a net. A closed cube needs six equal square faces.

Your turn

1. State the faces in the net of a triangular prism. 2. A radius-2 cm cylinder has height 7 cm. Give the dimensions of the rectangular face in its net.

Self-check answers

1. Two matching triangles and three rectangles. 2. Width 4π cm (about 12.57 cm), height 7 cm.

If this skill is insecure, use Diagnostic 20 in Volume 4 and revisit it after 48 hours.

21. Drawing solids, plans and elevations

NATIONAL CONTENT LINK: SoS 21 | Measures, shape and space

Choose a viewing direction before drawing. A plan records width and depth. A front elevation records width and height. A side elevation records depth and height. Orthographic views use straight-on outlines, without perspective. For stacked cubes, an elevation uses the maximum stack height visible along each sightline; it does not add hidden stacks.

Worked example

A block is 6 cm wide, 4 cm deep and 3 cm high. Draw a 6 × 4 cm plan, a 6 × 3 cm front elevation and a 4 × 3 cm side elevation. Keep the front-view width aligned with the plan width.

Check the reasoning

Label which side is the front. Without a direction, several different elevations may be reasonable.

Your turn

1. A cuboid is 5 units wide, 2 deep and 4 high. Give dimensions of each view. 2. In a row of three cube stacks, heights are 1, 3 and 2. Draw the front elevation.

Self-check answers

1. Plan 5 × 2, front 5 × 4, side 2 × 4. 2. Three adjacent unit-width columns of heights 1, 3 and 2.

If this skill is insecure, use Diagnostic 21 in Volume 4 and revisit it after 48 hours.

22. Angles and geometric reasoning

NATIONAL CONTENT LINK: SoS 22 | Measures, shape and space

Angles on a straight line total 180°; angles around a point total 360°; angles in a triangle total 180°; angles in a quadrilateral total 360°. Vertically opposite angles are equal. In an isosceles triangle the base angles are equal. When parallel lines are stated or marked, corresponding angles and alternate angles are equal; co-interior angles sum to 180°.

Worked example

An isosceles triangle has apex angle 44°. Remaining total = 180 - 44 = 136°; each base angle = 68°. At a point, three angles are 85°, 120° and x: x = 360 - 205 = 155°.

Check the reasoning

Use stated geometric properties. A sketch that looks square or parallel does not establish those facts.

Your turn

1. A quadrilateral has angles 83°, 105°, 94° and x. Find x. 2. A straight line has adjacent angles 37° and y. Find y.

Self-check answers

1. x = 360 - 282 = 78°. 2. y = 180 - 37 = 143°.

If this skill is insecure, use Diagnostic 22 in Volume 4 and revisit it after 48 hours.

23. Median and mode

NATIONAL CONTENT LINK: SoS 23 | Information and data

The median is the middle value after ordering the data. If there are two middle values, find their mean. The mode is the most frequent value; there may be two modes or no uniquely most frequent value. Frequency tables count repeated values, so locate the middle observation using cumulative counts rather than the middle table row.

Worked example

For 4, 9, 5, 4, 8, 6, order: 4, 4, 5, 6, 8, 9. Median = (5 + 6)/2 = 5.5; mode = 4. For values 1, 2, 3 with frequencies 2, 5, 1, there are 8 observations; positions 4 and 5 are both 2.

Check the reasoning

Count observations, not distinct values. Check that the data have actually been sorted.

Your turn

1. Find median and mode of 7, 2, 5, 7, 9, 3, 7. 2. Find median of 2, 3, 8, 10.

Self-check answers

1. Ordered 2, 3, 5, 7, 7, 7, 9; median 7, mode 7. 2. (3 + 8)/2 = 5.5.

If this skill is insecure, use Diagnostic 23 in Volume 4 and revisit it after 48 hours.

24. Estimated mean from grouped data

NATIONAL CONTENT LINK: SoS 24 | Information and data

When exact values are unavailable, use the midpoint of each group as a representative value. Multiply each midpoint by its frequency, add those products, then divide by total frequency. The result is an estimate because values within each group are unknown. For discrete groups such as 0-4, the midpoint is 2, not 2.5.

Worked example

Orders per day are grouped: 0-4 on 3 days, 5-9 on 4 days, 10-14 on 3 days. Midpoints 2, 7, 12. Products 6, 28, 36; total 70 over 10 days. Estimated mean = 70/10 = 7 orders/day.

