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GCSE MATHS

Algebra

Edexcel 1MA1 | Subtopic collection Topic 18

Solving quadratic equations

Higher tier

Past paper question booklet

59	2003-2023	Higher
question groups	available papers	tier

Before you begin

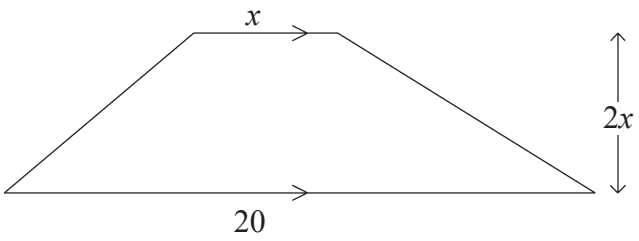
1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

13.

Diagram **NOT** accurately drawn



Leave blank

The diagram shows a trapezium.
The measurements on the diagram are in centimetres.
The lengths of the parallel sides are x cm and 20 cm.
The height of the trapezium is $2x$ cm.

The area of the trapezium is 400 cm^2.

(a) Show that

$$x^2 + 20x = 400$$

(2)

(b) Find the value of x.
Give your answer correct to 3 decimal places.

.....

(3)

9.

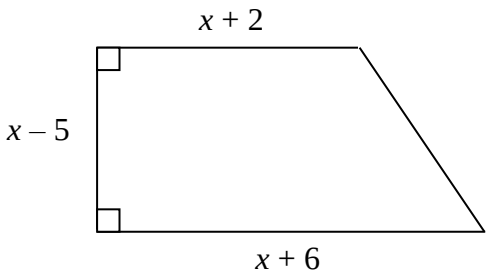


Diagram **NOT** accurately drawn

The diagram shows a trapezium.
The lengths of three of the sides of the trapezium are $x – 5$, $x + 2$ and $x + 6$.
All measurements are given in centimetres.

The area of the trapezium is 36 cm^2.

(a) Show that $x^2 – x – 56 = 0$

(4)

(b) (i) Solve the equation $x^2 – x – 56 = 0$

.....

(ii) Hence find the length of the shortest side of the trapezium.

..... cm
(4)

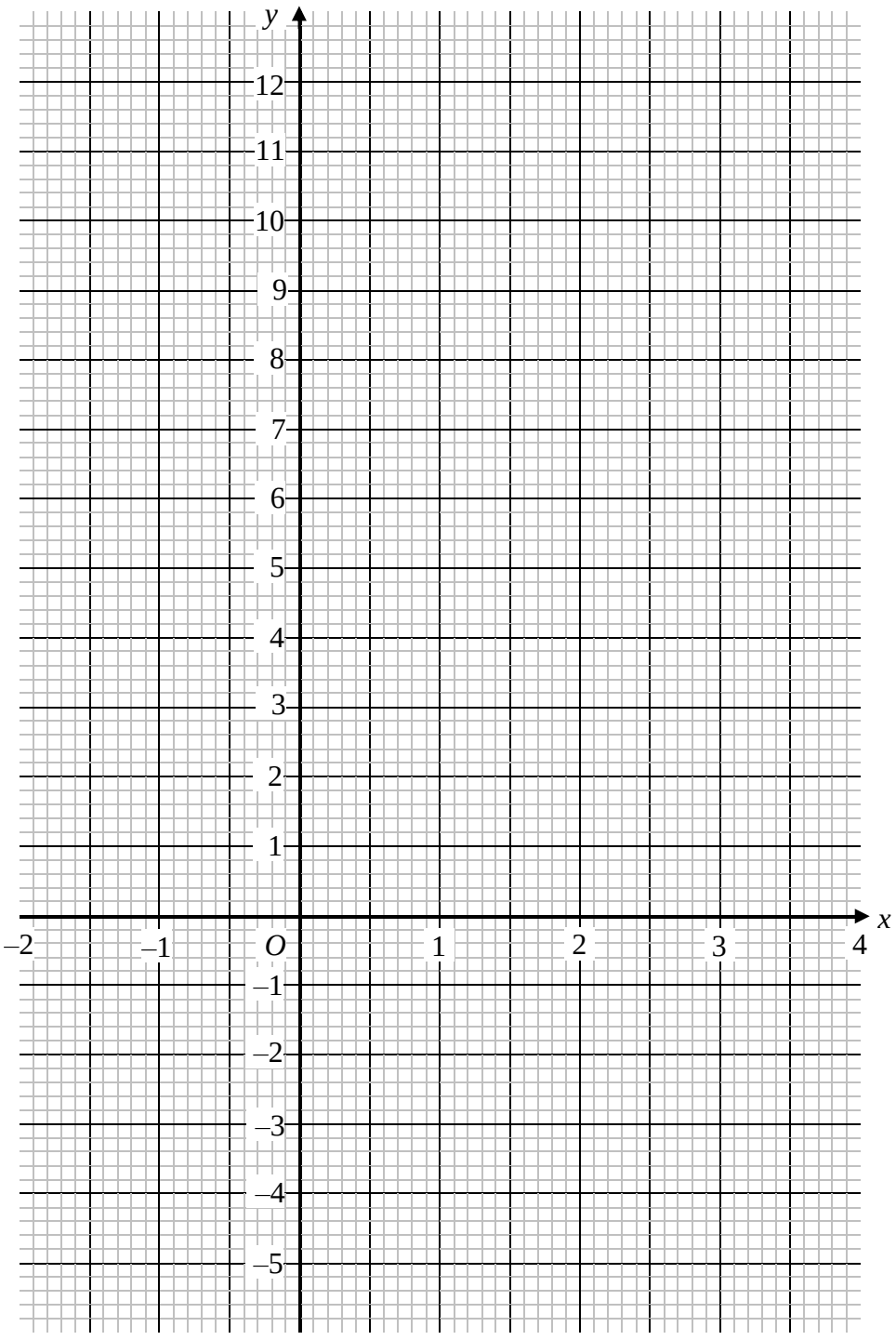
7. (a) Complete the table for $y = x^2 - 3x + 1$

x	–2	–1	0	1	2	3	4
y	11		1	–1		1	5

(2)

(b) On the grid, draw the graph of $y = x^2 - 3x + 1$

(2)



(c) Use your graph to find an estimate for the minimum value of y.

