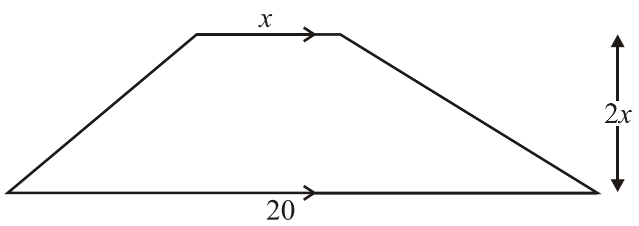
1.

Diagram **NOT** accurately drawn



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)
(Total 5 marks)

2. For all values of x and m, $x^2 - 2mx = (x - m)^2 - k$

(a) Express k in terms of m.

....

(2)

The expression $x^2 - 2mx$ has a minimum value as x varies.

(b) (i) Find the minimum value of $x^2 - 2mx$.
Give your answer in terms of m.

....

(ii) State the value of x for which this minimum value occurs.
Give your answer in terms of m.

....

(3)
(Total 5 marks)

3.

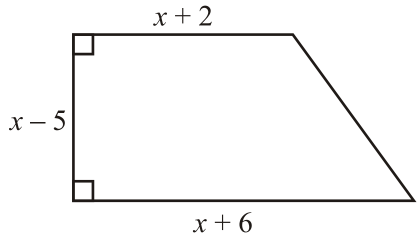


Diagram **NOT** accurately drawn

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)

(Total 8 marks)

4. 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)
(Total 6 marks)

5. (a) (ii) 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)

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)

(Total 13 marks)

6.

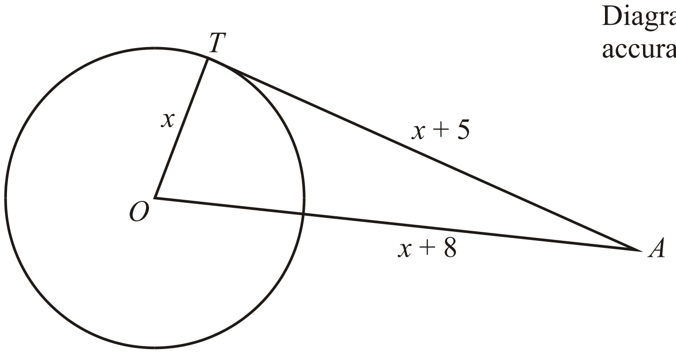


Diagram **NOT** accurately drawn

AT is a tangent at T to a circle, centre O.
$OT = x$ cm, $AT = (x + 5)$ cm, $OA = (x + 8)$ cm.

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

(4)

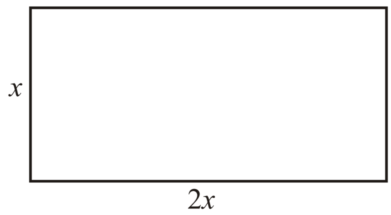
(b) Solve the equation $x^2 - 6x - 39 = 0$ to find the radius of the circle.
Give your answer correct to 3 significant figures.

.... cm

(3)

(Total 7 marks)

7. The length of a rectangle is twice the width of the rectangle.
The length of a diagonal of the rectangle is 25 cm.



Work out the area of the rectangle.
Give your answer as an integer.

.... cm^2
(Total 3 marks)

8. (a) Solve $x^2 + x + 11 = 14$
Give your solutions correct to 3 significant figures.

....
(3)

$$y = x^2 + x + 11$$

The value of y is a prime number when $x = 0, 1, 2$ and 3

The following statement is **not** true.
'$y = x^2 + x + 11$ is **always** a prime number when x is an integer'

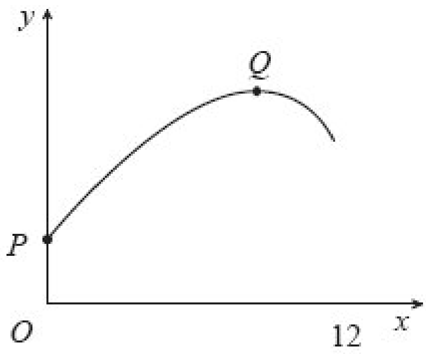
(b) Show that the statement is not true.

....

....

(2)
(Total 5 marks)

9. Here is a sketch of the graph of $y = 25 - \dfrac{(x-8)^2}{4}$ for $0 \le x \le 12$



P and *Q* are points on the graph.

P is the point at which the graph meets the *y*-axis.

Q is the point at which *y* has its maximum value.

(a) Find the coordinates of

(i) *P*,

(…… , ……)

(ii) *Q*.

(…… , ……)

(3)

(b) Show that $25 - \frac{(x-8)^2}{4} = \frac{(2+x)(18-x)}{4}$

(3)
(Total 6 marks)

10. The diagram below shows a 6-sided shape.

All the corners are right angles.

All measurements are given in centimetres.

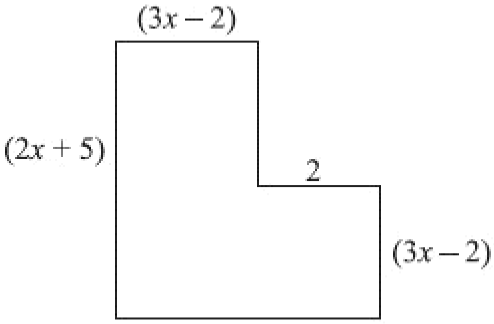


Diagram **NOT** accurately drawn

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)

11. Lisa said that –2 is the **only** value of x that satisfies the equation $x^2 + 4x + 4 = 0$

Was Lisa correct?
Show working to justify your answer.

(Total 2 marks)

12. (a) Solve the equation $19x^2 - 124x - 224 = 0$

x = ... , x = ...

(3)

A bag contains red counters and blue counters and white counters.

There are n red counters.
There are 2 more blue counters than, red counters.
The number of white counters is equal to the total number of red counters and blue counters.

(b) Show that the number of counters in the bag is $4(n + 1)$

(1)

Bob and Ann play a game.

Bob will take a counter at random from the bag.
He will record the colour and put the counter back in the bag.
Ann will then take a counter at random from the bag.
She will record its colour.

The probability that Bob's counter is red and Ann's counter is **not** red is $\frac{14}{81}$

(c) Prove that $19n^2 - 124n - 224 = 0$

(5)

(d) Using your answer to part (a), or otherwise, show that the number of counters in the bag is 36

(1)

Bob and Ann play the game with all 36 counters in the bag.

(e) Calculate the probability that Bob and Ann will take counters with **different** colours.

....

(3)
(Total 13 marks)

13. (a) Factorise $x^2 + 6x + 8$

....

(2)

(b) Solve $x^2 + 6x + 8 = 0$

x =………………………

or x =………………………

(1)
(Total 3 marks)

14. Solve this quadratic equation.

$x^2 - 5x - 8 = 0$

Give your answers correct to 3 significant figures.

x = ...or x = ...
(Total 3 marks)

15.

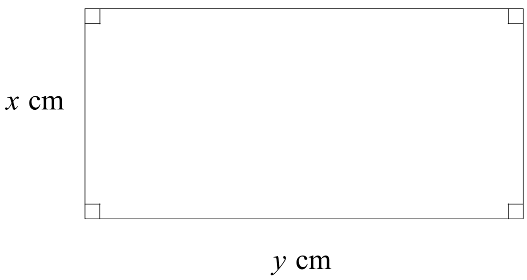


Diagram **NOT** accurately drawn

The diagram shows a rectangle.
The width of the rectangle is x cm and its length is y cm.

The perimeter of the rectangle is 10 cm.

(a) Show that $x + y = 5$

(1)

The length of a diagonal of the rectangle is 4 cm.

