

Mathematics Department

Course: A1MAA



Topic Title: Test 3 – Mensuration, similar figures and scale factors

Student Name: Solutions

Date: _____

Special Instructions: **Calculator Free**

Time Allowed: 30 minutes

Formulae Sheet

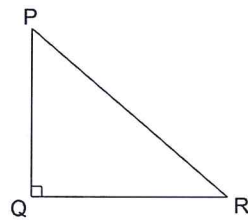
Marks: / 28

Show all working

Question 1

[1,2,2: 5 marks]

- (a) State the hypotenuse in this triangle.



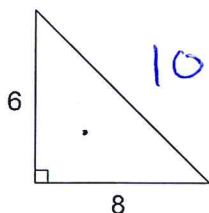
PR ✓

- (b) A right angled triangle has sides 3, 4 and 5 cm long.
Complete Pythagoras' Theorem, as it applies to this triangle.

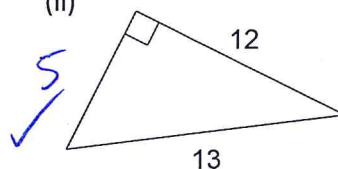
$3^2 + 4^2 = 5^2$ ✓

- (c) Determine the missing lengths in these triangles.

(i)



(ii)

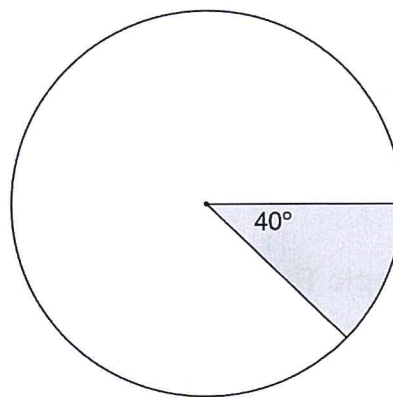


Question 2

[2,1,2,2,2:9 marks]

- (a) The circular spinner drawn below has an area of 234 cm^2 . Determine the area of the shaded section.

$$\frac{40}{360} \times 234 = 26 \text{ cm}^2 \checkmark$$



- (b) The length of each side of a cubic die is 5 mm.
- (i) Determine the total surface area of the die.

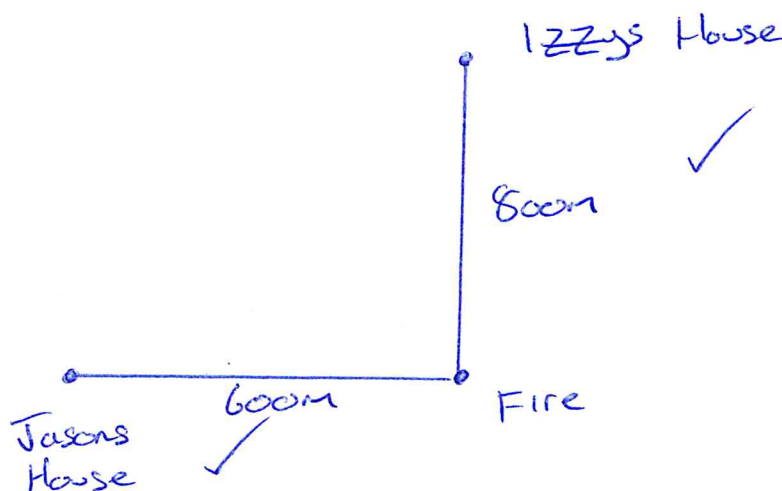
$$150 \text{ mm}^2 \checkmark$$

- (ii) Determine the space occupied by the die.

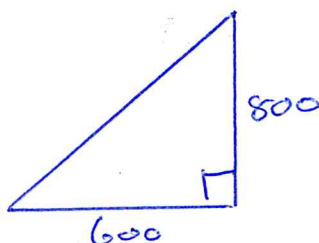
$$5 \times 5 \times 5 = 125 \text{ mm}^3 \checkmark$$

- (c) A fire started 600 m due East of Jason's house and 800 m due South of Izzy's house. Jason wants to go from his house to Izzy's house.

- (i) Draw a labelled diagram to show the locations of the two houses and the fire.



- (ii) Determine the shortest distance from Jason's house to Izzy's house.



