**1.** **Lawn**
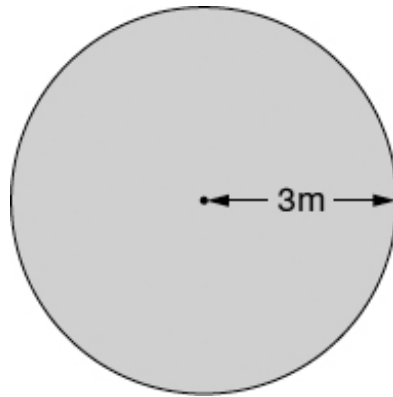
The diagram shows a plan of Luke's new lawn.

The lawn is a circle with radius 3m.



Work out the area of the lawn.

..................... m$^2$

2 marks

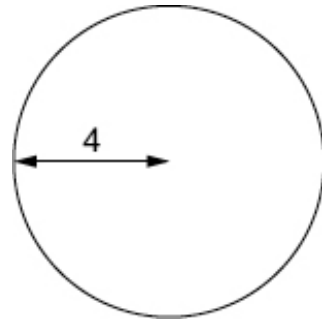**2.** **Circle working**

Kevin is working out the **area** of a circle with **radius 4**

He writes:



$$\text{Area} = \pi \times 8$$

Explain why Kevin's working is **wrong**.

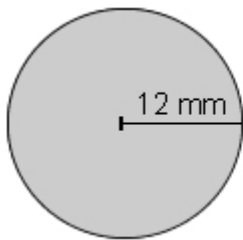1 mark

**3.** **Area**

The diagram shows a circle and a square.



12 mm

Not drawn accurately

(a) The radius of the circle is 12 mm.

What is the **area** of the circle to the nearest mm²?
Show your working.

........................ mm²

2 marks

(b)    The **ratio** of the area of the **circle** to the area of the **square** is **2:1**

What is the area of the square to the nearest mm²?

....................... mm²

1 mark

(c)    What is the side length of the square?
Show your working.

....................... mm

2 marks

**4.**    **Trundle Wheel**

A trundle wheel is used to measure distances.

Imran makes a trundle wheel, of **diameter 50cm**.

(a)    Calculate the **circumference** of Imran's trundle wheel.

Show your working.

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

2 marks

(b)    Imran uses his trundle wheel to measure the length of the school car park.

His trundle wheel rotates **87 times**.

What is the **length** of the car park, to the **nearest metre**?
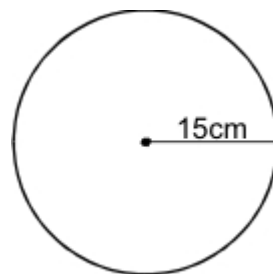
......................... m

1 mark

**5.**    **Circles**

(a)    A circle has a radius of 15cm.
       Calculate the **area** of the circle.
       Show your working.



15cm

....................... cm²

2 marks

(b)     A different circle has a **circumference** of **120cm**.

What is the **radius** of the circle?

Show your working.

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

2 marks

**6.**     **Table**

At Winchester there is a large table know as the Round Table of King Arthur.



The **diameter** of the table is **5.5 metres**.

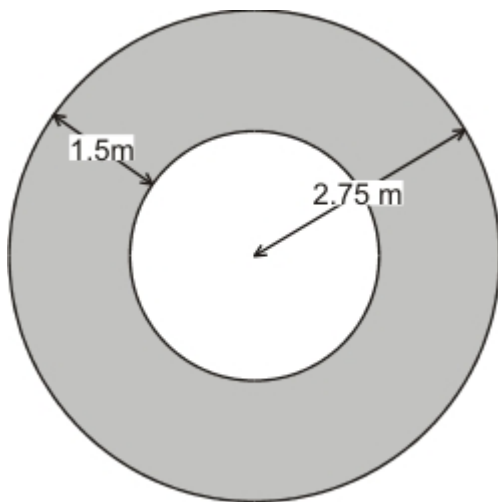(a)    A book claims that 50 people sat around the table.