(b) Show that $2x^2 - 10x + 9 = 0$

(3)

(c) Solve the equation $2x^2 - 10x + 9 = 0$ to find the possible values of x.
Give your answers correct to 3 significant figures.

....

(3)
(Total 7 marks)

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

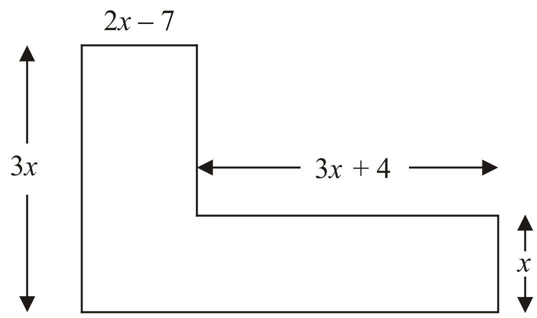


Diagram **NOT** accurately drawn

The area of the shape is 85 cm^2.

(a) Show that $9x^2 - 17x - 85 = 0$

(3)

(b) (i) Solve $9x^2 - 17x - 85 = 0$

Give your solutions correct to 3 significant figures.

x = ... or x = ...

(ii) Hence, work out the length of the shortest side of the 6-sided shape.

.... cm

(4)

(Total 7 marks)

17. The diagram shows an equilateral triangle.

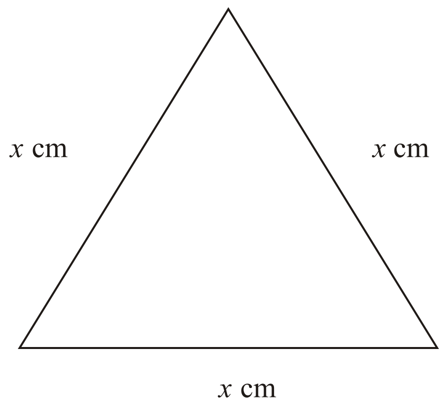


Diagram **NOT** accurately drawn

The area of the equilateral triangle is 36 cm^2.

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

x = ...

(Total 3 marks)

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

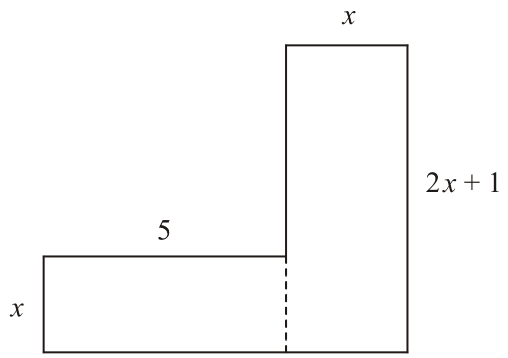


Diagram **NOT** accurately drawn

The area of the shape is 95 cm^2.

(a) Show that $2x^2 + 6x - 95 = 0$

(3)

(b) Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

x = ... or x = ...

(3)

(Total 6 marks)

19.

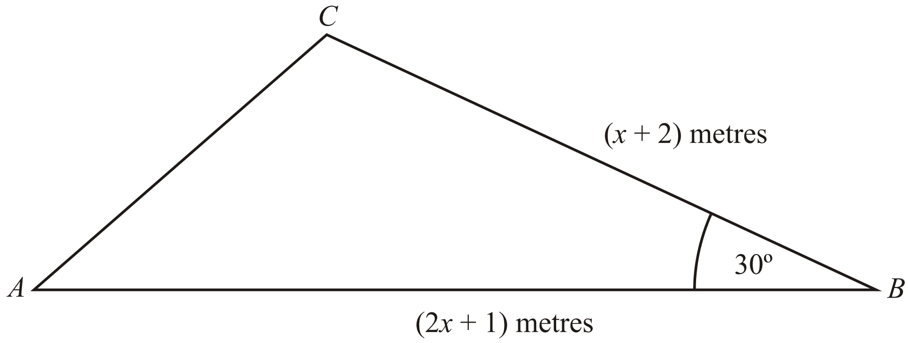


Diagram **NOT** accurately drawn

$AB = (2x + 1)$ metres.
$BC = (x + 2)$ metres.
Angle $ABC = 30°$.

The area of the triangle ABC is 3 m^2.
Calculate the value of x.

Give your answer correct to 3 significant figures.

……………………………
(Total 5 marks)

20. Solve $x^2 - 3x - 18 = 0$

....

(Total 3 marks)

21. (i) Factorise $x^2 - 7x + 12$

....

(ii) Solve the equation

$$x^2 - 7x + 12 = 0$$

....

(Total 3 marks)

22. Solve $x^2 + 3x - 5 = 0$
Give your solutions correct to 4 significant figures.

…………………………
(Total 3 marks)

23. Solve $x^2 + 6x = 4$
Give your answers in the form $p \pm \sqrt{q}$, where p and q are integers.

....
(Total 3 marks)

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

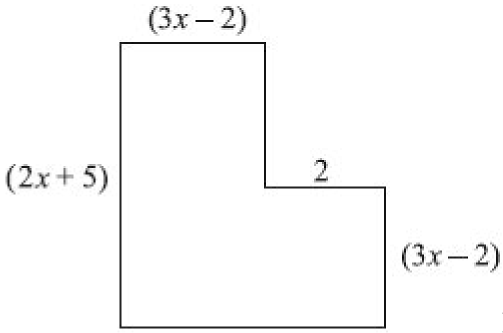


Diagram **NOT** accurately drawn

The area of the shape is 25 cm^2.

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

(Total 3 marks)

25. Given that

$$x^2 - 14x + a = (x + b)^2 \text{ for all values of } x,$$

find the value of a and the value of b.

a = ...

b = ...

(Total 3 marks)

26. Solve $3x^2 + 7x - 13 = 0$
Give your solutions correct to 2 decimal places.

x = ... or x = ...
(Total 3 marks)

27. Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

x = ... or x = ...
(Total 3 marks)

28. Solve $x^2 - 4x - 45 = 0$

....
(Total 3 marks)

29. (a) Solve $x^2 - 2x - 1 = 0$

Give your solutions correct to 2 decimal places.

....
(3)

(b) Write down the solutions, correct to 2 decimal places, of $3x^2 - 6x - 3 = 0$

....

(1)
(Total 4 marks)

1. (a) As given 2

$$\frac{2x(x+20)}{2} = 400$$

M1 $\frac{2x(x+20)}{2}$ *or* $\frac{2x \times x + 20}{2}$ *or* $2x(x + 20) = 800$

A1 cao following correct working, no need for = 400

SC B1 $2x \times x + \frac{1}{2} \times 2x(10 - \frac{x}{2}) \times 2$

(b) 12.361 — 3

$$\frac{-20 \pm \sqrt{20^2 - 4 \times 1 \times (-400)}}{2}$$

$$= \frac{-20 \pm 44.721}{2}$$

M1 for correct sub, up to signs, in the quad formula
A1 for 44.7 or $\sqrt{2000}$
A1 for 12.3606 – 12.361, ignore negative solution
T.I B3 for 12.361
OR
Completing the square
M1 for $(x + 10)^2$ *seen*
A1 for $-10 \pm \sqrt{500}$
A1 for 12.3606 – 12.361 ignore negative solution

[5]

2. (a) $k = m^2$ — 2

$x^2 - 2mx + m^2 - k$

M1 for correct exp of $(x - m)^2$ *or correct completion of the square eg* $\left(x - \frac{2m}{2}\right)^2 - \left(\frac{2m}{2}\right)^2$
A1 cao
SC B1 for $k = -m^2$

(b) (i) $-m^2$ — 3

Min value is $-m^2$

M1 for recognition that min value occurs when $(x - m)^2 = 0$ *(either (b)(i) or (b)(ii) correct implies this M1)*

