1.

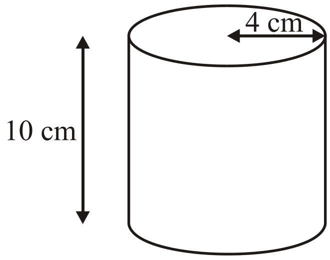


Diagram **NOT** accurately drawn

The diagram shows a cylinder with a height of 10 cm and a radius of 4 cm.

(a) Calculate the volume of the cylinder.
Give your answer correct to 3 significant figures.

..........................cm^3

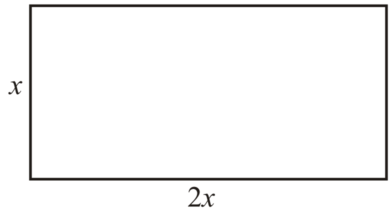
(2)

The length of a pencil is 13 cm.
The pencil cannot be broken.

(b) Show that this pencil cannot fit inside the cylinder.

(3)
(Total 5 marks)

2. 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)

3.

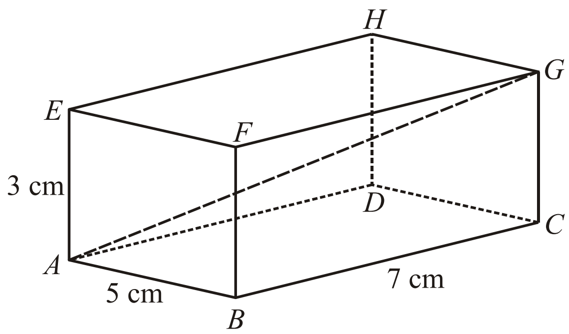


Diagram **NOT** accurately drawn

The diagram represents a cuboid $ABCDEFGH$.

$AB = 5$ cm.
$BC = 7$ cm.
$AE = 3$ cm.

(a) Calculate the length of AG.
Give your answer correct to 3 significant figures.

.... cm
(2)

(b) Calculate the size of the angle between *AG* and the face *ABCD*.
Give your answer correct to 1 decimal place.

....°

(2)
(Total 4 marks)

4.

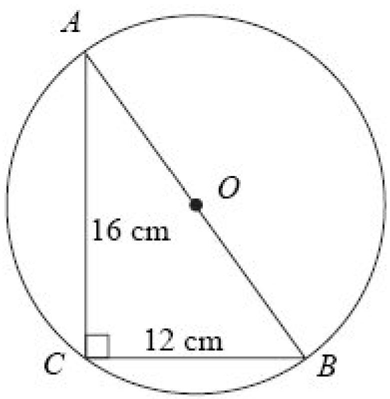


Diagram **NOT** accurately drawn

The diagram shows triangle *ABC* and a circle, centre *O*.

A, *B* and *C* are points on the circumference of the circle.

AB is a diameter of the circle.

AC = 16 cm and *BC* = 12 cm.

(a) Angle *ACB* = 90°.
Give a reason why.

....

(1)

(b) Work out the diameter AB of the circle.

………………..cm

(3)

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

………………..cm^2

(3)
(Total 7 marks)

5. (a) Rationalise

$$\frac{1}{\sqrt{7}}$$

....

(2)

(b) (i) Expand and simplify

$$(\sqrt{3} + \sqrt{15})^2$$

Give your answer in the form $n + m\sqrt{5}$, where n and m are integers.

....

(ii)

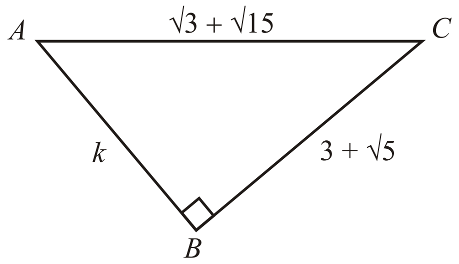


Diagram **NOT** accurately drawn

All measurements on the triangle are in centimetres.

ABC is a right-angled triangle.
k is a positive integer.

Find the value of *k*.

k = ...