Assume each person needs 45cm around the circumference of the table.
Is it possible for 50 people to sit around the table?

Show your working to explain your answer.

3 marks

(b)    Assume people sitting around the table could reach only **1.5m**.



Calculate the **area** of the table that could be reached.
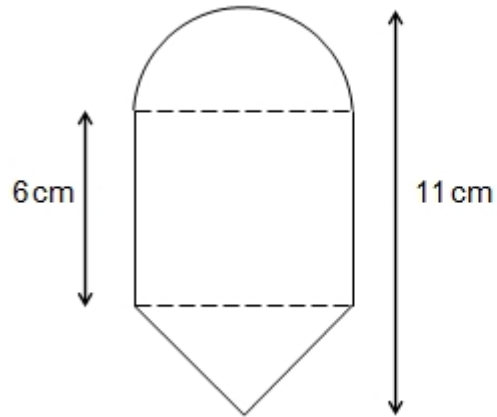
Show your working.

........................ m$^2$

3 marks

**7.**

A badge is made from an isosceles triangle, a square and a semi-circle.

Not drawn accurately

6 cm

11 cm

Work out the area of the badge.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____ cm$^2$

5 marks

# Mark schemes

**1.** 28.(…) or 9π

                **2**

**or** Shows or implies a complete correct method for finding the area of the lawn, with no evidence of conceptual error and not more than one computational or rounding error

eg
- Shows the digits 282(…) or 283
- 32 × π
- *π = 3 (rounding error)*, 9 × 3 = 27

> ***Do not accept for 1m, conceptual error***
> *eg*
> - $3^2 × π = 19$ *or 18.8(…) or 6π*
> - $π3^2 = 89$
> - *Area = 2 × 3 × π*

                **1**

                **[2]**

**2.** Gives a correct explanation

The most common correct explanations:

Show the correct working

eg

- It should be π × 16 not π × 8

- Needs to be π × radius$^2$, not π × diameter

> ***Accept: minimally acceptable explanation***
> *eg*
> - *16*
> - *$4^2$*
> - *4 × 4*
> - *$r^2$*
> - *$πr^2$*
>
> ***Do not accept: incomplete explanation***
> *eg*
> - *The 8 is wrong*

Address the misconception

eg

- He is finding the circumference not the area

- He is using $2\pi r$, not $\pi r^2$

- He has done $4 \times 2$ instead of $4^2$

> ***Accept: minimally acceptable explanation***
>
> *eg*
> - *Circumference*
> - *It's not 2πr [or πd]*
> - *He didn't square the 4*
> - *He didn't square the radius*
>
> **! Use of 'perimeter' for 'circumference'**
> *Condone*
>
> ***Do not accept: incomplete explanation***
>
> *eg*
> - *He used the wrong formula*
> - *He used the diameter*
> - *He hasn't used the radius*
> - *He doubled the radius*

Show that his working gives an incorrect answer

eg

- He gets 25.(…), but it should be 50.(…)

- His answer is half as big as it should be

> ***Accept: minimally acceptable explanation***
>
> *eg*
> - *50, not 25*
> - *It should be his answer × 2*
>
> ***Do not accept: incomplete explanation***
>
> *eg*
> - *50*
> - *His answer is too small*

**U1**

**[1]**

**3.** (a) 452

*or* **For only 1** Correct method, eg

- $\pi \times 12^2$

- $\pi \times 12 \times 12$

- 452.(..)

- $144\pi$

   *Do not accept use of mm$^2$ as evidence of 12$^2$, eg*

   - *3.14 × 12m$^2$*

        **2**

(b) 226

   *Accept follow through as part (a) ÷ 2*

   **!  Answer not rounded to the nearest mm$^2$**

   *If their answer to part (a) was 452.(..) or 144π, ie this error has already been penalised.*

        **1**

(c) 15 or 15.0(..)