(ii) m

$x = m$

A1 ft on 'k', " –k" gets M1 A0
A1 cao

[5]

3. (a) Printed 4

$\left(\frac{x+2+x+6}{2}\right)(x-5)$

$(x+4)(x-5)$

$x^2 - 5x + 4x - 20$

$x^2 - x - 20 = 36$

B1 for $\left(\frac{x+2+x+6}{2}\right)(x-5)$ *or any correct unsimplified form for the area*

M1 for at least 3 terms correct in expansion of form (x + a)(x + b) or (2x + a)(x + b)

A1 for area = $x^2 - 5x + 4x - 20$ *or better*

A1 for $x^2 - x - 56 (= 0)$ *obtained convincingly*

(b) (i) 8, –7 4

$(x-8)(x+7) = 0$

M1 for $(x \pm 8)(x \pm 7)$ *or correct subst. into quadratic formula (condone sign errors)*

A2 cao (B1 for either x = –7 or x = 8)

(ii) 3

B1 cao (the only value)

[8]

4. (a) $x(x-15) = 199.75$

$x^2 - 15x = 199.75$

$x^2 - 15x - 199.75 = 0$ 3

B1 for sight of $x - 15$ *or* $\frac{199.75}{x}$

B1 for $x(x-15) = 199.75$

B1 for $x^2 - 15x - 199.75 = 0$ *following correct algebra*

SC: $x \times x - 15 = 199.75 \Rightarrow x^2 - 15x - 199.75 = 0$ *is 1/3*

(b) 23.5 or – 8.5 3

$$\frac{15 \pm \sqrt{225 - 4 \times 1 \times \quad 199.75}}{2}$$

Or

$(x - 7.5)^2 - 56.25 = 199.75$

$x - 7.5 = \pm\ \sqrt{256}$

M1 for correct substitution into formula, allow sign errors
A1 for 23.5
A1 for – 8.5
Or
M1 for $(x - 7.5)^2 - 56.25$
A1 for 23.5
A1 for –8.5
Or
$4x - 60x - 799 = 0$
$(2x - 4)(2x + 17) = 0$ x =23.5 or – 8.5
M1 for attempt A1 A1
Trial and error: 1 solution B1
Other solution B2

[6]

5. (a) (i) $(2x - 7)(x - 14)$ 3

M1 x^2 term and constant term ($\pm$ 98 obtained
or $2x(x - 14) - 7(x - 14)$ or $x(2x - 7) - 14(2x - 7)$
A1 for $(2x - 7)(x - 14)$

(ii) $x = \frac{7}{2}$; $x = 14$

B1ft ft (i) provided of form $(2x \pm a)(x \pm b)$

(b) (i) $\frac{7}{n+7}$ 3

B1 for $\frac{7}{n+7}$ oe

(ii) n=10.5 is not possible since n has to be an integer

$\frac{7}{n+7} = \frac{2}{5} \Rightarrow 2(n + 7) = 5 \times 7$

$2n = 21$

M1 for $2(n + 7) = 5 \times 7$ or $n+7=5 \times 3.5$ (can be implied) ft
(b)(i) fractional in terms of n and < 1
A1 ft for n = 10.5 not possible (since n not integer) oe

(c) $2n^2 - 35n + 98 = 0$ 5

$2 \times \left(\frac{n}{n+7}\right) \times \left(\frac{7}{n+7}\right) = \frac{4}{9}$

$14n \times 9 = 4(n + 7)^2$

$14n \times 9 = 4(n^2 + 14n + 49)$

$4n^2 + 56n + 196 - 126n = 0$

M1 for $\left(\frac{n}{n+7}\right) \times \left(\frac{7}{n+7}\right)$ *seen*

M1 for $2 \times \left(\frac{n}{n+7}\right) \times \left(\frac{7}{n+7}\right)$ *oe* $= \left(\frac{4}{9}\right)$

M1(dep on 1st M) elimination of fractions within an equation

B1 3 terms correct in expansion of $(n + 7)^2 = n^2 + 7n + 7n + 49$

A1 full valid completion to printed answer

(d) $\frac{1}{9}$ 2

$\frac{7}{n+7} \times \frac{7}{n+7} = \frac{7}{21} \times \frac{7}{21} =$

M1 for $\frac{7}{n+7} \times \frac{7}{n+7}$ *or better or ft [answer (b)(i)]*^{2}

or $1 - \frac{4}{9} - \left(\frac{n}{n+7}\right)^2$

A1 for $\frac{1}{9}$ *oe cao*

[13]

6. (a) $(x + 8)^2 = x^2 + (x + 5)^2$

$x^2 + 16x + 64 = 2x^2 + 10x + 25$ 4

B1 for angle OTA = 90º (implied by use of Pythagoras with OA as hypotenuse)

M1 $(x + 8)^2 = x^2 + (x + 5)^2$ oe

M1 for correct squaring of $x + 8$ or $x + 5$

A1 for completion following correct working

(b) 9.93 3

$(+ 6 + \sqrt{(6^2 - - 4 \times 39)})/2$

$= (6 \pm \sqrt{(36 + 156)})/2$

$= (6 \pm \sqrt{192})/2 = (6 + 13.856)/2$

M1 for substitution into quadratic formula, allow sign errors in b and c

M1 for $x = (6 \pm \sqrt{192})/2$ [+ alone will do]

A1 for 9.92 – 9.93

M1 for $(x - 3)^2 - 9 - 39$

M1 for $x = 3 \pm \sqrt{48}$ [+ alone will do it]

A1 for 9.92 – 9.93

T&I= 9.93 gets M1,M0,A0

[7]

7. 250 cm² 3

$x^2 + (2x)^2 = 25^2$

$5x^2 = 625$

$x^2 = 125$

$x = \sqrt{125}$

$A = \sqrt{125} \times 2\sqrt{125}$

M1 for $x^2 + (2x)^2 = 25^2$ or using Pythagoras with x and 2x or $5x^2 = 625$

M1 for $x = \sqrt{125}$ or for A = "$\sqrt{125}$" × "$2\sqrt{125}$" or 2 × "125"

A1 for 250 cao

[3]

8. (a) 1.30
-2.30 3

$x^2 + x - 3 = 0$

$x = \dfrac{-1 \pm \sqrt{1^2 - 4\times1\times(-3)}}{2}$

$x = \dfrac{-1 \pm \sqrt{13}}{2}$

OR

$\left(x + \dfrac{1}{2}\right)^2 - \dfrac{1}{4} + 11 = 14$

$\left(x + \dfrac{1}{2}\right)^2 = \dfrac{13}{4}$

$x = -\dfrac{1}{2} \pm \sqrt{\dfrac{13}{4}}$

M1 correct substitution of LHS into quadratic formula, ignore sign errors
M1 $\dfrac{-1 \pm \sqrt{13}}{2}$
A1 1.30 to 1.303 and -2.30 to -2.303 (both)
OR
M1 for correct method to complete the square,
$\left(x + \dfrac{1}{2}\right)^2 - \dfrac{1}{4}$ *seen*
M1 for $-\dfrac{1}{2} \pm \sqrt{\dfrac{13}{4}}$
A1 1.30 to 1.303 and -2.30 to –2.303 (both)
OR
T &I M1 for one correct
M1 A1 for second correct

(b) Eg $x = 10$,
$y = 11 \times 11$
Or $x = 11$,
$y = 11 \times 13$ 2

B1 for a correct value of x
B1 demonstration that y is composite

[5]

9. (a) (i) (0, 9) — 3

B1 cao

(ii) (8, 25)

B1 for x = 8 cao
B1 for y = 25 cao
SC: B1 for (25, 8)