$y =$ .....

(1)

(d) Use a graphical method to find estimates of the solutions to the equation

$$x^2 - 3x + 1 = 2x - 4$$

$x =$ ..... or $x =$ .....

(3)

15. Two numbers have a difference of 15 and a product of 199.75

The larger of the two numbers is x.

(a) Show that

$$x^2 - 15x - 199.75 = 0$$

(3)

(b) Solve the equation

$$x^2 - 15x - 199.75 = 0$$

.....

(3)

19. (a) (i) Factorise $2x^2 - 35x + 98$

.....

(ii) Solve the equation $2x^2 - 35x + 98 = 0$

.....

(3)

A bag contains $(n + 7)$ tennis balls.
n of the balls are yellow.
The other 7 balls are white.

John will take at random a ball from the bag.
He will look at its colour and then put it back in the bag.

(b) (i) Write down an expression, in terms of n, for the probability that John will take a white ball.

.....

Bill states that the probability that John will take a white ball is $\frac{2}{5}$

(ii) Prove that Bill's statement cannot be correct.

(3)

Blank

After John has put the ball back into the bag, Mary will then take at random a ball from the bag.
She will note its colour.

(c) Given that the probability that John and Mary will take balls with **different** colours is $\frac{4}{9}$,
prove that $2n^2 - 35n + 98 = 0$

(5)

(d) Using your answer to part (a) (ii) or otherwise, calculate the probability that John and Mary will both take white balls.

.....

(2)

Page Total

15. The diagram below shows a 6-sided shape.
All the corners are right angles.
All measurements are given in centimetres.

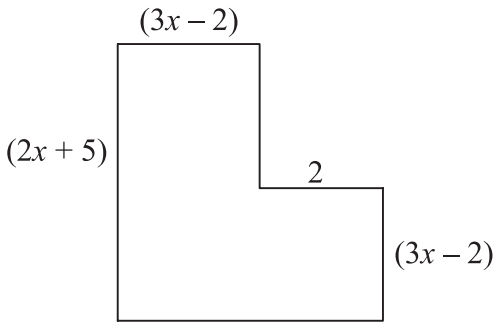


Diagram **NOT** accurately drawn

The area of the shape is 25 cm^2.

(a) Show that $6x^2 + 17x - 39 = 0$

(3)

(b) (i) Solve the equation

$6x^2 + 17x - 39 = 0$

$x =$ ..... or $x =$ .....

(ii) Hence work out the length of the longest side of the shape.

..... cm

(4)

(Total 7 marks)

Q15

25.

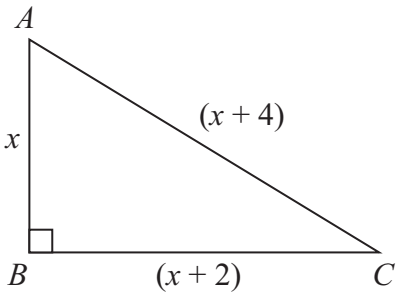


Diagram **NOT** accurately drawn

ABC is a right-angled triangle.
All the measurements are in centimetres.

$AB = x$
$BC = (x + 2)$
$AC = (x + 4)$

(a) Show that $x^2 - 4x - 12 = 0$

(3)

(b) (i) Solve $x^2 - 4x - 12 = 0$

.....

(ii) Hence, write down the length of *AC*.

$AC =$ ..... cm

(4)

(Total 7 marks)

Q25

19. (a) Factorise $x^2 - 7x + 10$

.....

(2)

(b) Solve $x^2 - 7x + 10 = 0$

$x =$ .....

or $x =$ .....

(1)

(Total 3 marks)

Blank

Q19

Blank

23. (a) Expand and simplify $(x - 3)(x + 5)$

.....

(2)

(b) Solve $x^2 + 8x - 9 = 0$

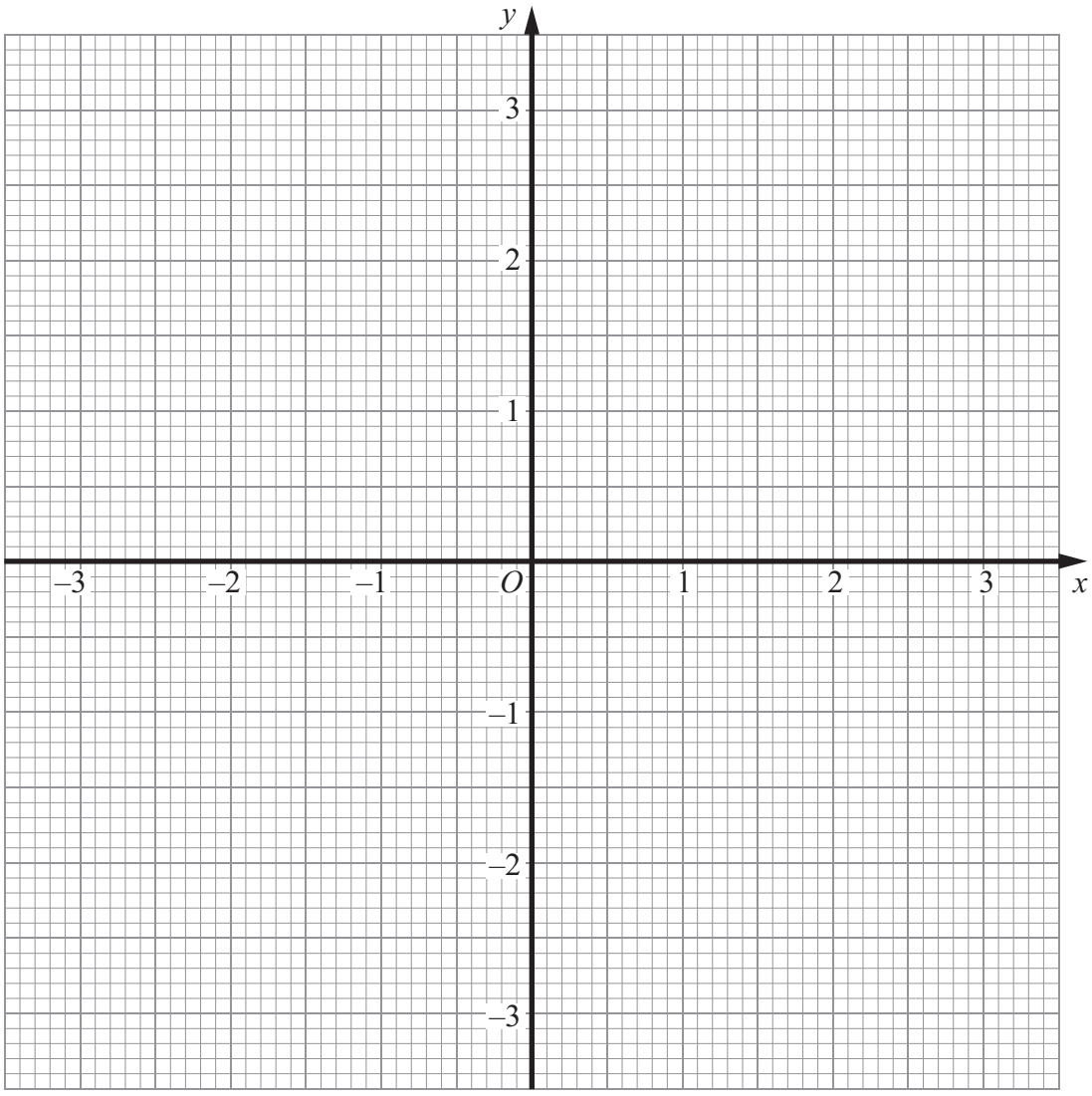
.....

