CAMBRIDGE
International Education

Specimen Paper Answers
Paper 2 Non-calculator (Extended)

Cambridge IGCSE™/Cambridge IGCSE™ (9–1)
Mathematics 0580/0980

For examination from 2025

v1

Cambridge Pathway

Contents

Introduction

These specimen answers have been produced by Cambridge International ahead of the examination in 2025 to exemplify approaches to the questions for those teaching Cambridge IGCSE Mathematics (0580). Questions have been selected from Specimen Paper 2, Questions 4, 6, 7, 8, 9, 11, 12, 14, 15, 17, 18, 19, 20, 21, 22, 24.

These are model answers. The working is accompanied by a brief commentary explaining alternative approaches or key considerations for the answers. Comments include more information about common misconceptions and key steps in working for students to be aware of.

The specimen materials are available to download from the School Support Hub at **www.cambridgeinternational.org/support**

2025 Specimen Paper 02

2025 Specimen Paper Mark Scheme 02

Past exam resources and other teaching and learning resources are available on the School Support Hub **www.cambridgeinternational.org/support**

Details of the assessment

The syllabus for Cambridge IGCSE Mathematics 0580 is available at **www.cambridgeinternational.org**

Assessment overview

All candidates take two components.

Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1 and Paper 3. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended subject content, and who are expected to achieve a grade C or above, should be entered for Paper 2 and Paper 4. These candidates will be eligible for grades A* to E.

Candidates should have a scientific calculator for Paper 3 and Paper 4. Calculators are **not** allowed for Paper 1 and 2.

Please see the *Cambridge Handbook* at **www.cambridgeinternational.org/eoguide** for guidance on use of calculators in the examinations.

Core assessment

Core candidates take Paper 1 and Paper 3. The questions are based on the Core subject content only:

Paper 1: Non-calculator (Core)		**Paper 3: Calculator (Core)**	
1 hour 30 minutes		1 hour 30 minutes	
80 marks	50%	80 marks	50%
Structured and unstructured questions		Structured and unstructured questions	
Use of a calculator is **not** allowed		A scientific calculator is required	
Externally assessed		Externally assessed	

Extended assessment

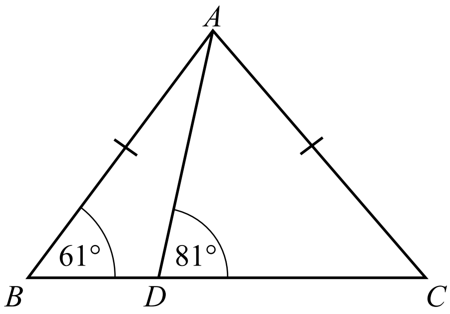
Extended candidates take Paper 2 and Paper 4. The questions are based on the Extended subject content only:

Paper 2: Non-calculator (Extended)		**Paper 4: Calculator (Extended)**	
2 hours		2 hours	
100 marks	50%	100 marks	50%
Structured and unstructured questions		Structured and unstructured questions	
Use of a calculator is **not** allowed		A scientific calculator is required	
Externally assessed		Externally assessed	

Question 4

Specimen answer

4 The diagram shows two triangles, *ABD* and *ADC*.



NOT TO SCALE

BDC is a straight line, *AB* = *AC*, angle *ABD* = 61° and angle *ADC* = 81°.

Work out angle *DAC*.

Method 1:
$\angle BCA = 61°$
$\angle DAC = 180 - 81 - 61 = 38°$

Method 2:
$\angle BAC = 180 - 2 \times 61 = 58°$
$\angle BDA = 180 - 81 = 99°$
$\angle BAD = 180 - 99 - 61 = 20°$
$\angle DAC = 58 - 20 = 38°$

Angle *DAC* = ...38°.................. [2]

Examiner comment

The first step is to identify isosceles triangle *ABC* which can be used to find angle *BCA* = 61° or angle *BAC* = 58°.

The more efficient method uses angle *BCA* in triangle *ACD* to find angle *DAC* in a single calculation. The method mark is awarded for showing this calculation, 180 – 81 – 61.

In method 2, both angle *BDA* and angle *BAD* are found and then subtracted to find angle *DAC*. Here the method mark is awarded for showing a correct calculation for one of these angles or for writing the correct value of one of these angles.

Common errors and general guidance for candidates

- It is helpful to indicate on the diagram the values for the angles that have been calculated to help with later steps.
- Calculations should be written down so that method marks can be awarded if the result of the calculation is incorrect.
- A common error is to misinterpret the diagram and use triangle *DAC* as an isosceles triangle rather than triangle *BAC*.