(5)
(Total 7 marks)

6. A cuboid has length 3 cm, width 4 cm and height 12 cm.

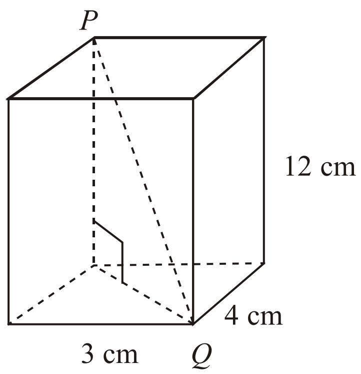


Diagram **NOT** accurately drawn

Work out the length of *PQ*.

.... cm
(Total 3 marks)

7.

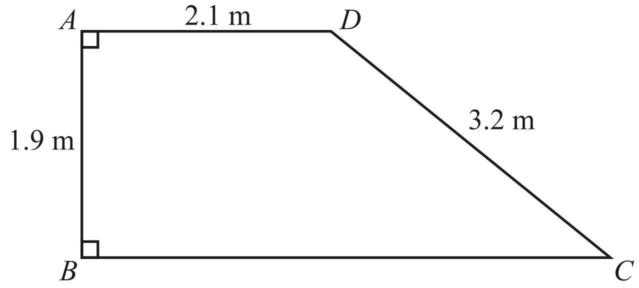


Diagram **NOT** accurately drawn

ABCD is a trapezium.
AD is parallel to *BC*.
Angle *A* = angle *B* = 90°.
AD = 2.1 m, *AB* = 1.9 m, *CD* = 3.2 m.

Work out the length of *BC*.
Give your answer correct to 3 significant figures.

.... m
(Total 4 marks)

8.

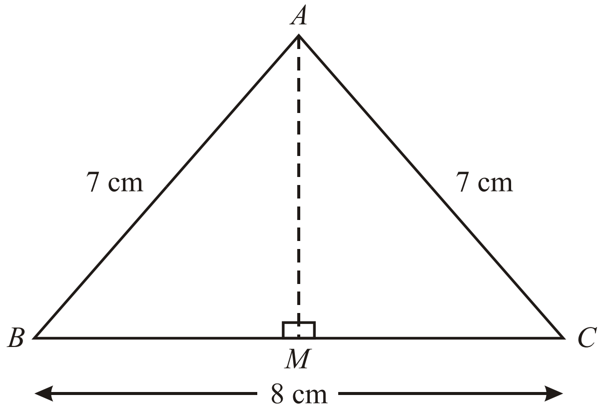


Diagram **NOT** accurately drawn

Work out the length, in centimetres, of *AM*.
Give your answer correct to 2 decimal places.

…………………… cm
(Total 3 marks)

9. *A* is the point with coordinates (2, 5)
B is the point with coordinates (8, 13)

Calculate the length *AB*.

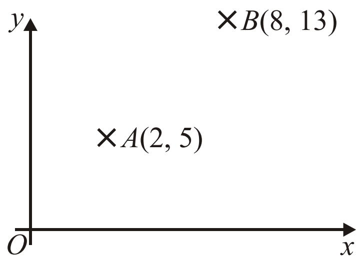


Diagram **NOT** accurately drawn

....
(Total 3 marks)

1. (a) 502 – 503 cm^3 2

$V = \pi \times 4^2 \times 10$

M1 for $\pi \times 4^2 \times 10$
A1 502 – 503

(b) $\sqrt{164} < 13$ 3

$P^2 = 10^2 + 8^2$
$P = \sqrt{164}$

M1 for sight of a correct right-angled triangle
M1 for $10^2 + 8^2$
A1 for conclusion based on a correct calculation or 12.8 seen

[5]

2. 250 cm^2 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]

3. (a) 9.11 — 2

$3^2 + 5^2 + 7^2 = 83$

M1 for correct use of 3D Pythagoras formula or 2 correct applications of the 2D formula
A1 for 9.11 to 9.12

(b) 19.2 — 2

Tan $GAC = 3 - \sqrt{(5^2 + 7^2)}$

M1 correct trig expression for angle GAC
A1 for 19.2 to 19.3

[4]

4. (a) Angle in a semicircle — 1

B1 oe

(b) 20 — 3

$12^2 + 16^2 = 400$
$\sqrt{400} = 20$

M1 for $12^2 + 16^2$
M1 for $\sqrt{144 + 256}$
A1 cao

(c) 314 — 3

$\pi \times 10^2$

M1 for $\pi \times \left(\frac{"20"}{2}\right)^2$
M1 (indep) for correct order of evaluation of $\pi \times r^2$ *for any r*
A1 for 314 – 315 inclusive