Check the reasoning

The estimated mean should lie between the smallest and largest possible values. Divide by total frequency, not the number of groups.

Your turn

Groups 1-5, 6-10, 11-15 have frequencies 2, 5, 3. Estimate the mean.

Self-check answers

Midpoints 3, 8, 13. Products 6, 40, 39; total 85. Frequency total 10. Estimated mean = 8.5.

If this skill is insecure, use Diagnostic 24 in Volume 4 and revisit it after 48 hours.

25. Comparing data with averages and range

NATIONAL CONTENT LINK: SoS 25 | Information and data

Mean = sum/count; range = maximum - minimum. Use the average to compare a typical result and the range to compare spread or consistency. The median can better represent a typical value when an extreme value distorts the mean. Always link the statistic to the context: a lower mean waiting time is useful, while a lower mean income may not be.

Worked example

Route A waiting times: 4, 5, 6, 7, 8 minutes; mean 6, median 6, range 4. Route B: 2, 3, 6, 9, 10; mean 6, median 6, range 8. Their average waits match, but A is more consistent in these samples.

Check the reasoning

A small range does not establish a good average. A service can be consistently slow.

Your turn

Compare X: 3, 4, 4, 5, 9 with Y: 4, 4, 5, 5, 7 using mean, median, mode and range.

Self-check answers

Both means = 25/5 = 5. X median 4, mode 4, range 6. Y median 5, modes 4 and 5, range 3. Y is less spread out; X has a lower median.

If this skill is insecure, use Diagnostic 25 in Volume 4 and revisit it after 48 hours.

26. Combined events and two-way tables

NATIONAL CONTENT LINK: SoS 26 | Information and data

List equally likely combined outcomes systematically with a table or tree. The denominator counts all outcomes in the relevant sample space. For independent events, multiply probabilities along a branch; add probabilities of mutually exclusive alternatives. Without replacement, the second probability changes. A two-way table records intersections and totals; conditional wording restricts the denominator.

Worked example

A fair coin and a fair six-sided die give 12 equally likely pairs. Head and an even number occurs in 3 pairs, so probability = 3/12 = 1/4. A group has 8 adults who cycle and 12 adults who do not; probability an adult cycles = 8/20, regardless of the number of children.

Check the reasoning

"And" usually restricts to an intersection; "or" may require removing an overlap. Do not add overlapping categories twice.

Your turn

A bag has 3 red and 2 blue counters. Two are drawn without replacement. Find P(both red) and P(one of each colour).

Self-check answers

P(RR) = 3/5 × 2/4 = 3/10. P(RB or BR) = 3/5 × 2/4 + 2/5 × 3/4 = 3/5.

If this skill is insecure, use Diagnostic 26 in Volume 4 and revisit it after 48 hours.

27. Probability formats and interpretation

NATIONAL CONTENT LINK: SoS 27 | Information and data

Probability runs from 0 for impossible to 1 for certain. Express the same probability as a simplified fraction, decimal or percentage. Probabilities for all mutually exclusive, exhaustive outcomes add to 1. The probability an event does not happen is 1 minus the probability it does. Experimental proportions estimate probability and can change with additional observations.

Worked example

A spinner has 8 equal sectors, 3 blue. P(blue) = 3/8 = 0.375 = 37.5%. P(not blue) = 5/8 = 62.5%. If 20 independent spins are planned, 20 × 3/8 = 7.5 is an expected count, not a guaranteed outcome.

Check the reasoning

Probabilities cannot be negative or exceed 1. An expected count need not be a whole number.

Your turn

1. Write 0.24 as a fraction and percentage. 2. If P(late) = 0.18, find P(not late). 3. A fair die is rolled; find P(number greater than 4).

Self-check answers

1. 24/100 = 6/25 and 24%. 2. 0.82. 3. 2/6 = 1/3.

If this skill is insecure, use Diagnostic 27 in Volume 4 and revisit it after 48 hours.

28. Scatter diagrams and correlation

NATIONAL CONTENT LINK: SoS 28 | Information and data

Plot each paired observation as a separate point. Label both axes with units and choose sensible scales. Positive correlation means larger x tends to accompany larger y; negative correlation means larger x tends to accompany smaller y. A scatter diagram may show no clear correlation. A line of best fit follows the overall pattern with points on both sides; do not join points in sequence.