Question 6

Specimen answer

6 The mass of a solid metal cuboid is 4 kg. The volume of the cuboid is 600 cm^3.

Calculate the density of the metal, giving your answer in **g/cm³**.
[Density = mass ÷ volume]

4 kg = 4000 g

$$\text{Density} = \frac{4000}{600} = \frac{40}{6} = \frac{20}{3} = 6\frac{2}{3}$$

$6\frac{2}{3}$ .... g/cm^3 [2]

Examiner comment

The question requires a change of units as the mass is given in kilograms and the answer is required in g/cm^3. Note that bold is used in the question to make this requirement clear. The first step is to convert 4 kg into grams. The formula for density is given so the next step is to substitute the values correctly and evaluate the result. An appropriate method on the non-calculator paper is to cancel common factors leading to an answer in its simplest form which can be written as a mixed number in this case. This answer could be converted to the decimal 6.67. As the decimal is not exact, it should be written correct to 3 significant figures.

The method mark is awarded for an answer with figures 666 or 667 which is the result of correctly dividing mass by volume with either no conversion from kilograms or an incorrect conversion of kilograms to grams. Figures 666 are acceptable for partial marks where the division has been truncated rather than correctly rounded, so a final answer of 6.66 would be awarded this mark.

Common errors and general guidance for candidates

- A common error is to use the units given rather than converting to the units required. In this question a common incorrect answer would be $\frac{2}{300}$ which has units kg/cm^3 not g/cm^3.
- When a change of units is required, candidates should check that they have used the correct conversion factor.
- An answer can be given as an exact fraction. There is no requirement to convert the answer of $6\frac{2}{3}$ to a decimal which is an extra step of working and may lead to an arithmetic or rounding error.
- Note that the syllabus specifies that the formula for density will be given in the question, so there is no requirement for candidates to learn this formula.

Question 7

Specimen answer

7 $\mathbf{u} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ $\mathbf{v} = \begin{pmatrix} -12 \\ 5 \end{pmatrix}$

(a) Find **u** – 2**v**.

$$\begin{pmatrix} 3 \\ -2 \end{pmatrix} - \begin{pmatrix} -24 \\ 10 \end{pmatrix} = \begin{pmatrix} 3+24 \\ -2-10 \end{pmatrix} = \begin{pmatrix} 27 \\ -12 \end{pmatrix}$$

$\begin{pmatrix} 27 \\ -12 \end{pmatrix}$

[2]

(b) Find |**v**| .

$$|\mathbf{v}| = \sqrt{(-12)^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$$

13 .... [2]

Examiner comment

(a) The correct answer scores 2 marks. If the answer is not correct, B1 is awarded for either 27 or –12 positioned correctly in the vector brackets.

It is good practice to work out the vector 2v first before carrying out the subtraction.

(b) The correct answer scores 2 marks. If the answer is not correct, the method mark is awarded for showing the sum of the squares of the two components of v.

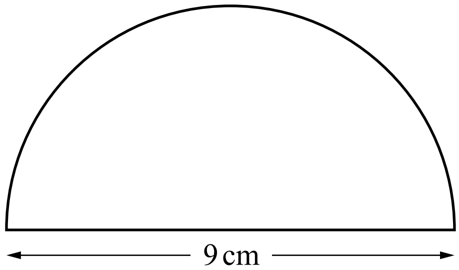
Common errors and general guidance for candidates

- Candidates should be familiar with the notation |**v**| for the magnitude of vector **v**.
- Candidates should be confident in working with negative numbers without a calculator.
- Errors when subtracting negative numbers are common, for example 3 – –24 = 3 – 24 = –21 rather than 3 – –24 = 3 + 24 = 27.
- Errors when squaring negative numbers are common, for example (–12)2 = –144 rather than 144.
- $\sqrt{169}$ = 13 is expected knowledge. Candidates are expected to recall squares and their corresponding square roots from 1 to 15.

Question 8

Specimen answer

8



NOT TO SCALE

The diagram shows a semicircle with diameter 9 cm.

Calculate the total perimeter of this semicircle.
Give your answer in exact form.

Circumference of circle = $2\pi r = \pi d$

Circumference of semicircle = $\frac{1}{2} \times \pi \times 9 = 4.5\pi$

Perimeter of semicircle = $9 + 4.5\pi$

........$9 + 4.5\pi$........ cm [3]

Examiner comment

The correct answer scores 3 marks. An acceptable equivalent answer is $9 + \frac{9}{2}\pi$. Including a mixed number in the answer is inadvisable as it may not be clear whether $9 + 4\frac{1}{2}\pi$ or $9 + 4\frac{1\pi}{2}$ is intended.

The formula for the circumference of a circle is given on the formula list. Two method marks are awarded for using this formula correctly to find the arc length of the semicircle or one method mark is awarded for finding the circumference of the complete circle.

Common errors and general guidance for candidates

- When a question involving circles asks for an answer in exact form, the answer should be given in terms of π. On the non-calculator paper, candidates are not expected to substitute values for π.
- A common error is to find the arc length for the semicircle only rather than adding the length of the diameter to give its perimeter.
- A common error is to use diameter in place of radius in the circumference formula.