*or* **For only 1** Correct method, eg

- $\sqrt{}$ their (b)

- $\sqrt{(72\pi)}$

   **!  For 2m, follow through as $\sqrt{}$ (their b)**

   *Answers rounded or truncated, provided there is no evidence of an incorrect method.*

   **!  Method is trial and improvement**

   **Do not penalise as an incorrect method, but do not credit as a correct method.**

        **2**

        **[5]**

**4.** (a) **157**.(...) or 50π

   *or*

        **2**

Correct method

eg

- 50 × π

- 3.14 × 2 × 25

        **1**

(b)     137

> *Accept follow through as 87 × their (a) ÷ 100, rounded to the nearest metre*

**1**

**[3]**

**5.**  (a)  **For 2m** indicates 710 or a value between 706 and 707.2 inclusive.

or

Gives as an answer a correct simplified expression involving π, eg:

- 225π

- 225 × π

**For only 1m** shows a correct method with a correct substitution for the radius, eg:

- $3.14 \times 15^2$

- $3.14 \times 15^2 = 2218$

- $\pi\, 15^2$

- π × 15 × 15

- 225 × π = *700*

> **For 1m** *accept as evidence the digits 706(...).*
>
> **For 1m** *accept p shown or implied as 3 or 3.1 eg:*
> - *'675'*
> - *'697.5'*

**2**

(b)  **For 2m** indicates a value between 19 and 19.11 inclusive.

*or*  Gives as an answer a correct simplified expression involving π, eg:

- 60/π

- 60 ÷ π

**For only 1m** shows a value between 38 and 38.22 inclusive.

*or*    Shows the circumference should be divided by π or 2 π, even if there are other errors or omissions, eg:

- 120 ÷ 3.14

- 120 ÷ 2 π

- 120 ÷ 6.28

- 120 ÷ 2 ÷ 22/7

- 120 ÷ (2 × π)

- 60 ÷ π with incorrect further working.

- C ÷ 2 π

        **For 1m** *accept as evidence the digits 191(...) or 382(...).*

        **For 1m** *accept $p$ shown or implied as 3 or 3.1, eg:*
- *a value between 19.3 and 19.4 inclusive '20'*

        **For 1m** *accept omission of brackets eg:*
- *'120 ÷ 2 × π'*
- *'C ÷ 2 × π = 188.5'*
- *'C ÷ π × 2 = 76.4'*

        *but **do not accept** the result of such calculations, eg 188.4... or 76.4..., without the method shown.*

                              **2**

                                    **[4]**

**6.**   (a)   **For 3m** justifies through a correct calculation and correct interpretation that the table is not large enough. Most justifications involve calculation of the circumference as **17 m**, or **17.2** to **17.3 m** inclusive, then one of:

**Circumference** ÷ 50 to find the space each person has, ie 34 to 35 cm inclusive eg:

- 1727 ÷ 50 = 34 No.

- 1727 ÷ 50 = 34 cm

- Each person gets 0.35 m

- 5.5 ÷ 50 × 3.14 = 0.3454, Not enough.

**Circumference** ÷ (0.)45 to find the number of people, ie 37 to 39 inclusive eg:

- 17.3 ÷ 0.45 = 38.4 No.

- 38 so no.

- 38 people could.

- 1728 ÷ 45 < 50

Comparing **circumference** with **50 × (0.)45**, the amount of space 50 people need eg:

- C = 17 m, need 22.5 m.

- 50 × 45 = 2250, 2πr = 17.258 Too small.

