1.

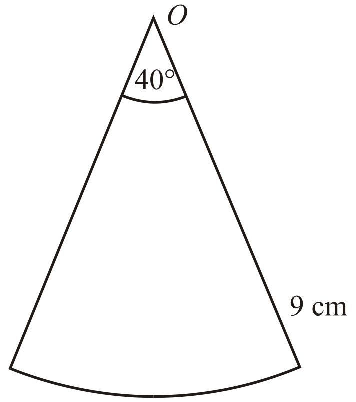


Diagram **NOT** accurately drawn

The diagram shows a sector of a circle, centre *O*.
The radius of the circle is 9 cm.
The angle at the centre of the circle is 40°.

Find the perimeter of the sector.
Leave your answer in terms of π.

...........................cm
(Total 4 marks)

2.

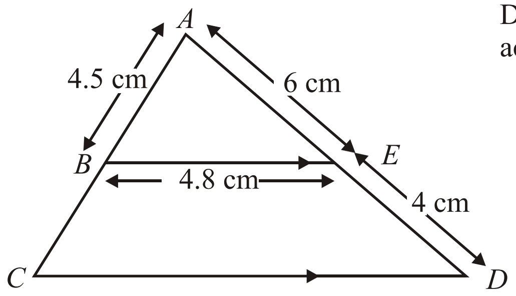


Diagram **NOT** accurately drawn

BE is parallel to *CD*.
AE = 6 cm, *ED* = 4 cm, *AB* = 4.5 cm, *BE* = 4.8 cm.

(a) Calculate the length of *CD*.

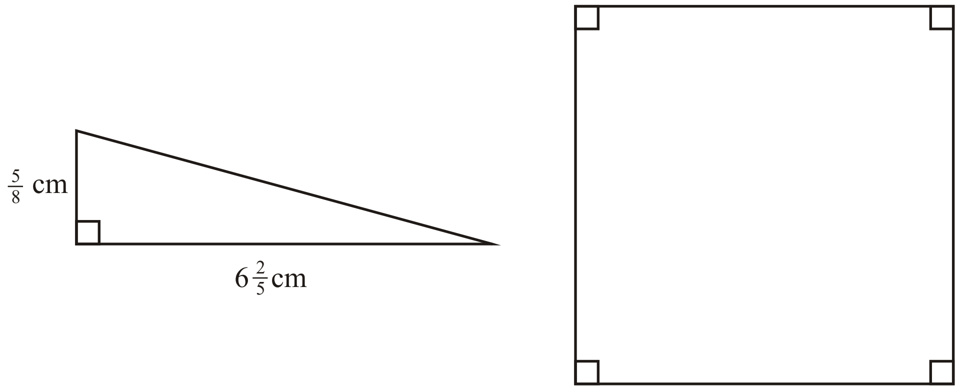
.......................cm
(2)

(b) Calculate the perimeter of the trapezium *EBCD*.

.......................cm
(2)
(Total 4 marks)

3.

Diagrams **NOT** accurately drawn



The area of the square is 18 times the area of the triangle.

Work out the **perimeter** of the square.

.... cm

(Total 5 marks)

4.

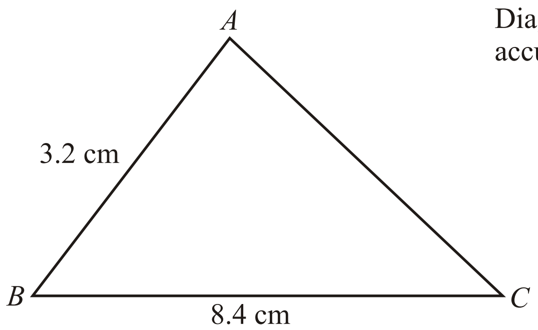


Diagram **NOT** accurately drawn

$AB = 3.2$ cm
$BC = 8.4$ cm

The area of triangle *ABC* is 10 cm^2.

Calculate the perimeter of triangle *ABC*.
Give your answer correct to three significant figures.

