IGCSE Mathematics 0580 Extended

Practice Paper A: ANSWERS and Worked Solutions

ANSWERS to Paper A (Calculator) | 100 marks | Numrahedu.com | Free, no login needed

How to use this PDF. Attempt every question first, under timed conditions if you can. Only then read the solution. Reading a worked answer feels like learning, but it is not the same as producing one.

Every answer here has been checked by calculation, and where a result can be verified a second way, the check is shown.

Understanding the mark scheme

Cambridge uses three kinds of mark. Knowing which is which tells you where the marks actually come from, and why working is worth writing down even when you are unsure of the answer.

Code	Name	What earns it
M1	Method mark	Awarded for a correct method, even if the arithmetic that follows is wrong. You cannot earn it if you write nothing down.
A1	Accuracy mark	Awarded for a correct answer. It usually depends on the method mark being earned first.
B1	Independent mark	Awarded for a correct answer or statement on its own, with no method required.

EXAM TIP

- Follow through applies: if you make one slip early but your later method is right, you still earn the method marks that follow.
- Give answers to 3 significant figures unless the question says otherwise, and angles to 1 decimal place. Keep full accuracy in your calculator until the final step.
- For circle theorems and trigonometry, name the rule you are using. Cambridge awards a mark for the reason.

Question 1 — 20 marks

Number

(a) **Write 0.000 34 in standard form** [1]

$0.000\ 34 = 3.4 \times 10^{-4}$

The digits move 4 places to give a number between 1 and 10, and the original is smaller than 1, so the index is negative.

Mark scheme B1 for 3.4×10^{-4}

(b) **Calculate $(3.6 \times 10^5) \times (2.5 \times 10^3)$** [2]

$= (3.6 \times 2.5) \times (10^5 \times 10^3)$

$= 9 \times 10^{5+3} = 9 \times 10^8$

Check: $360\,000 \times 2500 = 900\,000\,000 = 9 \times 10^8$.

Mark scheme M1 for multiplying the front numbers and adding the indices, A1 for 9×10^8

(c) **Evaluate $64^{\frac{2}{3}}$** [2]

$64^{\frac{2}{3}} = (\sqrt[3]{64})^2$

$\sqrt[3]{64} = 4$, because $4 \times 4 \times 4 = 64$

$= 4^2 = 16$

Check: Take the root first. Doing the power first gives $64^2 = 4096$ and $\sqrt[3]{4096} = 16$, the same answer but much harder.

Mark scheme M1 for the cube root of 64 = 4, A1 for 16

(d) **Write 2^{-3} as a fraction** [1]

$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

Mark scheme B1 for $\frac{1}{8}$

(e) **A jacket costs \$200 and rises by 35 percent** [2]

Multiplier $= 1 + \frac{35}{100} = 1.35$

New price $= 200 \times 1.35 = \$270$

Mark scheme M1 for 200×1.35 or for finding 35 percent = 70, A1 for \$270

(f) **After a 20 percent decrease a book costs \$96. Find the original price** [2]

After the decrease the price is 80 percent of the original.

$0.80 \times \text{original} = 96$

Original $= \frac{96}{0.80} = \$120$

Check: $120 \times 0.8 = 96$. Correct. Note that taking 20 percent off \$96 gives \$76.80, and adding 20 percent to \$96 gives \$115.20. Both are wrong.

Mark scheme M1 for recognising 96 as 80 percent of the original, A1 for \$120

(g) **\$1000 invested at 5 percent compound interest for 3 years** [3]

$A = P(1 + \frac{r}{100})^n$

$A = 1000 \times (1.05)^3$

$A = 1000 \times 1.157\,625$

$A = \$1157.63$ (nearest cent)

Check: Simple interest would give 1000 + 150 = \$1150, so the compound figure being slightly larger is what we expect.