(b) LHS $= \left(\dfrac{100-(x^2-16x+64)}{4}\right)$

$= \left(\dfrac{36+16x-x^2}{4}\right)$

RHS $= \left(\dfrac{36-2x+18x-x^2}{4}\right) =$ LHS — 3

M1 for expansion of either set of brackets with at least 3 of 4 terms correct
M1 for common denominator of 4 or multiplying through by 4 or reducing each numerator to a single term
A1 for fully correct solution
Alternative method
M1 for $\left(5-\dfrac{(x-8)}{2}\right)\left(5+\dfrac{(x-8)}{2}\right)$
M1 for $\left(\dfrac{2\times5-(x-8)}{2}\right)\left(\dfrac{2\times5+(x-8)}{2}\right)$
A1 for $\dfrac{(18-x)(x+2)}{4}$

[6]

10. (a) $6x^2 + 11x - 10 + 6x - 4 = 25$
$6x^2 + 17x - 39 = 0$ — 3

M1 for an expression for the area involving either
$(3x-2)(2x+5) + 2(3x-2)$
or $3x(3x-2) + (3x-2)(7-x)$
or $3x(2x+5) - 2(7-x)$
or $(3x-2)^2 + 2(3x-2) + (3x-2)(7-x)$
where in each case at least one of 2 or 3 product terms must be correct
M1 (indep) for one correct expansion involving x^2
A1 for simplification to final answer

(b) (i) $1.5,\ -\frac{13}{3}$ 4

$$x = \frac{-17 \pm \sqrt{17^2 - 4 \times 6 \times (-39)}}{2 \times 6}$$
$$= \frac{-17 \pm \sqrt{289 + 936}}{12}$$
$$x = +\frac{18}{12} \text{ or} -4.33$$

$$x^2 + \frac{17}{6}x - \frac{39}{6} = 0$$
$$\left(x + \frac{17}{12}\right)^2 - \left(\frac{17}{12}\right)^2 - \frac{39}{6} = 0$$
$$\left(x + \frac{17}{12}\right)^2 = \left(\frac{17}{12}\right)^2 + \frac{39}{6}$$

M1 for $x = \frac{-17 \pm \sqrt{17^2 - 4 \times 6 \times (-39)}}{2 \times 6}$ *up to signs in b & c*

M1 for $x = \frac{-17 \pm \sqrt{1225}}{12}$

A1 x= 1.5 or – 4.33, or better

OR

M2 for (3x + 13)(2x – 3)

(M1 for (3x ± a)(2x ± b) with ab = ± 39

A1 x = 1.5 or – 4.33, or better

OR

M1 for $\left(x + \frac{17}{12}\right)^2$ *seen*

M1 $\left(x + \frac{17}{12}\right)^2 = \left(\frac{17}{12}\right)^2 + \frac{39}{6}$

A1 x = 1.5 or – 4.33, or better

SC:M1 for answer “1.5” with no working or T & I

(ii) 8

B1 cao length = 8

[7]

11. $x^2 + 4x + 4 = (x + 2)(x + 2)$
$x^2 + 4x + 4 = 0$, so $(x + 2)^2 = 0$, so $x = -2$ is the only value of x that satisfies the equation oe Lisa is correct. 2

B2 for a complete solution
(B1 for verifying that $x = -2$ is a root or for factorising oe)

[2]

12. (a) $(19x + 28)(x - 8)$
$x = 8$
$x = -28/19$ 3

M1 for either $(ax + b)(cx + d)$ with $ac = 19$ and $bd = \pm 224$
or for a clear attempt to use $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with $a = 19$, $b = \pm 124$, $c = \pm 224$
A1 for either $(19x + 28)(x - 8)$ or for $x = \dfrac{124 \pm \sqrt{32400}}{38}$
A1 for 8 <u>and</u> $-28/19$ oe (accept -1.47 or better)

(b) red $= n$ blue $= n + 2$ white $= n + (n + 2)$
$n + (n + 2) + [n + (n + 2)] = 4n + 4 = 4(n + 1)$*
Proof 1

B1 for $n + (n + 2) + [n + (n + 2)]$

(c) $\left(\dfrac{n}{4(n+1)}\right) \times \left(1 - \dfrac{n}{4(n+1)}\right) = \dfrac{14}{81}$

$\left(\dfrac{n}{4(n+1)}\right) \times \left(\dfrac{3n+4}{4(n+1)}\right) = \dfrac{14}{81}$

$81n(3n + 4) = 14 \times 16(n + 1)^2$
$243n^2 + 324n = 224(n^2 + 2n + 1)$
$243n^2 + 324n = 224n^2 + 448n + 224$
$\Rightarrow 19n^2 - 124n - 224 = 0$*
Proof 5

M1 for multiplying two fractions
A1for $\left(\dfrac{n}{4(n+1)}\right) \times \left(1 - \dfrac{n}{4(n+1)}\right)$ oe
B1 for correct expansion of $(n + 1)^2$
M1 for a valid method to eliminate fractions from an algebraic expression
A1 complete proof

(d) from (a) $n = 8$ so $4(n + 1) = 36$
Proof — 1

B1 for substituting n = '8' into 4(n + 1) or 8, 10, 18 seen

(e) P(different colours) = 1 – [P(RR)+P(BB)+P(WW)]

$$\left[\frac{8}{36}\times\frac{8}{36}+\frac{10}{36}\times\frac{10}{36}+\frac{18}{36}\times\frac{18}{36}\right]$$

OR

P(different colours) = 2 × [P(RB)+P(RW)+P(BW)]

$$=2\times\left[\frac{8}{36}\times\frac{10}{36}+\frac{8}{36}\times\frac{18}{36}+\frac{10}{36}\times\frac{18}{36}\right]$$

OR

P(different colours) =P(RR')+P(BB')+P(WW')

$$=\left[\frac{8}{36}\times\frac{28}{36}+\frac{10}{36}\times\frac{26}{36}+\frac{18}{36}\times\frac{18}{36}\right]$$

$\frac{101}{162}$ — 3

M1 for [P(RR)+P(WW)+P(BB)]
or [P(RB)+P(RW)+P(BW)]
or [P(RR')+P(BB')+P(WW')]
Allow algebraic fractions

M1 (dep) for 1 –[P(RR)+P(WW)+P(BB)]
or 2×[P(RB)+P(RW)+P(BW)]
or P(R)×[1–P(R)]+P(B)×[1–P(B)]+P(W)×[1–P(W)]
Numerical values required

A1 cao for $\frac{101}{162}$ *oe or 0.62(3...)*

SC *B2 for* $\frac{202}{315}$ *oe or 0.65(1...)*

[13]

13. (a) $(x + 2)(x + 4)$ — 2

M1 (x ± 2)(x ± 4)
A1 cao

(b) –2, –4 — 1

B1ft from (a) or –2, –4

[3]

14. $x = \dfrac{5 \pm \sqrt{25 - 4 \times 1 \times -8}}{2}$

$\dfrac{5 \pm \sqrt{57}}{2} = \dfrac{5 \pm 7.54983}{2}$

$x = 6.2749$ or $x = -1.2749$

6.27 or –1.27 — 3

M1 for correct substitution into formula up to signs on b and c

M1 for $\dfrac{5 \pm \sqrt{57}}{2}$

A1 6.27 to 6.275 and –1.27 to –1.275

[3]

15. (a) $2x + 2y = 10$ — 1

B1 for $2x + 2y = 10$ *oe*

(b) $x^2 + y^2 = 16$ — 3

$x^2 + (5 - x)^2 = 16$

B1 for $x^2 + y^2 = 4^2$ *oe*

M1 for rearranging first equation and substituting into second

A1 for sight of $25 - 10x + x^2$ *and correct simplification to the given equation*

(c) $x = \dfrac{10 \pm \sqrt{(-10)^2 - 4x \times 2 \times 9}}{2 \times 2}$ — 3

$\dfrac{10 \pm \sqrt{28}}{4}$

$= 3.82;\ 1.18$

M1 for correct substitution into quadratic formula (allow sign errors)

A1 for correct simplification

A1 for 3.82 – 3.823, 1.177 – 1.18

[7]

16. (a) $3x(2x - 7) + x(3x + 4) = 85$

$6x^2 - 21x + 3x^2 + 4x = 85$ 3

$= \text{AG}$

M1 for 3x(2x – 7), x(3x + 4) oe

M1 for $6x^2 - 21x + 3x^2 + 4x$ oe (at least 3 out of 4 terms correct)

A1 fully correct working leading to given equation

or

M1 x(5x – 3),2x(2x – 7) oe

M1 $5x^2 - 3x + 4x^2 - 14x$ oe (at least 3 out of 4 terms correct)

A1 fully correct working leading to given equation

or

M1 3x(5x – 3), 2x(3x + 4) oe

M1 $15x^2 - 9x - 6x^2 - 8x$ oe(at least 3 out of 4 terms correct)

A1 fully correct working leading to given equation.

