Pythagoras' Theorem (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

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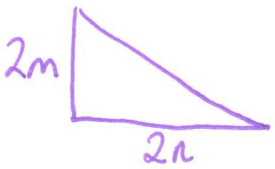
Total Marks:	

1. The lengths of the sides of a right-angled triangle are all integers.

   Prove that if the lengths of the two shortest sides are even, then the length of the third side must also be even.



$\sqrt{(2m)^2 + (2n)^2}$

$\sqrt{4m^2 + 4n^2}$

$\sqrt{4(m^2+n^2)}$

$= 2\sqrt{m^2+n^2}$ ∴ even as has factor of 2.

Even × Even = even

even + even = even

$\sqrt{\text{even}}$ = even

[3]

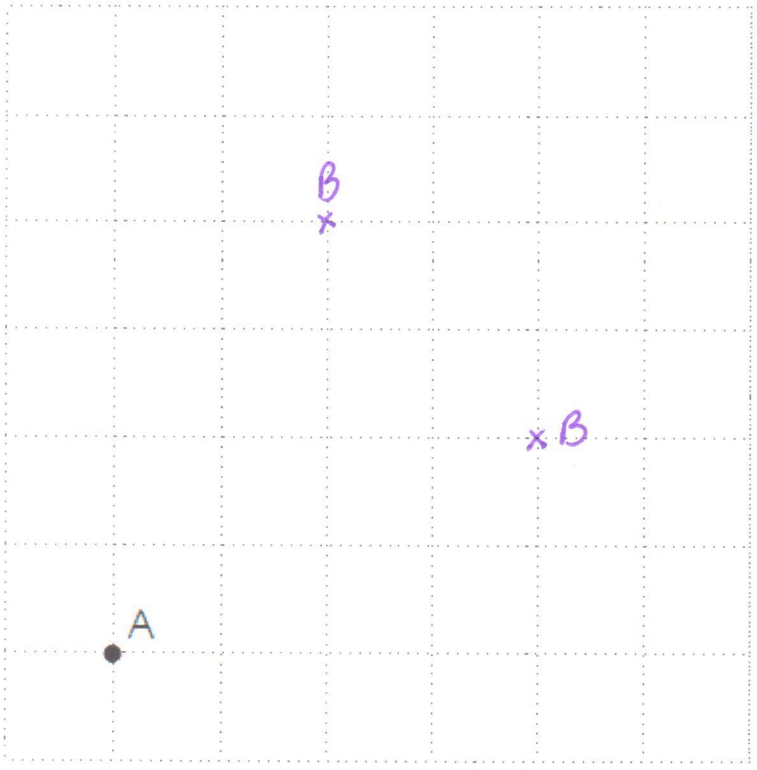
2. The point A is shown on the unit grid below.

   The point B is $2\sqrt{5}$ units from A and lies on the intersection of two grid lines.

   Mark one possible position for B.

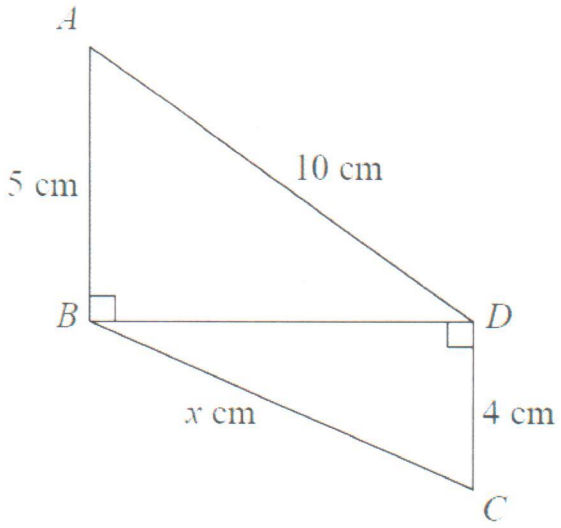
$2\sqrt{5} = \sqrt{20}$

$4^2 + 2^2 = 20$



[3]

3. Triangles ABD and BCD are right-angled triangles.



Work out the value of x.

Give your answer correct to 2 decimal places.

