

MENTORA



O-LEVEL E-MATH

FINAL PUSH

20–30 min mixed E-Math check

Show your working. Give non-exact numerical answers to 3 significant figures unless otherwise stated.

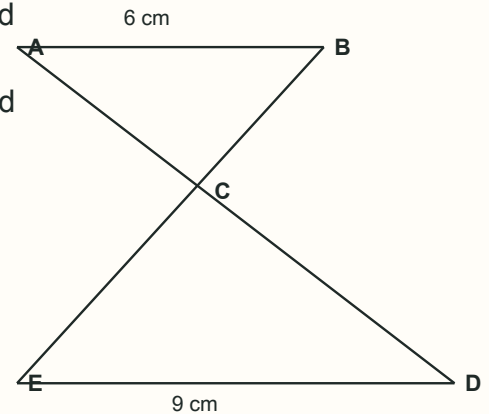
- 1 A quadratic curve has equation $y=x^2+bx+c$. Its x-intercepts are -2 and 6 . Find its minimum point.

- 2 Two fair six-sided dice are rolled. A student records the larger score (recording that score once if the dice agree). Find the probability that the recorded score is 4.

- 3 Before rounding to the nearest cent, a bill has a 9% service charge and then a 5% discount on the resulting amount. The calculated amount is \$93.195. Find the original bill b . Is the net change a 4% increase? Explain.

4

AB and DE are parallel segments with lengths 6 cm and 9 cm. Lines AD and BE cross at C, with C between A and D and between B and E. Given that $AC = 8$ cm, find CD. Give geometrical reasons for your working.



5

In triangle ABC, $AB = 12$ cm, $AC = 8$ cm and $\angle ABC = 30^\circ$. Find all possible values of $\angle ACB$. Explain why the information does not determine a unique triangle. Do not calculate any side lengths.

6

(a) A cyclist travels the first half of a route at 12 km/h and the second half at 18 km/h. Find the average speed.

(b) Rice costing \$12/kg and rice costing \$18/kg are bought in equal dollar amounts. Find the average cost per kilogram of the combined purchase.

Explain why 15 is not the answer to either part.

7

A school is arranging an outing for n pupils, where n is an integer from 100 to 140. Two packages are available.

A: Coaches seat 36 and cost \$150 each. Admission costs \$12 per pupil, reduced to \$10 for every pupil if at least 120 attend.

B: Each package costs \$590 and includes a 40-seat coach and admission for up to 40 pupils. Partly filled coaches cost the full amount.

- (a) Find the cheaper option for 117 pupils.
- (b) Find all values of n for which A is cheaper than B. Justify your answer.
- (c) With a budget of \$1900, find the greatest number of pupils who can attend and state the package.

ANSWERS & WORKED SOLUTIONS

Q1

(2, -16)

The intercepts give the factorised form directly:

$$y = (x + 2)(x - 6) = x^2 - 4x - 12 = (x - 2)^2 - 16$$

The square term is smallest when $x = 2$, giving the minimum point shown above.

IF THIS BROKE, LOOK HERE FIRST →

turning roots into a quadratic. Start with the x-intercepts → factors → turning point.

Q2

$\frac{7}{36}$

For the recorded score to be 4, both dice must be at most 4, but they cannot both be at most 3.

$$\text{Number of favourable outcomes} = 4^2 - 3^2 = 7$$

There are 7 favourable outcomes from 36 equally likely outcomes.

IF THIS BROKE, LOOK HERE FIRST →

translating the event into cases. "Largest score is 4" means both dice ≤ 4 , but not both ≤ 3 .

Q3

Original bill = \$90; net increase = 3.55%

$$0.95(1.09b) = 93.195$$

$$b = 93.195 \div (0.95 \times 1.09)$$

The overall multiplier is $1.09 \times 0.95 = 1.0355$, so it is not a 4% increase.

IF THIS BROKE, LOOK HERE FIRST →

successive percentage changes. Turn each percentage into a multiplier and apply them in order.

