1.

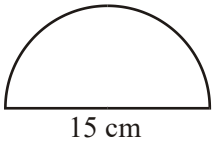


Diagram **NOT** accurately drawn

The diagram shows a semi-circle.
The diameter of the semi-circle is 15 cm.

Calculate the area of the semi-circle.
Give your answer correct to 3 significant figures.

.....

(Total 3 marks)

2. The diameter of a circle is 12 centimetres.

(a) Work out the circumference of the circle.
Give your answer, in centimetres, correct to 1 decimal place.

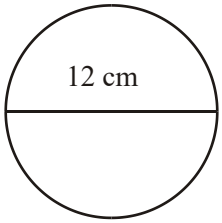


Diagram **NOT** drawn accurately

..... cm

(2)

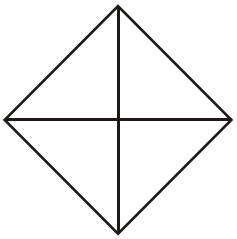


Diagram **NOT** accurately drawn

The length of each diagonal of a square is 20 cm.

(b) Work out the area of the square.

..... cm^2

(2)

(Total 4 marks)

3. A 10 pence coin is made from copper and nickel.
The ratio of the weight of copper to the weight of nickel is 18:6

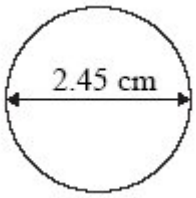
(a) Write the ratio 18:6 in its simplest form

……..

(1)

The diameter of the 10 pence coin is 2.45 cm.

(b) Work out the circumference of the coin.
Give your answer correct to 1 decimal place.



……cm

(2)

(Total 3 marks)

4.

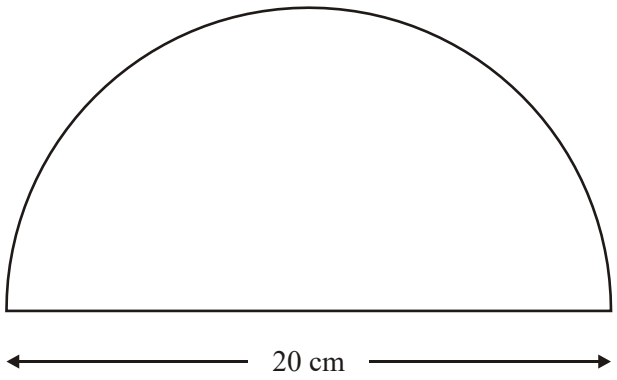


Diagram **NOT** accurately drawn

A semicircle has a diameter of 20 cm.

Work out the perimeter of the semicircle.
Take the value of π to be 3.14

..... cm
(Total 3 marks)

5. The top of a table is a circle.
The radius of the top of the table is 50 cm.

(a) Work out the area of the top of the table.

……cm^2
(2)

The base of the table is a circle.
The diameter of the base of the table is 40 cm.

(b) Work out the circumference of the base of the table.

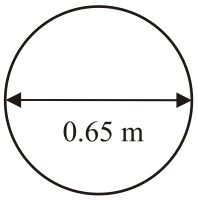
……cm

(2)
(Total 4 marks)

6. The diameter of a wheel on Harry's bicycle is 0.65 m.

Calculate the circumference of the wheel.
Give your answer correct to 2 decimal places.

Diagram **NOT** accurately drawn



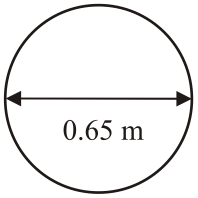
..... m

(Total 2 marks)

7. The diameter of a wheel on Harry's bicycle is 0.65 m.

(a) Calculate the circumference of the wheel.
Give your answer correct to 2 decimal places.

Diagram **NOT** accurately drawn



..... m

(2)

Harry cycles 1000 metres.

(b) Calculate the number of turns the wheel makes.

.....