(3) **Q23**

(Total 5 marks)

Blank

28. (a) Construct the graph of $x^2 + y^2 = 9$



(2)

(b) By drawing the line $x + y = 1$ on the grid, solve the equations $x^2 + y^2 = 9$, $x + y = 1$

$x =$ ..... , $y =$ .....

or $x =$ ..... , $y =$ .....

(3)

Q28

(Total 5 marks)

27. Solve the equation $\frac{x}{2} - \frac{2}{x+1} = 1$

blank

.....

Q27

(Total 4 marks)

blank

18. (a) Simplify $(c^2 k^5)^4$

.....

(1)

(b) Expand and simplify $(3x + 5)(4x - 1)$

.....

(2)

(c) Solve $x^2 - 3x - 10 = 0$

$x =$ .....

(3)

Q18

(Total 6 marks)

20. (a) Factorise $2x^2 - 9x + 4$

.....

(2)

Hence, or otherwise,

(b) solve $2x^2 - 9x + 4 = (2x - 1)^2$

.....

(4) **Q20**

(Total 6 marks)

19. Find the exact solutions of $x + \frac{3}{x} = 7$

.....

Q19

(Total 3 marks)

14 (a) Expand and simplify $(p + 9)(p - 4)$

.....

(2)

(b) Solve $\frac{5w - 8}{3} = 4w + 2$

$w =$ .....

(3)

(c) Factorise $x^2 - 49$

.....

(1)

(d) Simplify $(9x^8y^3)^{\frac{1}{2}}$

.....

(2)

(Total for Question 14 is 8 marks)

Question 16

22 Solve $3x^2 - 4x - 2 = 0$
Give your solutions correct to 3 significant figures.

.....

(Total for Question 22 is 3 marks)

22 (a) Solve $2x^2 + 9x - 7 = 0$

Give your solutions correct to 3 significant figures.

.....

(3)

(b) Solve $\frac{2}{y^2} + \frac{9}{y} - 7 = 0$

Give your solutions correct to 3 significant figures.

.....

(2)

(Total for Question 22 is 5 marks)

20 (a) (i) Factorise $x^2 - 12x + 27$

.....

(ii) Solve the equation $x^2 - 12x + 27 = 0$

.....

(3)

(b) Factorise $y^2 - 100$

.....

(1)

(Total for Question 20 is 4 marks)

25 Here are two triangles $\mathbf{T_1}$ and $\mathbf{T_2}$.

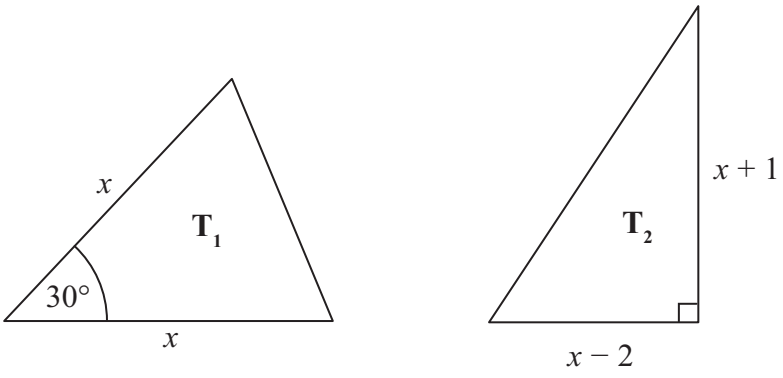


Diagram **NOT** accurately drawn

The lengths of the sides are in centimetres.

The area of triangle $\mathbf{T_1}$ is equal to the area of triangle $\mathbf{T_2}$.

Work out the value of x, giving your answer in the form $a + \sqrt{b}$ where a and b are integers.

.....

(Total for Question 25 is 5 marks)

Question 20

20 Solve $2x^2 + 5x - 3 = 0$

.....

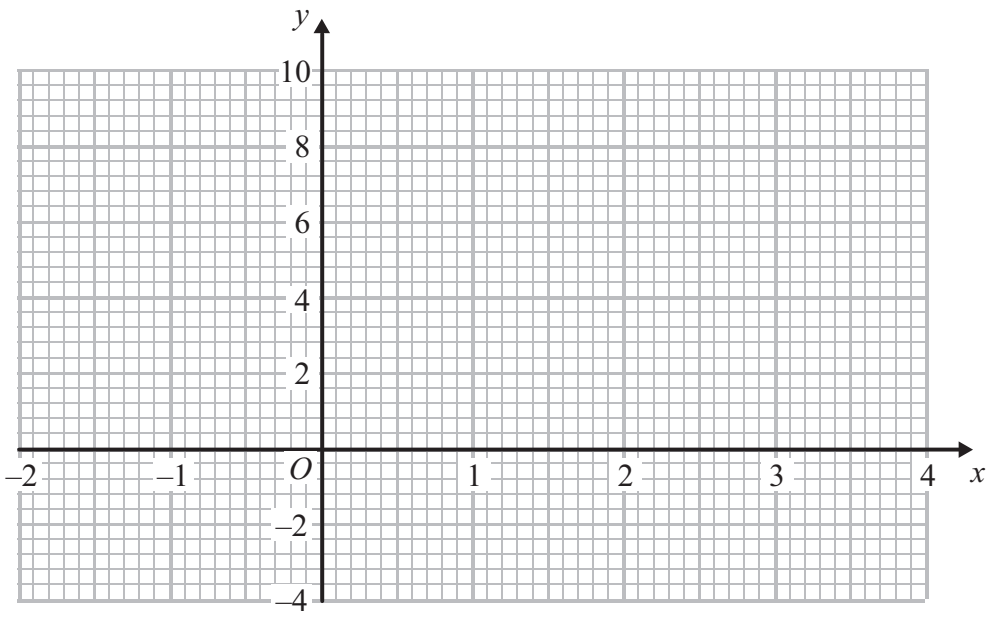
(Total for Question 20 is 3 marks)