[7]

5. (a) $\frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$

$\frac{\sqrt{7}}{7}$ — 2

M1 $\frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$
A1 cao

(b) (i) $3 + 15 + 2\sqrt{(3 \times 15)}$
$18 + 2\sqrt{45}$
$18 + 6\sqrt{5}$
$18 + 6\sqrt{5}$ 5

M1 for $(\sqrt{3})^2 + (\sqrt{15})^2 + \sqrt{3} \times \sqrt{15} + \sqrt{15} \times \sqrt{3}$
A1 $18 + 2\sqrt{45}$
B1 for $18 + 6\sqrt{5}$

(ii) $(3 + \sqrt{5})^2 = 9 + 5 + 6\sqrt{5} = 14 + 6\sqrt{5}$
$(\sqrt{3} + \sqrt{15})^2 - (3 + \sqrt{5})^2 = 18 + 6\sqrt{5} - (14 + 6\sqrt{5}) = 4$
2

M1 for correct expansion of $(3 + \sqrt{5})^2$ *to* $3^2 + (\sqrt{5})^2 + 3\sqrt{5} + 3\sqrt{5}$
A1 cao

[7]

6. $3^2 + 4^2 + 12^2 = 169$ 3

$\sqrt{169} = 13$

M1 for $3^2 + 4^2$ *or* $3^2 + 12^2$ *or* $4^2 + 12^2$ *or* $a^2 + 12^2$
(where a is the length of their base diagonal)
M1 for $3^2 + 4^2 + 12^2$
A1 for 13 cao

[3]

7. 4.67 4

DX is perp from D to BC
CX =/ 3.2 – 1.9 = 2.5748…
BC = 2.1 + 2.5748…

B1 for perpendicular line DX drawn
M1 for $CX^2 + 1.9^2 = 3.2^2$ *oe*
A1 for 2.57 or better (2.5748…)
A1 ft (dep on 1^{st} *M1) for " 2.57" + 2.1*

[4]

7. 5.74 3

Height = $\sqrt{7^2 - 4^2}$

M1 for 7^2 = height^2 + 4^2 oe
M1 for height = $\sqrt{49 - 16}$ (= $\sqrt{33}$)
A1 for 5.74… or better

[3]

9. $\sqrt{(8-2)^2 + (13-5)^2}$

$\sqrt{6^2 + 8^2} = \sqrt{100}$

10 3

M1 for 8 – 2 (= 6) or 13 – 5 (= 8)
M1 (dep on previous M1) for "6"^{2} + "8"^{2}
A1 cao

[3]

1. Mathematics A

Paper 4

Less than half the candidates answered part (a) correctly. This was a straightforward question but a significant number failed to recall the correct formula. Many incorrect methods were seen. Often these started with $\pi \times 4$ or $2 \times \pi \times 4$ but some candidates did not use π at all. Part (b) was answered very poorly indeed. Few candidates thought of placing the pencil in the cylinder at an angle and even fewer recognised it to be a question in which they could use Pythagoras.

Paper 6

Part (a) was usually well done. There were some students who thought that the correct formula was $2\pi r^2$ presumably because of the two ends.
Part (b) caused no difficulty for candidates who realised that the crucial idea was to consider the pencil lying diagonally in the can, so making a right-angled triangle. Once that was realised most candidates scored full marks, although there was a significant number who used $10^2 + 4^2$.

Mathematics B Paper 19

The vast majority of candidates answered part (a) correctly. Part (b) was less well done. Many candidates did not recognise that they had to consider the diagonal length in the cylinder. Of those who did consider the diagonal and use Pythagoras's Theorem, a sizeable number used the radius instead of the diameter in their calculation.

2. 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.

3. Part (a) required candidates to find the length of the space diagonal of a cuboid.. Most successful candidates found the length of the face diagonal of the base first, followed by a second application of Pythagoras to triangle *GAC* Very few examples of $\sqrt{a^2 + b^2 + c^2}$ were seen. Some candidates lost an accuracy mark through premature approximation of the length of the base diagonal.
It was pleasing to see so many successful attempts at part (b) of the question. The best solutions used either sin or tan in the right angled triangle. A minority of candidates seized on the formula page and used the sine rule. These candidates were generally less successful. A few candidates calculated the angle *AGC*.