Question 9

Specimen answer

9 In a sequence

$$T_1 = 17 \qquad T_2 = 12 \qquad T_3 = 7 \qquad T_4 = 2.$$

Find

(a) T_5

17 12 7 2
–5 –5 –5
$T_5 = 2 - 5 = -3$

............–3............ [1]

(b) T_n .

Difference is –5, so $T_n = a - 5n$
$T_1 = 17$ so $a - 5 \times 1 = 17$
$a = 17 + 5 = 22$
$T_n = 22 - 5n$

............$22 - 5n$............ [2]

Examiner comment

(a) There is a constant difference of –5 between the terms of the sequence. The fifth term is found by subtracting 5 from the fourth term.

(b) A correct expression for the *n*th term scores 2 marks. It is acceptable to give an unsimplified equivalent as the final answer for 2 marks, for example 17 – 5(*n* – 1). If a correct expression is seen but then incorrectly simplified this scores B1 only.

The sequence has a constant difference of –5, so the *n*th term will be of the form –5*n* + *a*. An answer of this form with an incorrect value for a is awarded B1. The value of a can be found using one of the known terms. Alternatively, the difference of –5 can be used to find T_0 = 22 and an answer of the form 22 – *kn* is awarded B1 if the value of *k* is incorrect provided it is not equal to 0.

Common errors and general guidance for candidates

- Candidates should be familiar with subscript notation for terms of a sequence, for example T_5 is the fifth term of the sequence and T_n is the *n*th term of the sequence.
- A common error is to use the difference of the sequence as 5 rather than –5 when finding the *n*th term.
- Candidates should take care to write the expression for the *n*th term correctly, particularly for a decreasing sequence. Use of *a* + (*n* – 1)*d* may lead to writing the expression 17 + (*n* – 1) – 5 which is incorrect unless brackets are included around the – 5, i.e. 17 + (*n* – 1) (– 5).

Question 11

Specimen answer

11 Find the value of $64^{\frac{2}{3}}$.

$64^{\frac{2}{3}} = 4^2 = 16$

16 .... [2]

Examiner comment

The correct answer must be evaluated as 16 for 2 marks. The answer 4^2 is awarded B1 only. The first step is to find the cube root of 64, so B1 is awarded if the value 4 is seen.

Common errors and general guidance for candidates

- Candidates should be able to interpret the power of $\frac{2}{3}$ as the cube root of 64 squared. Although these operations can be performed in either order, the calculation should be simplified by finding the cube root first and then squaring. Candidates are not expected to evaluate 64^2 without a calculator.
- The cubes and corresponding roots of 1, 2, 3, 4, 5 and 10 so $\sqrt[3]{64} = 4$ is expected knowledge.
- Although it is possible to work the answer out mentally in a single step, candidates are advised to write down the stages of working so that partial marks can be awarded if the final answer is incorrect.

Question 12

Specimen answer

12 Work out, giving your answer in standard form,

(a) $(7.1 \times 10^{-15}) \times (2 \times 10^{3})$

$7.1 \times 2 = 14.2$ $\quad 10^{-15} \times 10^{3} = 10^{-15+3} = 10^{-12}$

$14.2 \times 10^{-12} = 1.42 \times 10 \times 10^{-12} = 1.41 \times 10^{-11}$

.... 1.41×10^{-11} .... [2]

(b) $(5.2 \times 10^{7}) + (5.2 \times 10^{6})$.

$5.2 \times 10^{6} = 0.52 \times 10^{7}$

$5.2 \times 10^{7} + 0.52 \times 10^{7} = 5.72 \times 10^{7}$

.... 5.72×10^{7} .... [2]

Examiner comment

(a) The first stage is to multiply 7.1 and 2 and to use the laws of indices to multiply 10^{-15} and 10^{3} leading to 14.2×10^{-12}. This number is not in standard form, so the power of 10 must be adjusted to give an answer in standard form for 2 marks. If the answer is not correct, the B1 mark is awarded for either a number with figures 142 but an incorrect power of 10 or for correct use of index laws leading to 10^{-12}.

(b) The first stage is to adjust the numbers to have the same power of 10, so that the digits can be aligned correctly and added. The result is a value in standard form, so no further adjustment is needed. The method mark is awarded for an answer with figures 572 which may be the correct answer not written in standard form or for a number with the correct figures 572 but an incorrect power of 10.

Common errors and general guidance for candidates

- Candidates should understand that a number in standard form is written as $A \times 10^{n}$ where n is an integer and A is in the range $1 \leqslant A < 10$.
- When adjusting to give an answer in standard form, a common error is to change the power incorrectly for example adjusting 14.2×10^{-12} to 1.42×10^{-13} rather than 1.42×10^{-11}.
- When multiplying numbers in standard form, a common error is to multiply the powers rather than adding them. In this case, this would lead to the incorrect answer of 14.2×10^{-45} which gains B1 for the figures 142.
- When adding numbers in standard form, a common error is to add the numbers without first adjusting to the same power of 10. Often this error is combined with the error of adding the powers. In this case, this would lead to the incorrect answer of 10.4×10^{13} which gains no credit.