$BD = \sqrt{10^2 - 5^2}$
$= 5\sqrt{3}$

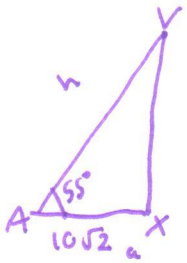
$BC = \sqrt{5\sqrt{3}^2 + 4^2}$
$= 9.539392014$

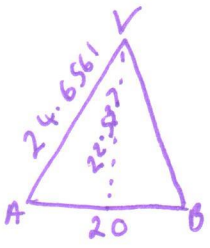
9.54

..... [4]

4. VABCD is a solid pyramid.

$AC = \sqrt{20^2 + 20^2}$
$= 20\sqrt{2}$

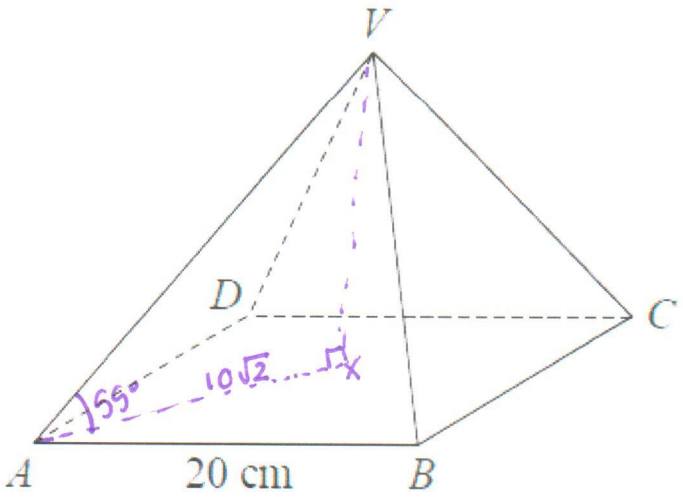




$\cos 55 = \frac{10\sqrt{2}}{h}$

$h = \frac{10\sqrt{2}}{\cos 55} = 24.6561$

$\sqrt{24.6561^2 - 10^2}$
$= 22.537$



ABCD is a square of side 20 cm.

The angle between any sloping edge and the plane ABCD is 55°

Calculate the surface area of the pyramid.

Give your answer correct to 2 significant figures.

base = $20 \times 20 = 400$

triangle = $\frac{20 \times 22.537}{2} = 225.37$
$\times 4$
$= 901.4844$

$901.4844 + 400 = 1301.4844$

1300

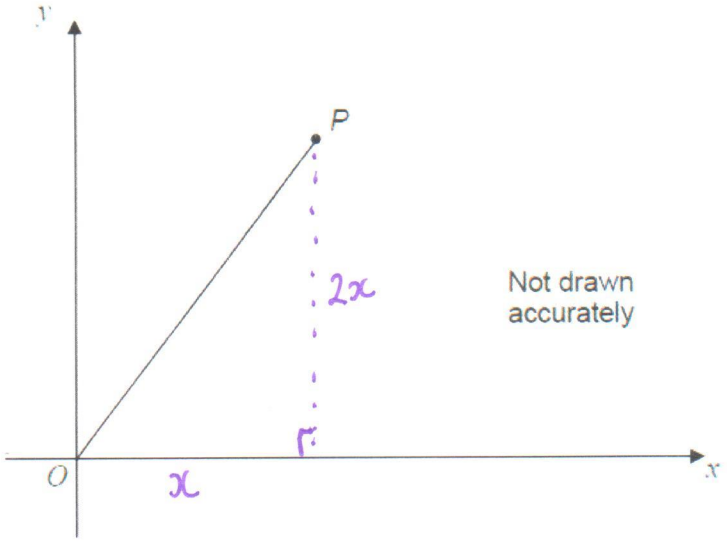
.....cm^2 [5]

5. The diagram shows a line joining O to P.

The gradient of the line is 2

The length of the line is $\sqrt{2645}$

Work out the coordinates of P.



$\sqrt{x^2 + (2x)^2} = \sqrt{2645}$

$x^2 + 4x^2 = 2645$

$5x^2 = 2645 \quad (\div 5)$

$x^2 = 529$

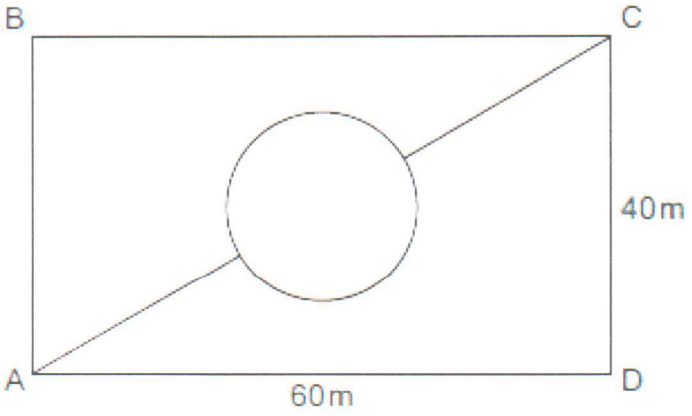
$x = 23$

$2x = 46$

$= (23, 46)$

[4]

6. The rectangle ABCD represents a park.



Not to scale

The lines show all the paths in the park.

The circular path is in the centre of the rectangle and has a diameter of 10m.