.... cm
(Total 6 marks)

5. The length of a rectangle is 6.7 cm, correct to 2 significant figures.

(a) For the length of the rectangle write down

(i) the upper bound,

.....................................cm

(ii) the lower bound.

.....................................cm

(2)

The area of the rectangle is 26.9 cm^2, correct to 3 significant figures.

(b) (i) Calculate the upper bound for the width of the rectangle.
Write down all the figures on your calculator display.

.....................................cm

(ii) Calculate the lower bound for the width of the rectangle.
Write down all the figures on your calculator display.

.....................................cm

(3)

(c) (i) Write down the width of the rectangle to an appropriate degree of accuracy.

.....................................cm

(ii) Give a reason for your answer.

....

(2)
(Total 7 marks)

6.

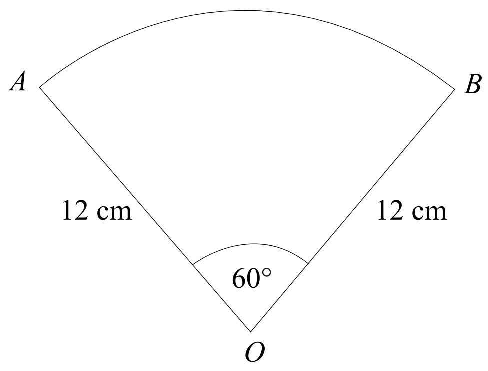


Diagram **NOT** accurately drawn

OAB is a sector of a circle, centre *O*.
Angle *AOB* = 60º.
OA = *OB* = 12 cm.

Work out the length of the arc *AB*.
Give your answer in terms of π.

.... cm
(Total 3 marks)

7.

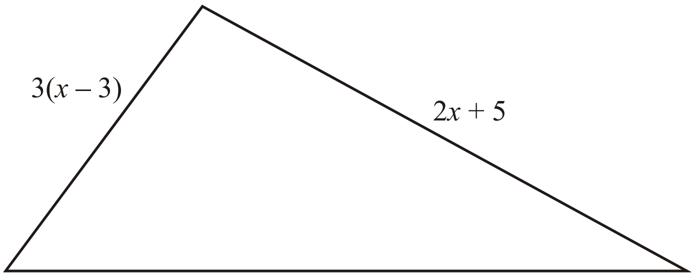


Diagram **NOT** accurately drawn

The lengths, in cm, of the sides of the triangle are $3(x - 3)$, $4x - 1$ and $2x + 5$

(a) Write down, in terms of x, an expression for the perimeter of the triangle.

.... cm

(1)

The perimeter of the triangle is 49 cm.

(b) Work out the value of x.

x = ...

(2)

(Total 3 marks)

8.

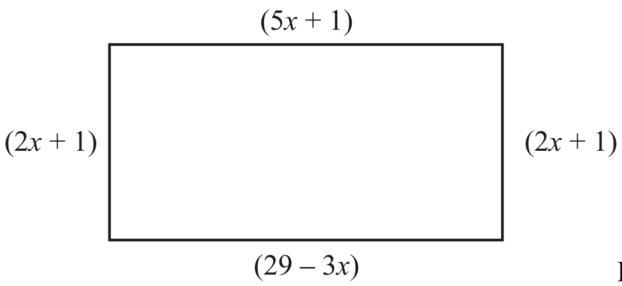


Diagram **NOT** accurately drawn

The diagram shows the length, in centimetres, of each side of the rectangle.
The perimeter of the rectangle is P cm.

Work out the value of P.

P = ...
(Total 4 marks)

9.