(2)
(Total 4 marks)

8.

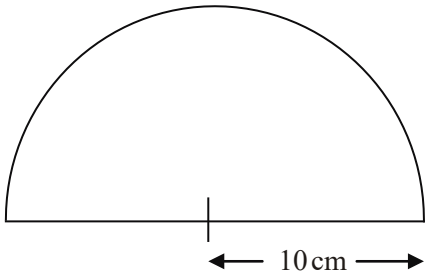


Diagram **NOT** accurately drawn

The diagram shows a semicircle.
The radius of the semicircle is 10 cm.

Calculate the area of the semicircle.
Give your answer correct to 3 significant figures.
State the units of your answer.

.....

(Total 3 marks)

9.

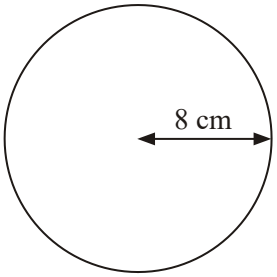


Diagram **NOT** accurately drawn

The radius of this circle is 8 cm.

Work out the circumference of the circle.
Give your answer correct to 2 decimal places.

..... cm

(Total 2 marks)

10.

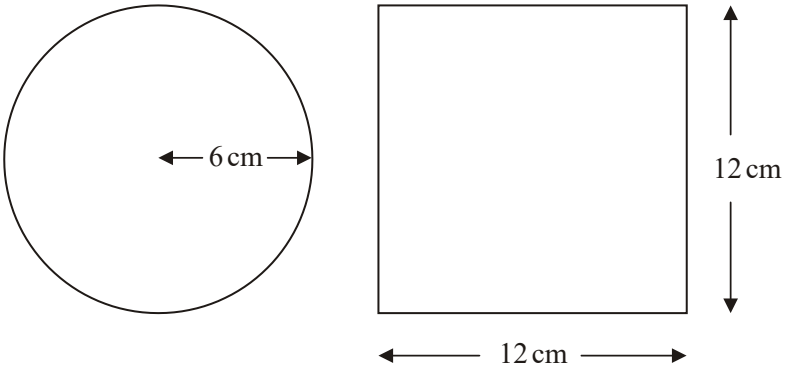


Diagram **NOT** accurately drawn

A circle has a radius of 6 cm.

A square has a side of length 12 cm.

Work out the difference between the area of the circle and the area of the square.
Give your answer correct to one decimal place.

..... cm^2

(Total 4 marks)

11. Here is a tile in the shape of a semicircle.

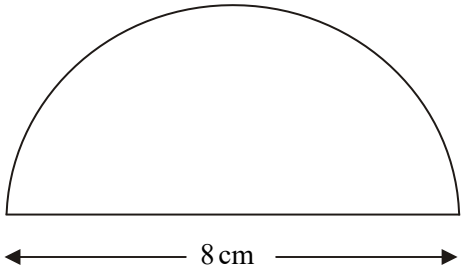


Diagram **NOT** accurately drawn

The diameter of the semicircle is 8 cm.

Work out the perimeter of the tile.
Give your answer correct to 2 decimal places.

..... cm

(Total 3 marks)

12.

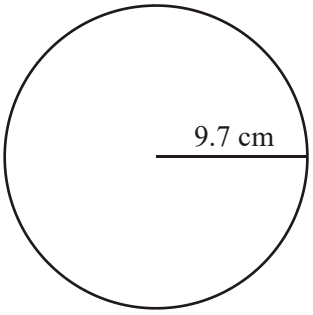


Diagram **NOT** accurately drawn

The radius of the circle is 9.7 cm.
Work out the area of the circle.
Give your answer to 3 significant figures.

…… cm^2

(Total 2 marks)

13. A circle has a radius of 6.1 cm.
Work out the area of the circle.

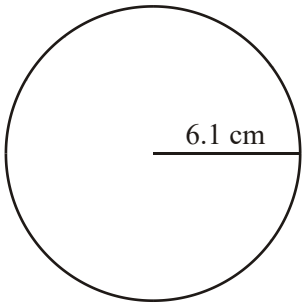


Diagram **NOT** accurately drawn

.....