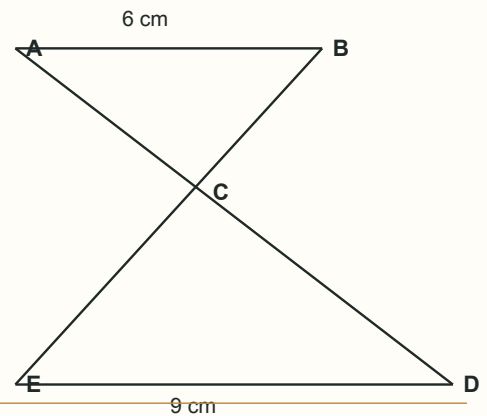
Q4

$$CD = 12 \text{ cm}$$

$\angle ACB = \angle DCE$ (vertically opposite angles) and $\angle CAB = \angle CDE$ (alternate angles). Therefore triangles ACB and DCE are similar.

$$\frac{AC}{CD} = \frac{AB}{DE} = \frac{6}{9}$$

$$\frac{8}{CD} = \frac{6}{9}$$



IF THIS BROKE, LOOK HERE FIRST →

parallel-line angles → similarity → scale factor. Establish the equal angles before using the lengths.

Q5

$$\text{Angle ACB} = 48.6^\circ \text{ or } 131^\circ$$

Using the sine rule:

$$\frac{\sin C}{12} = \frac{\sin 30^\circ}{8}, \quad \sin C = \frac{3}{4}$$

The calculator gives $C = 48.590\dots^\circ$. Since sine is also positive in the second quadrant, C may also be:

$$180^\circ - 48.590\dots^\circ = 131.409\dots^\circ$$

Both values leave a positive third angle when added to 30° , so both triangles are possible.

IF THIS BROKE, LOOK HERE FIRST →

opposite side-angle pair → sine rule → ambiguous case. Check whether a second angle is possible.

Q6

$$\text{(a) } 14.4 \text{ km/h (b) } \$14.40/\text{kg}$$

(a) Take a 36 km route. The time is

$$\frac{18}{12} + \frac{18}{18} = 2.5 \text{ h, average speed} = \frac{36}{2.5}$$

(b) Spend \$36 on each type. The mass is

$$\frac{36}{12} + \frac{36}{18} = 5 \text{ kg, average cost} = \frac{72}{5}$$

The quantities are not equally weighted, so the arithmetic mean 15 is not valid in either part.

IF THIS BROKE, LOOK HERE FIRST →

what is actually being averaged. Work out the correct weighting before choosing a formula.

Q7

(a) For 117 pupils, A needs four coaches and B needs three packages.

$$\text{Cost of A} = 4(150) + 117(12) = \$2004$$

$$\text{Cost of B} = 3(590) = \$1770$$

Package B is cheaper.

For part (b), split the range wherever a coach count or the admission price changes: after 108 pupils, at 120 pupils, and after 120 pupils.

Pupils n	Cost A (\$)	Cost B (\$)	Cheaper
100 to 108	$450 + 12n$	1770	A
109 to 119	$600 + 12n$	1770	B
120	1800	1770	B
121 to 140	$600 + 10n$	2360	A

Therefore A is cheaper for $100 \leq n \leq 108$ or $121 \leq n \leq 140$.

(c) Above 120 pupils, B costs \$2360 and exceeds the budget. Under A:

$$600 + 10n \leq 1900, \text{ so } n \leq 130$$

At $n = 130$, A costs exactly \$1900. Hence the greatest possible number is 130 pupils, using package A.

IF THIS BROKE, LOOK HERE FIRST →

where the conditions change → split into cases. Solve each interval separately.

WHAT CHANGES AS YOU GO

This set starts with familiar E-Math skills. As you move through it, less of the thinking is done for you.

1–3 · Execute

The maths should look familiar. The challenge is doing it cleanly.

4–5 · Recognise

The method is less obvious. You have to decide what idea applies before you can use it.

6 · Question the obvious answer

The calculation isn't the hardest part. Choosing the right interpretation is.

7 · Hold the whole problem together

Several conditions change at once. You have to organise the information before calculating.

WHEN YOU MARK THIS

Don't just count how many you got wrong.

Look at where you got stuck.

Did you not know the maths?

Did you know it, but not recognise when to use it?

Did the working fall apart halfway through?

Or did you misread what the question was asking?

That's the kind of difference Mentora is built to look for.

WHAT TO DO WITH A MISS

One question doesn't diagnose an entire topic. But it can tell you where to look first.

If several misses point to the same kind of breakdown, that's probably more useful than the raw score.

Repeated misses on 1–3?

Use the “look here first” line under each solution — the underlying skill may be different each time.

Mostly 4–5?

Practise recognising the method without being told the topic.

6 caught you?

Slow down before choosing the obvious calculation.

7 fell apart?

Practise organising multi-step information before calculating.

About this set

Original Mentora practice built around Singapore O-Level E-Math syllabus skills and exam-style problem solving. Worked solutions use E-Math methods throughout.

Keep going



Not sure where to focus? → **E-Math diagnostic**

More mixed practice → **Final Push**

Revision drops → **Join our Telegram community**