15 (a) Complete the table of values for $y = x^2 - 2x$

x	–2	–1	0	1	2	3	4
y		3	0			3	

(2)

(b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from –2 to 4



(2)

(c) Solve $x^2 - 2x - 2 = 1$

.....

(2)

(Total for Question 15 is 6 marks)

18 Solve $5x^2 + 6x - 2 = 0$
Give your solutions correct to 2 decimal places.

.....

(Total for Question 18 is 3 marks)

22 The diagram shows a trapezium.

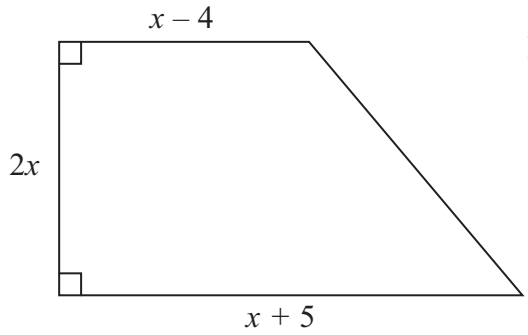


Diagram **NOT** accurately drawn

All the measurements are in centimetres.

The area of the trapezium is 351 cm^2.

(a) Show that $2x^2 + x - 351 = 0$

(2)

(b) Work out the value of x.

.....

(3)

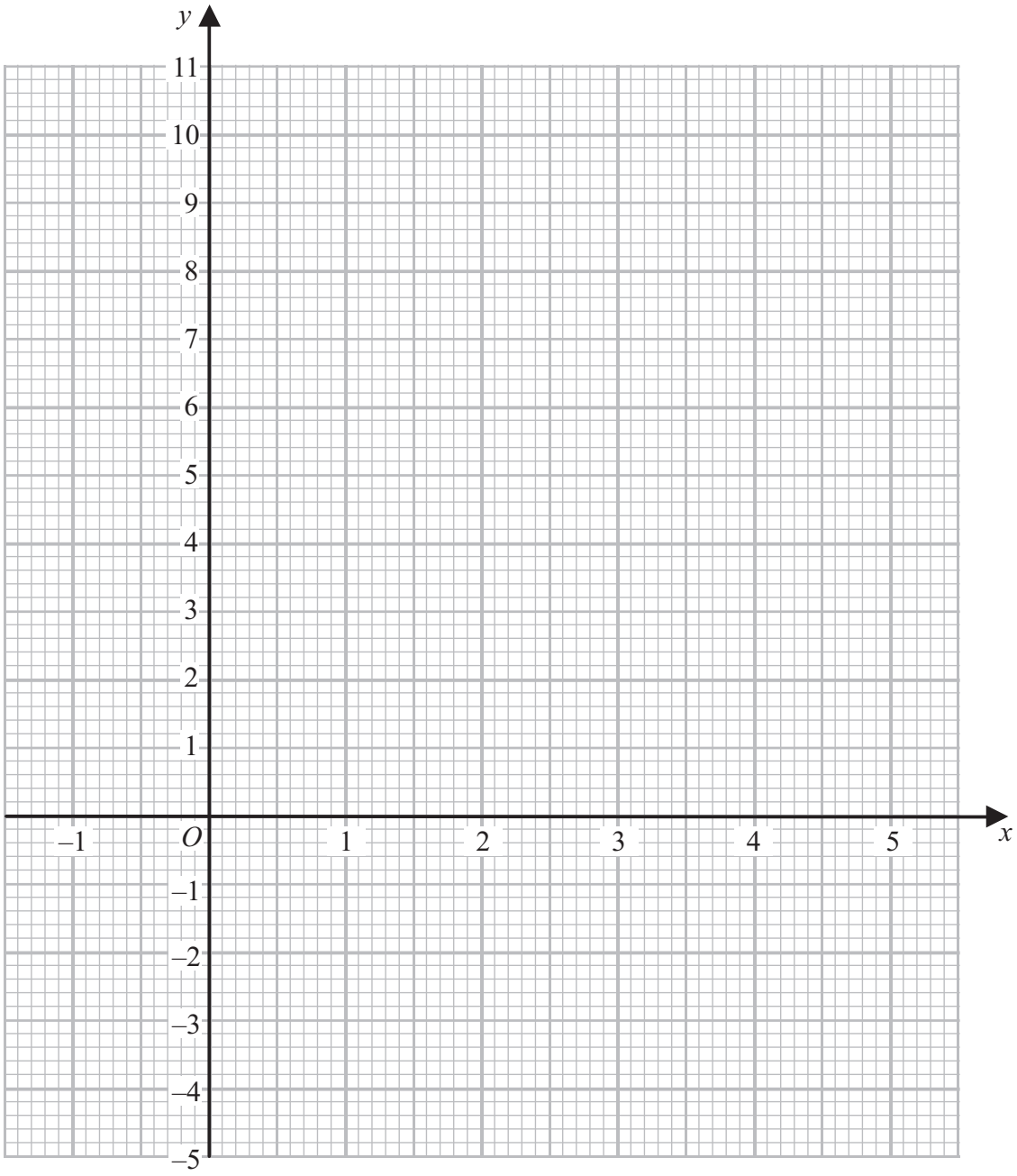
(Total for Question 22 is 5 marks)

9 (a) Complete the table of values for $y = x^2 - 5x + 3$

x	–1	0	1	2	3	4	5
y		3	–1		–3		3

(2)

(b) On the grid below, draw the graph of $y = x^2 - 5x + 3$ for values of x from $x = -1$ to $x = 5$



(2)

(c) Find estimates of the solutions of the equation $x^2 - 5x + 3 = 0$

$x =$ .....

or $x =$ .....