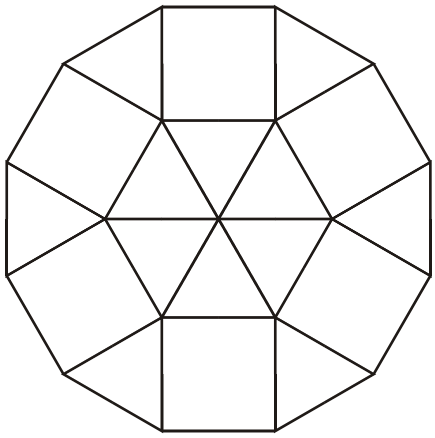


Diagram **NOT** accurately drawn

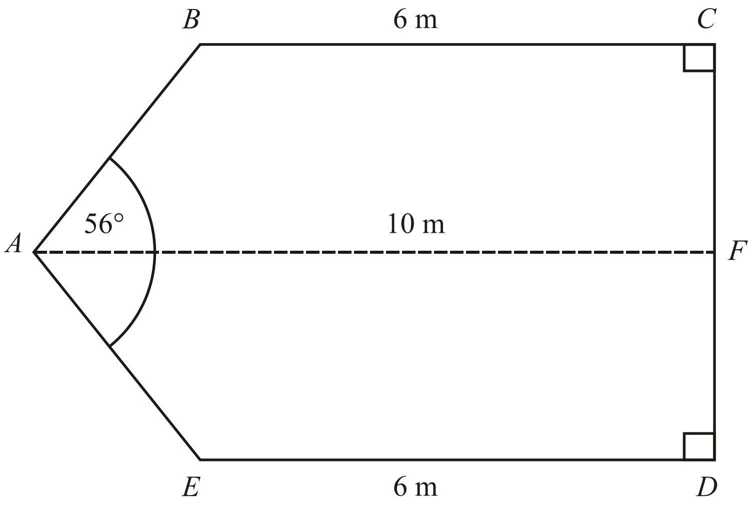
This 12-sided window is made up of squares and equilateral triangles.
The perimeter of the window is 15.6 m.

Calculate the area of the window.
Give your answer correct to 3 significant figures.

.... m^2
(Total 6 marks)

10.

Diagram **NOT** accurately drawn



ABCDE is a pentagon.
BC = *ED* = 6 m.
Angle *BCD* = angle *CDE* = 90°.
Angle *BAE* = 56°.

The point *F* lies on *CD* so that *AF* is the line of symmetry of the pentagon and *AF* = 10 m.

Calculate the perimeter of the pentagon.
Give your answer correct to 3 significant figures.

.... m
(Total 6 marks)

11.

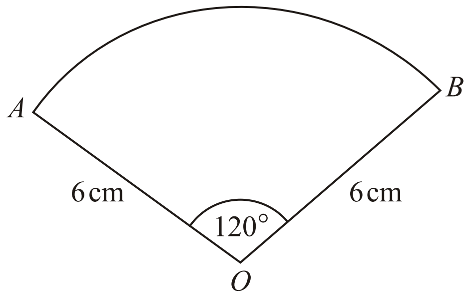


Diagram **NOT** accurately drawn

The diagram shows a sector of a circle, centre *O*.
The radius of the circle is 6 cm.
Angle *AOB* = 120°.

Work out the **perimeter** of the sector.
Give your answer in terms of π in its simplest form.

.... cm
(Total 3 marks)

1. $2\pi + 18$ 4

(arc =) $\frac{40}{360} \times 2\pi \times 9 = 2\pi$

M1 for $\frac{40}{360} \times$

M1 for $2\pi \times 9$

M1 (dep) for $\frac{40}{360} \times 2\pi \times 9$ *oe*

A1 for $\frac{18 \times \pi}{9} + 18$ *oe exact form*

[4]

2. (a) 8 2

SF = $\frac{10}{6}$

$\frac{10}{6} \times 4.8 = 8$

M1 for sight of $\frac{10}{6}$ *or* $\frac{10}{6}$ *or 1.67 or better or* $\frac{CD}{10} = \frac{4.8}{6}$

A1 cao

(b) 19.8 2

$\frac{10}{6} \times 4.5 - 4.5 = 3$

M1 for use of SF from (a) to find AC or BC or

$\frac{BC}{4.5} = \frac{4}{6}$ *and adding 4 sides*

A1 cao

[4]