- 50 × 45 = 2250 cm, 2πr = 17 m

- 45 × 50 > π × 550

> *Interpretation may either be through an explanation or by showing correct units, such as cm, m or people.*
>
> *Accept comparisons with one measurement in metres and the other in centimetres.*
>
> *Accept alternative correct justifications, such as comparing the given diameter with the required diameter to scat all 50 people eg:*
>
> - *'50 × 45 ÷ π > 5.5m.'*
>
> **For 3m** *a correct value must be evaluated or explicitly compared to a given value eg, accept*
>
> - *'1727 ÷ 50 < 45'*
>
> *but not*
>
> - *'1727 ÷ 50 No.'*

**For only 2m** makes only one error eg:

- 1727 ÷ 50 = 34 *people.*

- 2 × 3.14 × 2.25 = 14.13, ÷ *50* = 28 No.

- *172* ÷ 45 = 3.8 people.

- Circum = 1727 cm, 45 × 50 = 27250 cm

> *For 2m* **Do not accept** *the use of the area formula.*
>
> *Errors are defined as follows:*
>
> *Using incorrect radius, eg 2.25*
>
> *Using diameter as radius.*
>
> *Calculation not evaluated or compared.*
>
> *Incorrect conversion between units.*
>
> *Selecting wrong units.*
>
> *Making an arithmetic error.*
>
> *Interpreting incorrectly.*
>
> *Not interpreting.*

**For only 1m** makes only two errors eg:

- 2π2.25 = 14.1, ÷ 50 = 0.282m = 282cm

- 2 × π × 5.5 = 34.5, 50 × 45 = 2250

**or**

Shows a correct calculation for the circumference of the table eg:

- 3.14 × 5.5

- 17.2

**or**

Uses the area formula but makes no other errors eg:

- π × $2.75^2$ = 23.76, ÷ 50 = 47.5 Yes.

- 23.8 ÷ 45 = 53 people.

- 23.7 m > 22.5 m

**3**

(b)   **For 3m** indicates a value between 18.84 and 18.86 inclusive.

**or**

Indicates 6π or 18.8 or 18.9 or 19

> *For 3m* *accept 18 only if a correct method, or a correct response, is seen in the working.*
>
> *For 3m* *accept correct conversion to other units, provided the units are stated eg:*
>
> - *'189000 cm $^2$'*

**For only 2m** shows a correct evaluation of both π × $2.75^2$ and π × $1.25^2$ even if rounded or truncated

eg

- 23.7, 4.9 seen in working.

> *For 2m or 1m* *accept working in other units, even if the units are not stated.*

**or**

Shows a complete correct method with correct values substituted, even if incorrectly calculated

eg

- $\pi \times 2.75^2 - \pi \times 1.25^2$

- $\pi 2.75^2 - \pi 1.25^2 = 74.6 - 15.4 = 59.2$

- $\pi \times 2.75^2 - \pi \times (2.75 \times 1.5)^2$

- $7.5625 - 1.5625$ then $\times 3.14$

- $(2.75 + 1.25)(2.75 - 1.25) \times \pi$

    *For 2m **do not accept** the area formula shown incorrectly eg:*

    - *'$2.75\pi^2$'*
    - *$(2.75 \times \pi)^2$*
    - *$2\pi \times 2.75^2$*

**For only 1m** shows or implies that the radius of the smaller circle is 1.25

eg

- 1.25 shown in working, even if an incorrect formula is used.

- $\pi \times (2.75 - 1.5)^2$

- Area of smaller circle shown as a value between 4.84 and 4.91 inclusive.

- $(\pi \times 2.75)^2 - (\pi \times 1.25)^2$

- $2 \times \pi \times 1.25$

- $\pi \times 2.5$

or

Shows that the area of the larger circle is 24 or a value between 23.7 and 23.8 inclusive.

**3**

**[6]**

**7.**

$6^2$ (= 36)

M1

$\pi \times 3^2 \div 2 \ (= 14.1....)$

*[14.1, 14.2]*

M1

$\frac{1}{2} \times 6 \times 2 \ (= 6)$

M1

Their 36 + their 14.1 + their 6

M1

56.1 …

*[56.1, 56.2]*

A1