Worked example

Hours of practice x = 1, 2, 3, 4, 5 have scores y = 42, 49, 54, 61, 68. The pattern is positive. A reasonable trend estimate near x = 3.5 is around 58, but is not an exact prediction. Association alone does not prove practice caused the score difference.

Check the reasoning

Predictions within the observed range are more defensible than distant extrapolation. Investigate unusual points before discarding them.

Your turn

Temperature (°C): 5, 10, 15, 20, 25. Heating use (kWh): 32, 28, 22, 18, 12. Plot the pairs and describe the pattern. Is predicting at 40°C equally reliable?

Self-check answers

The pattern is negative correlation. A 40°C estimate extrapolates well beyond the data and is less reliable.

If this skill is insecure, use Diagnostic 28 in Volume 4 and revisit it after 48 hours.

Prerequisite refresher: practical number

Fractions of quantities

Divide by the denominator, then multiply by the numerator. For 3/5 of 85, calculate 85/5 × 3 = 51. This is different from expressing 3 as a fraction of 85.

Time, dates and timetables

Use 60 minutes per hour. From 09:47 to 12:18 is 13 minutes to 10:00, then 2 hours 18 minutes: 2 hours 31 minutes. Across midnight, count to 24:00 then continue from 00:00. Read dates carefully when scheduling over month ends.

Simple interest and everyday money

At a stated simple rate of 6% per year, £700 earns 700 × 0.06 × 3 = £126 over 3 years. Final balance £826. Simple interest uses the same starting amount each year; compound interest changes the base. For money, write £8.50 rather than £8.5 when presenting a final cost.

Practice and answers

Find 7/8 of 96; elapsed time 23:35 to 02:10; simple interest on £900 at 4% for 5 years. Answers: 84; 2 h 35 min; £180 interest and £1,080 final balance.

Rounding for purpose

Round a measurement to the precision requested. Round containers up when buying enough. Round capacity down when counting complete groups that fit. Do not carry a rounded intermediate value into the next calculation unless it represents a real whole-item decision.

Prerequisite refresher: reading data

Tables, bars and line graphs

Read the title, category labels, units, time interval and key. A table may include totals that should not be counted twice. Bar height represents frequency; equal-width bars should have gaps for separate categories. A line graph shows change over an ordered variable such as time. Check whether the vertical axis starts at zero and how much each small division represents.

Pie charts and grouped frequencies

For a pie chart, sector angle = category frequency/total × 360°. For a sector of 72°, the share is 72/360 = 1/5 = 20%. Grouped frequencies summarise counts in intervals. Make groups non-overlapping: for discrete counts, 0-4, 5-9, 10-14 is clear.

Two reading examples

A chart axis labels 0, 20, 40 with four equal intervals between labels. Each interval is 5. A point two intervals above 20 represents 30. A table of bus journeys has frequencies 8, 12, 10; total 30. The middle category is 12/30 = 40% and needs a 144° pie sector.

Practice and answers

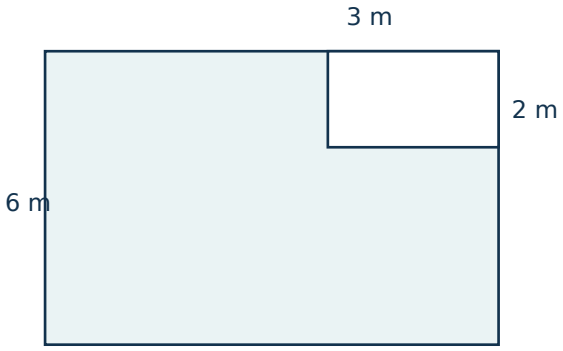
A 50-person survey has 15 cyclists. Find the pie angle. A line graph rises from 120 to 156 sales; find the increase and percentage change. Answers: 108°; increase 36; 36/120 × 100 = 30%.

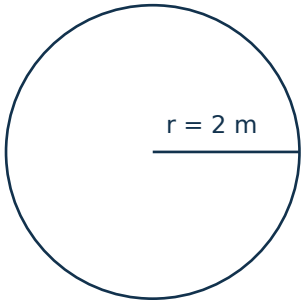
A data claim needs evidence

State the comparison, give the values and units, then explain the implication. Notice missing data, unequal sample sizes, extreme values and graphical choices that could mislead.