3. 24 5

$6\frac{2}{5} = \frac{32}{5}$

Area of triangle = $\frac{1}{2} \times \frac{5}{8} \times 6\frac{2}{5}$ (= 2)

Length of a side of sq. = $\sqrt{18 \times "2"}$ (= 6)

Perimeter of square = 4 × 6

B1 for $6\frac{2}{5} = \frac{32}{5}$ oe or $3\frac{1}{5} = \frac{16}{5}$ oe or $\frac{30}{8} + \frac{2}{8}$ oe (or implied by area of triangle = 2)

M1 for $\frac{1}{2} \times \frac{5}{8} \times 6\frac{2}{5}$ oe

M1 for (area of square) = 18 × product of two lengths

A1 = $\sqrt{18 \times "2"}$

A1 for 24

[5]

4. 18.3 — 6

$0.5 \times 3.2 \times 8.4 \times \text{Sin } B = 10$
sin $B = 0.74404\ldots$
48.077
$AC^2 = 3.2^2 + 8.4^2 - 2 \times 3.2 \times 8.4 \times \cos B$
$AC^2 = 44.8815\ldots..$
$AC = 6.69\ (936\ldots)$
Perimeter = 18.3

Use the altitude AD, $\frac{h \times 8.4}{2} = 10 \Rightarrow h = (2.381)$

$BD = \sqrt{3.2^2 - h^2} = 2.139$
$DC = 6.261$

$AC = \sqrt{2.38^2 + '6.261'^2} = 6.69(936)$

Perimeter = 18.3

M1 for 0.5 × 3.2 × 8.4 × sin B (= 10)
A1 for sin B = 0.74(404...) or B = 47.7 – 48.1
M1 for $3.2^2 + 8.4^2 - 2 \times 3.2 \times 8.4 \times \cos$ *“48.077”*
M1(dep) for AC^2 *= “44.8(815)”..... with correct order of evaluation*
A1 AC = 6.69 – 6.7
A1 18.29 – 18.3
M1 for $\frac{h \times 8.4}{2} = 10$ □ $h = (2.381)$
M1 for $BD^2 = 3.2^2 - \text{"}2.381\text{"}^2$
A1 BD = 2.1 – 2.2
M1 (dep) $AC^2 = \text{"}2.381\text{"}^2 + \text{"}6.261\text{"}^2$
A1 AC = 6.69 – 6.7
A1 18.29 – 18.3

5. (a) (i) 6.75 — 1
B1 cao

(ii) 6.65 — 1
B1 cao

(b) (i) 26.95 ÷ 6.65
4.05263 — 3
M1 for “26.95” ÷ “6.65” where 26.9 < “26.95” ≤ 26.95 and 6.65 ≤ “6.65” < 6.7
A1 for 4.05263 (....)

(ii) 26.85 ÷ 6.75
3.97778
If M1 not earned in (i), then M1 for '26.85'÷'6.75' where 26.85 ≤ '26.85' < 26.9 and 6.7 < '6.75' ≤ 6.75
A1 for 3.9777 (.....)

(c) (i) 4 — 2
B1 cao

(ii) bounds agree to 1sf
B1 for appropriate reason for 4

[7]

6. $\frac{60}{360} \times 2 \times \pi \times 12 = 4\pi$ — 3

M2 for $\frac{60}{360} \times 2 \times \pi \times 12$*, accept numerical* π
(M1 for $\frac{60}{360} \times k$*, where k in terms of* π*, or* $n \times 2 \times \pi \times 12$*, n < 1)*
A1 for 4π *or* $\frac{a\pi}{b}$ *cao, where a and b are correct integers*

[3]