(Total 3 marks)

14. Jerry has a new garden roller.
Part of the roller is a cylinder.
The diameter of the cylinder is 0.7 m.
Jerry pushes the roller along.
The cylinder goes around exactly 16 times.

Picture **NOT** accurately drawn

Work out how far the roller moves.
Give your answer correct to 3 significant figures.

…… m
(Total 3 marks)

15. The radius of a circle is 3.60 m.

Work out the area of the circle.
Give your answer correct to 3 significant figures.

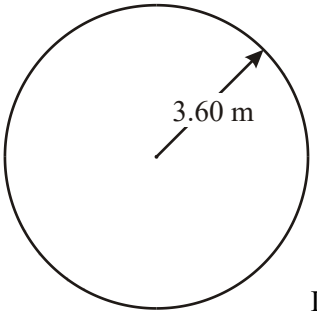


Diagram **NOT** accurately drawn

……..……..

(Total 3 marks)

16. The radius of a circle is 6.4 cm.

Work out the circumference of this circle.

Give your answer correct to 1 decimal place.

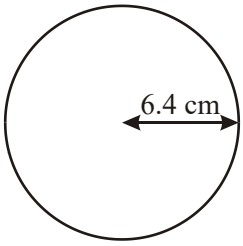


Diagram **NOT** accurately drawn

..... cm

(Total 2 marks)

17.

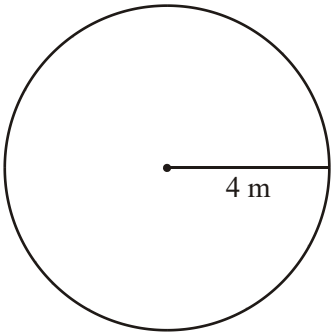


Diagram **NOT** accurately drawn

The radius of a circle is 4 m.

Work out the area of the circle.
Give your answer correct to 3 significant figures.

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

18.

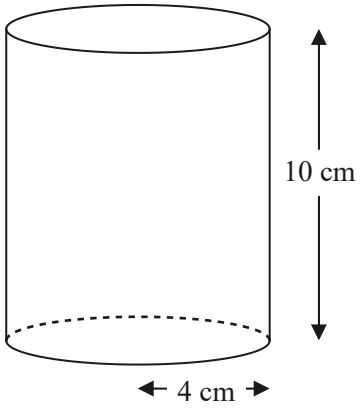


Diagram **NOT** accurately drawn

A solid cylinder has a radius of 4 cm and a height of 10 cm.

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

..... cm^3

(Total 2 marks)

19.

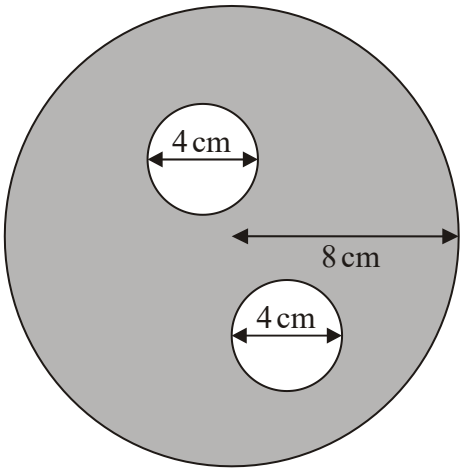


Diagram **NOT** accurately drawn

The diagram shows two small circles inside a large circle.
The large circle has a radius of 8 cm.

Each of the two small circles has a diameter of 4 cm.

(a) Write down the radius of each of the small circles.

..... cm

(1)

(b) Work out the area of the region shown shaded in the diagram.
Give your answer correct to one decimal place.

..... cm^2

(4)
(Total 5 marks)

20.