Mark scheme M1 for the compound interest method, M1 for 1000×1.05^3, A1 for \$1157.63

(h) **Share $450 in the ratio 2 : 3 : 5** [3]

Total parts = 2 + 3 + 5 = 10

One part = $\frac{450}{10}$ = $45

Shares = 2 × 45 = $90, 3 × 45 = $135, 5 × 45 = $225

Check: 90 + 135 + 225 = 450. Correct.

> **Mark scheme** M1 for 10 parts, M1 for one part = $45, A1 for all three shares correct

(i) **y is directly proportional to x^2, and y = 36 when x = 3. Find y when x = 5** [3]

$y = kx^2$

$36 = k \times 3^2 = 9k$, so $k = 4$

$y = 4x^2$, so when $x = 5$, $y = 4 \times 25 = 100$

Check: x has gone up by a factor of $\frac{5}{3}$, so y should go up by $(\frac{5}{3})^2 = \frac{25}{9}$. And $36 \times \frac{25}{9} = 100$. Correct.

> **Mark scheme** M1 for $y = kx^2$, A1 for $k = 4$, A1 for $y = 100$

(j) **Find the lowest common multiple of 12 and 18** [1]

$12 = 2^2 \times 3$ and $18 = 2 \times 3^2$

Take the highest power of each prime: LCM = $2^2 \times 3^2 = 4 \times 9 = 36$

> **Mark scheme** B1 for 36

Question 2 20 marks

Algebra

(a) **Expand and simplify (3x − 2)(2x + 5)** [2]

= 3x(2x + 5) − 2(2x + 5)

= $6x^2 + 15x − 4x − 10$

= $6x^2 + 11x − 10$

Check: At x = 2 the left side is (6 − 2)(4 + 5) = 36, and the right side is 24 + 22 − 10 = 36. Correct.

> **Mark scheme** M1 for a correct four term expansion, A1 for $6x^2 + 11x − 10$

(b) **Factorise completely $2x^2 + 7x + 3$** [2]

Two numbers multiplying to 2 × 3 = 6 and adding to 7 are 1 and 6.

$2x^2 + 6x + x + 3$

= 2x(x + 3) + 1(x + 3)

= (2x + 1)(x + 3)

Check: At x = 1 the original is 12, and (2 + 1)(1 + 3) = 12. Correct.

> **Mark scheme** M1 for splitting the middle term or for one correct bracket, A1 for (2x + 1)(x + 3)

(c) **Solve $2x^2 - 5x - 3 = 0$** [3]

$a = 2, b = -5, c = -3$

$b^2 - 4ac = 25 + 24 = 49$, and $\sqrt{49} = 7$

$x = \frac{5 \pm 7}{4}$

$x = \frac{12}{4} = 3$ or $x = \frac{-2}{4} = -0.5$

Check: At $x = 3$: $18 - 15 - 3 = 0$. At $x = -0.5$: $0.5 + 2.5 - 3 = 0$. Correct.

> **Mark scheme** M1 for the quadratic formula or for factorising to $(2x + 1)(x - 3)$, A1 for one root, A1 for both roots

(d)(i) **Find the nth term of 5, 9, 13, 17** [2]

The common difference is $d = 4$ and the first term is $a = 5$.

nth term $= a + (n - 1)d = 5 + 4(n - 1) = 4n + 1$

Check: $n = 1$ gives 5 and $n = 4$ gives 17. Correct.

> **Mark scheme** M1 for identifying $d = 4$ or for the structure $4n + c$, A1 for $4n + 1$

(d)(ii) **Find the 50th term** [1]

$4 \times 50 + 1 = 201$

> **Mark scheme** B1 for 201

(e) **Solve $3x + 2y = 16$ and $x - y = 2$** [3]

From the second equation, $x = y + 2$.

Substituting: $3(y + 2) + 2y = 16$

$3y + 6 + 2y = 16$, so $5y = 10$ and $y = 2$

$x = y + 2 = 4$

Check: $3(4) + 2(2) = 16$ and $4 - 2 = 2$. Both correct.

