

CAMBRIDGE IGCSE (0580) — EXTENDED BOOSTER BOOKLET

Cambridge IGCSE (0580) Extended Booster

(Extended Tier • 2025–2027 Syllabus)

Complete IGCSE Extension Pack: Cross-Reference Guide, Tutorials, Worked Examples & Practice

- 1-Page Syllabus Cross-Reference Guide (how to pair with Grades 4–9 Booklets)
- All 7 Extra IGCSE Topics with Concept Notes & Worked Examples
- 42 Exam-Style Practice Questions with full working-out spaces
- Complete Answer Key Appendix at the back

Student Name: _____

School / Class: _____

Target Grade: _____



SCAN FOR INTERACTIVE IGCSE PRACTICE & WORKED SOLUTIONS

BreakingDownMaths.com

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CROSS-REF CHECKLIST — SYLLABUS BRIDGE

Cambridge IGCSE (0580 / 0980 · 2025–2027) Cross-Reference Guide

Use this Extended Booster Booklet alongside our main Grades 1–9 Booklets for complete coverage of the updated 2025–2027 Cambridge IGCSE (0580 & 0980) syllabus.

2025–2027 Syllabus Additions Already in Main Booklets: Make sure you revise **Trigonometry Exact Values** (Grade 5 Booklet — tested on Non-Calculator Paper 2!) and **Surds: Simplifying, Expanding & Rationalising** (Grade 7 Booklet). Note that Matrices, Linear Programming, Box-and-Whisker Plots, Loci, and Proper Subsets ($\subset$) have been removed for 2025–2027.

1. UK-GCSE-ONLY TOPICS TO SKIP IN THE MAIN GRADES 3–9 BOOKLETS

Topic in Main Booklet	Booklet	IGCSE Guidance
3D Plans & Elevations	Grade 3	Keep nets & surface area/volume; skip plan/elevation drawings
Frequency Trees	Grade 3	UK GCSE only — not examined on Cambridge 0580
Constructions & Loci	Grade 4	Loci & ruler-compass bisectors removed in 2025–2027 (triangle construction only)
Product Rule for Counting	Grade 6	UK GCSE only — not examined on Cambridge 0580
Box Plots	Grade 6	Box-and-whisker plots removed from 0580 in 2025–2027 (keep Cumulative Freq!)
Stratified Sampling & Capture-Recapture	Grade 6	UK GCSE only — not examined on Cambridge 0580
Iteration	Grade 8	Fixed-point iteration is not on Cambridge 0580
Equation of a Circle	Grade 9	$x^2 + y^2 = r^2$ is not on Cambridge 0580

2. YOUR 7 EXTRA IGCSE TOPICS MASTERED IN THIS BOOKLET

IGCSE Extension Topic	Syllabus Area	Notes	Practice
1. Formal Set-Builder & Subset Notation	Probability	☐	☐
2. 3D Symmetry: Planes & Rotational Axes	Geometry and Measures	☐	☐
3. Cubic & Exponential Sequences	Algebra	☐	☐
4. Functions: Domain & Range	Algebra	☐	☐
5. Curve Asymptotes & Exponential Equations	Algebra	☐	☐
6. Magnitude (Modulus) of a Vector	Geometry and Measures	☐	☐
7. Differentiation & Turning Points	Algebra	☐	☐

3. BONUS 0580 (2025–2027) EXAM-FORMAT & TOPIC BRIDGE

- New 50/50 Non-Calculator Exam Split:** Paper 2 (Extended, 2 hrs, 100 marks, 50%) is now **strictly Non-Calculator**, and Paper 4 (2 hrs, 100 marks, 50%) is Calculator (both provide a 2-page Formula Sheet). Recall squares up to 15^2 and cubes of 1, 2, 3, 4, 5, 10 without a calculator.
- Solving Trig Equations for $0^\circ \leq x \leq 360^\circ$:** Find **both** angles in $0^\circ \leq x \leq 360^\circ$ (e.g. $\sin x = 0.5$ or $2 \cos x + 1 = 0$). From primary angle θ , use symmetry: $\sin x \rightarrow 180^\circ - \theta$ | $\cos x \rightarrow 360^\circ - \theta$ | $\tan x \rightarrow \theta + 180^\circ$.
- Fractional Power Graphs ($n = \frac{1}{2}$ and $n = -\frac{1}{2}$):** New for 2025–2027 alongside Topic 5: recognise $y = ax^{1/2} = a\sqrt{x}$ (starts at $(0, 0)$, curves gently for $x \geq 0$) and $y = ax^{-1/2} = \frac{a}{\sqrt{x}}$ (first quadrant for $a > 0$, asymptotes $x = 0$ and $y = 0$).
- Stem-and-Leaf Diagrams & Congruence Criteria:** Revise **Stem-and-Leaf (incl. Back-to-Back)** diagrams for median/IQR (Grade 3 Booklet — still tested on 0580), and **skip** formal Congruent Triangle Proofs (SSS, SAS, ASA, RHS — removed in 2025–2027).

Formal Set-Builder & Subset Notation

1 Elements, Cardinality $n(A)$ & Empty Sets

CORE CONCEPT & METHOD

IGCSE formal set language uses compact symbols:

- $x \in A / x \notin A$: x is an element of A / is not an element of A .
- $n(A)$: The **number of elements** in set A (its cardinality).
- $\emptyset$ (or $\{\}$): The **empty set** containing zero elements, so $n(\emptyset) = 0$.
- **Inclusion–Exclusion**: $n(A \cup B) = n(A) + n(B) - n(A \cap B)$.