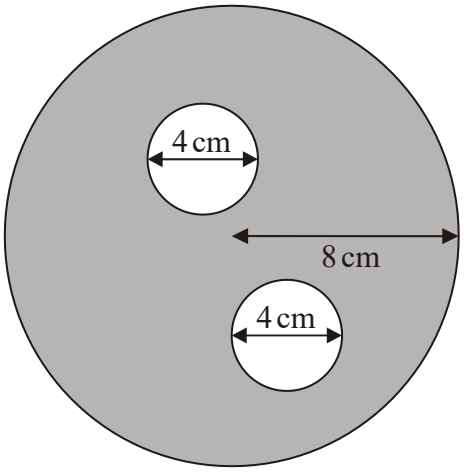


Diagram **NOT** accurately drawn

The diagram shows two small circles inside a large circle.
The large circle has a radius of 8 cm.

Each of the two small circles has a diameter of 4 cm.

(a) Write down the radius of each of the small circles.

..... cm

(1)

(b) Work out the area of the region shown shaded in the diagram.
Give your answer correct to one decimal place.

..... cm^2

(4)
(Total 5 marks)

21.

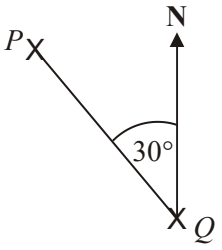


Diagram **NOT** accurately drawn

What is the bearing of *P* from *Q*?

030°	120°	150°	210°	330°
A	**B**	**C**	**D**	**E**

(Total 1 mark)

1. 88.4cm^2 3

$\pi \times \left(\frac{15}{2}\right)^2 = 176.715$

M1 for $\pi \times \left(\frac{15}{2}\right)^2$

A1 88.3 – 88.4

B1 for cm²(independent)

[3]

2. (a) 37.7cm 2

$\pi \times 12$

M1 for $\pi \times 12$

A1 for 37.68 – 37.71

(b) 200cm^2 2

$0.5 \times 10 \times 10 = 50$

$50 \times 4 = 200$

M1 for 0.5 × 10 × 10, 0.5 × 10 × 20, 0.5 × 20 × 20, $\sqrt{(10^2 + 10^2)}$*, or 5 seen*

A1 cao for 200

[4]

3. (a) 3 : 1 1

B1 cao

(b) 7.7 2

$\pi \times 2.45$

M1 for $\pi \times 2.45$ *(accept* π *as 3.1 or better)*

A1 for 7.59 to 7.70

[3]

4. $2 \times 3.14 \times 10 = 62.8 (62.8 – 62.9)$
$62.8 \div 2 = 31.4 (31.4 – 31.5)$
$31.4 + 20 = 51.4 – 51.5$ 3

M1 for $2 \times 3.14 \times 10$ or $\pi \times 20$ or $2 \times \pi \times 10$, or $3.14 \times 20/2$ or $\pi \times 20/2$ or $2 \times \pi \times 10/2$ or 62.8 seen
A1 for 31.4 – 31.5 seen for arc length
B1 ft (indep) for "31.4" + 20 or 51.4 – 51.5
NB: allow use of 3.142, 3.1, 3, 22/7 instead of 3.14

[3]

5. (a) $3.14 \times 50 \times 50$
7854 2

M1 for $\pi \times 50 \times 50$ (accept π as 3.1 or better
A1 for 7750 to 7860 or 2500 π or π2500

(b) 3.14×40
126 2

M1 for $\pi \times 40$ (accept π as 3.1 or better)
A1 for 124 to 126 or 40π or 40π

[4]

6. $\pi \times 0.65$
2.04 – 2.05 2

M1 for $\pi \times 0.65$ or 3.14×0.65 or 3.142×0.65
A1 for 2.04 – 2.05
SC Award B1 for 2.0 seen (not 2)

[2]