Visual atlas: area and circles

Composite area: 8 × 6 - 3 × 2 = 42 m²





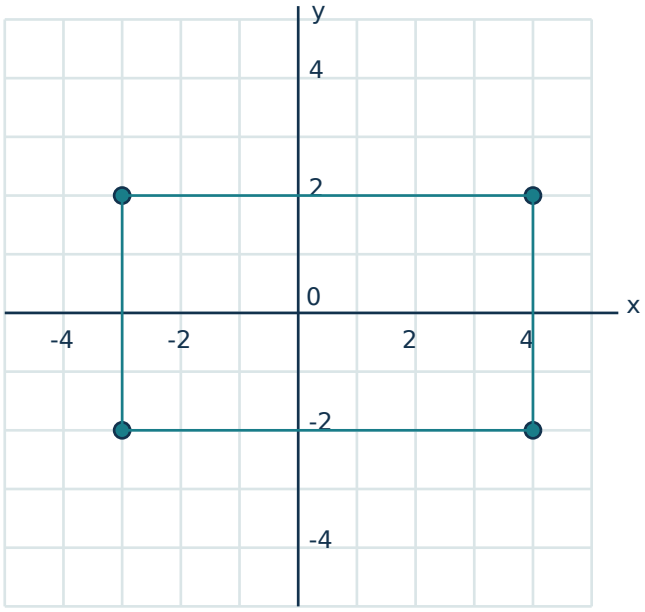
A = πr²; C = 2πr

The L-shape is a full rectangle with a corner removed. The removed edges replace lengths on the old boundary, so do not use the area subtraction as a perimeter method. All dimensions are teaching labels; this diagram is not for scale measurement.

Try a linked calculation

If floor tiles cover 1.6 m² per pack, covering 42 m² requires 42/1.6 = 26.25 packs, so 27 packs. At £19 per pack the cost is £513 before any delivery or waste allowance. Area is continuous; packs are discrete.

Visual atlas: coordinates and views



A(-3,2), B(4,2)

C(4,-2), D(-3,-2)

Width = 7

Height = 4

Area = 28 units²

The rectangle crosses both axes. Differences of negative coordinates are handled by subtraction: 4 - (-3) = 7. Missing coordinates can be inferred because opposite sides are horizontal or vertical.

Draw and interpret

Give the coordinates after moving every point 2 units right and 1 unit down. Answers: A(-1,1), B(6,1), C(6,-3), D(-1,-3). The width, height and area remain the same because every point moves equally.

Visual atlas: plans and elevations

One cuboid: width 6, depth 4, height 3 units



Plan 6 × 4 | Front 6 × 3 | Side 4 × 3

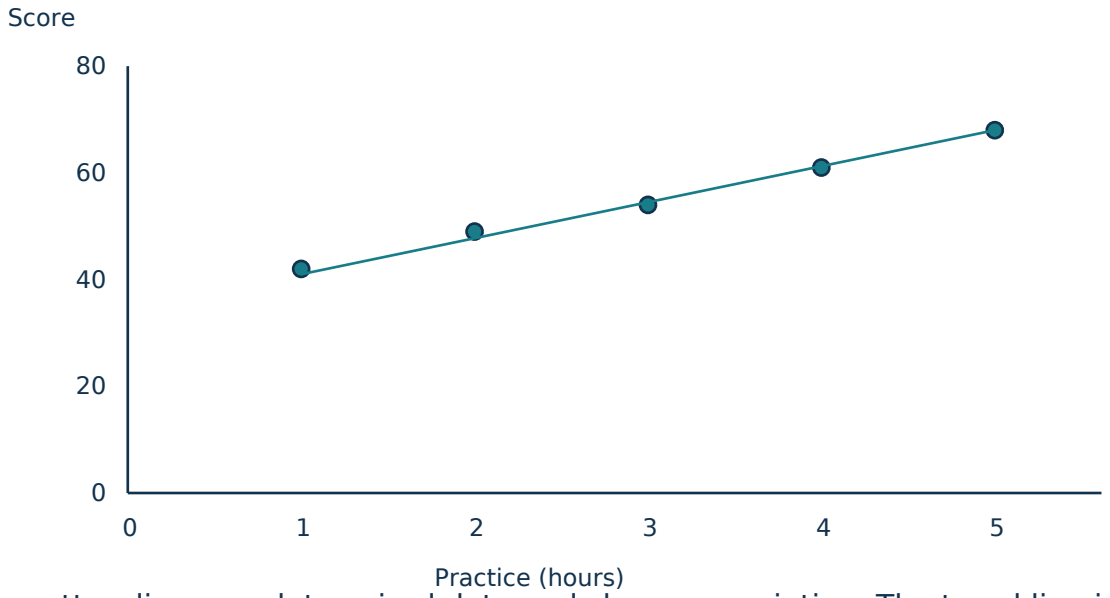
Straight-on views show two dimensions; depth is absent from the front view.