MODEL WORKED EXAMPLE

EXAMPLE 1.1

Given $n(\mathcal{E}) = 30$, $n(A) = 14$, $n(B) = 11$ and $n(A \cap B) = 4$, find $n(A \cup B)$ and $n((A \cup B)')$.

STEP-BY-STEP SOLUTION:

$$n(A \cup B) = 14 + 11 - 4 = 21.$$

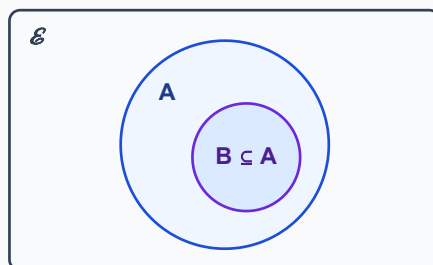
$$n((A \cup B)') = 30 - 21 = 9.$$

21; 9

2 Subsets ($\subseteq$) & Combined Operations

CORE CONCEPT & METHOD

$B \subseteq A$ means B is a **subset** of A : every element of B also belongs to A .



- When $B \subseteq A$, we automatically have $A \cap B = B$ and $A \cup B = A$.
- A finite set with k elements has exactly 2^k subsets (including $\emptyset$ and the set itself).

MODEL WORKED EXAMPLE

EXAMPLE 2.1

Given $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8\}$, $A = \{2, 4, 6, 8\}$ and $B = \{1, 2, 3, 4\}$, list $A' \cap B$.

STEP-BY-STEP SOLUTION:

$A' = \{1, 3, 5, 7\}$. Intersecting with $B = \{1, 2, 3, 4\}$ gives $\{1, 3\}$.

$\{1, 3\}$

3 Set-Builder Notation & Algebraic Venn Diagrams

CORE CONCEPT & METHOD

Set-builder notation $\{x : \text{rule}\}$ reads as "*the set of all x such that...*". Always check the universal set $\mathcal{E}$ (e.g. integers $\mathbb{Z}$ vs positive integers $\mathbb{Z}^+$) before listing elements!

In algebraic Venn diagrams, write an expression for **each separate region** (especially subtracting the overlap x from the outer parts!) and equate the sum of all regions to $n(\mathcal{E})$.

MODEL WORKED EXAMPLE

EXAMPLE 3.1

Let $\mathcal{E} = \{\text{integers}\}$, $A = \{x : 2x + 1 \geq 5\}$ and $B = \{x : x < 6\}$. List $A \cap B$.

STEP-BY-STEP SOLUTION:

$2x + 1 \geq 5 \implies x \geq 2$. Combining $x \geq 2$ and $x < 6$ for integers gives $\{2, 3, 4, 5\}$.

$$\{2, 3, 4, 5\}$$

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Total: 11 marks

Formal Set-Builder & Subset Notation — Practice Questions

Answer all 6 questions. Show clear algebraic working in the spaces provided.

Question 1

(1 mark)

Given the set $B = \{\text{positive factors of } 36\}$, write down the value of $n(B)$.

WORKING OUT SPACE

Answer:

Question 2

(1 mark)

Let $M = \{x : x \text{ is a factor of } 24\}$. How many integers k satisfy BOTH $k \in M$ and $k > 7$?

WORKING OUT SPACE

Answer:

Question 3

(2 marks)

Sets P and Q satisfy $P \subseteq Q$, with $n(\mathcal{E}) = 30$, $n(P) = 8$ and $n(Q) = 21$.
Work out $n(P' \cap Q)$.

WORKING OUT SPACE

Answer:

Question 4**(2 marks)**

$A = \{1, 4, 9, 16\}$, $B = \{2, 4, 8, 16\}$ and $C = \{4, 6, 8, 10\}$ (within universal set $\mathcal{E} = \{1, 2, \dots, 20\}$).
List the elements of $A \cap B \cap C$.

WORKING OUT SPACE

Answer:

Question 5**(2 marks)**

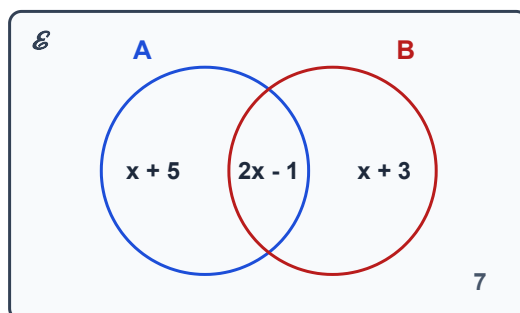
$\mathcal{E} = \{\text{integers}\}$, $A = \{x : 3x + 2 > -4\}$ and $B = \{x : 2x + 1 \leq 9\}$.
List all the elements of $A \cap B$.

WORKING OUT SPACE

Answer:

Question 6**(3 marks)**

The Venn diagram shows the number of elements in each region of $\mathcal{E}$.



Given that $n(\mathcal{E}) = 30$, find $n(A \cup B)$.

WORKING OUT SPACE

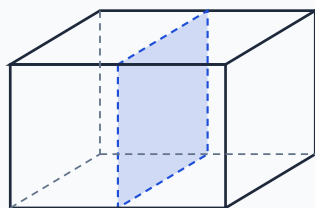
Answer:

3D Symmetry: Planes & Rotational Axes

1 Planes of Symmetry in 3D Solids

CORE CONCEPT & METHOD

A **plane of symmetry** is a flat 2D slice that divides a 3D solid into two exact mirror-image halves.