7. (a) $\pi \times 0.65$
$= 2.04 – 2.05$ 2

M1 for $\pi \times 0.65$ or 3.14×0.65 or 3.142×0.65 oe
A1 2.04 – 2.05
SC Award B1 for 2.0 seen (not 2)

(b) $1000 \div$ "(a)"
$= 487 – 491$ 2

M1 for 1000 (or 100) ÷ "(a)"
A1 for 487 – 491

[4]

8. $\frac{1}{2}\pi \times 10^2 = 157\ \text{cm}^2$ 3

M1 for sight of $\frac{1}{2}\pi \times 10^2$ *or* $\pi \times 10^2$

A1 157 – 157.1

B1 (indep) cm^2

[3]

9. $C = 2 \times \pi \times 8$

50.24-50.29 2

M1 $C = 2 \times \pi \times 8$ *or* $\pi \times 16$ *oe*

A1 50.24-50.29

[2]

10. $\pi \times 6^2$

$12^2 - \pi \times 6^2$

30.9 4

M1 for 12^2 *or 144 seen*

M1 for $\pi \times 6^2$ *or 113. ... seen*

M1 (dep on M2) for "12^2*" – "*$\pi \times 6^2$*"*

A1 for 30.88 – 31

[4]

11. $(0.5 \times 3.14... \times 8) + 8$

20.56 – 20.58 3

M2 for $(0.5 \times \pi \times 8)$ *or* $\pi \times 4$ *or* $(\pi \times 8 + 8)$ *or* $(0.5 \times \pi \times 8 + 8)$ *oe*

(M1 for $\pi \times 8$ *or* $2\pi \times 4$*; for a value 25.1-25.2 inclusive unless seen with incorrect working eg* πr^2*)*

A1 for 20.56 – 20.58

*(**SC**: B2 if M0 scored for 12.56 – 12.58)*

[3]

12. 296 cm^2 2

$\pi \times 9.7^2$

M1 for $\pi \times 9.7^2$
A1 for 295 to 296

[2]

13. 116… cm^2 3

$\pi(6.1)^2$

M1 for $6.1^2 \times \pi$ (or 37.(21) × 3.14…)
A1 for 116. ….,117 or 120
B1 (indep)

[3]

14. 35.2 m 3

$\pi \times 0.7$ (= 2.1991…)
16 × "2.1991…"

M1 for $\pi \times 0.7$ (= 2.1991…)
M1 for 16 × "2.1991…"
A1 for 35.2 or any answer that rounds to 35.2

[3]

15. 40.7 m^2 3

$\pi 3.6^2$

M1 for $\pi 3.6^2$
A1 for a number rounding to 40.7
B1 (indep) for m^2

[3]

16. 40.2 2

$2 \times \pi \times 6.4$

M1 for 2 × □ × 6.4
A1 for 40.2 or better

[2]

17. 50.2 to 50.3 2

$\pi \times 4^2$

M1 for $\pi \times 4^2$
A1 for 50.2 to 50.3

[2]

18. $\pi \times 4^2 \times 10 = 502.65$
(502 – 503)

503 2

M1 for $\pi \times 4^2 \times 10$ (= 502.65)
A1 for 502 – 503
SC: B1 for $\pi \times 8^2 \times 10$

[2]

19. (a) 2 cm 1

B1 cao

(b) $\pi \times 8^2 - 2 \times \pi \times 2^2$ 4
175.9cm^2

M1 (=201.06…) May be implied by 201
M1 (=12.566…) May be implied by 12.5 or 12.6
M1 (dep on at least M1) "201…" – 2×"12.56.."
A1 175.8 – 176 inclusive

[5]

20. (a) 2 1

B1 cao

(b) $\pi \times 8^2 - 2 \times \pi \times 2^2$ 4

175.9

M1 $\pi \times 82$ (= 201.06…) may be implied by 201
M1 $\pi \times 22$ (= 12.566…) may be implied by 12.5 or 12.6
M1(dep on at least M1) for "201…" – 2 × "12.56..."
A1 175.8 – 176

[5]

21. E

[1]

1. Paper 4

Answers to this question proved to be disappointing. Many candidates failed to recall the correct circle formula and the circumference was often calculated in error, although $\pi \times 15^2$ and$(\pi \times 7.5)^2$ were also quite common. Some of those who used the correct formula failed to half the area of the circle to get the area of the semi-circle. Candidates were expected to give units with their answer. Many neglected to do so but when units were given "cm^2" was often seen.