(2)

(Total for Question 9 is 6 marks)

20 Solve, by factorising, the equation $8x^2 - 30x - 27 = 0$

.....

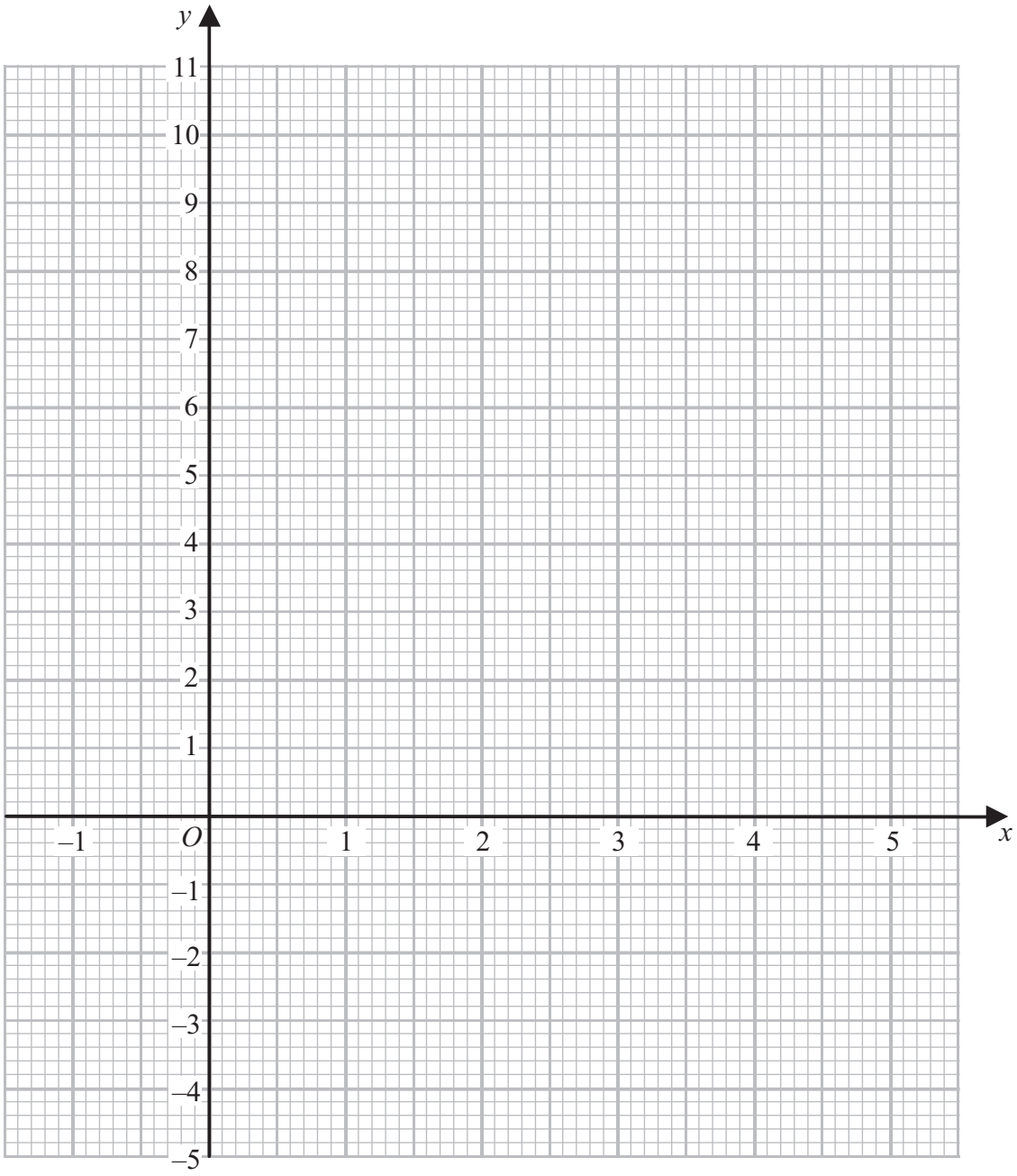
(Total for Question 20 is 3 marks)

9 (a) Complete the table of values for $y = x^2 - 5x + 3$

x	–1	0	1	2	3	4	5
y		3	–1		–3		3

(2)

(b) On the grid below, draw the graph of $y = x^2 - 5x + 3$ for values of x from $x = -1$ to $x = 5$



(2)

(c) Find estimates of the solutions of the equation $x^2 - 5x + 3 = 0$

$x =$ .....

or $x =$ .....

(2)

(Total for Question 9 is 6 marks)

20 Solve, by factorising, the equation $8x^2 - 30x - 27 = 0$

.....