Plane of Symmetry (mirror halves)

- **Uniform prism (not a cube):** (lines of symmetry of cross-section) + 1 mid-plane halfway along its length!
- **Right pyramid (not regular tetrahedron):** Equal to the lines of symmetry of its base (all passing through the apex — *no* horizontal plane!).
- **Cube:** 3 face-parallel mid-planes + 6 diagonal planes = 9.

MODEL WORKED EXAMPLE

EXAMPLE 1.1

How many planes of symmetry do (a) an equilateral triangular prism and (b) a square-based pyramid have?

STEP-BY-STEP SOLUTION:

(a) Equilateral triangle has 3 lines of symmetry + 1 mid-plane = 4.

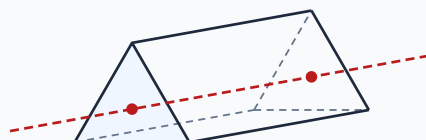
(b) Square base has 4 lines of symmetry through the apex = 4.

(a) 4, (b) 4

2 Axes & Order of Rotational Symmetry in 3D

CORE CONCEPT & METHOD

An **axis of rotational symmetry** is a line through a 3D solid about which the solid looks identical more than once during a full 360° rotation. The number of matching positions in 360° is the **order**.



Equilateral Triangular Prism: Main Axis (Order 3)

- **Cuboid** ($l \neq w \neq h$): 3 axes (each of order 2).
- **Cube** (13 axes total): 3 face-to-face axes (order 4), 4 vertex-to-vertex diagonals (order 3), and 6 edge-midpoint axes (order 2).

MODEL WORKED EXAMPLE

EXAMPLE 2.1

State the order of rotational symmetry of a regular pentagonal prism about the axis joining the centres of its two pentagonal faces.

STEP-BY-STEP SOLUTION:

A regular pentagon matches itself 5 times in 360° (every 72°), so the order is 5.

5

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Total: 8 marks

3D Symmetry: Planes & Rotational Axes — Practice Questions

Answer all 6 questions. Show clear algebraic working in the spaces provided.

Question 1**(1 mark)**

A cuboid has a **square cross-section** of $4\text{ cm} \times 4\text{ cm}$ and length 10 cm .

Write down the total number of planes of symmetry of this cuboid.

WORKING OUT SPACE

Answer:

Question 2**(1 mark)**

A uniform prism has a **regular pentagon** as its cross-section and length 20 cm .

Write down the total number of planes of symmetry of the prism.

WORKING OUT SPACE

Answer:

Question 3**(1 mark)**

A prism has cross-section a **parallelogram** (with sides 4 cm and 7 cm and interior angles 60° and 120°) and length 12 cm .

How many planes of symmetry does this prism have?

WORKING OUT SPACE

Answer:

Question 4**(1 mark)**

How many **axes of rotational symmetry** in total does a $3\text{ cm} \times 5\text{ cm} \times 9\text{ cm}$ cuboid have?

WORKING OUT SPACE

Answer:**Question 5****(2 marks)**

For a cube, write down:

- (a) the number of axes of rotational symmetry of order 4,
- (b) the total number of axes of rotational symmetry.

WORKING OUT SPACE

Answer: (a) **(b)****Question 6****(2 marks)**

A right pyramid has a regular hexagon as its base and an apex directly above the centre of the base.

Write down:

- (a) the total number of planes of symmetry of the pyramid,
- (b) the order of rotational symmetry about the vertical axis through the apex.

WORKING OUT SPACE

Answer: (a) **(b)**

Cubic & Exponential Sequences

1 Cubic Sequences ($an^3 + bn^2 + cn + d$)

CORE CONCEPT & METHOD

In a **cubic sequence** $an^3 + bn^2 + cn + d$, the 3rd **differences** are constant and equal to $6a$:

Step 1: Find the 1st, 2nd, and 3rd differences. Solve $6a = (\text{3rd difference})$.

Step 2: Subtract an^3 ($a, 8a, 27a, 64a, \dots$) from the original sequence.

Step 3: Find the n th term of the remaining linear or quadratic sequence!

MODEL WORKED EXAMPLE

EXAMPLE 1.1

Find the n th term of the cubic sequence 3, 12, 33, 72, 135.

STEP-BY-STEP SOLUTION:

1. 1st diffs: 9, 21, 39, 63; 2nd diffs: 12, 18, 24; 3rd diff = 6 $\implies 6a = 6 \implies a = 1$.

2. Subtract n^3 (1, 8, 27, 64, 125) from 3, 12, 33, 72, 135 to get 2, 4, 6, 8, 10 = $2n$.

3. n th term = $n^3 + 2n$.

$$n^3 + 2n$$

2 Exponential n th Terms

CORE CONCEPT & METHOD

An **exponential (geometric) sequence** multiplies by a constant ratio r each step: $u_n = a \times r^{n-1}$.

Cambridge Extended Tip: If the differences between terms double ($\times 2$) or triple ($\times 3$) each step, compare the sequence directly against 2^n (2, 4, 8, 16, ...) or 3^n (3, 9, 27, 81, ...)!

MODEL WORKED EXAMPLE

EXAMPLE 2.1

Find the n th term of 6, 12, 30, 84, 246.