Paper 6

Most candidates made a good go of this question, although some forgot to add the units or, incredibly, put in the wrong units (typically cm^3). There were a few who used the formula for a circumference.

2. There were many examples of candidates starting with the wrong formula: πr^2, πd^2, $\pi^2 d$ amongst them. About half used the correct formula, but many then went on to spoil their answer by carrying out quite absurd approximations, even though clear direction was given in the question that answers should be left to one decimal place. Part (b) was very poorly answered. In most cases candidates took the 20 cm to be the length of a side, thereby arriving at a final answer of 400 cm^2.
A significant number of candidates attempted to use Pythagoras, but were unable to work to a sufficient degree of accuracy.

3. Specification A

Foundation Tier

Usually attempted, but this question drew a very small number of correct answers (8%). Few candidates seemed to be able to give the correct formula for the circumference of a circle. There were some bizarre attempts to the question. A majority of candidates mistakenly either multiplied the diameter by two and gave the answer 4.90, attempted to work out the area of the coin or even multiplied 2.45 by 10, the value of the coin to give the answer 24.5.

Intermediate Tier

It was disappointing that only about 60% of candidates managed to write the ratio 18:6 in its simplest form in part (a). 9:3 and 6:2 were the most common incorrect answers. In part (b) those candidates who knew the formula for the circumference of a circle were usually successful and almost half achieved the correct answer. The most common error was for candidates to work out the area of the circle. Some used $2 \times \pi \times d$ or $\pi \times r$ and others had no idea what to do and did not use π at all.

Specification B

Simplifying the ratio 18:6 looked an easy mark by applying a division by 6 to both numbers but many processed it to only 9:3 rather than 3:1. Unexplainable results of 3:6, 2:2 and 1:1 were evident along with 18.6kg and the mysterious 19 which appeared in quite a few cases.
Finding the circumference of a 10 pence coin of diameter 2.45 cm lead to various combinations of the 10"and 2.45. with over 90% of the candidates making no use of π to achieve a solution. Other misuses included finding only the radius of the coin and then multiplying this by 10 in the hope that it gave the circumference.

4. Intermediate Tier

There were some inevitable attempts to use πr^2 but the majority of the candidates realised that it was the alternative formula that was needed. There was some confusion about whether to use radius or diameter figures, but most earned method marks. Few candidates added the straight edge to give their final answer.

Higher Tier

Nearly all candidates used the correct formula for a circumference. There were very few who used πr^2. Most went on to divide the circumference by 2, but the addition of the 20 was often omitted. Generally the arithmetic was accurate.

5. Specification A

Foundation Tier

This question was very poorly answered. Candidates often mistook circumference for area and radius for diameter. Only 1% could find the area in part (a) and 4% the circumference in part (b).

Intermediate Tier

Many candidates could either calculate the area in part (a) or calculate the circumference in part (b) but far less could do both. It was disappointing that many candidates could not recall the formulae for the area and the circumference of a circle and there were a large number of answers that made no use of π at all. About 40% of candidates answered part (a) correctly. Those who used π *r*2 were usually successful with fewer squaring π *r* than has been the case in the past. A common error in this part was to simply multiply the radius by π. Slightly more candidates were able to calculate the circumference in part (b). It was not uncommon, though, for candidates to mix up diameter and radius.