4. **Specification A**

Higher Tier

The most economical answer of 'angle in a semi-circle' was rarely seen. Many candidates failed to earn the mark because their reason was so vague or they merely stated that it is 90° because it is a right angle.
Most candidates could apply Pythagoras correctly to get 20cm. A few correctly stated that the triangle was an enlargement of the Pythagorean triple 3, 4, 5.
Part (c) was also answered well although some candidates used $\pi \times 100$ or $\pi \times 400$ as well as $\frac{12 \times 16}{2}$.

Intermediate Tier

Many of the candidates who gave a reason in part (a) struggled to use correct geometric language and "angle in a semi-circle" was mentioned by surprisingly few. "Because it is a right angle" was a very common response. Part (b) was answered quite well and candidates who used Pythagoras' theorem usually obtained the correct answer. Many candidates, though, were unsure of what to do. Some simply added 12 and 16 and quite a few attempted to use trigonometry – usually without success. Part (c) was done less well with only a quarter of candidates gaining full marks. Marks were often lost because candidates confused the formula for the area of a circle with that for the circumference. Those that used the correct formula were usually able to evaluate $\pi \times r^2$ in the correct order.

Specification B

Higher Tier

In part (a) only about one quarter of candidates were able to quote that the 'angle in a semi-circle is 90°'. Some candidates correctly used the fact that the angle at the circumference would be half the angle at the centre but, on the whole, part (a) was poorly done. Parts (b) was answered correctly by over 90% of candidates. In part (c), however only about 75% of candidates were able to score full marks. The wrong formula was occasionally used for the area of a circle. Some candidates misread the question and gave the area of the triangle instead of the area of the circle.

Intermediate Tier

Very few candidates offered an acceptable reason for angle C being 90°; many merely arguing that it was 90° because "it is a right angle". Many made reasonable attempts to explain the reason with reference to geometric facts but we were really looking for accuracy in awarding this mark. If candidates failed to give the preferred "angles in a semicircle = 90°" then acceptable answers needed to refer to the angle subtended by the ends of a diameter on the circumference of a circle being equal to 90°.
In part (b), when the decision to use Pythagoras was made correct working usually followed. Answers of 20 came from different calculations; eg $4 \times 5 = 20$, and $16 - 12 = 4 \therefore 16 + 4 = 20$, the recognition of a 3, 4, 5 triangle enlarged by scale factor 4 not always convincing. A common error by weaker candidates was an answer of 28 (12 + 16).
In part (c) Many candidates used their answer from (b) to find a radius and hence the area of a circle, and gained at least one or two marks; however $(\pi r)^2$ was often evaluated by mistake. A substantial number of candidates used incorrect formulae, either finding the circumference by mistake or using $2\pi r^2$ or $2\pi d$.

5. Many candidates knew what to do with the standard part (a). Parts (b) and c) proved to be challenging although the mark scheme was written to reward good attempts. A common error was to write $\sqrt{45} + \sqrt{45} = \sqrt{90}$. In part (c) many candidates obtained the answer $k = 2$ from the equivalent of $(x + y)2 = x^2 + y^2$.

6. The majority of candidates recognised the need to use Pythagoras in some part of this question, but few were able to do as the single calculation $\sqrt{a^2 + b^2 + c^2}$ Some candidates had difficulty visualising the right angled triangle for the base diagonal, and thought that they could calculate this by halving the area of the base. Poor arithmetic proved an obstacle for some, typically when calculating 12^2 or $\sqrt{169}$. A small number of candidates were able avoid any calculations and simply wrote down the length of the diagonal from their knowledge of 3, 4, 5 and 5, 12, 13 Pythagorean triangles.

7. Done well by the majority of candidates. Some candidates lost marks following premature rounding. Pythagoras's Theorem was frequently misused in the triangle *DBC* where candidates incorrectly assumed that angle *BDC* was 90°.

8. This question was well answered by the majority of candidates. The most common incorrect method seen was $7^2 + 4^2$.

9. The majority of candidates were able to gain some credit by subtracting the x and y values of the given coordinates. There was plenty of evidence of arithmetic errors with 8 – 2 frequently given as 4 or 5 and numbers squared incorrectly by some of those candidates who realised that they had to go on to use Pythagoras's theorem. Fully correct solutions were seen from approximately 50% of candidates. The calculation 8 + 6 = 14 was frequently seen.