Name	.....
Class	.....

GCSE Mathematics – Higher Tier

Spot the Mistake

Geometry and Measures

Calculator allowed

Suggested time: 45 minutes

Equipment needed: a pen, a pencil, a rubber, a ruler and a scientific calculator.

How this paper works

- Each question shows a student's worked solution, set out in numbered lines.
- Every solution contains **exactly one** mistake.
- For each question: (a) find the line with the mistake, (b) explain what went wrong, and (c) write a correct solution.

Before you start

- Fill in your name and class at the top of this page.
- Write in black pen. Attempt every question.
- Set out your method clearly in part (c). Marks are given for correct working.
- Diagrams are sketches and are not drawn to scale.

About this paper

- There are 10 questions, worth 40 marks altogether.
- The number in brackets, for example (2), tells you how many marks a part is worth.

Solutions are provided separately.

1) A right-angled triangle has a hypotenuse of 13 cm and another side of 5 cm.
Work out the length of the third side, x.

Aisha's working

Line 1	$x^2 = 13^2 + 5^2$
Line 2	$x^2 = 169 + 25 = 194$
Line 3	$x = \sqrt{194} = 13.9$ cm

(a) Write down the line where Aisha makes the mistake.

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(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 1: 4 marks]

2) In a right-angled triangle, the side opposite angle θ is 7 cm and the hypotenuse is 12 cm. Work out the size of angle θ. Give your answer to 1 decimal place.

Billy's working

Line 1	Opposite = 7, hypotenuse = 12
Line 2	$\tan\theta = \frac{7}{12}$
Line 3	$\theta = \tan^{-1}\left(\frac{7}{12}\right) = 30.3°$

(a) Write down the line where Billy makes the mistake.

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

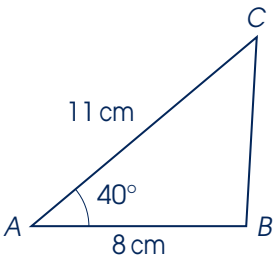
(c) Write out a correct solution.

.....

(2)

[Question 2: 4 marks]

3) In triangle ABC, $AB = 8$ cm, $AC = 11$ cm and angle $BAC = 40°$.
Work out the length of BC. Give your answer to 3 significant figures.



Cara's working

Line 1	$a^2 = b^2 + c^2 - 2bc \cos A$
Line 2	$a^2 = 11^2 + 8^2 - 2 \times 11 \times 8 \times \cos 40°$
Line 3	$a^2 = (185 - 176) \cos 40° = 9 \cos 40° = 6.894$
Line 4	$a = 2.63$ cm

(a) Write down the line where Cara makes the mistake.

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 3: 4 marks]

4) A triangle has sides of 9 cm and 14 cm with an included angle of 110°.
Work out the area of the triangle. Give your answer to 3 significant figures.

Dev's working

Line 1	Area $= \frac{1}{2} \times 9 \times 14 \times \cos 110°$
Line 2	$= 63 \times -0.342 = -21.5$
Line 3	Area cannot be negative, so area $= 21.5\ cm^2$

(a) Write down the line where Dev makes the mistake.

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(1)

(b) Explain the mistake.

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.....

(1)

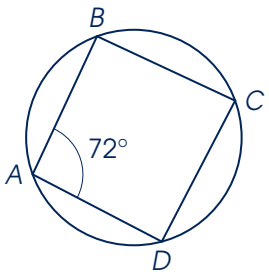
(c) Write out a correct solution.

.....

(2)

[Question 4: 4 marks]

5) *A*, *B*, *C* and *D* are points on a circle. Angle *DAB* = 72°.
Find angle *BCD*. Give a reason for your answer.



Emily's working

Line 1	Angle BCD is opposite angle DAB
Line 2	Opposite angles in a cyclic quadrilateral are equal
Line 3	Angle BCD = 72°

(a) Write down the line where Emily makes the mistake.

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(1)

(b) Explain the mistake.

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(1)

(c) Write out a correct solution.

.....

(2)

[Question 5: 4 marks]

6) A sector of a circle has radius 9 cm and angle 80°.
Work out the perimeter of the sector. Give your answer to 1 decimal place.

Felix's working

Line 1 Arc length = $\frac{80}{360} \times 2 \times \pi \times 9$

Line 2 $= 4\pi = 12.57$ cm

Line 3 Perimeter = 12.57 + 9 = 21.6 cm

(a) Write down the line where Felix makes the mistake.

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(1)

(b) Explain the mistake.

.....

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(1)

(c) Write out a correct solution.

.....

(2)

[Question 6: 4 marks]

7) A sphere has a diameter of 12 cm.

Work out the volume of the sphere. Give your answer to 1 decimal place. (volume = $\frac{4}{3}\pi r^3$)

Gemma's working

Line 1 $V = \frac{4}{3} \times \pi \times 12^3$

Line 2 $= \frac{4}{3} \times \pi \times 1728$

Line 3 $= 2304\pi = 7238.2\ cm^3$

(a) Write down the line where Gemma makes the mistake.

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

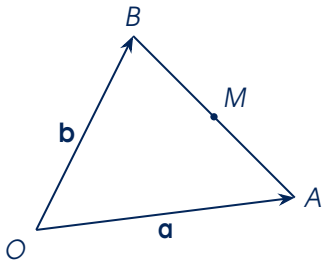
(c) Write out a correct solution.

.....

(2)

[Question 7: 4 marks]

8) $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. M is the midpoint of AB.
Find $\overrightarrow{OM}$ in terms of **a** and **b**. Simplify your answer.



Henry's working

Line 1 $\overrightarrow{AB} = \underline{a} - \underline{b}$

Line 2 $\overrightarrow{AM} = \frac{1}{2}(\underline{a} - \underline{b})$

Line 3 $\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM} = \underline{a} + \frac{1}{2}(\underline{a} - \underline{b})$

Line 4 $= \frac{3}{2}\underline{a} - \frac{1}{2}\underline{b}$

(a) Write down the line where Henry makes the mistake.

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(1)

(b) Explain the mistake.

.....

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(1)

(c) Write out a correct solution.

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(2)

[Question 8: 4 marks]

9) Each interior angle of a regular polygon is 156°.
How many sides does the polygon have?

Ivy's working

Line 1	*Number of sides = 360 ÷ 156*
Line 2	*= 2.31*
Line 3	*This is not a whole number, so the polygon cannot exist*

(a) Write down the line where Ivy makes the mistake.

.....

(1)

(b) Explain the mistake.

.....

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(1)

(c) Write out a correct solution.

.....

(2)

[Question 9: 4 marks]

10) A cuboid measures 3 cm by 4 cm by 12 cm.
Work out the length of the longest diagonal inside the cuboid.

Josh's working

Line 1	Diagonal of the 3 cm by 4 cm base = $\sqrt{3^2 + 4^2}$
Line 2	= $\sqrt{25}$ = 5 cm
Line 3	Longest diagonal = 5 + 12 = 17 cm

(a) Write down the line where Josh makes the mistake.

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(1)

(b) Explain the mistake.

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(1)

(c) Write out a correct solution.

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(2)

[Question 10: 4 marks]

End of paper – 40 marks in total