> **Mark scheme** M1 for a correct elimination or substitution, A1 for $y = 2$, A1 for $x = 4$

(f) **Make r the subject of $A = \pi r^2$** [2]

Divide both sides by π: $\frac{A}{\pi} = r^2$

Take the square root: $r = \sqrt{\left(\frac{A}{\pi}\right)}$

Check: r is a radius, so only the positive root is meaningful here.

> **Mark scheme** M1 for dividing by π, A1 for $r = \sqrt{\left(\frac{A}{\pi}\right)}$

(g) **Solve $3x - 7 > 2$ and show it on the number line** [2]

$3x - 7 > 2$

$3x > 9$

$x > 3$

On the number line: an **open** circle at 3, because 3 itself is not included, with the arrow pointing right.

Check: $x = 4$ gives $12 - 7 = 5 > 2$, and $x = 3$ gives exactly 2, which is not greater than 2. So the circle must be open.

> **Mark scheme** M1 for $3x > 9$, A1 for $x > 3$ with a correct open circle and arrow

(h) **Simplify $\frac{x^2 - 9}{x^2 - x - 6}$** [3]

Numerator: $x^2 - 9 = (x + 3)(x - 3)$, the difference of two squares.

Denominator: $x^2 - x - 6 = (x - 3)(x + 2)$

$$\frac{(x + 3)(x - 3)}{(x - 3)(x + 2)} = \frac{x + 3}{x + 2}$$

Check: At $x = 4$ the original is $\frac{7}{6}$ and the answer is $\frac{7}{6}$. Correct.

> **Mark scheme** B1 for the numerator factorised, B1 for the denominator factorised, A1 for $\frac{x + 3}{x + 2}$

Question 3 20 marks

Geometry and Mensuration

(a) **Distance between A(2, 1) and B(8, 9)** [2]

$d = \sqrt{((8 - 2)^2 + (9 - 1)^2)}$

$= \sqrt{(36 + 64)} = \sqrt{100} = 10$

Check: The sides are 6 and 8, a 3, 4, 5 triangle doubled. Correct.

> **Mark scheme** M1 for the distance formula with correct substitution, A1 for 10

(b) **Equation of the line through (1, 3) and (5, 11)** [3]

$m = \frac{11 - 3}{5 - 1} = \frac{8}{4} = 2$

$y - 3 = 2(x - 1)$

$y = 2x + 1$

Check: At $x = 5$, $y = 11$. Correct.

> **Mark scheme** M1 for the gradient, M1 for substituting a point into $y - y_1 = m(x - x_1)$, A1 for $y = 2x + 1$

(c) **Circle of radius 6 cm, in terms of π** [2]

Area $= \pi r^2 = 36\pi$ cm^2

Circumference $= 2\pi r = 12\pi$ cm

Check: In terms of π means leave the π in. Writing 113 cm^2 would lose the mark here.

> **Mark scheme** B1 for 36π, B1 for 12π

(d) **Cylinder, radius 4 cm and height 9 cm** [4]

$V = \pi r^2 h = \pi \times 16 \times 9 = 144\pi = 452$ cm^3 (3 sf)

Total SA $= 2\pi r^2 + 2\pi rh = 32\pi + 72\pi = 104\pi = 327$ cm^2 (3 sf)

Check: $144 \times 3.1416 = 452.4$ and $104 \times 3.1416 = 326.7$. Correct. Forgetting the two ends gives 226 cm^2, a common error.

> **Mark scheme** M1 for the volume formula, A1 for 452 cm^3, M1 for the full surface area formula including both circular ends, A1 for 327 cm^2

(e) **Cone, base radius 5 cm and vertical height 12 cm** [4]

Slant height: $l = \sqrt{(r^2 + h^2)} = \sqrt{(25 + 144)} = \sqrt{169} = 13$ cm

$V = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 25 \times 12 = 100\pi = 314$ cm^3 (3 sf)

Check: 5, 12, 13 is a Pythagorean triple. Note the volume uses the vertical height 12, never the slant height 13.

