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

GCSE Mathematics – Higher Tier

Spot the Mistake

Algebra

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) Expand and simplify $(x + 4)(x - 3)(2x - 1)$

Kai's working

Line 1	$(x + 4)(x - 3) = x^2 + x - 12$
Line 2	$(x^2 + x - 12)(2x - 1) = 2x^3 - x^2 + 2x^2 - x - 24x - 12$
Line 3	$= 2x^3 + x^2 - 25x - 12$

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 1: 4 marks]

2) Factorise fully $6x^2 + x - 12$

Leah's working

Line 1	$a \times c = 6 \times -12 = -72$
Line 2	Two numbers that multiply to -72: 8 and -9
Line 3	$6x^2 + 8x - 9x - 12$
Line 4	$= 2x(3x + 4) - 3(3x + 4)$
Line 5	$= (2x - 3)(3x + 4)$

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 2: 4 marks]

3) Solve $-3x + 7 > 19$

Mason's working

Line 1	$-3x > 19 - 7$
Line 2	$-3x > 12$
Line 3	$x > -4$

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 3: 4 marks]

4) Make x the subject of $y = \dfrac{3x + 2}{x - 4}$

Nadia's working

Line 1 $y(x - 4) = 3x + 2$

Line 2 $xy - 4y = 3x + 2$

Line 3 $xy - 3x = 2 - 4y$

Line 4 $x(y - 3) = 2 - 4y$

Line 5 $x = \dfrac{2 - 4y}{y - 3}$

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 4: 4 marks]

5) Solve the simultaneous equations

$2x + 3y = 13$
$2x - y = 1$

Oscar's working

Line 1	Subtract the second equation from the first
Line 2	$3y - y = 12$, so $2y = 12$
Line 3	$y = 6$
Line 4	$2x - 6 = 1$, so $x = 3.5$

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 5: 4 marks]

6) Solve $2x^2 - 5x - 4 = 0$. Give your answers to 2 decimal places.

Priya's working

Line 1	$a = 2,\ b = -5,\ c = -4$
Line 2	$x = \frac{5 \pm \sqrt{25 - 32}}{4}$
Line 3	$\sqrt{-7}$ cannot be worked out
Line 4	So the equation has no solutions

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 6: 4 marks]

7) Write $x^2 - 8x + 3$ in the form $(x + a)^2 + b$.
Hence write down the coordinates of the turning point of $y = x^2 - 8x + 3$

Quinn's working

Line 1	$x^2 - 8x + 3 = (x - 4)^2 - 16 + 3$
Line 2	$= (x - 4)^2 - 13$
Line 3	Turning point $= (-4, -13)$

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

.....

(1)

(b) Explain the mistake.

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(1)

(c) Write out a correct solution.

.....

(2)

[Question 7: 4 marks]

8) $f(x) = 3x - 2$ and $g(x) = x^2 + 1$

Work out fg(2)

Ruby's working

Line 1	fg(2): work out f first
Line 2	$f(2) = 3 \times 2 - 2 = 4$
Line 3	$g(4) = 4^2 + 1 = 17$

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 8: 4 marks]

9) Find an expression for the nth term of the sequence 4, 9, 18, 31, 48, ...

Sam's working

Line 1	First differences: 5, 9, 13, 17
Line 2	Second difference: 4
Line 3	So the nth term starts with $4n^2$
Line 4	$4n^2$: 4, 16, 36, 64, 100
Line 5	Sequence - $4n^2$: 0, -7, -18, -33, -52
Line 6	This is not linear, so the sequence has no nth term

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

.....

(1)

(b) Explain the mistake.

.....

.....

(1)

(c) Write out a correct solution.

.....

(2)

[Question 9: 4 marks]

10) Find the equation of the tangent to the circle $x^2 + y^2 = 25$ at the point $(3, 4)$.

Tara's working

Line 1	Gradient of radius from $(0, 0)$ to $(3, 4)$ = $\frac{4}{3}$
Line 2	The tangent is perpendicular to the radius, so its gradient is $-\frac{4}{3}$
Line 3	$y - 4 = -\frac{4}{3}(x - 3)$
Line 4	$y = -\frac{4}{3}x + 8$

(a) Write down the line where Tara 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 10: 4 marks]

End of paper – 40 marks in total