Question 14

Specimen answer

14 The range, mode, median and mean of five positive integers are all equal to 10.

Find one possible set of these five integers.

Median = 10 …… , …… , 10 , …… , ……
Mode = 10, trial with three 10s. …… , 10 , 10 , 10 , ……
Mean = 10 so sum of 5 integers is $5 \times 10 = 50$.
Sum of remaining integers is $50 - 3 \times 10 = 20$
Range = 10, highest integer– lowest integer = 10
Sum = 20, difference = 10 $\rightarrow$ highest = 15, lowest = 5

5 , 10 , 10 , 10 , 15 [4]

Examiner comment

Candidates need to identify an appropriate strategy to solve this problem involving range, mode, median and mean. There are three possible alternative solutions each of which score 4 marks: 4, 10, 10, 12, 14; 5, 10, 10, 10, 15; 6, 8, 10, 10, 16.

A starting point is to use the fact that median of the five integers is 10, so 10 can be placed in the middle of the list. As the mode is 10, there must be at least two 10s in the list. The mean is 10 which means that the sum of the five integers is 50. This could mean that all five numbers are 10, however this would give a range of 0 so the conditions are not satisfied.

If three 10s are placed in the list, this means that the sum of the remaining two integers is 20. Using the fact that the range is 10 leads to selecting 5 and 15 as the final two numbers to complete the solution.
The alternative solutions with two 10s require identifying three numbers with a sum of 30 and a range of 10 which are 4, 12 and 14 or 6, 8 and 16.

Partial marks are awarded for a set of five numbers that meet some of the four given conditions. B3 is awarded if three conditions are satisfied, B2 if two conditions are satisfied and B1 if one condition is satisfied.

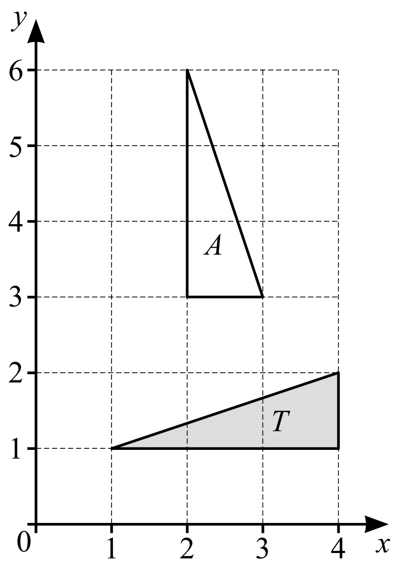
Common errors and general guidance for candidates

- Candidates should be familiar with the different averages and be able to apply them to a problem.
- Candidates should check their final answer to ensure that all the conditions have been met, for example the answer 6, 10, 10, 10, 16 has the correct range, mode and median, but the mean is not equal to 10 so would be awarded B3 marks.
- If the mean of a set of n numbers is given, then the sum of the set of numbers is equal to the mean multiplied by *n*. This fact is often required in problems involving the mean.
- This question does not require the numbers to be given in order, however writing the list in order makes it easier to check that the conditions have been met.

Question 15

Specimen answer

15



Describe fully the **single** transformation that maps triangle *T* onto triangle *A*.

Rotation 90° clockwise centre (4, 3)

.... [3]

Examiner comment

The description required has three parts, with 1 mark awarded for each correct part of the description. A brief description using correct terms and notation is expected.

Triangle *T* is a rotated to give triangle *A*. 1 mark is awarded for writing rotation.

The angle and direction of rotation is required. 1 mark is awarded for writing 90° clockwise. An alternative correct description is 270° anticlockwise.

Tracing paper can be used to help identify the coordinates of the centre of rotation. 1 mark is awarded for writing (4, 3). It is acceptable to omit the word centre if the coordinates are clearly shown.

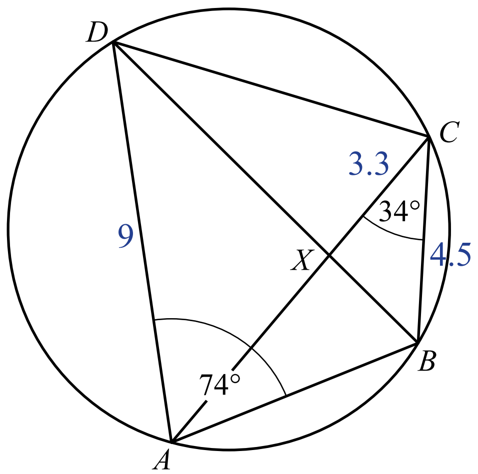
Common errors and general guidance for candidates

- The mark allocation of 3 indicates that there are three parts to the required description. It is common for candidates to state the type of transformation and omit one of the remaining parts of the description.
- The question asks for a single transformation. A common error is to use two transformations in the description, for example a rotation followed by a translation. If more than one transformation is mentioned, no marks are awarded.
- The correct language used in the syllabus should be used. It is not acceptable to use 'turn' in place of 'rotation'.
- It is common for candidates to state the angle as 90° and omit the direction.
- Some candidates give the centre of rotation as a vector rather than coordinates which is not acceptable.