> **Mark scheme** M1 for Pythagoras with r and h, A1 for l = 13 cm, M1 for the cone volume formula, A1 for 314 cm^3

(f) **Sector, radius 8 cm and angle 135°** [3]

$\frac{135}{360} = \frac{3}{8}$

Arc $= \frac{3}{8} \times 2\pi \times 8 = 6\pi = 18.8$ cm (3 sf)

Area $= \frac{3}{8} \times \pi \times 64 = 24\pi = 75.4$ cm^2 (3 sf)

Check: The whole circumference is 16π and the whole area 64π. Three eighths of each gives 6π and 24π. Correct.

> **Mark scheme** M1 for the fraction $\frac{135}{360}$, A1 for 18.8 cm, A1 for 75.4 cm^2

(g) **Angle ACB, given angle AOB = 112° and C on the major arc** [2]

O is the centre, so angle AOB is the angle at the centre standing on the minor arc AB.

C is on the major arc, so angle ACB stands on that same minor arc.

Angle at the centre = 2 × angle at the circumference

Angle ACB $= \frac{112}{2} = 56°$

Check: The reflex angle AOB is 360 − 112 = 248°. If C had been on the minor arc, the answer would be $\frac{248}{2} = 124°$ instead. Which arc C sits on matters.

> **Mark scheme** M1 for naming the theorem, that the angle at the centre is twice the angle at the circumference on the same arc, A1 for 56°

Question 4 20 marks

Trigonometry, Vectors and Probability

(a) **Right-angled triangle, opposite 8 cm and hypotenuse 17 cm. Find θ** [3]

Opposite and hypotenuse are given, so use sine (the S in SOHCAHTOA).

$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{8}{17}$

$\theta = \sin^{-1}(\frac{8}{17}) = 28.1°$ (1 dp)

Check: The adjacent side is $\sqrt{(289 - 64)} = 15$, so 8, 15, 17 is a Pythagorean triple. $\tan^{-1}(\frac{8}{15})$ also gives 28.1°.

> **Mark scheme** M1 for choosing sine, M1 for $\sin\theta = \frac{8}{17}$, A1 for 28.1°

(b) **Sine rule with a = 10 cm, A = 30° and B = 45°. Find b** [3]

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{10}{\sin 30°} = \frac{b}{\sin 45°}$$

$$b = \frac{10 \times \sin 45°}{\sin 30°} = \frac{10 \times 0.7071}{0.5}$$

b = 14.1 cm (3 sf), exactly $10\sqrt{2}$

Check: B is the larger angle, so side b must be longer than side a. 14.1 > 10. Correct.

Mark scheme M1 for the sine rule, M1 for correct substitution, A1 for 14.1 cm

(c) **Cosine rule with PQ = 7 cm, PR = 9 cm and angle QPR = 60°. Find QR** [4]

$QR^2 = PQ^2 + PR^2 - 2(PQ)(PR)\cos(QPR)$

$QR^2 = 49 + 81 - 2 \times 7 \times 9 \times \cos 60°$

$QR^2 = 130 - 126 \times 0.5 = 130 - 63 = 67$

$QR = \sqrt{67} = 8.19$ cm (3 sf)

Check: The angle is less than 90°, so QR must be shorter than the 11.4 cm a right angle would give. 8.19 < 11.4. Correct. Remember to square root at the end.

Mark scheme M1 for the cosine rule, M1 for correct substitution, A1 for $QR^2 = 67$, A1 for QR = 8.19 cm

(d) **Area of a triangle with sides 6 cm and 8 cm and an included angle of 50°** [2]

$$\text{Area} = \frac{1}{2}ab\cdot\sin C$$

$$= \frac{1}{2} \times 6 \times 8 \times \sin 50° = 24 \times 0.7660$$

$= 18.4$ cm^2 (3 sf)

Check: If the angle were 90° the area would be 24 cm^2. At 50° it must be less. Correct.