Specification B

Foundation Tier

Of the two parts in the question there was more success in finding the circumference than the area of the circular parts of the table, but this difference was minimal as well over 95% of the candidates failed to score in either of the two parts. There was little recognition of $\pi \times d$ for the calculation of the circumference leading to the correct $40 \times \pi$ and thus an acceptable distance. In contrast there were even fewer successful attempts to find the area. Working was much in evidence in this question which sometimes highlighted the failings such as $50 \times 50 = 2500$ in part (a) ignoring the value of π completely. It was not uncommon to see answers of 100 and 80 for the two parts!

6. Less than one in ten candidates could recall the formula needed for working out the circumference of a circle. Many candidates simply doubled or squared the diameter.

Of those who used πd successfully, some gave their answers rounded to two significant figures (2.0) rather than the two decimal places requested.

7. The most common errors in part (a) were use of the formula for area instead of circumference, and use of the 0.65 as a radius instead of a diameter. In part (b) the success rate was worse. Firstly there were many who thought that you had to multiply instead of divide, using their answer to part (a). Worse still were those candidates who thought that they should use 0.65 to either multiply or divide with 1000. The most common incorrect answer to part (b) was 1538, from $1000 \div 0.65$

8. **Higher Tier**

The vast majority of candidates were able to do this, although a few failed to include the units. There were a few candidates who used $2 \times \pi \times 10$.

Intermediate Tier

There was much to go for in this question, but easy mistakes were common. Even though they were prompted, it was surprising how many candidates failed to include units with their answer; where they did so, they were usually correct. Another common error was a failure to divide the answer by 2. A third category of errors were those associated with the formula for area of a circle. Sometimes this was given incorrectly as the formula for circumference $2\pi r$, or misquoted as $\pi 2r$ or $(\pi r)2$, or the radius used as 20 instead of 10! With so many unprompted errors occurring, few candidates gained full marks.

9. This was the first question, in which the majority of the candidates were clearly out of their depth, unless they were working towards grade C standard. This was also the first question with a significant number of non-attempts. There was a preponderance of area formulae, and much confusion about whether to use 8 or 16 in either the area or circumference formula. Other problems occurred where candidates used an incorrect value for π, and rounded answers to the nearest whole number without working shown.

10. Foundation

There was a wide variety of incorrect answers to this question although most candidates were able to score at least one mark, generally for sight of 12 × 12 (although it was disturbing to note how many candidates wrote 12 × 12 = 48 even when they could use a calculator and that 42% of the candidates scored no marks at all!). 108 was a common incorrect answer from $144 – 6^2$. A significant number were not able to find the area of the square, let alone the area of the circle. Many candidates realised they had to use π for the area of the circle but then used the formula for the circumference of the circle. As a result it was not uncommon to see an answer of 106.3. Others squared π or used π in their attempt at finding the area of the square! However just over 20% of the candidates did score all 4 available marks which was pleasing to see.

Higher

Most students managed to correctly find the area of the square as 12squared or 12 × 12, a common error was to double 12 instead of squaring. Others found the perimeter rather than the area. A significant number of candidates either used 6squared or 2 × pi × 6 for the area of the circle. For the final method mark, some candidates didn't realise they had to subtract. Most who gained the 3 method marks also gained the accuracy mark. The transcription error of 133(..) instead of 113(..) was frequently seen and led to some candidates losing the final accuracy mark. The correct answer was seen from about 57% of candidates.

11. Specification A

Foundation

Very few correct answers were seen. The errors made by candidates were many and common, including incorrect choice of formula to use (πr^2 quoted and used incorrectly) use of 8 as a radius, incorrect values of π used (though given on the front of the paper), failure to divide by 2, and leaving the answer as the arc, without adding on the straight edge to give the total perimeter.

Higher

A significant number of candidates were unable to gain any marks in this question, this was frequently due to the formula for the area of a circle being used. Common errors were forgetting to halve the circumference, confusing the radius with the diameter or most commonly forgetting to add on the diameter. Many candidates just found the length of the arc rather than the perimeter of the shape.