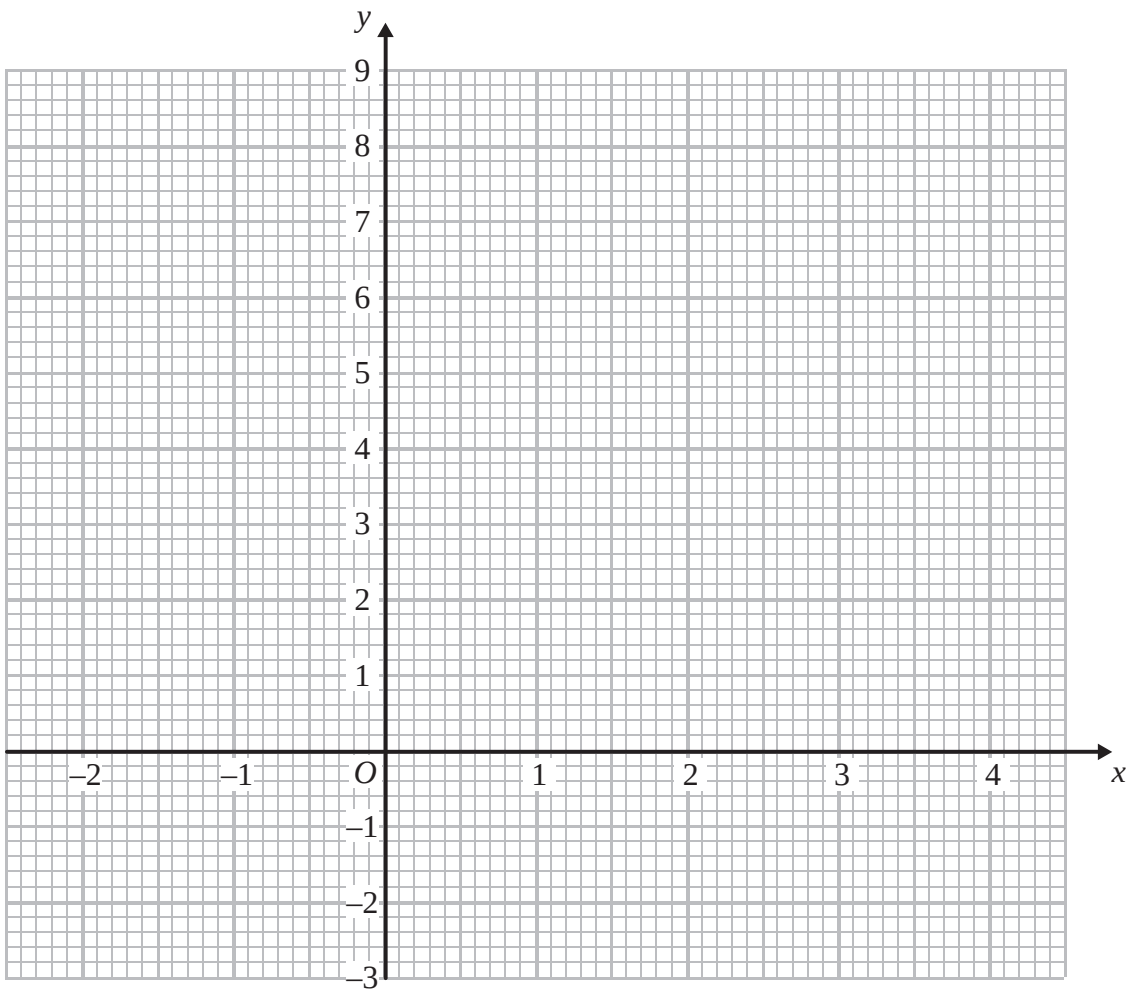
(Total for Question 20 is 3 marks)

15 (a) Complete the table of values for $y = x^2 - 2x - 1$

x	–2	–1	0	1	2	3	4
y	7			–2	–1		

(2)

(b) On the grid, draw the graph of $y = x^2 - 2x - 1$ for values of x from –2 to 4



(2)

(c) Solve $x^2 - 2x - 1 = x + 3$

.....

(2)

(Total for Question 15 is 6 marks)

26 Solve the equations

$$x^2 + y^2 = 36$$
$$x = 2y + 6$$

.....

(Total for Question 26 is 5 marks)

12 (a) Factorise $3e^2 + 5e$

.....

(1)

(b) Solve $7(k - 3) = 3k - 5$

$k =$ .....

(3)

(c) Expand and simplify $(2x + 3)(x - 8)$

.....

(2)

(d) Solve $\frac{7 - 3f}{4} = 2$

$f =$ .....

(3)

(Total for Question 12 is 9 marks)

20 Solve $3x^2 - 5x - 1 = 0$
Give your solutions correct to 3 significant figures.

.....

(Total for Question 20 is 3 marks)

14 (a) Solve $3x^2 = 147$

$x =$ .....

(2)

(b) Solve $\frac{y-1}{2} + \frac{y+1}{3} = 15$

$y =$ .....

(3)

(Total for Question 14 is 5 marks)

18 Solve $2x^2 + 4x - 5 = 0$
Give your solutions correct to 2 decimal places.

.....

(Total for Question 18 is 3 marks)

19 There are n sweets in a bag.
6 of the sweets are orange.
The rest of the sweets are yellow.

Hannah takes at random a sweet from the bag.
She eats the sweet.

Hannah then takes at random another sweet from the bag.
She eats the sweet.

The probability that Hannah eats two orange sweets is $\frac{1}{3}$

(a) Show that $n^2 - n - 90 = 0$

(3)

(b) Solve $n^2 - n - 90 = 0$ to find the value of n.

.....

(3)

(Total for Question 19 is 6 marks)

25 Solve the equation $3x^2 + 4x - 12 = 0$
Give your solutions correct to 2 decimal places.

.....

(Total for Question 25 is 3 marks)

11 (a) Solve $3x^2 = 147$

.....

(2)

(b) Work out the value of 2^{-3}

.....

(1)

(c) Simplify $(3x^2)^3$

.....

(2)

$w = 4p - 16$

(d) Make p the subject of this formula.

.....

(2)

(Total for Question 11 is 7 marks)

22 Alison is using the quadratic formula to solve a quadratic equation.
She substitutes values into the formula and correctly gets

$$x = \frac{-7 \pm \sqrt{49 - 32}}{4}$$

Work out the quadratic equation that Alison is solving.
Give your answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers.

.....

(Total for Question 22 is 3 marks)

18 Solve $6x^2 - x - 15 = 0$

.....

(Total for Question 18 is 3 marks)

22 Solve $x^2 = 4(x - 3)^2$

.....

(Total for Question 22 is 3 marks)

20 Solve $3x^2 + 6x - 2 = 0$
Give your solutions correct to 2 decimal places.

.....

(Total for Question 20 is 3 marks)

19 (a) Expand and simplify $(y + 2)(y + 5)$

.....

(2)

(b) Factorise $e^2 + e - 12$

.....

(2)

(c) Solve $3x^2 - x - 1 = 0$
Give your solutions correct to 2 decimal places.

.....

(3)

(Total for Question 19 is 7 marks)

19 (a) Solve $x^2 + 2x - 35 = 0$

.....

(3)

(b) Solve $\frac{2}{x+1} + \frac{x}{2x+3} = 1$

Give your solutions as surds.

.....