7. 6 — 3

$3(x - 3) + 2x + 5 + 4x - 1$
$3x - 9 + 2x + 5 + 4x - 1 = 49$
$9x = 54$
B1 for $3(x - 3) + 2x + 5 + 4x - 1$ *or better (=* $9x - 5$*)*
M1 ft for "$3(x - 3) + 2x + 5 + 4x - 1$*" = 49 ft on ax + b from (a), a, b ≠ 0*
A1 cao

[3]

8. 53 4

$5x + 1 = 29 - 3x$
$8x = 28$
$x = 3.5$
$2 \times (2 \times 3.5 + 1) + 2 \times (5 \times 3.5 + 1)$

M1 for 5x + 1=29 – 3x or
(2x + 1)(5x + 1) = (2x + 1)(29 – 3x)
A1 for 3.5
M1 for any correct expression for perimeter
A1 for 53

[4]

9. 18.9…. 6

Each side = 15.6 ÷ 12 = 1.3
"1.3"^{2} "0.65" ^{2} + h^2
$h = \sqrt{(1.3^2 - 0.65^2)} = \sqrt{1.2675}$
Area Δ = ½ × "1.3" × "$\sqrt{1.2675}$ "
= 0.73179…
6□ + 12Δ= "10.14" + "8.781…"
= 18.9215…

M1 for 15.6 ÷ 12 (= 1.3)
M1 for "1.3"^{2} = "0.65"^{2} + h^2 *or* $\sin 60 = \frac{h}{\text{"1.3"}}$ *oe*
or (h^2 =) "1.3"^{2} – "0.65"^{2}
M1 (dep) for (h =) $\sqrt{(1.3^2 - 0.65^2)} = \sqrt{1.2675}$
or (h =) "1.3" × sin 60 (= 1.12583…)
M1 (dep) for area of triangle = ½ × "1.3" × "h"
M1 (indep) for 6 × "area of square" (= 10.14…) + 12 ×"area of triangle" (= 8.78…)
A1 for $18.9 \le \text{ans} \le 19.0$

[6]

10. $CF = 4 \tan 28°$ (=2.1268…)
$AB = 4 \div \cos 28°$ (= 4.53028)
6+6+2 × "4.53…" + 2 × "2.126…"
25.3 6

M1 for right angled triangle with 4cm in correct position
***or** 1 correct angle (28° or 62°)*
M1 for correct trig or Pythagoras statement involving
(eg. $\tan"28" = \frac{CF}{"4"}$)
M1 for making CF the subject (eg(CF=) "4" tan "28")
CF (=2.1268...)
M1 for correct trig or Pythagoras statement involving
(eg. $\cos "28" = \frac{"4"}{AB}$
or $\sin "28" = \frac{"CF"}{AB}$
or $"4"^2 + "CF"^2 = AB^2$)
M1 for making AB the subject
(eg. (AB =) $\frac{"4"}{\cos"28"}$
or $AB = \frac{"CF"}{\sin"28"}$
or $AB = \sqrt{"4"^2 + "CF"^2}$)
AB (= 4.5302...)
A1 for $25.3 \le ans < 25.32$
SC: If 56° used for angle BAF or 34° for angle $A\hat{B}E$
then award a maximum of M5A0 ($38.16 \le ans \le 38.2$)

[6]

11. $\frac{120}{360} \times \pi \times 2 \times 6$
$4\pi + 12$ 3

M1 for $\frac{120}{360} \times \pi \times 2 \times 6$ oe allow 3.14, 3.142, $\frac{22}{7}$ for π
A1 for 4π or anything in the closed interval [12.56, 12.57],
or $12\frac{4}{7}$ oe or $\frac{a\pi}{b}$ where a and b are integers with a = 4b
A1 4π + 12 or π4 + 12 oe
SC (B2 for a fully correct, but unsimplified expression for the perimeter, including $\left(\frac{2\pi r}{3}\right) + 12$ or $\left(\frac{2\pi r}{3}\right) + 2r$
Or for any value in the closed interval [24.56, 24.57])

[3]

1. Although many candidates had a good understanding of the required method it was not uncommon to see others using the wrong formula for the circumference of the circle. Again, basic numerical slips were in evidence, for example $\frac{360}{40} = 8$, but the most common loss of a mark was due to forgetting to add the two radii to the arc length to find the perimeter. A small minority of candidates insisted on using a value for π and generally got lost in a maze of numbers.