Question 17

Specimen answer

17



NOT TO SCALE

The diagram shows a cyclic quadrilateral *ABCD*.
BD and *AC* intersect at *X*.

(a) Angle *BAD* = 74° and angle *BCA* = 34°.

Find

(i) angle *BDA*

$\angle BDA = 34°$

Angle *BDA* = ...34°............ [1]

(ii) angle *BCD*

$\angle BCD = 180 - 74 = 106°$

Angle *BCD* = ...106°............ [1]

(iii) angle *ABD*.

$\angle ABD = 180 - 74 - 34 = 72°$

Angle *ABD* = ...72°............ [1]

(b) In the diagram, triangle *ADX* is similar to triangle *BCX*.
BC = 4.5 cm, *AD* = 9 cm and *CX* = 3.3 cm.

Work out *XD*.

$\frac{XD}{XC} = \frac{AD}{BC} \qquad \frac{XD}{3.3} = \frac{9}{4.5}$

$XD = \frac{9 \times 3.3}{4.5} = 2 \times 3.3 = 6.6$

XD = ...6.6........................ cm [2]

Examiner comment

(a) (i) Angles in the same segment are used to find angle *BDA* = 34°.

(a) (ii) Opposite angles in a cyclic quadrilateral are used to find angle *BCD* = 106°.

(a) (iii) The sum of the angles in triangle *ABD* are used to find angle *ABD* = 72°. An alternative approach is to use angle *BCD* to find angle *ACD* = 106 – 34 = 72° and then angle *ABD* = 72° using angles in the same segment. If the answer to part **(a)(i)** is incorrect, the mark is awarded here for an answer that correctly follows through from their incorrect value of *BDA*.

(b) The correct answer scores 2 marks.

It is helpful to start by adding the given lengths to the diagram so that corresponding sides in the similar triangles can be related correctly. The question requires *XD* to be found so an equation relating the known sides to is set up. The method mark is awarded for any equation that is equivalent to $\frac{4.5}{9} = \frac{3.3}{XD}$.

This equation is rearranged to find the value of *XD*. Simplifying the division of 9 ÷ 4.5 = 2 before multiplying leads to the straightforward calculation 2 × 3.3 to give the answer 6.6.

Common errors and general guidance for candidates

- In questions requiring angles to be found, it is often helpful to indicate angles on the diagram. They also need to be written on the answer line for marks to be awarded.
- Candidates should be familiar with all the circle theorems given in the syllabus and be able to quote them precisely if reasons are required.
- A common error is for candidates to assume incorrectly that angles are right angles. In this question, some may use *BCD* = 90°, a result of assuming incorrectly that *BXD* is a diameter. If *BD* were a diameter or *X* were the centre of the circle, the question would state this.
- A common error is for candidates to assume that lines are parallel and use alternate or corresponding angles. If lines were parallel, the question would state this or the parallel lines would be indicated on the diagram.
- When using similar triangles, candidates should refer to the diagram to check whether the length of the side to be found should be smaller or larger than the given side. It is common to find the correct scale factor, but to apply it wrongly for example reaching an answer of 1.65 rather than 6.6 in this case.
- On a non-calculator paper common factors should be cancelled where possible to simplify the arithmetic required. In this case it is easier to cancel 9 and 4.5 in $\frac{3.3 \times 9}{4.5}$ leading to 3.3 × 2 rather than first calculating 3.3 × 9 = 29.7 and then attempting to divide this by 4.5.

Question 18

Specimen answer

18 $f(x) = 3 - 2x$ $g(x) = 2x + 3$ $h(x) = 2^x$

(a) **(i)** Find f(–3).

$f(-3) = 3 - 2 \times -3 = 3 + 6 = 9$

9 .... [1]

(ii) Find gf(–3).

$gf(-3) = g(9) = 2 \times 9 + 3 = 18 + 3 = 21$

21 .... [1]

(b) Find $f^{-1}(x)$.

$y = 3 - 2x \quad x = 3 - 2y$

$f^{-1}(x) =$ $\frac{3-x}{2}$ .... [2]

(c) Find x when $gg(x) = 7$.

$gg(x) = 2(2x + 3) + 3 = 4x + 6 + 3 = 4x + 9$

$4x + 9 = 7$

$4x = 7 - 9 = -2$

$x =$ $-\frac{1}{2}$ .... [3]

(d) Find x when $h^{-1}(x) = 5$.