(4)

(Total for Question 19 is 7 marks)

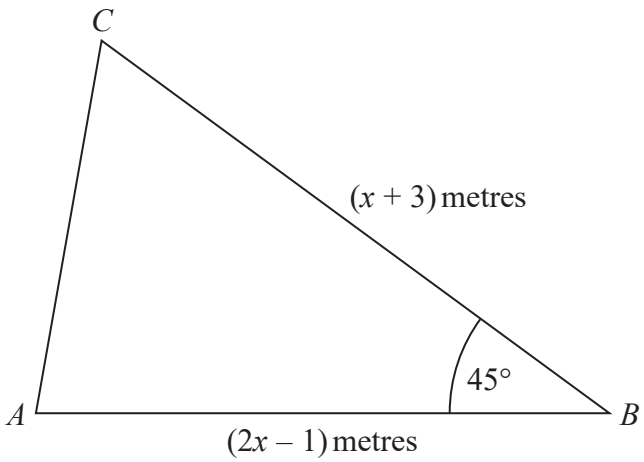
Question 43

21 Solve $2x^2 + 3x - 7 = 0$
Give your solutions correct to 2 decimal places.

.....

(Total for Question 21 is 3 marks)

15



The area of triangle ABC is $6\sqrt{2}$ m^2.

Calculate the value of x.
Give your answer correct to 3 significant figures.

.....

(Total for Question 15 is 5 marks)

Question 45

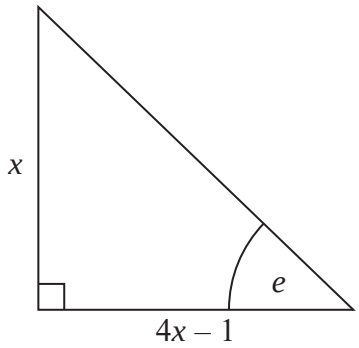
June 2017 | 1MA1/3H | Original Q19

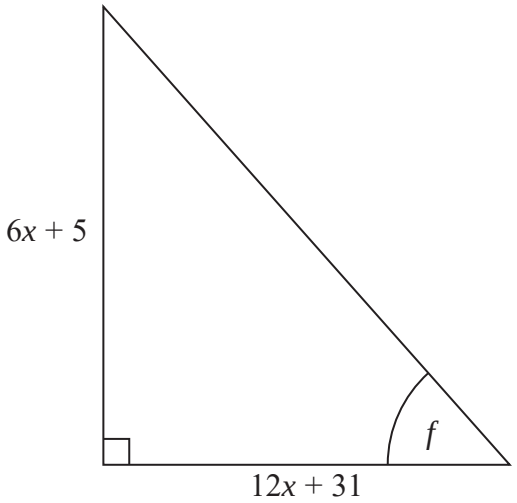
19 Solve $2x^2 + 3x - 2 > 0$

.....

(Total for Question 19 is 3 marks)

19 Here are two right-angled triangles.





Given that

$$\tan e = \tan f$$

find the value of x.

You must show all your working.

.....

(Total for Question 19 is 5 marks)

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

.....

(3)

$$\frac{y^4 \times y^n}{y^2} = y^{-3}$$

(b) Find the value of n.

.....

(2)

(c) Solve $5x^2 - 4x - 3 = 0$
Give your solutions correct to 3 significant figures.

.....

(3)

(Total for Question 9 is 8 marks)

Question 48

June 2019 | 1MA1/1H | Original Q17

17 Given that

$$x^2 : (3x + 5) = 1 : 2$$

find the possible values of x.

.....

(Total for Question 17 is 4 marks)

18 (a) Show that $(2x + 1)(x + 3)(3x + 7)$ can be written in the form $ax^3 + bx^2 + cx + d$ where a, b, c and d are integers.

(3)

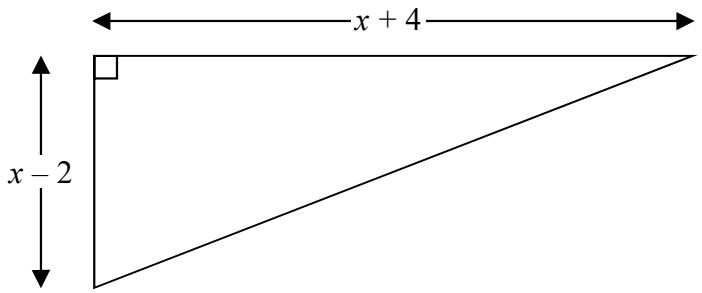
(b) Solve $(1 - x)^2 < \frac{9}{25}$

.....

(3)

(Total for Question 18 is 6 marks)

14 The diagram shows a right-angled triangle.



All the measurements are in centimetres.

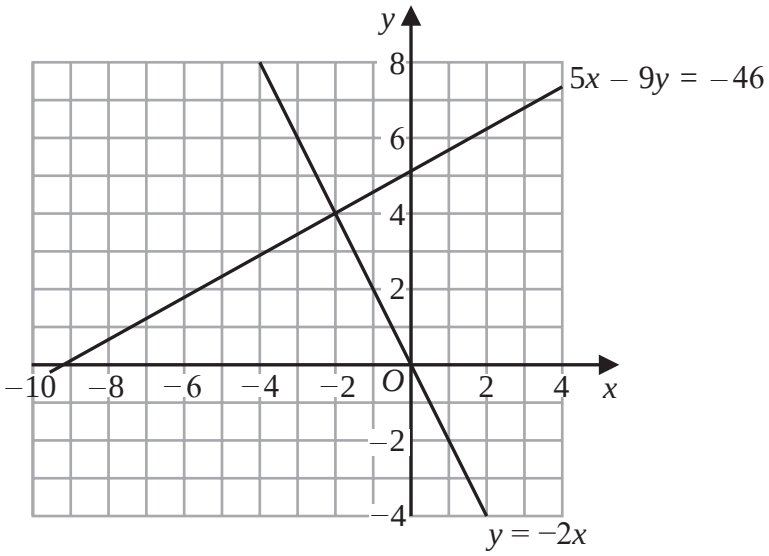
The area of the triangle is $27.5\,\text{cm}^2$

Work out the length of the shortest side of the triangle.
You must show all your working.