2. **Paper 4**

This was a very poorly attempted question. Those candidates who recognised similar triangles were usually unable to identify the correct scale factor, with $\frac{6}{4}$ often being used. Some candidates gained one mark in part (b) for correctly calculating the length of *BC* but many assumed the trapezium to be isosceles with *BC* = *ED*.

Paper 6

Candidates who realised that this was the standard question on similar triangles, or enlargement had little trouble with the question. However, there was a great deal of confusion over which sides to use in order to find the scale factor. Few candidates opted to use the expedient of drawing the two triangles separately and specifically identifying the corresponding sides.
Part (b) was a more unusual question. Many candidates tried to find the perimeter of the triangle.
There was a great deal of confusion what to use as scale factors.

3. **Mathematics A**

Paper 3

Most candidates found this question very difficult and numerous misconceptions were demonstrated. In many cases little care was taken over the presentation or structure of answers and working was often difficult to follow. Some candidates did manage to write $6\frac{2}{5}$ as $\frac{32}{5}$ but those who decided to write both lengths as decimals rarely did so correctly. Many used 'base × height' to find the area of the triangle and $6\frac{2}{5} \times \frac{5}{8}$ was often evaluated as $6\frac{10}{40}$. Candidates who got as far as multiplying their area by 18 were often unable to continue correctly. Few appreciated that it was necessary to find the square root of the area of the square and a common error was for the area to be divided by 4.

Paper 5

In this multi-step question on fractions and area/perimeter many of the grade B and higher grade candidates scored some credit but many made ‘heavy work’ of it. When multiplying $\frac{5}{8}$ by $6\frac{2}{5}$ the most common approach was to convert each to 40ths, (some even changing the 6 and the 2/5 each separately to 40ths) then use long multiplication generally getting lost in a mass of numbers before even considering multiplying the answer by 18. Another common mistake was to miss out the factor of ½ when finding the area of the triangle. Better candidates used correct formulae and direct cancelling methods to complete the whole question within a line, dealing directly with the expression $\sqrt{18\times\frac{1}{2}\times\frac{32}{5}\times\frac{5}{8}}\times 4$.

Candidates who included a few words within their solution, for example “area of triangle =…….”, “area of square = 18 ×…..” were often more successful than those who just listed lots of calculations in random positions in the working space.

Mathematics B Paper 18

In general, this question produced a great deal of working from the majority of candidates. However, a fully correct solution was seen from only a minority of candidates. Of those candidates who successfully changed $6\frac{2}{5}$ into $\frac{32}{5}$, few then realised that cancelling fractions was the most efficient route to take. A significant number of candidates changed both fractions to obtain a common denominator before multiplying; this generally then led to arithmetical errors occurring. Some of the candidates that were successful in obtaining the correct length of one side of the square then failed to read the question carefully and gave the answer as 6cm instead of going on further to determine the perimeter.

4. **Mathematics A Paper 6**

This proved to be a somewhat challenging question, but it is pleasing to see how many candidates made inroads into this multistep problem. Successful candidates fell into two groups. The first used area = $\frac{1}{2}ab\sin C$ to find the angle at *B* and then use the cosine rule to find the length of the opposite side *AC*. The second used the rule area = $\frac{1}{2}bh$ to find the length of the altitude *AD*. Two uses of Pythagoras in triangle *ABD* and *ACB* resulted in *AC* being found. The two approaches seemed to be equally common. However, those who chose the trigonometrical approach often fell into one of two errors. The first one was to think that they had found the angle *C,* instead of angle *B;* the second was to evaluate the cosine rule incorrectly.