STEP-BY-STEP SOLUTION:

Differences are 6, 18, 54, 162 (multiplying by 3 each time!).

Compare with 3^n (3, 9, 27, 81, 243): each term is 3 larger, so $u_n = 3^n + 3$.

$$3^n + 3$$

3 Multi-Row Sequence Tables

CORE CONCEPT & METHOD

Multi-row sequence tables frequently appear at the end of Cambridge Paper 2 & Paper 4. Look for relationships **down the columns** (e.g. Row C = Row A + Row B) as well as **across each row**!

MODEL WORKED EXAMPLE

EXAMPLE 3.1

In a pattern table, Row A has n th term $2n + 1$ and Row B has n th term n^2 . Row C is the sum of Row A and Row B. Find the n th term of Row C.

STEP-BY-STEP SOLUTION:

Add the two n th terms: $n^2 + 2n + 1 = (n + 1)^2$.

$$n^2 + 2n + 1$$

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Total: 13 marks

Cubic & Exponential Sequences — Practice Questions*Answer all 6 questions. Show clear algebraic working in the spaces provided.***Question 1****(2 marks)**

Here are the first five terms of a cubic sequence:

 $-2, 5, 24, 61, 122$ Find an expression, in terms of n , for the n th term of this sequence.

WORKING OUT SPACE

Answer:

Question 2**(3 marks)**

Here are the first five terms of a sequence:

 $3, 7, 21, 51, 103$ Find the n th term of this sequence in terms of n .

WORKING OUT SPACE

Answer:

Question 3**(2 marks)**

Here are the first terms of an exponential (geometric) sequence:

5, 10, 20, 40, 80, ...

Work out the 10th term of this sequence.

WORKING OUT SPACE

Answer:

Question 4**(2 marks)**

Find an expression, in terms of n , for the n th term of the sequence:

1, 2, 5, 12, 27

WORKING OUT SPACE

Answer:

Question 5**(2 marks)**

In a tile pattern, Diagram n has $W = 3n + 1$ white tiles and $G = n^2$ grey tiles.

Find a simplified expression, in terms of n , for the **total number of tiles** T in Diagram n .

WORKING OUT SPACE

Answer:

Question 6**(2 marks)**

In the dot-and-line pattern where $D = (n + 1)^2$ and $L = 2n^2 + 2n$, work out $L - D$ when $n = 10$.

WORKING OUT SPACE

Answer:

Functions: Domain & Range

1 Excluded Values & Natural Domains

CORE CONCEPT & METHOD

The **domain** of a function is the set of allowed **input** (x) values. Two rules restrict real domains:

- **Never divide by zero:** In $f(x) = \frac{a}{g(x)}$, solve $g(x) = 0$ to find the **excluded** value(s) of x .
- **No negative square roots:** In $f(x) = \sqrt{g(x)}$, require $g(x) \geq 0$.

MODEL WORKED EXAMPLE

EXAMPLE 1.1

State the value of x that must be excluded from any domain of $f(x) = \frac{5}{2x-8}$, and find the largest possible domain of $g(x) = \sqrt{x-3}$.

STEP-BY-STEP SOLUTION:

For $f(x)$: set $2x - 8 = 0 \implies x = 4$ must be excluded.

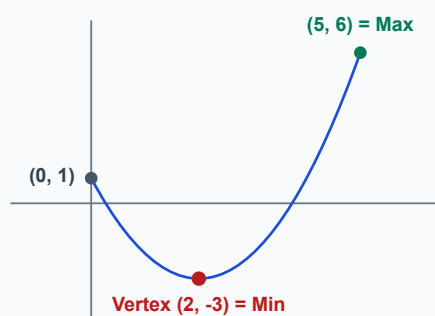
For $g(x)$: require $x - 3 \geq 0 \implies x \geq 3$.

$$x = 4; \quad x \geq 3$$

2 Finding the Range of a Function

CORE CONCEPT & METHOD

The **range** of f is the set of all possible **output values** $f(x)$ produced by the domain.



Quadratic Turning-Point Trap: On $f(x) = (x-2)^2 - 3$ for $0 \leq x \leq 5$, do *not* only test $x = 0$ and $x = 5$! Because the vertex $x = 2$ lies inside $[0, 5]$, the minimum output is $f(2) = -3$, giving $-3 \leq f(x) \leq 6$.

MODEL WORKED EXAMPLE

EXAMPLE 2.1

Find the range of $f(x) = (x-3)^2 + 4$ for all real x .

STEP-BY-STEP SOLUTION:

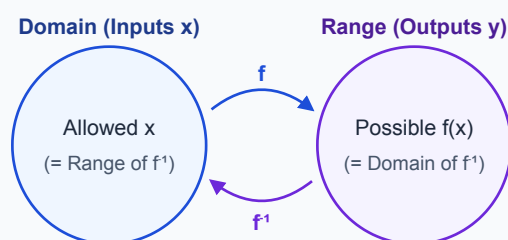
Because $(x-3)^2 \geq 0$ for all real x , adding 4 gives $(x-3)^2 + 4 \geq 4$.

$$f(x) \geq 4$$

3 Domain & Range of Inverse Functions

CORE CONCEPT & METHOD

Because an inverse function f^{-1} swaps inputs and outputs:



$$\text{Domain of } f^{-1} = \text{Range of } f \quad \text{and} \quad \text{Range of } f^{-1} = \text{Domain of } f$$

MODEL WORKED EXAMPLE

EXAMPLE 3.1

The function $f(x) = (x - 2)^2 + 5$ is defined for $x \geq 2$. State the domain and range of $f^{-1}(x)$.