Calculate the shortest distance from A to C across the park, using only the paths shown.

A → D → C = 60m + 40m
= 100m

A → C via circle

$\frac{\pi \times 10}{2} = 5\pi$

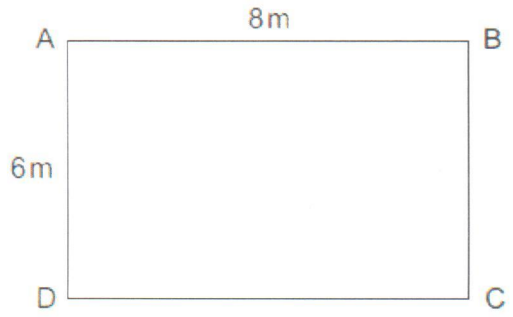
$AC^2 = 60^2 + 40^2$

$AC = 20\sqrt{3}$

So $20\sqrt{3} - 10 + 5\pi$

$= 77.8$m ..... 77.8 ..... m [6]

7. ABCD is a rectangle.



Not to scale

(a) Sunita calculates the length of AC, but gets it wrong.

$$8^2 - 6^2 = AC^2$$
$$\sqrt{28} = AC$$
$$\sqrt{28} = 5.29 \text{ or } -5.29$$
$$AC = 5.29$$

Explain what Sunita has done wrong. She has subtracted $8^2 - 6^2$ Should have added $8^2 + 6^2$

[1]

(b) Calculate the length of AC.

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

$= 10$

10 ..... m [2]

8. A triangle has sides of length 23.8 cm, 31.2 cm and 39.6 cm.

Is this a right-angled triangle?

Show how you decide.

If a right angled triangle then

$23.8^2 + 31.2^2 = 39.6^2$

$23.8^2 + 31.2^2 = 1539.88$

$39.6^2 = 1568.16$ ∴ not a right angled triangle

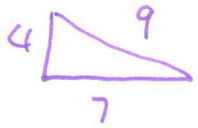
[4]

6. Triangle ABC has perimeter 20 cm.

AB = 7 cm.

BC = 4 cm.

By calculation, deduce whether triangle ABC is a right-angled triangle.



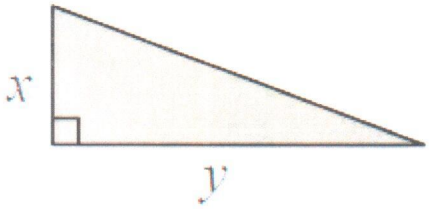
$\sqrt{7^2+4^2} = \sqrt{65}$

$9 \neq \sqrt{65}$

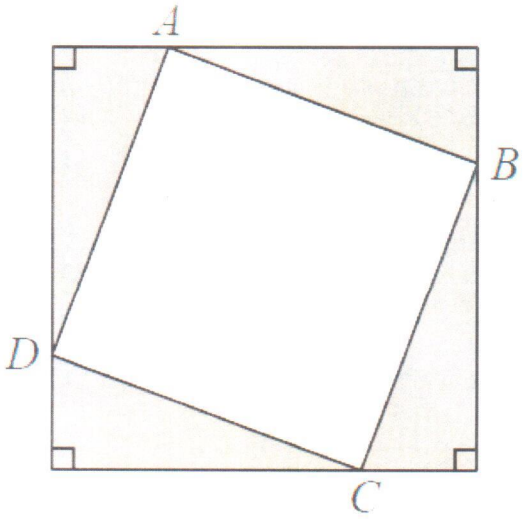
$\therefore$ not a right angled triangle

[4]

7. Here is a right-angled triangle.



Four of these triangles are joined to enclose the square ABCD as shown below.



Show that the area of the square ABCD is $x^2 + y^2$

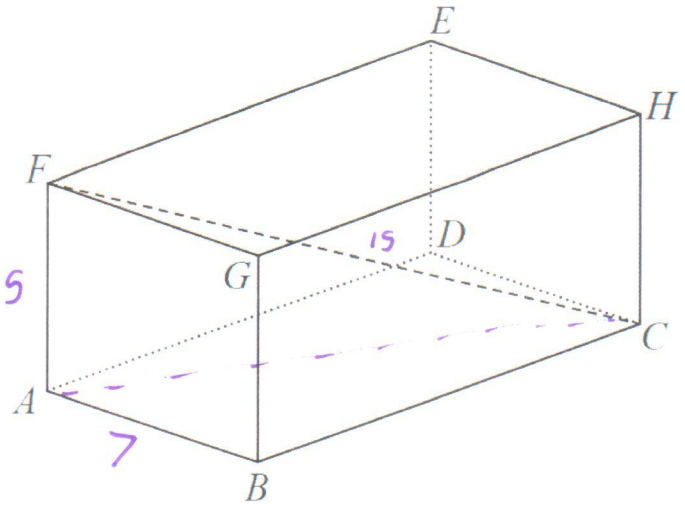
$AD = \sqrt{x^2+y^2}$

area ABCD $= \sqrt{x^2+y^2} \times \sqrt{x^2+y^2}$

$= x^2 + y^2$

[3]

11. The diagram shows a cuboid ABCDEFGH.



AB = 7 cm, AF = 5 cm and FC = 15 cm.