Mathematics B Paper 19

A variety of different methods were seen. The most common approach was to use the sine rule to evaluate angle *B* then the cosine rule to evaluate *AC*. In this approach, the most common error came when evaluating *AC* by carrying out the arithmetic operations in the wrong order. The other method commonly seen was to work out *BC* (or *AB*) from using area of triangle = $\frac{1}{2}$ × base × height, then using Pythagoras's Theorem twice to obtain *AC* (or a combination of trigonometry and Pythagoras's theorem). A very common error was for candidates to assume that triangle *ABC* was right-angled and attempt to use Pythagoras's theorem.

5. Most candidates were able to identify the correct upper and lower bounds. There were a few 6.74s for (i) and also a few 6 974. □□s. Responses to part (b) were not generally correct, the main error being that candidates used 26.9 rather than the upper and lower bounds of the 26.9. Of these candidates that did recognise this, most were successful in pairing up the correct upper and lower bounds in the quotient.

6. Virtually all the candidates attempted this question, but with varying success. Some used the circumference formula with 12 instead of 24; some calculated the perimeter of the sector, adding 24 to the arc length; Some calculated the area of the sector instead of the length.

Other common errors involved a misuse of the fraction $\frac{60}{360}$, which resulted in multiplying the arc length by 6 or by $\frac{1}{4}$.

A significant number of candidates gave their final answer unsimplified as $\frac{60}{360} \times \pi \times 24$. Very few used 3.14 in their calculations.

7. The majority of candidates were able to answer part (a) correctly. There were, however, a minority of candidates who multiplied out $3(x - 3)$ incorrectly without having previously written out the correct expression. Candidates should be reminded to show all their working. In part (b), a common error was to subtract 5 from 49 instead of adding it.

8. Higher Tier

Approximately one fifth of candidates were able to give a fully correct solution to this question. The majority of candidates were able to gain some credit for writing down a correct expression for the perimeter. Those candidates who appreciated that $5x + 1$ must be equal to $29 – 3x$ were able to score full marks. Candidates who used trial and improvement were rarely successful.

Intermediate Tier

Only a small number (5%) gained full marks, and this was usually a result of a trial and improvement as opposed to any algebraic method. The majority of candidates attempted to derive an algebraic expression for the perimeter of the rectangle and this gained one mark if a correct expression was given. Quite often $5x + 1$ was put equal to $6x$, etc. which lead to expressions of $38x$ or, in some cases, just 38.

9. Just over 10% of candidates were able to give fully correct solutions to this question. Over 80% of candidates were able to score some marks generally for recognising that 15.6 needed to be divided by 12 and for adding together the area of six squares and twelve triangles. The most common error was to use 1.3 for both the base and height of the triangle (or assume incorrectly that the area of a triangle was half the area of a square) thus the most commonly seen answer to the question was 20.28 coming from this incorrect method. Some candidates used $\frac{1}{2}ab\sin C$ to find the area of one triangle. This method does not form part of the modular stage 1 specification but was awarded marks as a fully correct method. Of those candidates who recognised the necessity to find the height of the triangle, most used Pythagoras's theorem. The common error was then to forget to take the square root following the relevant subtraction.

10. The majority of candidates were able to realise that a right angled triangle needed to be formed in order to calculate the missing lengths needed to calculate the perimeter. A fully correct method was seen from approximately one quarter of candidates. Some candidates used 56° for angle *BAF* instead of the correct 28°A common error of candidates was to write $\cos 28° = \frac{4}{hyp}$ and then follow up with hyp = 4 × cos28°. Some of these candidates then went on to use Pythagoras with the hypotenuse shorter than the adjacent side.

11. The sector is, of course, in this case one third of its circle so the fraction demand was reasonable for a higher tier paper, although some candidates assumed it was a quarter of a circle.. Many candidates used the area formula and thus scored no marks. Of those that used the correct formula many could not simplify completely the expression for the arc length. Those that did get the arc length, did, however often go on to add 12 to get an expression for the perimeter although a few spoiled things at the end by writing $12 + 4\pi = 16\pi$.