Mark scheme M1 for $\frac{1}{2}ab\cdot\sin C$ with correct substitution, A1 for 18.4 cm^2

(e)(i) **a = (3, 2) and b = (−1, 4). Find a + b** [1]

$\mathbf{a} + \mathbf{b} = (3 + (-1), 2 + 4) = (2, 6)$

Mark scheme B1 for (2, 6)

(e)(ii) **Find 2a − b** [2]

$2\mathbf{a} = (6, 4)$

$2\mathbf{a} - \mathbf{b} = (6 - (-1), 4 - 4) = (7, 0)$

Check: Subtracting a negative adds. 6 − (−1) = 7, not 5.

Mark scheme M1 for $2\mathbf{a} = (6, 4)$, A1 for (7, 0)

(e)(iii) **Find |a|** [2]

$|\mathbf{a}| = \sqrt{(3^2 + 2^2)} = \sqrt{13}$

$= 3.61$ (3 sf)

Mark scheme M1 for $\sqrt{(3^2 + 2^2)}$, A1 for 3.61

(f) **P(rain) = 0.3. Find P(rain on exactly 2 of the next 3 days)** [3]

Exactly 2 wet days and 1 dry day can happen in 3 ways: WWD, WDW, DWW.

Each of those has probability $0.3 \times 0.3 \times 0.7 = 0.063$

$P = 3 \times 0.063 = 0.189$

Check: The four outcomes 0, 1, 2, 3 wet days give 0.343, 0.441, 0.189 and 0.027, and these add to 1. Correct.

> **Mark scheme** M1 for $0.3^2 \times 0.7$, M1 for multiplying by 3 arrangements, A1 for 0.189

Question 5 20 marks

Statistics and Graphs

(a) **For 7, 4, 9, 4, 12, 6, 8 find the mean, median, mode and range** [3]

In order: 4, 4, 6, 7, 8, 9, 12

Mean $= \frac{50}{7} = 7.14$ (3 sf)

Median = the 4th of 7 values = 7

Mode = 4 (the only value appearing twice)

Range $= 12 - 4 = 8$

Check: Order the list before finding the median. Taking the middle of the unordered list would wrongly give 4.

> **Mark scheme** B1 for the mean, B1 for the median, B1 for the mode and range both correct

(b) **Estimate the mean time from the grouped table** [3]

Midpoints: 5, 15, 25, 35, 45

Σ(midpoint $\times$ frequency) $= 20 + 135 + 300 + 245 + 135 = 835$

Σfrequency $= 35$

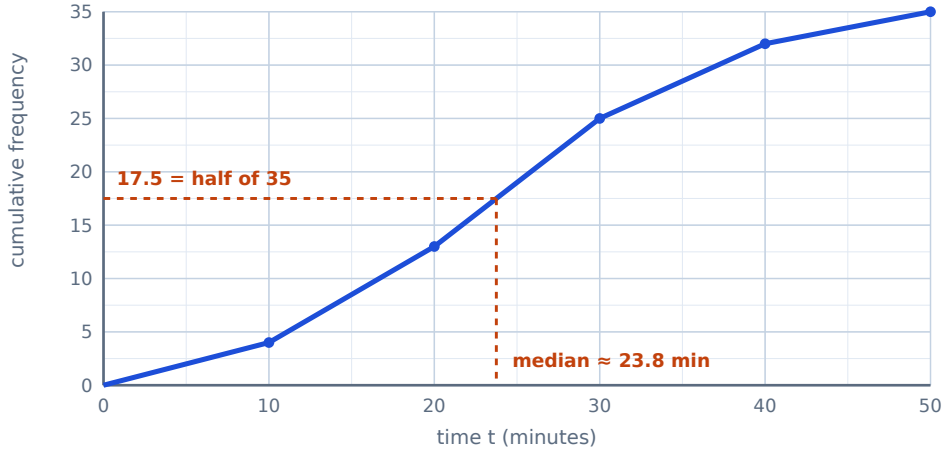
Estimated mean $= \frac{835}{35} = 23.9$ minutes (3 sf)

Check: It is an estimate because we do not know where inside each class the values sit. 23.9 falls in the 20 to 30 class, which holds the most students. Sensible.