Specification B

Foundation

The penultimate question on the paper proved to be a challenge for most of the students with nearly 80% of the students failing to make a valid start on this question. Finding half the circumference of a circle was recognised as in $\pi \times 8$ and then dividing this result by 2. It was the next stage that seemed to lie outside the experience of the student as they failed to grasp that they needed to add on the diameter in order to find the perimeter of the tile. There were a number of candidates who used πr^2 to find the perimeter, scoring no marks. Others showed $\pi \times 4$ but then proceeded to divide this by 2, clearly showing they did not know which formula to use.

Higher

Successful candidates saw that they had to find half the circumference and then add on the diameter to get the base. The others unusually fell into 3 categories and gained 2, 1 or 0 marks as appropriate. Firstly, there were those who found the arc length correctly, but did not add on the base (2marks). Secondly, there were those who found the circumference of the full circle, but then did nothing else (1 mark). Thirdly, were the candidates who either confused perimeter with area or confused the formula for the circumference of a circle with the formula for its area. (0 marks).

12. Errors found in this question were very typical : $(3.142 \times 9.7)^2$, $2 \times 3.142 \times 9.7$ and 3.142×9.7 being the most common. However many candidates gained full marks from the majority of centres.

13. There seemed to be an awareness of the formula for finding the area of a circle but beyond that the idea of squaring the radius was beyond most. Many gave '6.1 squared' as '12.2' whilst others tried '$6.1 \times \pi$' and left it at that. Others left out the use of pi altogether. The vast majority of the candidates did not put any unit as part of their answer. If it was remembered then 'cm' was the favourite.

14. Full marks in this question were rare; many candidates simply giving 11.2 (16×0.7) as their answer, without any real thought into what the needed to calculate. The minority who appreciated the need for a step preceding multiplication by 16 often used πr^2 or pi r rather than πd.

15. Nearly half (45%) accurately calculated the area of the given circle but less than 1/3 of these went on to quote the correct units, usually by omitting the units altogether. The circumference was often found instead of the area and $(\pi \times 3.6)^2$ was frequently seen.

16. There were very few correct answers to this question as candidates struggled to recall the formula for the circumference of the circle. By far the most popular answer was $2 \times 6.4 = 12.8$ with many incorrect responses of 40.96 obtained by squaring 6.4. There was little evidence of the use of π in any of the calculations.

17. Predictably, the most common wrong answers were 12.6 ($\pi \times 4$), 25.1 ($\pi \times 8$), 39.4 ($\pi^2 \times 4$) and 158 ($(\pi \times 4)^2$).

18. Success in this question was dependent on candidates being able to recall the correct formula for the volume of a cylinder. Many incorrect formulae were seen.; these generally involved the circumference rather than the area of a circle, the use of the formula for the volume of a cone or the area of a rectangle. A minority of candidates wrote down the correct calculation but then used their calculator incorrectly. A number of candidates neglected to calculate the volume, having found the area of the circle correctly. There were a few who correctly found the surface area of the cylinder; a more complicated process than calculating the volume.

19. Apart from part (a) this question was not well answered. Problems included failure to recall the formula for calculating the area of a circle, substitution of the diameter rather than the radius, doubling rather than squaring, and subtraction of the area of a single small circle, rather two. There was also some premature rounding which placed otherwise correct answers outside the acceptable range. Consequently there were very few cases where full marks were awarded.

20. In part (a) most candidates were able to write down the correct radius although some wrote down '4' or worked out either the circumference or the area. In part (b) those candidates who knew the formula for the area of a circle were usually quite successful and many achieved the correct answer. A common error was for candidates to subtract the area of only one small circle from the area of the large circle. Some candidates worked out the circumference of each circle rather than the area. Many had little or no idea what was required and did not attempt to work out the area or tried to work it out without using π.

21. No Report available for this question.