(b) (i) $x = \dfrac{-(-17) \pm \sqrt{(-17)^2 - 4 \times 9 \times (-85)}}{2 \times 9}$

$x = \dfrac{17 \pm \sqrt{3349}}{18} = \dfrac{17 \pm 57.87}{18}$ 4

M1 correct substitution up to signs

M1 $x = \dfrac{17 \pm \sqrt{3349}}{18}$

A1 4.15 – 4.16, –2.27 – –2.271

T&I B1 first value, B2 second value

(ii) 1.32

B1 1.3 – 1.32

[7]

17. $\frac{1}{2} \times x^2 \times \sin 60 = 36$

$x^2 = \frac{72}{\sin 60} = 83.13..$

$= 9.12$ 3

M1 $\frac{1}{2} \times x^2 \times \sin 60 (= 36)$ *or* $\frac{1}{2} \times ab \times \sin 60 (= 36)$

or $\frac{1}{2} \times x \times \sqrt{x^2 - \left(\frac{x}{2}\right)^2} (= 36)$

M1 $x^2 = \frac{72}{\sin 60}$ *or* $ab = \frac{72}{\sin 60}$ *or* $x^2 = \frac{36 \times 2}{\sqrt{0.75}}$

A1 9.11 – 9.12

[3]

18. (a) $x(2x + 1) + x \times 5$

$2x^2 + 6x$

As given 3

M1 $x(2x + 1)$ and $x \times 5$ OR $x(x + 5)$ and $x(x + 1)$ condone missing brackets.

M1 $2x^2 + x + 5x$ OR $x^2 + 5x + x^2 + x$ (can imply first M1)

A1 $2x^2 + 6x = 95$ AG

(b) $x = \dfrac{-6 \pm \sqrt{6^2 - 4 \times 2 \times (-95)}}{4}$

$x = \dfrac{-6 \pm \sqrt{796}}{4}$

or

$x^2 + 3x - 47.5 = 0$
$(x + 1.5)^2 - 1.5^2 - 47.5 = 0$
$x = -1.5 \pm \sqrt{49.75}$

5.55, –8.55 — 3

M1 for correct substitution in formula of 2, 6 and ± 95
M1 for reduction to $\dfrac{-6 \pm \sqrt{796}}{4}$
A1 5.55 to 5.555 inclusive ***and*** *–8.55 to –8.555 inclusive*
OR
M1 $(x + 1.5)^2 - 1.5^2 - 47.5 = 0$
M1 $x = -1.5 \pm \sqrt{49.75}$
A1 5.55 to 5.555 and –8.55 to –8.555
[SC: B1 for one answer correct with or without working]

[6]

19. $x = 1.31$m — 5

$0.5 \times (2x + 1) \times (x + 2) \times \sin 30 = 3$
$0.25 \times (2x^2 + 4x + x + 2) = 3$
$2x^2 + 5x + 2 = 12$
$2x^2 + 5x - 10 = 0$
$x = \dfrac{-5 \pm \sqrt{(5^2 - 4 \times 2 \times -10)}}{2 \times 2}$
$= 1.311737...$

M1 for $0.5 \times (2x + 1) \times (x + 2) \times \sin 30$ *or used*
M1 (dep) ... = 3 and an attempt to expand algebraic brackets
A1 oe in form $ax^2 + bx + c = d$
M1 ft (dep on 1st 2 M1s) for correct process to solve quadratic equation
A1 for 1.31 or better

[5]

20. 6, – 3 3

$(x - 6)(x + 3)$

M2 for $(x - 6)(x + 3)$
(M1 for $(x \pm 6)(x \pm 3)$)
A1 cao for 6 and –3

[3]

21. (i) $(x - 3)(x - 4)$

B1 cao

(ii) $x = 3$, $x = 4$ 3

$(x - 3)(x - 4) = 0$

M1 for "(i)" = 0 provided "(i)" is of the form
$(x + a)(x + b)$ where a and b are integers
(SC: If M0, B1 for $x = 3$ or $x = 4$)

[3]

22. 1.193, –4.193 3

$$\frac{-3 \pm \sqrt{\left(3^2 - 4 \times 1 \times (-5)\right)}}{2 \times 1}$$

$$\frac{-3 \pm \sqrt{29}}{2}$$

M1 for correct sub. into quadratic formula, condone wrong sign of a, b or c
A1 for $\frac{-3 \pm \sqrt{29}}{2}$ $\left(= \frac{-3 \pm 5.3(85....)}{2}\right)$
*A1 for 1.193 **and** – 4.193*
Alternative method:
M1 sight of $(x + 1.5)^2$
A1 for $-1.5 \pm \sqrt{7.25}$
A1 cao for both answers

[3]

23. $-3 \pm \sqrt{13}$ 3

$(x + 3)^2 - 9 = 4$
$x + 3 = \pm \sqrt{13}$

M1 for $(x + 3)^2$
M1 for $(x + 3)^2 - 9(= 4)$
A1 cao
Alternative Method
M1 for substitution into formula, condone incorrect signs
M1 for $\frac{-6 \pm \sqrt{52}}{2}$
A1 cao

[3]

24. $6x^2 + 11x - 10 + 6x - 4 = 25$
$6x^2 + 17x - 39 = 0$ 3

M1 for an expression for the area involving either
$(3x - 2)(2x + 5) + 2(3x - 2)$
or $3x(3x - 2) + (3x - 2)(7 - x)$
or $3x(2x + 5) - 2(7 - x)$
or $(3x - 2)^2 + 2(3x - 2) + (3x - 2)(7 - x)$
where in each case at least one of 2 or 3 product terms must be correct
M1 (indep) for one correct expansion involving x^2
A1 for simplification to final answer

[3]

25. $a = 49$
$b = -7$ 3

M1 for $(x - \frac{14}{2})^2 - \left(\frac{14}{2}\right)^2$ or $x^2 + bx + bx + b^2$
A1 for $a = 49$
A1 for $b = -7$ or $(x - 7)^2$

[3]