STEP-BY-STEP SOLUTION:

1. For $x \geq 2$, the range of f is $f(x) \geq 5$, so the **domain of** f^{-1} is $x \geq 5$.
2. The domain of f is $x \geq 2$, so the **range of** f^{-1} is $f^{-1}(x) \geq 2$.

$$\text{Domain: } x \geq 5, \quad \text{Range: } f^{-1}(x) \geq 2$$

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Total: 13 marks

Functions: Domain & Range — Practice Questions

Answer all 6 questions. Show clear algebraic working in the spaces provided.

Question 1

(2 marks)

The function f is defined by $f(x) = \frac{4x + 1}{2x + 6}$.

State the value of x that must be **excluded** from any domain of f .

WORKING OUT SPACE

Answer:

Question 2

(2 marks)

The real-valued function h is defined by $h(x) = \sqrt{15 - 3x}$.

Write down an inequality in x for the largest possible domain of h .

WORKING OUT SPACE

Answer:

Question 3

(2 marks)

Find the range of the function $f(x) = 5x + 1$ for the domain $x > -1$.

Write your answer as an inequality in $f(x)$ or y (e.g. $f(x) \geq 2$).

WORKING OUT SPACE

Answer:

Question 4**(2 marks)**

The function f is defined by $f(x) = (x - 1)^2 + 2$ for the domain $-3 \leq x \leq 3$.

The range of f is $a \leq f(x) \leq b$. Work out the values of a and b .

WORKING OUT SPACE

Answer:**Question 5****(3 marks)**

The one-to-one function f is defined by $f(x) = x^2 + 4x - 3$ for $x \geq -2$.

Complete the square to find the range of f , and hence state the **domain of the inverse function** $f^{-1}(x)$.

WORKING OUT SPACE

Answer:**Question 6****(2 marks)**

The function f is defined by $f(x) = (x - 4)^2 - 1$ for the domain $x \geq 4$.

Work out the value of $f^{-1}(35)$.

WORKING OUT SPACE

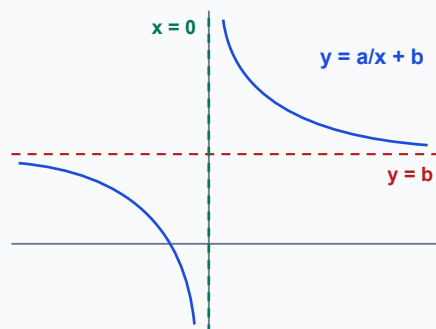
Answer:

Curve Asymptotes & Exponential Equations

1 Asymptotes of Reciprocal Curves

CORE CONCEPT & METHOD

An **asymptote** is a straight line that a curve approaches closer and closer as x or y tends to infinity, without ever crossing that boundary behaviour.



- **Vertical asymptote:** Set the denominator equal to 0 (e.g. for $y = \frac{a}{x-h} + k$, $x = h$).
- **Horizontal asymptote:** Let $x \rightarrow \pm\infty$ so the fraction $\rightarrow 0$, leaving $y = k$.
- Always write asymptotes as **full line equations** ($x = \dots$ or $y = \dots$).

MODEL WORKED EXAMPLE

EXAMPLE 1.1

State the equations of the two asymptotes of $y = \frac{5}{x-3} + 2$.

STEP-BY-STEP SOLUTION:

Vertical asymptote: $x - 3 = 0 \implies x = 3$.

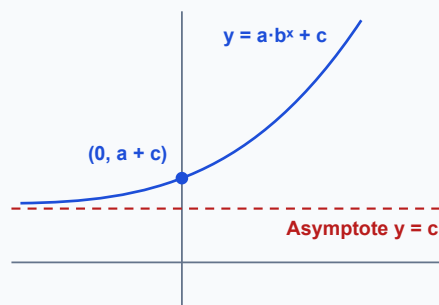
Horizontal asymptote: as $x \rightarrow \pm\infty$, $\frac{5}{x-3} \rightarrow 0 \implies y = 2$.

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

2 Exponential Curves & Asymptotes

CORE CONCEPT & METHOD

For an exponential curve $y = a \cdot b^x + c$ ($b > 0, b \neq 1$):



- Because $b^x > 0$ for all real x , $a \cdot b^x$ approaches 0 at one end and never reaches 0.
- Therefore, the **horizontal asymptote is $y = c$** (and there is *no* vertical asymptote!).
- At the y -intercept ($x = 0$), $b^0 = 1$, so $y = a + c$.

MODEL WORKED EXAMPLE

EXAMPLE 2.1

The curve $y = k^x - 4$ passes through $(2, 5)$. State its asymptote and find k ($k > 0$).

STEP-BY-STEP SOLUTION:

Asymptote: $y = -4$.

Substitute $(2, 5)$: $k^2 - 4 = 5 \implies k^2 = 9 \implies k = 3$.

$$y = -4, \quad k = 3$$

3 Exponential Equations by Common Base

CORE CONCEPT & METHOD

To solve exponential equations without logarithms, rewrite every number as a power of the **same prime base** (2, 3, or 5):

- $4 = 2^2$, $8 = 2^3$, $16 = 2^4$, $32 = 2^5$, $64 = 2^6$
- $9 = 3^2$, $27 = 3^3$, $81 = 3^4$, $243 = 3^5$
- $\frac{1}{b^n} = b^{-n}$ and $b^0 = 1$. Once $b^A = b^B$, equate the powers $A = B$!