..... cm

(Total for Question 14 is 4 marks)

6



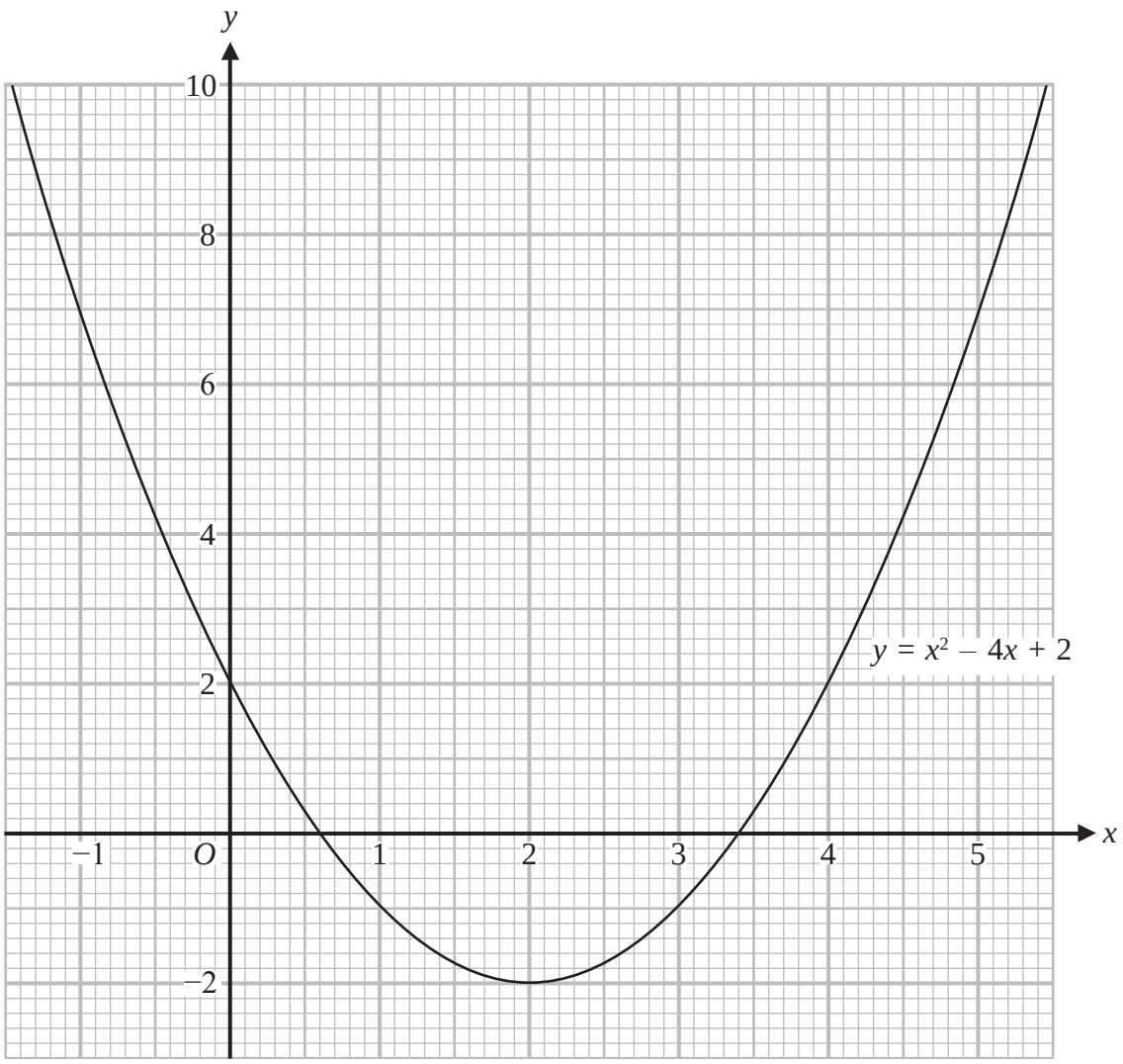
(a) Use these graphs to solve the simultaneous equations

$$5x - 9y = -46$$
$$y = -2x$$

$x =$ .....

$y =$ .....

(1)



(b) Use this graph to find estimates for the solutions of the quadratic equation $x^2 - 4x + 2 = 0$

.....

(2)

(Total for Question 6 is 3 marks)

Question 52

8 Solve $x^2 = 5x + 24$

.....

(Total for Question 8 is 3 marks)

Question 53

16 The curve **C** has equation $y = x^2 + 3x - 3$

The line **L** has equation $y - 5x + 4 = 0$

Show, algebraically, that **C** and **L** have exactly one point in common.

(Total for Question 16 is 4 marks)

Question 54

19 Solve $\frac{1}{2x-1}+\frac{3}{x-1}=1$

Give your answer in the form $\frac{p\pm\sqrt{q}}{2}$ where p and q are integers.

.....

(Total for Question 19 is 4 marks)

22 **L** is the straight line with equation $y = 2x - 5$

C is a graph with equation $y^2 = 6x^2 - 25x - 8$

Using algebra, find the coordinates of the points of intersection of **L** and **C**.
You must show all your working.

(..... , ...)

(..... , ...)

(Total for Question 22 is 5 marks)

Question 56

19 Solve $\frac{1}{x} - \frac{1}{x+1} = 4$

Give your answer in the form $a \pm b\sqrt{2}$ where a and b are fractions.

.....

(Total for Question 19 is 5 marks)

Question 57

November 2022 | 1MA1/2H | Original Q19

19 Solve $6x^2 + 5x - 6 = 0$

.....

(Total for Question 19 is 3 marks)

17 (a) Factorise $6x^2 - 5x - 4$

.....

(2)

(b) Hence, or otherwise, solve $6x^2 - 5x - 4 < 0$

.....

(2)

(Total for Question 17 is 4 marks)

17 (a) (i) Write $x^2 - 8x + 3$ in the form $(x - a)^2 - b$ where a and b are integers.

.....

(2)

(ii) Hence, write down the coordinates of the turning point on the graph of $y = x^2 - 8x + 3$

(..... , ...)

(1)

(b) Solve $7x^2 + 8x - 5 = 0$
Give your solutions correct to 3 significant figures.

.....

(3)

Alex has to find the solutions of the quadratic equation $3k^2 + 10k - 8 = 0$
Here is his working and answer.

$(3k - 2)(k + 4) = 0$

$k = 2$ or $k = -4$

(c) What mistake has Alex made?

.....

.....

.....

(1)

(Total for Question 17 is 7 marks)