$x = h(5) = 2^5 = 32$

$x =$ 32 .... [2]

Examiner comment

(a) **(i)** The value $x = -3$ is substituted into $3 - 2x$ to find the value of f(–3).

(a) **(ii)** The value of f(–3) found in part **(a)(i)** is substituted into $2x + 3$ to find the value of gf(–3).

(b) The notation $f^{-1}(x)$ means the inverse function. The inverse function is given in terms of *x*. The approach shown involves swapping *x* and *y* as the first step and then rearranging the formula to give *y* in terms of *x*. A correct final answer scores 2 marks.

The method mark is awarded for a correct first step in rearrangement, in this case swapping *x* and *y* to give $x = 3 - 2y$. An alternative approach is to rearrange the formula to give *x* in terms of *y* and then swap *x* and *y* at the end of the rearrangement, in this case a correct first step is either $y + 2x = 3$ or $\frac{y}{2} = \frac{3}{2} - x$.

(c) The first step is to find an expression for gg(*x*). This can be simplified before equating with 7. This leads to a simple linear equation to solve. A correct answer of $-\frac{1}{2}$ or –0.5 scores 3 marks.

The method mark is awarded for a correct expression for gg(*x*) which does not need to be equated with 7. If the brackets are correctly expanded and the expression is equated with 7 the B2 mark is awarded in place of the method mark.

(d) The notation $h^{-1}(x) = 5$ means $x = h(5)$. The method mark is awarded for this statement. Candidates should be able to work with powers of 2 without a calculator and evaluate $2^5 = 32$.

Common errors and general guidance for candidates

- Candidates should check answers to avoid arithmetic errors when substituting values into functions, particularly when negative numbers are involved.
- A common error when finding the inverse function is to give an answer in terms of *y* instead of in terms of *x*. This would score M1 only for a correct step. Sign errors are common when rearranging, for example $y - 2x = 3$ as a first step rather $y + 2x = 3$ which would score M0.
- Candidates should be familiar with the notation for composite functions. gg(*x*) does not mean $g(x) \times g(x)$.
- Integer answers should always be evaluated. An answer of 25 must be evaluated correctly as 32 for full credit.

Question 19

Specimen answer

19 **(a)** Simplify.

$$\sqrt{32} + \sqrt{98}$$

$\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$

$\sqrt{98} = \sqrt{49 \times 2} = 7\sqrt{2}$

$4\sqrt{2} + 7\sqrt{2} = 11\sqrt{2}$

.... $11\sqrt{2}$ .... [2]

(b) Rationalise the denominator.

$$\frac{1}{\sqrt{2}+1}$$

$$\frac{1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} = \frac{\sqrt{2}-1}{2+\sqrt{2}-\sqrt{2}-1} = \frac{\sqrt{2}-1}{1}$$

.... $\sqrt{2}-1$ .... [2]

Examiner comment

(a) The first step is to simplify each surd by finding a square number that is a factor of the number under the root. 16 is a factor of 32, so the square root of 16 can be taken outside the square root to give $4\sqrt{2}$. 49 is a factor of 98, so the square root of 49 can be taken outside the square root to give $7\sqrt{2}$. As the surds are both in terms of $\sqrt{2}$, they can be added to give the answer $11\sqrt{2}$ for 2 marks.

If the final answer is incorrect, B1 is awarded for one of the surds correctly simplified.

(b) The numerator and denominator of the fraction are multiplied by the conjugate $\sqrt{2} - 1$ to rationalise the denominator. The method mark is awarded for showing this multiplication. Simplifying the denominator $(\sqrt{2} + 1)(\sqrt{2} - 1)$ leads to a denominator of 1 giving a correct answer of $\sqrt{2} - 1$ for 2 marks.

Common errors and general guidance for candidates

- This is new syllabus content and candidates need to be familiar with simplifying expressions involving surds and with a method to rationalise a denominator.
- When adding or subtracting surds, the surds must have the same value under the square root. The first stage is to simplify the surds to achieve this.
- Surds should be fully simplified. $\sqrt{32}$ can be written as $\sqrt{4 \times 8} = 2\sqrt{8}$, but this is not fully simplified because 8 has a factor of 4 which is a square number.
- Rationalising a denominator often involves expanding brackets of the form $(a + \sqrt{b})(a - \sqrt{b})$ leading to $a^2 - b$. Candidates should be familiar with this result.

Question 20

Specimen answer

20 $y \propto \frac{1}{\sqrt{x}}$

When $y = 8$, $x = 4$.

Find y when $x = 49$.

$y = \frac{k}{\sqrt{x}}$ $8 = \frac{k}{\sqrt{4}}$ $k = 8 \times 2 = 16$

$y = \frac{16}{\sqrt{x}}$ When $x = 49$, $y = \frac{16}{\sqrt{49}} = \frac{16}{7}$

$y =$ .... $\frac{16}{7}$ .... [3]

Examiner comment

The first step is to write the proportion equation. The given values of *x* and *y* are substituted to find the value of the constant *k*. This is then used with *x* = 49 in the proportion equation to find the value of *y*. The answer can be given as a fraction or a mixed number for 3 marks.