MODEL WORKED EXAMPLE

EXAMPLE 3.1

Solve $9^{x+1} = 27^{x-1}$.

STEP-BY-STEP SOLUTION:

Rewrite both sides in base 3: $(3^2)^{x+1} = (3^3)^{x-1} \implies 3^{2x+2} = 3^{3x-3}$.

Equate powers: $2x + 2 = 3x - 3 \implies x = 5$.

$$x = 5$$

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Curve Asymptotes & Exponential Equations — Practice Questions

**Total: 11
marks**

Answer all 6 questions. Show clear algebraic working in the spaces provided.

Question 1**(1 mark)**

Write down the equation of the **horizontal asymptote** of the curve $y = \frac{7}{x} - 5$.

WORKING OUT SPACE

Answer:**Question 2****(1 mark)**

Write down the equation of the **vertical asymptote** of the curve $y = \frac{4}{(x+5)^2} + 7$.

WORKING OUT SPACE

Answer:**Question 3****(1 mark)**

Write down the equation of the asymptote of the exponential curve $y = 3^x - 6$.

WORKING OUT SPACE

Answer:

Question 4**(2 marks)**

Find the coordinates of the point where the curve $y = 2^{x+3} - 1$ crosses the y -axis.

WORKING OUT SPACE

Answer:**Question 5****(3 marks)**

Solve the exponential equation:

$$3^{2x+1} = 81$$

WORKING OUT SPACE

Answer:**Question 6****(3 marks)**

Solve the exponential equation:

$$\frac{9^x}{3^{x-4}} = \frac{1}{27}$$

WORKING OUT SPACE

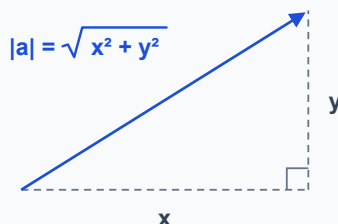
Answer:

Magnitude (Modulus) of a Vector

1 Modulus of a Column Vector

CORE CONCEPT & METHOD

The **magnitude** (or **modulus**) of a vector $\mathbf{a} = \begin{pmatrix} x \\ y \end{pmatrix}$, written $|\mathbf{a}|$, is its length found by Pythagoras' theorem:



$$|\mathbf{a}| = \sqrt{x^2 + y^2}$$

MODEL WORKED EXAMPLE

EXAMPLE 1.1

Given $\mathbf{a} = \begin{pmatrix} -6 \\ 8 \end{pmatrix}$, work out $|\mathbf{a}|$.

STEP-BY-STEP SOLUTION:

$$|\mathbf{a}| = \sqrt{(-6)^2 + 8^2} = \sqrt{36 + 64} = \sqrt{100} = 10.$$

10

2 Combined & Displacement Vectors $\overrightarrow{AB}$

CORE CONCEPT & METHOD

Crucial Rule: $|\mathbf{a} + \mathbf{b}|$ is *not* equal to $|\mathbf{a}| + |\mathbf{b}|$!

- Always combine the vectors into a **single column vector first**, then apply $\sqrt{x^2 + y^2}$.
- For two points $A(x_1, y_1)$ and $B(x_2, y_2)$, first find $\overrightarrow{AB} = \begin{pmatrix} x_2 - x_1 \\ y_2 - y_1 \end{pmatrix}$, then find $|\overrightarrow{AB}|$.

MODEL WORKED EXAMPLE

EXAMPLE 2.1

A is $(-1, 4)$ and B is $(4, -8)$. Work out $|\overrightarrow{AB}|$.

STEP-BY-STEP SOLUTION:

$$1. \overrightarrow{AB} = \begin{pmatrix} 4 - (-1) \\ -8 - 4 \end{pmatrix} = \begin{pmatrix} 5 \\ -12 \end{pmatrix}.$$

$$2. |\overrightarrow{AB}| = \sqrt{5^2 + (-12)^2} = \sqrt{25 + 144} = 13.$$

13

3 Missing Components & Parallel Vectors

CORE CONCEPT & METHOD

When you are given the magnitude $|\mathbf{v}| = m$ and asked to find an unknown k , square both sides ($x^2 + y^2 = m^2$) so the square root disappears!

Remember: unless k is restricted (e.g. $k > 0$), taking a square root gives **two solutions** ($\pm$). To scale a vector $\mathbf{p}$ to a new length L , multiply $\mathbf{p}$ by $\frac{L}{|\mathbf{p}|}$.

MODEL WORKED EXAMPLE

EXAMPLE 3.1

Vector $\mathbf{v} = \begin{pmatrix} k \\ -8 \end{pmatrix}$ has $|\mathbf{v}| = 10$ with $k < 0$. Find k .

STEP-BY-STEP SOLUTION:

$$k^2 + (-8)^2 = 10^2 \implies k^2 + 64 = 100 \implies k^2 = 36 \implies k = \pm 6.$$

Since $k < 0$, $k = -6$.

$$k = -6$$

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Total: 13 marks

Magnitude (Modulus) of a Vector — Practice Questions*Answer all 6 questions. Show clear algebraic working in the spaces provided.***Question 1****(2 marks)**

Given that $\mathbf{a} = \begin{pmatrix} -5 \\ 12 \end{pmatrix}$, work out $|\mathbf{a}|$.