26. a = 3, b = 7, c = –13

$x = \dfrac{-7 \pm \sqrt{7^2 - 4 \times 3 - 13}}{2 \times 3}$

$= \dfrac{-7 \pm \sqrt{(49 + 156)}}{6} = \dfrac{-7 \pm \sqrt{205}}{6}$

$x = 1.2196\ldots$ or $-3.55297\ldots.$

OR

$x^2 + \dfrac{7}{3}x - \dfrac{13}{3} = 0$

$(x + \dfrac{7}{6})^2 - \dfrac{49}{36} - \dfrac{13}{3} = 0$

$(x + \dfrac{7}{6})^2 = \dfrac{205}{36}$

$x = -\dfrac{7}{6} \pm \sqrt{\dfrac{205}{36}}$

1.22

–3.55 3

M1 for correct substitution in formula of 3, 7 and ±13

M1 for reduction to $\dfrac{(7 \pm \sqrt{205})}{6}$

A1 1.215 to 1.22 and –3.55 to –3.555

OR

M1 for $(x + \dfrac{7}{6})^2$

M1 for $-\dfrac{7}{6} \pm \sqrt{\dfrac{205}{36}}$

A1 1.215 to 1.22 and –3.55 to –3.555

SC: Trial and Improvement: 1 mark for 1 correct root, 3 marks for both correct roots

[3]

27. $x = \dfrac{-6 \pm \sqrt{6^2 - 4 \times 2 \times (-95)}}{4}$ 3

5.55, –8.55

M1 for correct substitution in formula of 2, 6 and ± 95

$x = \dfrac{-6 \pm \sqrt{796}}{4}$

M1 for reduction to $\dfrac{-6 \pm \sqrt{796}}{4}$

A1 5.55 to 5.555 ***and*** *–8.55 to –8.555*

OR

$x^2 + 3x - 47.5 = 0$

$(x + 1.5)^2 - 1.5^2 - 47.5 = 0$

$x = -1.5 \pm \sqrt{49.75}$

M1 $(x + 1.5)^2 - 1.5^2 - 47.5 = 0$

M1 $x = -1.5 \pm \sqrt{49.75}$

A1 5.55 to 5.555 and –8.55 to –8.555

SC : ***B1*** *for one answer correct with or without working*

[3]

28. $(x + 5)(x - 9)$

9, –5 3

M2 for $(x - 9)(x + 5)$

(M1 for $(x \pm 9)(x \pm 5)$*)*

A1 cao 9 and –5

OR

M1 for substitution into formula (condone incorrect signs)

M1 for $\dfrac{4 \pm \sqrt{196}}{2}$

A1 cao

OR

M1 for $(x - 2)^2 - 2^2 - 45$ *(= 0)*

M1 for $x = 2 \pm \sqrt{4 + 45}$

A1 cao

OR T&I

B3 Both solutions correct

(B1 One solution correct)

[3]

29. (a) $x = \dfrac{--2 \pm \sqrt{(-2)^2 - 4 \times 1 \times (-1)}}{2}$

$= \dfrac{2 \pm \sqrt{8}}{2}$

$= \dfrac{2 \pm 2.82843}{2}$

$x = -0.4142$ or $x = 2.4142$

$-0.41, 2.41$ 3

M1 for substitution into formula (condone incorrect signs)

M1 for $\dfrac{2 \pm \sqrt{8}}{2}$

A1 for –0.41 to -0.415 and 2.41 to 2.415

OR

M1 for $(x - 1)^2 - 1^2 - 1$ *seen*

M1 for $(x - 1) = \pm\sqrt{2}$

A1 for–-0.41 to – 0.415 and 2.41 to 2.415

T&I B3 both solutions, B1 1 solution

(b) $-0.41, 2.41$ 1

B1 ft from (a)

[4]

1. **Mathematics A Paper 6**

Part (a) required candidates to write down an appropriate expression for the area of the trapezium, set it equal to 230 and to simplify. Again, the standard of algebra was poor, with brackets often omitted. Some candidates did not realise that they had to derive an equation but tried to find the value of x in part (a).
Part (b) was also disappointing, in that many candidates did not recognise this as a quadratic equation. There were many attempts involving incorrect algebra as well as using trial and error.

Mathematics B Paper 19

In part (a) those candidates who clearly knew how to find the area of a trapezium were often successful. Part (b) was poorly done. Very few candidates used the quadratic formula. Trial and improvement was a popular method used but candidates favouring this method frequently failed to give their answer to the required accuracy and therefore failed to gain any marks.

2. **Mathematics A Paper 6**

This proved to be too hard for the candidature. Many candidates were let down in part (a) by poor algebra, in particular $(x - m)^2 = x^2 - 2mx - m^2$ or $(x - m)^2 = x^2 - m^2$. However, many did not realise the nature of the task. Very few were able to complete part (b).

Mathematics A Paper 19

This question was poorly done. In part (a) those candidates who started by expanding the bracket on the left hand side of the given identity were often successful although errors were frequently seen in expanding $(x - m)^2$. Correct answers to part (b) were very rarely seen, few candidates were able to appreciate that the minimum value occurred when the value of $(x - m)^2$ was zero.

3. **Paper 3**

Part (a) proved to be inaccessible to most candidates. Very few started with the formula for the area of a trapezium and substituted the expressions from the diagram. Of those that managed the first step, many failed to put brackets around '$x - 5$' and their subsequent working indicated that they did not appreciate how to manipulate this expression. Many candidates simply substituted numbers into the given equation. Only a few correct factorisations were seen in part (b). Trial and improvement was often used and sometimes resulted in an answer of '$x = 8$'. Those candidates who obtained '8' in part (i) were usually able to gain the final mark by correctly writing the length of the shortest side as '3' in part (ii).

Paper 5

As mentioned in the general comments, many candidates had problems obtaining the printed result in part (a). Some better attempts were spoilt by leaving out brackets or by assuming that the foot of the perpendicular from the top right vertex to the base was at a distance of $(x + 4)$ from the acute-angled vertex. In part (b)(i) many candidates had some understanding on how to solve the quadratic equation but it was disappointing to see so many sign errors and also so many solutions using trial and improvement in which most were satisfied when they had just found one of the two solutions. In part (ii) some candidates just gave the answer "$x - 5$"; presumably they did not understand the meaning of 'hence'.

4. art (a) was poorly done as it was clear that many candidates did not realise that a construction of an algebraic expression was first required, followed by setting the algebraic expression equal to 199.75. A good number decided to solve the equation and then use the positive value of x to show that it satisfied the equation.
In part (b), too many candidates tried to solve the quadratic equation by trial and improvement. Of those that used the formula a great number got the sign of c wrong and ended up with a negative sign under the square root sign. Some candidates, who used the formula to get the two solutions, rejected the negative value.

5. Mathematics A Paper 5

Although full correct solutions for this question were seen by the best candidates it was a rarity. Except for answers to (b)(i) it was unusual to find candidates at grade C and low B gain any further credit although some high grade B candidates scored 4 or 5 marks normally in parts (a) and (b). In part (a) those who applied a systematic approach were generally far more successful as illustrated by "2 × 98; 4 × 49; 28 × 7**" In part (b)(i) many of the given expressions were correct although $\frac{n}{n+7}$ was a common wrong answer. In part (b)(ii), although many could not present an adequate proof/explanation with a common wrong approach based on the 'fact' that "Bill is saying that there is only a total of 5 balls and we have 7 white balls", it was pleasing to find even some grade B candidates presenting a full logical proof based on n=10.5 and unable to have half a ball. Part (c) was very poorly answered with most just attempting to solve the equation (again). Of the reasonable attempts most gained credit for one product of two probabilities and a correct expansion of $(x \quad 7)^2$ but many failed to eliminate the algebraic fractions correctly or missed out the second combination of probabilities. It was pleasing to find candidates recovering in the last part to gain a method mark for a relevant squaring of their answer to part (b)(i).

Mathematics B Paper 18

In part (a), the majority of candidates were unable to factorise the given expression. Of those who did obtain the correct factorisation a number then went onto solve the associated equation incorrectly with 7 (instead of $\frac{7}{2}$) being a popular incorrect solution. The majority of candidates were able to give the correct probability in part (bi) but then in (bii) were unable to offer a convincing proof that Bill's statement could not be correct. Part (c) was very poorly done with the majority of candidates starting with the equation given rather than using the information given to derive it. In part (d) very few candidates referred back to the expression for the probability quoted in (bi).