If the answer is not correct two method marks are awarded for writing the correct proportion equation $y = \frac{16}{\sqrt{x}}$ or for setting up an equation using the three given values, $y\sqrt{49} = 8\sqrt{4}$ in which case the constant *k* is not required. If the constant is not found correctly, one method mark is awarded for the first step of writing a correct proportion equation, $y = \frac{k}{\sqrt{x}}$.

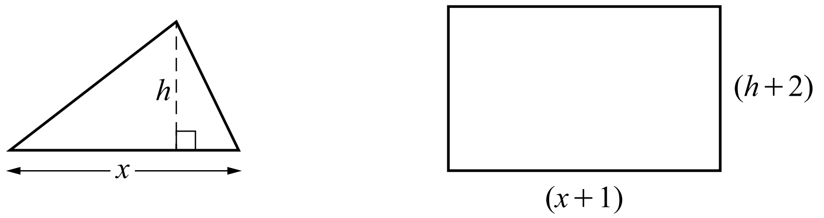
Common errors and general guidance for candidates

- Candidates should be familiar with the proportion symbol.
- A common error is to write the proportion equation as $y = \frac{1}{\sqrt{x}}$ rather than $y = \frac{k}{\sqrt{x}}$.
- A common error when rearranging is $k = \frac{8}{\sqrt{4}}$ rather than $k = 8\sqrt{4}$. If this is the first stage of working shown, then the method mark cannot be awarded as a correct equation has not been seen.
- Method marks are only awarded for equations using an = symbol. If working is shown using the proportion symbol the marks will not be awarded.

Question 21

Specimen answer

21 In this question, all measurements are in centimetres.



The height of the triangle is h and the height of the rectangle is $(h + 2)$.
The length of the base of the triangle is x and the length of the rectangle is $(x + 1)$.
The area of the triangle is 11 cm^2 and the area of the rectangle is 39 cm^2.

(a) Write down an expression, in terms of x, for the height of the rectangle.

Area of rectangle = $(x + 1) \times$ height = 39

$\frac{39}{x+1}$ .... [1]

(b) Show that $2x^2 - 15x + 22 = 0$.

Area of triangle = $\frac{1}{2}xh = 22$ $\quad h = \frac{22}{x}$

Height of rectangle – height of triangle = 2

$\frac{39}{x+1} - \frac{22}{x} = 2$

$39x - 22(x + 1) = 2x(x + 1)$

$39x - 22x - 22 = 2x^2 + 2x$

$2x^2 + 2x - 39x + 22x + 22 = 0$

$2x^2 - 15x + 22 = 0$

[3]

(c) By factorising and solving $2x^2 - 15x + 22 = 0$, find the two possible heights of the triangle.

$(2x - 11)(x - 2) = 0$

$x = \frac{11}{2}, x = 2$

Height of triangle $= \frac{22}{x}$

When $x = \frac{11}{2}$, $h = \frac{22}{11/2} = 2 \times 2 = 4$

When $x = 2$, $h = \frac{22}{2} = 11$

$h =$ ....4........ or $h =$ ....11........ [5]

Examiner comment

(a) The area and length of the rectangle are used to find an expression for its height. Using the area of the triangle to reach the alternative expression $\frac{22}{x} + 2$ is also acceptable.

(b) This question requires a result to be shown, so full credit is only awarded if all stages of the working leading to the required equation are shown with no errors.

The first step required is to form an equation using the fact that the height of the rectangle is 2 more than the height of the triangle. The first method mark is awarded for a correct equation.

Both sides of the equation are multiplied by $x(x + 1)$ to eliminate the fractions. The second method mark is awarded if this stage is shown correctly. If both sides of the equation are shown over a common denominator the method mark may be awarded. If the starting equation was incorrect, this mark can be awarded for eliminating the fractions from an equation provided it involves two fractions with linear algebraic denominators.

The final step is to expand the brackets and rearrange the equation to reach $2x^2 - 15x + 22 = 0$. The accuracy mark is awarded if correct working leading to this equation is shown with no errors or omissions.

An alternative approach to this question is to use the expression $\frac{22}{x} + 2$ for the height of the rectangle to form an equation for the area of the rectangle in terms of x, $(x + 1)\left(\frac{22}{x} + 2\right) = 39$. In this case, the second method mark is awarded for correctly expanding the brackets to $22 + 2x + \frac{22}{x} + 2 = 39$. The accuracy mark is then awarded for completing the rearrangement to the given equation with no errors or omissions.