WORKING OUT SPACE

Answer:

Question 2**(2 marks)**

A vector is given in component form as $\mathbf{p} = -10\mathbf{i} + 24\mathbf{j}$.
Calculate the magnitude $|\mathbf{p}|$.

WORKING OUT SPACE

Answer:

Question 3**(2 marks)**

Given that $\mathbf{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$, work out $|3\mathbf{a} - \mathbf{b}|$.

WORKING OUT SPACE

Answer:

Question 4**(2 marks)**

Given that $\overrightarrow{AB} = \begin{pmatrix} 11 \\ -3 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} -3 \\ -12 \end{pmatrix}$, work out $|\overrightarrow{AC}|$.

WORKING OUT SPACE

Answer:**Question 5****(2 marks)**

Given that $\mathbf{a} = \begin{pmatrix} k \\ -12 \end{pmatrix}$ where $k < 0$, and $|\mathbf{a}| = 13$, find the value of k .

WORKING OUT SPACE

Answer:**Question 6****(3 marks)**

Let $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$.

Given that $k > 0$ and $|\mathbf{a} + k\mathbf{b}| = 13$, find the value of k .

WORKING OUT SPACE

Answer:

Differentiation & Turning Points

1 Differentiating Polynomials

CORE CONCEPT & METHOD

Differentiation finds the **gradient function** $\frac{dy}{dx}$ (or $f'(x)$) of a curve at any point.

The Power Rule: If $y = ax^n$, then $\frac{dy}{dx} = anx^{n-1}$

"Multiply by the power, then subtract 1 from the power."

- **Linear terms (kx):** Differentiate to k (since $x^1 \rightarrow 1x^0 = 1$).
- **Constants (c):** Differentiate to 0 (a horizontal line $y = c$ has gradient 0).
- **Brackets or fractions:** Always **expand brackets** or **divide through** so y is written as separate powers of x before differentiating!

MODEL WORKED EXAMPLES

EXAMPLE 1.1

Given that $y = 4x^3 - 7x^2 + 9x - 12$, find $\frac{dy}{dx}$.

STEP-BY-STEP SOLUTION:

Differentiate each term separately:

$$4x^3 \rightarrow 4 \times 3x^{3-1} = 12x^2$$

$$-7x^2 \rightarrow -7 \times 2x^{2-1} = -14x$$

$$+9x \rightarrow +9 \text{ and } -12 \rightarrow 0.$$

$$12x^2 - 14x + 9$$

EXAMPLE 1.2

Find $\frac{dy}{dx}$ when $y = x(2x - 5)^2$.

STEP-BY-STEP SOLUTION:

1. Expand the brackets first:

$$y = x(4x^2 - 20x + 25) = 4x^3 - 20x^2 + 25x$$

2. Apply the power rule to each term:

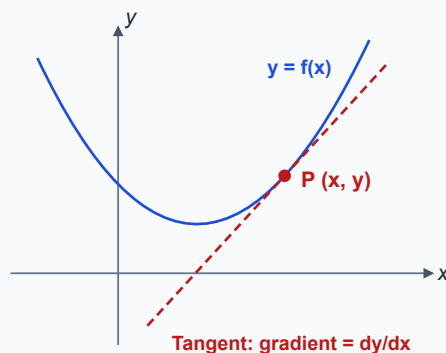
$$\frac{dy}{dx} = 12x^2 - 40x + 25$$

$$12x^2 - 40x + 25$$

2 Gradients & Equations of Tangents

CORE CONCEPT & METHOD

The derivative $\frac{dy}{dx}$ gives the **exact gradient of the tangent** to the curve at any x -coordinate.



- **Gradient at $x = a$:** Find $\frac{dy}{dx}$, then substitute $x = a$.
- **Where is the gradient equal to m ?** Solve the equation $\frac{dy}{dx} = m$ for x .
- **Equation of the tangent at (x_1, y_1) :** Find $m = \frac{dy}{dx}$ at x_1 , then substitute m and (x_1, y_1) into $y = mx + c$.

MODEL WORKED EXAMPLE

EXAMPLE 2.1

Find the equation of the tangent to the curve $y = x^2 - 3x + 5$ at the point $(4, 9)$.

STEP-BY-STEP SOLUTION:

1. Differentiate to find the gradient function:

$$\frac{dy}{dx} = 2x - 3$$

2. Substitute $x = 4$ to get the tangent gradient:

$$m = 2(4) - 3 = 5$$

3. Substitute $m = 5$ and $(4, 9)$ into $y = mx + c$:

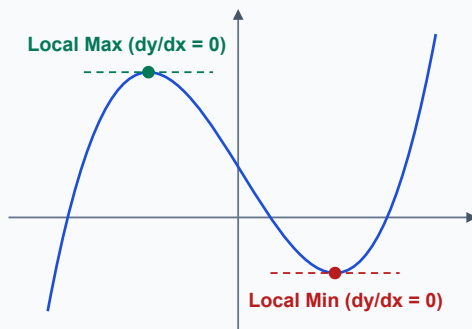
$$9 = 5(4) + c \implies c = -11$$

$$y = 5x - 11$$

3 Stationary Points & Optimisation

CORE CONCEPT & METHOD

At a **stationary point** (turning point), the tangent is completely horizontal, so $\frac{dy}{dx} = 0$.