> **Mark scheme** M1 for using midpoints, M1 for $\frac{\Sigma fx}{\Sigma f}$, A1 for 23.9

(c) **Complete the cumulative frequency table, draw the curve and estimate the median** [4]

Running totals: 4, then $4 + 9 = 13$, then 25, then 32, then 35



Mark scheme B1 for the cumulative frequency table, M1 for plotting at the upper class boundaries, M1 for a smooth curve, A1 for a median of about 23.8 minutes (accept 23 to 25)

Time t minutes	t ≤ 10	t ≤ 20	t ≤ 30	t ≤ 40	t ≤ 50
Cumulative frequency	4	13	25	32	35

COMMON MISTAKES

- Plot at the **upper** boundary of each class, never the midpoint.
- Read across from $\frac{35}{2} = 17.5$ on the cumulative frequency axis, then straight down. Marks are given for the read-off lines being shown.

(d) **Calculate the frequency density for each class** [3]

Frequency density $= \frac{\text{frequency}}{\text{class width}}$

$0 < x \leq 10$: $\frac{15}{10} = 1.5$

$10 < x \leq 20$: $\frac{25}{10} = 2.5$

$20 < x \leq 40$: $\frac{30}{20} = 1.5$

$40 < x \leq 70$: $\frac{15}{30} = 0.5$

Check: The 20 to 40 class has the largest frequency but not the tallest bar, because it is twice as wide. That is exactly why a histogram uses frequency density.

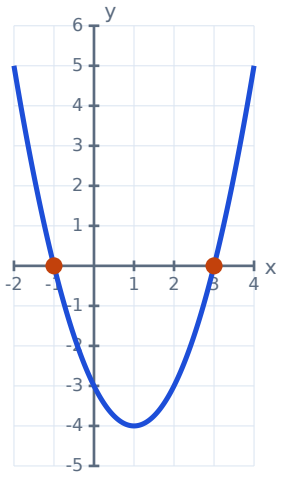
Mark scheme M1 for dividing frequency by class width, A1 for two correct, A1 for all four correct

(e) **Complete the table for $y = x^2 - 2x - 3$, draw the graph and solve $x^2 - 2x - 3 = 0$** [5]

Missing values: at $x = -1$, $y = 1 + 2 - 3 = 0$. At $x = 1$, $y = 1 - 2 - 3 = -4$. At $x = 3$, $y = 9 - 6 - 3 = 0$.

Full table: 5, 0, −3, −4, −3, 0, 5

The solutions are where the curve crosses the x axis: **$x = -1$ and $x = 3$**



The curve crosses the x axis at x = −1 and x = 3

> **Mark scheme** B1 for all three missing values, B1 for correctly plotted points, B1 for a smooth curve, B1 for x = −1, B1 for x = 3

EXAM TIP

- Join the points with a smooth curve, never with straight line segments. The bottom of a parabola is round, not pointed.
- Factorising gives (x + 1)(x − 3) = 0, confirming the same two roots. The graph and the algebra must agree.

(f) **30 students: 18 study French, 15 study German, 8 study both** [2]

French only = 18 − 8 = 10

German only = 15 − 8 = 7

At least one language = 10 + 8 + 7 = 25

Neither language = 30 − 25 = **5**

Check: 10 + 8 + 7 + 5 = 30, the whole group. Correct. Adding 18 + 15 = 33 without subtracting the overlap counts the 8 twice.

> **Mark scheme** M1 for a correct Venn diagram or for 18 + 15 − 8 = 25, A1 for 5

Examiner advice

- Write the method down even when you are unsure. Method marks are awarded for a correct approach with a wrong answer, but never for a blank space.
- Name the rule. For circle theorems, trigonometry and probability, the reason carries a mark of its own.
- Keep full accuracy on your calculator and round only at the very end. Rounding halfway through is the most common way to lose an accuracy mark.
- Check that the answer is sensible. A length longer than the hypotenuse, a probability above 1, or a negative area all mean something has gone wrong.
- Watch the units. cm, cm^2 and cm^3 are not interchangeable.