(c) The question asks for the quadratic equation to be solved by factorisation, which means that the quadratic formula cannot be used to solve the equation. The factorised equation must be shown for any marks to be awarded in this part. Two method marks are awarded for a correct factorisation, or one method mark is awarded for a partially correct factorisation.

Following correct factorisation one accuracy mark is awarded for the correct solutions $\frac{11}{2}$ and 2.

These solutions are then used to find the two possible heights for the triangle, by substituting into $h = \frac{22}{x}$.

One accuracy mark is awarded for each correct value of h.

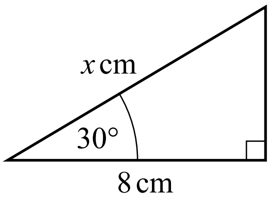
Common errors and general guidance for candidates

- Candidates should read the question carefully and find an expression for the height of the rectangle and not for *h*, the height of the triangle.
- Common errors in show that questions are omitting necessary brackets in the working or omitting = 0 in the final equation, in which case the accuracy mark is not awarded.
- Candidates are advised to show an expression involving brackets such as $39x – 22(x + 1) = 2x(x + 1)$ rather than combining the two steps of removing fractions and expanding brackets because errors in expansion or sign errors are common. The method mark can only be awarded when a correct equation is shown. Examples of common errors seen in expansions are $39x – 22x + 22 = 2x^2 + 2x$ or $39x – 22x – 22 = 2x^2 + 1$.
- When the question specifies a method to be used, marks are not awarded for an alternative method leading to the correct answer. In part **(c)**, if the quadratic formula or completing the square are used to solve the equation, no marks are awarded even if the values of the height are correct.

Question 22

Specimen answer

22



NOT TO SCALE

Find the exact value of x.

$\cos 30 = \frac{8}{x}$ $\quad\quad$ $x = \frac{8}{\cos 30}$

Exact value of $\cos 30 = \frac{\sqrt{3}}{2}$ $\quad\quad$ so $x = \frac{8}{\frac{\sqrt{3}}{2}} = \frac{8 \times 3}{\sqrt{3}}$

$x = \frac{16}{\sqrt{3}}$ [4]

Examiner comment

This question uses right-angled trigonometry with exact trigonometric values. Cosine is used to find the value of x and two method marks are awarded for a correct expression for $x = \frac{8}{\cos 30}$. If this is incorrect, one method mark is awarded for the implicit equation $\cos 30 = \frac{8}{x}$. The B1 mark is awarded for stating the exact value of cos 30.

The question does not require the final answer to be simplified, so either $\frac{16}{\sqrt{3}}$ or $\frac{16\sqrt{3}}{3}$ is acceptable for 4 marks.

Common errors and general guidance for candidates

- Exact trigonometric values is new syllabus content. Candidates need to know the exact values of sin, cos and tan for the angles specified in the syllabus.
- The implicit equation for x is sometimes rearranged incorrectly to $x = 8\cos 30$.
- There is no need to simplify the answer after reaching $\frac{16}{\sqrt{3}}$.

Question 24

Specimen answer

24 **(a)** Write $x^2 - 4x + 7$ in the form $(x - a)^2 + b$.

$x^2 - 4x + 7 = (x - 2)^2 - 4 + 7 = (x - 2)^2 + 3$

.... $(x - 2)^2 + 3$ .... [2]

(b) Write down the coordinates of the turning point of the graph of $y = x^2 - 4x + 7$.

(2, 3)

(....... 2 .... , ... 3 ....) [1]

Examiner comment

(a) The question requires the quadratic expression to be written in completed square form. The first step is to use the coefficient of *x* to find the value of *a* = 4 ÷ 2 = 2. The value of *b* is found by subtracting 22 from 7.

The correct expression is awarded 2 marks. If this is not correct, the method mark is awarded for the first step showing $(x - 2)^2$.

(b) The mark is awarded for writing the correct coordinates for the turning point. If the candidate has written an incorrect expression in the correct form in part **(a)**, the mark is awarded for the correct turning point for this expression.

Common errors and general guidance for candidates

- Candidates are expected to be able to write down the coordinates of the turning point of a quadratic graph using the equation written in completed square form. The coordinates of the turning point of an equation in the form $y = (x - a)^2 + b$ are (a, b).
- A common error when completing the square is to use 7 + 4 = 11 as the value of *b* rather than the correct 7 – 4 = 3.
- Some candidates use the method of expanding $(x - a)^2 + b$ to $x^2 - 2ax + a + b$ and equating coefficients to find the values of *a* and *b*. This method relies on a correct expansion and would not be awarded the method mark unless $(x - 2)^2$ was shown at some stage.
- Although the turning point can be found using calculus, this involves much more work than using the completed square method and will be time-consuming for a 1-mark question. The question uses the command word 'Write down' which indicates that no working is required.

For further information about common mistakes made by candidates, please refer to the examiner reports which are published after the first exam series in 2025 on the School Support Hub at **www.cambridgeinternational.org/support**

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