6. Candidates found the first part hard. Many did realise that the angle at T was a right angle, so the method into doing the part was to use Pythagoras. Some candidates multiplied x by $(x + 5)$ and set this equal to $(x \quad 8)$.
Part (b) was answered more successfully but there were still many poor attempts, many based on the use of -6^2, rather than $(-6)^2$ in the quadratic formula.

7. This question was well understood but not well answered. About 40% of candidates gained at least one mark whilst the full solution was only given by 5% of candidates. It was disappointing to see that poor algebra was the greatest cause of candidates losing marks in this question where most candidates realised that they needed a statement of Pythagoras' theorem and wrote $x^2 + 2^2 = 25^2$ instead of $x^2 + (2x)^2 = 25^2$ and further compounded their error by writing $3x^2 = 625$. Partial credit was given on this occasion for recognising that Pythagoras' theorem was needed.

8. Part (a) was a slightly different quadratic equation question. Candidates were expected to recognise that they had to subtract 14 from both sides and then use the formula to solve the resulting equation. Many candidates were able to do this successfully. The most common errors were to mishandle the evaluation of $\frac{-1+\sqrt{13}}{2}$ which was often worked out as – 1 + $\frac{\sqrt{13}}{2}$

The few candidates who used the method of completing the square were generally successful.
Part (b) asked candidates to provide a counterexample to a mathematical statement. There was a great deal of misunderstanding what the statement meant, with many candidates substituting in the given integer values and confirming that the answers were indeed prime.
Those candidates who did understand the part usually provided $x = 10$ or $x = 11$ as suitable cases with either the evaluation of the resulting numerical expression and a demonstration that the resulting number was composite or by the demonstration of
11 (11 + 1 + 1) or its equivalent.

9. **Specification A**

Many candidates working at grade B level, or above, had a good attempt at this question- often scoring a mark in each of the parts.
In part (a), very few candidates had difficulty with coordinate notation usually scoring at least one mark for (0, 9). Only candidates working at the highest grades were able to access the marks for part (a)(ii) and part (b).
In part (b), many candidates were able to score a mark for expanding either of the quadratic brackets, but were unable to deal successfully with the fractions. A common error was to multiply each fraction by 4 and ignore the 25. The best candidates were able to set up their answers in a clear and logical manner- usually starting from the left hand equation and progressing to the right hand equation. There were many sound approaches where candidates worked on both sides of the equation together.

Specification B

This was a demanding question for candidates. Over half of the candidates were, however, able to gain credit somewhere in the question. Answers to part (a) were of a very variable standard with only about 10% of candidates able to gain full marks in this part of the question. In (b) the majority of candidates appreciated the need to multiply out at least one of the pairs of brackets. This was generally done successfully although $(x – 8)^2$ was often seen incorrectly expanded as $x^2 – 64$ or $x^2 + 64$. Few candidates used a correct method to deal with the fraction on the left hand side of the given identity. There was evidence of some very creative but incorrect algebra. Candidates should be reminded that examiners will scrutinise working and only award marks for correct methods seen. A number of candidates tried to answer the question by inserting specific values for x rather than supplying a general proof; this approach gained no marks.

10. This proved to be the first really challenging question for the candidates. There is still a minority of candidates who do not understand that in part (a) they are required to derive the quadratic equation from given information. They give themselves away by trying to solve the equation as their answer to part (a). The most commonly successful approach was to identify two rectangles of areas $(3x – 2)(2x +5)$ and $2(3x – 2)$ respectively and then set the algebraic sum equal to 25. Further marks were then gained by using correct algebra to get to the given equation. Splitting the shape horizontally proved to be less successful as often the top rectangle was given the measurements $(3x – 2)$ and $(2x + 5)$. Other methods involved splitting into the sum of three parts and working on the difference between the area of the full rectangle $(2x + 5)$ by $3x$ and the small rectangle 2 by $(2x + 5) – (3x – 2)$ although in many cases the second term was not worked out correctly.

Part (b) was generally tackled by using the formula. The usual error of not spotting that $17^2 – 4 \times 6 \times (– 39) = 289 – 936$ is incorrect was often seen. Other errors included a faulty evaluation of $\frac{-17 \pm 35}{12}$ as $– 17 \pm 35 \div 12$ and 2 in the denominator rather than 12. Sometimes the negative sign was omitted from the second solution.

Some candidates realised that they could factorise the left hand side and often did so successfully. A minority once they had found the solutions reversed the signs.

11. **Intermediate Tier**

Only a few fully correct solutions, in which candidates had solved the equation by factorising, were seen. Most candidates substituted $x = –2$ into the equation and some gained one mark for verifying that $x = –2$ satisfies the equation. The most common error occurred when candidates attempted to square –2 and got an answer of –4, leading to the conclusion that Lisa was wrong because the value of the expression was –8.

Higher Tier

There were two approaches to answering this question. The first approach involved solving the equation. This was generally done by factorisation or by quadratic formula. Most candidates attempting this approach were able to score both marks.

The other approach involved substituting –2 into the formula. This approach was awarded a maximum of only one mark. A significant proportion of these candidates often concluded that Lisa was wrong, erroneously calculating –2 squared as –4 and thus demonstrating $–2^2 + 4(–2) + 4 =$ ‘–8’.

12. Some weaker candidates gained marks in (a) and (b). In part (a), strong candidates gained a mark for substituting the values of *a, b* and *c* into the quadratic formula- those quoting the formula with greater success than those who didn't. The negative values of *b* and *c* proved a hurdle to many in their evaluation of $b^2 -4ac$.
Part (b) was done well by the majority of candidates.
In part (c), only the best candidates gained any credit, usually for writing
$\frac{n}{4(n+1)} \times \frac{3n+4}{4(n+1)} = \frac{14}{81}$. Those that went on to eliminate the fraction generally managed to complete the proof without error. Candidates that solved part (a) correctly usually gained the mark for part (d). A significant number of candidates solved 4 (n+ 1)=36 to get n = 8, but did not then relate this to part (a). A few recovered by listing 8, 10 and 18.
In part (e), an encouraging number of candidates could add the product of three fractions, usually *P*(*RB*), *P*(*RW*) and *P*(*RW*) which were often derived from a tree diagram. Final answers were usually given as a fraction.

13. **Specification A**

Intermediate Tier

Few marks were earned in this question. Of those who did manage to factorise in part (a), frequently they did not know how to apply this in part (b). The most common response to part (a) was $x(x + 6)$ with –6 and –-8 following in part (b), none of which earned any marks.

Higher Tier

This question was generally done well. Many candidates were able to factorise the expression in part (a) and use this to answer part (b). A common mistake in part (a) was the incomplete factorisation $2x(x + 3) + 8$. A common mistake in part (b) was to incorrectly interpret the factorised expression in part (a) to derive an answer with incorrect signs. A significant number of candidates obtained their answer to part (b) by the quadratic formula even though they had a completely factorised expression in part (a).

Specification B

Intermediate Tier

Factorisation of the given quadratic expression was poor, $x(x + 6)+ 8$ being the best of the failed efforts. Those candidates who understood the method usually got the correct answer. In part (b) answers of $x = 2$ and $x = 4$ often followed a correct part (a). A few candidates, having failed in part (a), started again in part (b) and successfully found the correct solutions. This gained one mark only, unless there had been no attempt at all in part (a).

14. This standard question was tackled with confidence by many candidates to obtain full marks. The most common errors were with signs in '*b'* and *'c*'. Candidates should be aware that many calculators give the answer –25 for $–5^2$.