Calculate the volume of the cuboid.

Give your answer correct to 3 significant figures.

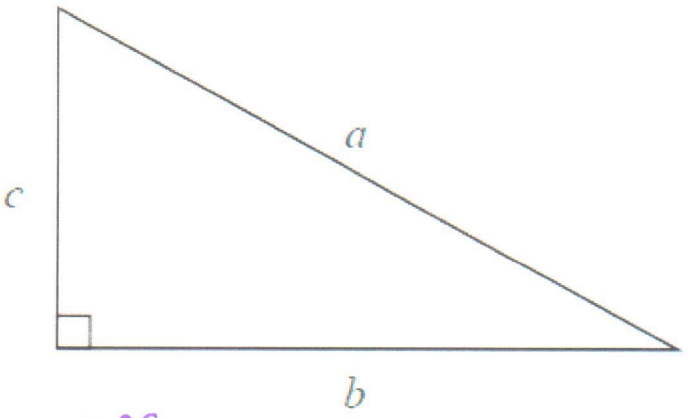
$AC = \sqrt{15^2 - 5^2}$
$= 10\sqrt{2}$

$BC = \sqrt{(10\sqrt{2})^2 - 7^2}$
$= \sqrt{151}$

Volume $= 5 \times 7 \times \sqrt{151}$
$= 430.087200\ldots$

430 cm^3 [4]

12



a is 8.3 cm correct to the nearest mm

lb = 8.25
ub = 8.35

b is 6.1 cm correct to the nearest mm

lb = 6.05
ub = 6.15

Calculate the upper bound for c.

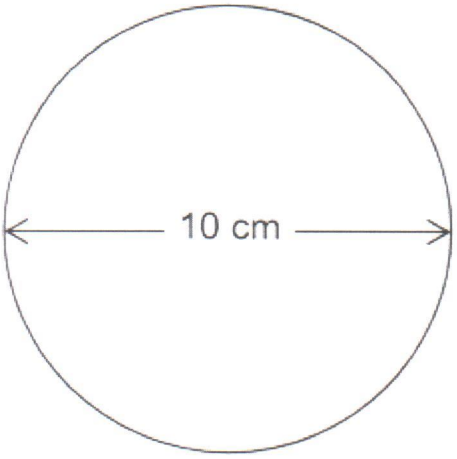
You must show your working.

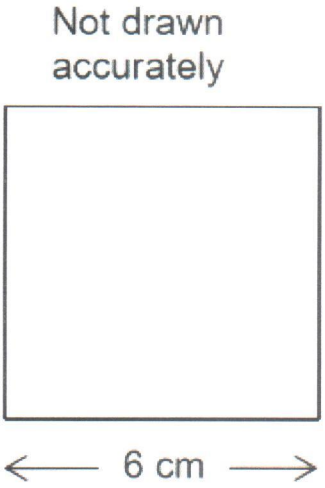
$c^2 = \sqrt{a^2 - b^2}$
$= \sqrt{8.35^2 - 6.05^2}$
$= 5.754997828$

5.75 cm [4]

13. A circle has diameter 10 cm

A square has side length 6 cm





Use Pythagoras' theorem to show that the square will fit inside the circle without touching the edge of the circle.

Length of diagonal of square $\sqrt{6^2+6^2}$

$= 8.5$ cm (1dp)

$\therefore$ square will fit inside the circle

[3]

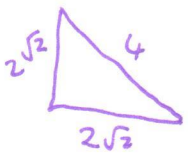
14. The area of a right-angled, isosceles triangle is 4 cm^2

Work out the perimeter of the triangle in centimetres. Give your answer in the form $a + b\sqrt{c}$, where a, b and c are integers.

$x^2 = 4$ $\quad \frac{b \times h}{2}$

$x^2 = 8$

$x = 2\sqrt{2}$



$\sqrt{2\sqrt{2}^2 + 2\sqrt{2}^2}$

$= 4$

$2\sqrt{2} + 2\sqrt{2} + 4$

$= 4 + 4\sqrt{2}$

[4]

15. Which of these points is not 5 units from the point (0, 0)? Circle your answer.

[1]

(−5, 0) (1, 4) (3, 4) (0, 5)