These three views describe the same solid. A front elevation does not show the 4-unit depth. A side elevation does not show the 6-unit width. If a plan alone were supplied, the height could not be recovered without further information.

Draw a solid from its views

Use the views to sketch the cuboid in three dimensions. Label width 6, depth 4 and height 3. Its volume is 6 × 4 × 3 = 72 cubic units; its surface area is 2(24 + 18 + 12) = 108 square units.

Visual atlas: scatter and conversion



A scatter diagram plots paired data and shows association. The trend line is an estimate, not a rule that every point must lie on. Here scores generally rise with practice time.

Conversion graphs are different

A conversion with a fixed factor is an exact relationship under the stated factor. With 1 mile = 1.6 km, plot (0,0), (5,8), (10,16) with miles horizontally and kilometres vertically. Join with a straight line. Read 7.5 miles as 12 km. A scatter trend line should not automatically be forced through the origin.

Complex problems: planning the chain

At Level 2 you must choose a route through connected steps and explain what the result means. Some tasks connect all three content areas. A good plan turns the requested decision into a sequence of measurable quantities. [DFE]

Stage	What to write
Read	Target, units, constraints, all data and any excluded items
Plan	The relationships needed and the order of the steps
Calculate	A labelled line per step; keep precision where appropriate
Check	Estimate, inverse calculation, unit check or alternative route
Decide	Answer the original question with numbers and a reason

Worked chain

A centre expects turnout equal to the median of 68, 72, 74, 75, 81 previous attendees. Median 74. It budgets £4.50 food per person and a £120 room fee. Total = 74 × 4.50 + 120 = £453. With £500 available the margin is £47. The plan uses a statistical estimate to support a money decision; attendance is not guaranteed.

Independent prompt

The next five attendance values are 63, 70, 76, 80, 86. Food rises to £4.80 each and the room fee remains £120. Does £500 still cover a median-based estimate? Answer: median 76; total £484.80; yes, margin £15.20.

Readiness and a revision programme

Session	Focus and evidence
1-3	Signed number, arithmetic, decimals and order of operations; show estimates
4-6	Fractions, percentages, ratio, formulae; explain the reference whole
7-9	Money, units, time, rates, area and solids; show unit conversions
10-11	Scales, coordinates, views and angle reasoning; label drawings
12-14	Statistics, probability and graphs; justify data-based conclusions
15-16	Mixed complex tasks; complete a timed assessment and repair errors

Evidence of readiness

Complete a fresh question correctly without copying a model, explain why the method applies, check it independently, then succeed on a linked unfamiliar problem. A previous score alone is not evidence that a repaired weakness has stayed repaired.

Before the real assessment

Confirm your qualification number, current availability, timings, calculator type, equipment, assessment location and access arrangements with your centre. Use the official onscreen practice system if applicable. Obtain current resit and result timescales where a progression deadline matters.

Use the marking information honestly

The workbook uses independent teaching marks. Its scores show areas to improve; they do not certify a Pass or predict an awarding organisation boundary.

Sources and edition notes

Official sources checked on 13 November 2026. Links open the source documents; publication versions and current booking instructions take precedence over this independent guide.

[DFE] DfE: Functional Skills mathematics subject content (updated November 2024)

Open official source

[OFQ] Ofqual: mathematics conditions and requirements (updated May 2024)

Open official source

Content mapping is independently paraphrased from DfE subject content. Public-sector information is used under the Open Government Licence v3.0 where applicable. All worked examples and questions are original.