15. Part (a) required candidates to demonstrate the relationship between $2x$ and $2y$ and the perimeter x and y and the semi perimeter. A surprising number did not realise that this was a general result to be shown and instead selected a value of x and y 'to show it was true'. Part (b) proved to be a challenge. Not only did candidates have to realise that this was a question about the theorem of Pythagoras, but also that they had to demonstrate competence in expanding $(5 - x)^2$. Many realised the first, but not the second in that they did not make the step from $x^2 + y = 4^2$ to an equation in the variable x alone, because they did not see the relevance of part (a) to part (b). Part (c) was dealt with well by good candidates. The usual errors of sign on the –10 were frequently seen and of the 10 becoming detached from the rest of the expression.

16. This was quite a complex problem, generally answered poorly. In part (a) many candidates scored some marks but were prevented from scoring full marks by poor algebra. For example many candidates wrote down the area of the shape as $3x \times 2x - 7$, $3x + 4 \times x$ although some went on to evaluate the expressions correctly.

Answers to part (b) were generally poor with many candidates only managing a maximum of 1 mark from the initial stage in using the formula. As expected the most common error was in the calculation of the discriminant with the answer appearing often. Another common error was to detach the 17 from the rest of the expression or write −17. Surprisingly, many candidates who found the correct solutions of the equation automatically assumed that the answer to (ii) was just the positive root of the equation.

17. Good candidates wrote down $\frac{1}{2}ab$ sin 60 as their first step and then applied this idea to get an equation in x. Good candidates went on to write equations like $x^2 = \frac{72}{\sin 60^\circ}$ and then find 9.12 for the value of x. A few candidates lost their marks by writing $2x$ for x^2 or by dividing 36 by 2 instead of multiplying by 2. Candidates who tried to use base × height ÷2 were generally unsuccessful as they could not get the correct algebraic expression for the height, generally writing $\sqrt{x^2 - \frac{1}{2}x^2}$.

18. Good candidates experienced little difficulty with this question particularly with part (a). However many candidates made very poor attempts often to both parts of the question. In part (a), although the dotted lines in the diagram gave a clue for the algebra needed, many candidates attempted to rearrange the equation and some attempted to substitute numbers into the equation. In part (b), despite the predictability of having to solve a quadratic equation, a good proportion of responses suggested a lack of familiarity or practice in the process. Those candidates who did attempt to use the formula often failed to substitute in the values correctly or made errors in using it such as putting and using the division by 2a for the square root part only. Some also substituted correctly but then made errors with the signs or the arithmetic. A few candidates did attempt to solve by completing the square but usually this was unsuccessful. A number also tried trail and improvement and many of these managed to find one solution, 5.55, and were awarded 1 mark.

19. There were a few candidates who obtained full marks for the question using a complete algebraic process. Many candidates recognised that they had to use the formula $\frac{1}{2}ab\ \sin C$ with the appropriate algebraic expressions substituted in. Those candidates who set this equal to 3 and expanded the brackets frequently then failed to get the correct quadratic equation. Of those candidates who did get a quadratic equation (correct or not) it was disappointing to see so few make use of the given quadratic equation formula. A significant number of candidates attempted trial and improvement from a very early stage. Few such candidates reached the correct answer in this approach. A number of candidates tried to use the sine or cosine rule; this led nowhere.

20. A significant number of candidates tried to solve this quadratic equation by using methods for a linear equation. Those who used factorisation generally had the correct factors but frequently wrong signs appeared. Many candidates who attempted to use the quadratic formula often made mistakes with the signs. Those candidates who used trial and error generally gained no marks as they only gave one of the solutions.

21. Only very few candidates understood the concept of factorisation, and of those only a small number managed to factorise the polynomial accurately. In part (ii) algebraic methods usually ignored part (i), even if correct, and attempted to solve the quadratic by separating $x^2 - 7x$ from the 12, leading to failure. It was more common to award marks in this part of the question for a single correct solution found by trial and improvement; rarely were both solutions found correctly by this method.

22. Those candidates who used the quadratic formula generally gained some credit although a number of these candidates either used 0 for the value of a or went on to evaluate the discriminant as –11 rather than 29. A number of candidates made a correct start with the method of completing the square but then often forgot to include both positive and negative values when taking the square root. Those candidates who used trial and improvement invariably scored 0 as they failed to find both roots correctly.

23. The most efficient way to answer this question was to complete the square. This method was used successfully by only a very small minority of candidates. The popular method used was to use the quadratic formula. Candidates who used this method often failed to substitute the values of a, b and c correctly, 4 instead of –4 was frequently substituted for c. Candidates who did use the quadratic formula correctly were then generally unable to simplify the final solution correctly, $-3 \pm \sqrt{26}$ was a frequently seen incorrect answer. Disappointingly, three quarters of candidates scored no marks on this question.

24. There were a variety of approaches to this question; not all of them correct. A number of candidates simply attempted to solve the given equation rather than deduce it from the given information. This was not what was required and so gained no marks. The most successful candidates were those who drew a vertical line to split the given shape and so were able to use all the given sides to find the area of the shape. Candidates who split the shape up in a different way had to find an expression for the length of one of the sides. Attempts to do this often resulted in incorrect or lengthy expressions which were often incorrect, usually because of the omission of brackets. Approximately one quarter of candidates were able to derive the given equation correctly.

25. This question was very poorly answered. Although some fully correct solutions were seen, about three quarters of candidates were unable to gain any marks. From those candidates who tried to equate coefficients, the most common error was to expand $(x + b)^2$ as $x^2 + b^2$. Candidates who expanded $(x + b)^2$ correctly gained a method mark.

26. Those candidates that recognized the need to use the quadratic formula generally scored one mark for correct substitution into the formula. Following this the most common error was to evaluate the discriminant incorrectly. Candidates also lost marks by only dividing their discriminant by 6. Some candidates lost marks by saying that 2a was 2×13. Even candidates who were able to evaluate this correctly then frequently made errors when using their calculators for the final evaluation. A number of candidates used a trial and improvement method but generally only found $x = 1.22$ and so put $x = -1.22$ as their other solution; this approach only gained one mark for one correct solution. A fully correct solution was seen from approximately 13% of candidates.

27. The question asked for solutions to be given correct to 3 significant figures and this should have alerted candidates to the fact that they needed to use the quadratic formula. Relatively few, however, used the formula. Many used trial and improvement and some of these candidates were able to find one solution to a sufficient degree of accuracy to gain one mark. Attempts at factorising were common as were attempts to rearrange the equation. Many of those who did use the formula were unable to gain all 3 marks. The formula was usually written down correctly but even if the substitution was correct an inability to deal with negative numbers meant that the discriminant was often evaluated incorrectly. Another common error was to divide only the discriminant by 4.

28. Apart from some cases of trial and improvement where the $x = 9$ was found, this proved to be inaccessible for many candidates. As calculators were not available, most successful candidates tried to factorise the left hand side. Those that did try the quadratic formula generally could not handle the number work, even if they had substituted in correctly.

Common errors which scored marks were based on incorrect factorisations of the quadratic expression to, for example, $(x - 9)(x - 5)$ or $(x + 9)(x - 5)$. A very common and disappointing error was to write the factorised form as the answer on the answer line – so the candidates were presumably unaware of the requirement from the key word 'solve'

29. Part (a) was a standard quadratic equation. Many candidates tried factorisation despite the hint that the answers should be correct to 2 decimal places. Others did not use the formula with sufficient care or precision so often the 'b' term was detached from its denominator.

Candidates who used completing the square were often successful.

Part (b) was intended to tease out whether candidates understood that multiplying through any equation by a constant leaves the solutions unchanged. Many candidates took the opportunity offered by the working space to use whatever method they had used (often unsuccessfully) in part (a). Few saw the connection despite the instruction in the question that is was a 'write down'.