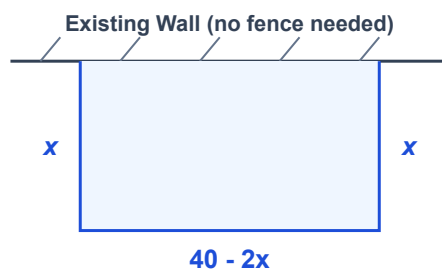


- **Step 1:** Solve $\frac{dy}{dx} = 0$ to find the x -coordinate(s).
- **Step 2:** Substitute x back into the original equation $y = f(x)$ to find y .
- **Max vs Min on a positive cubic ($+ax^3$):** The curve rises first then falls then rises ($\nearrow \searrow \nearrow$), so the **smaller** x is the local maximum and the **larger** x is the local minimum!

MODEL WORKED EXAMPLE

EXAMPLE 3.1

A farmer uses 40 m of fencing for three sides of a rectangular enclosure against a wall, giving area $A = 40x - 2x^2 \text{ m}^2$.



Find the maximum possible area.

STEP-BY-STEP SOLUTION:

1. At maximum area, $\frac{dA}{dx} = 0$:

$$\frac{dA}{dx} = 40 - 4x = 0 \implies x = 10 \text{ m}$$

2. Substitute $x = 10$ into A :

$$A_{\max} = 40(10) - 2(10)^2 = 400 - 200 = 200 \text{ m}^2$$

$$200 \text{ m}^2$$

CAMBRIDGE IGCSE (0580) EXAM PRACTICE

Total: 17 marks

Differentiation & Turning Points — Practice Questions

Answer all 6 questions. Show clear algebraic working in the spaces provided.

Question 1**(2 marks)**

Given that $y = 2x^3 + 6x^2 - 3x + 11$, find $\frac{dy}{dx}$.

WORKING OUT SPACE

Answer:

Question 2**(2 marks)**

Expand and simplify first to find $\frac{dy}{dx}$ when $y = (2x + 3)(x - 4)$.

WORKING OUT SPACE

Answer:

Question 3**(2 marks)**

Find the gradient of the curve $y = x^3 + 4x^2 - 5x + 7$ at the point where $x = -2$.

WORKING OUT SPACE

Answer:

Question 4**(3 marks)**

Find the equation of the tangent to the curve $y = x^3 - 2x^2 + x$ at the point $(2, 2)$.

Give your answer in the form $y = mx + c$.

WORKING OUT SPACE

Answer:**Question 5****(4 marks)**

A curve has equation $y = x^3 - 3x^2 - 9x + 7$.

Use differentiation to find the coordinates of its two stationary points, and state which is the local maximum.

WORKING OUT SPACE

Answer:**Question 6****(4 marks)**

A rectangular paddock against a long hedge is divided into two equal pens by an internal fence parallel to the ends of length x m (so three sides have length x m). Given that 120 m of fencing is used in total, form an expression in terms of x for the total area A , and use differentiation to find the maximum total area of the paddock (in m^2).

WORKING OUT SPACE

Answer:

APPENDIX

Answers & Mark Schemes

Final answers and mark allocations for all 42 CAMBRIDGE IGCSE (0580 / 0980) practice questions. Scan the cover QR code for interactive step-by-step worked solutions online.

Topic 1: Formal Set-Builder & Subset Notation

Q1:	9	[1m]
Q2:	3	[1m]
Q3:	13	[2m]
Q4:	{4}	[2m]
Q5:	{-1, 0, 1, 2, 3, 4}	[2m]
Q6:	23	[3m]

Topic 2: 3D Symmetry: Planes & Rotational Axes

Q1:	5	[1m]
Q2:	6	[1m]
Q3:	1	[1m]
Q4:	3	[1m]
Q5:	(a) 3, (b) 13	[2m]
Q6:	(a) 6, (b) 6	[2m]

Topic 3: Cubic & Exponential Sequences

Q1:	$n^3 - 3$	[2m]
Q2:	$n^3 - n^2 + 3$	[3m]
Q3:	2560	[2m]
Q4:	$2^n - n$	[2m]
Q5:	$n^2 + 3n + 1$	[2m]
Q6:	99	[2m]

Topic 4: Functions: Domain & Range

Q1:	-3	[2m]
Q2:	$x \leq 5$	[2m]
Q3:	$f(x) > -4$	[2m]
Q4:	$a = 2, b = 18$	[2m]
Q5:	$x \geq -7$	[3m]
Q6:	10	[2m]

Topic 5: Curve Asymptotes & Exponential Equations

Q1:	$y = -5$	[1m]
Q2:	$x = -5$	[1m]
Q3:	$y = -6$	[1m]
Q4:	(0, 7)	[2m]
Q5:	1.5	[3m]
Q6:	-7	[3m]

Topic 6: Magnitude (Modulus) of a Vector

Q1:	13	[2m]
Q2:	26	[2m]
Q3:	13	[2m]
Q4:	17	[2m]
Q5:	-5	[2m]
Q6:	2	[3m]

Topic 7: Differentiation & Turning Points

Q1:	$6x^2 + 12x - 3$	[2m]
Q2:	$4x - 5$	[2m]
Q3:	-9	[2m]
Q4:	$y = 5x - 8$	[3m]
Q5:	Max (-1, 12), Min (3, -20)	[4m]
Q6:	$A = 120x - 3x^2; 1200$	[4m]