Pythagorean triple 3,4,5 $1000 \text{ m} \checkmark$

or $6^2 + 8^2 = 100 \checkmark$
 $\sqrt{100} = 10 \therefore 10 \times 100 = 1000 \text{ m} \checkmark$

Question 3

[2,3:5 marks]

For a raised garden bed in the shape of a cylinder with radius (r) and height (h), the following rules apply:

1. $r = 3$ metres
2. $h = (5 - r) \div 4$ (in metres)
3. $Volume = \frac{\pi}{4}(5r^2 - r^3)$

(a) From rules 1 and 2, determine the height, in **centimetres**, of the garden bed.

$$h = (5 - 3) \div 4 \quad \checkmark$$

$$h = 0.5 \text{ metres} \quad \checkmark$$

(b) By substituting the given value for the radius, determine a simplified expression for the volume of the garden bed in the form of $Volume = k \times \pi$ where k is a constant.

$$V = \frac{\pi}{4}(5(3^2) - 3^3) \quad \checkmark$$

$$= \frac{\pi}{4}(45 - 27)$$

$$= \frac{\pi}{4}(18) \quad \checkmark = \pi(4.5)$$

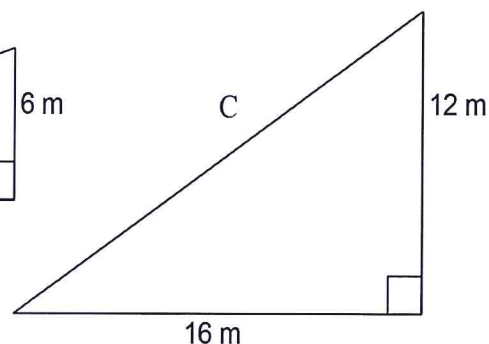
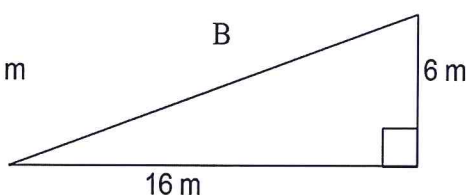
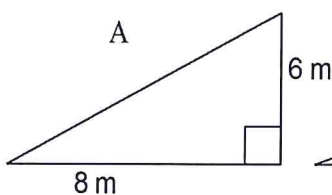
$$\therefore Volume = 4.5\pi \quad \checkmark$$

Question 4

[1,1,1,2:5 marks]

Jim and Bill are planning a series of triangular lawns in the school grounds. They are investigating the amount of water and fertiliser required and hence the areas of the lawns.

Three of the lawns they have investigated are drawn below: they are labeled A, B and C.
The diagrams are not to scale.



- (a) Determine the area of lawn A.

$$A = \frac{1}{2} \times 8 \times 6 = 24 \text{ m}^2 \quad \checkmark$$

- (b) The scale factor for the area of lawn B compared to lawn A is 2.
What is the scale factor for the area of lawn C compared to lawn A?

$$\frac{96}{24} = \text{Scale factor } 4 \quad \checkmark$$

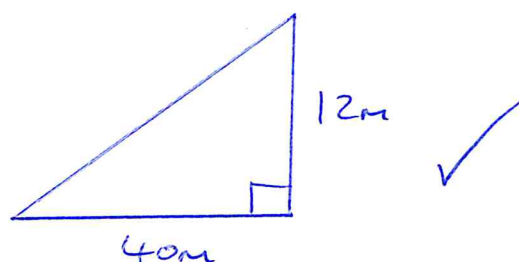
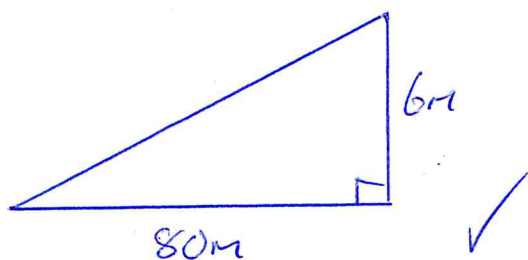
- (c) Lawn D (not pictured here) is 4 times as long as lawn A and 4 times as wide.
What is the scale factor for the area of lawn D compared to lawn A?

$$4^2 = \text{Scale factor } 16 \quad \checkmark$$

- (d) There are other lawns which are similar to lawn A. One of these is lawn K for which the scale factor for the area of lawn K compared to lawn A is 10.

Sketch and label two possible diagrams to represent lawn K.

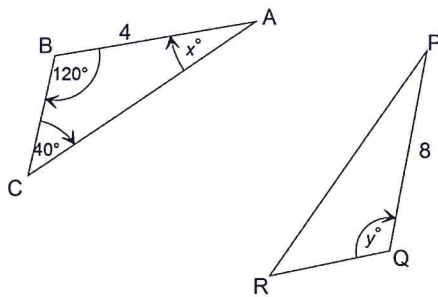
Area must equal 240 m^2



Question 15

[1,1,1,1:4 marks]

Triangle ABC is similar to triangle PQR.



State the values of:

(a) x $20^\circ \checkmark$

(b) y $120^\circ \checkmark$

(c) $\frac{BC}{QR}$ $\frac{1}{2} \checkmark$

(d) $PR : AC$ $2 : 1 \checkmark$

Mathematics Department

Course: A1MAA



Topic Title: Test 3 - Mensuration, similar figures and scale factors

Mensuration, similar

figures and scale factors

Student Name: Solutions

Date: _____

Special Instructions: **Calculator Allowed**

Time Allowed: 50 minutes

Formulae Sheet and 1 A4 page of notes allowed.

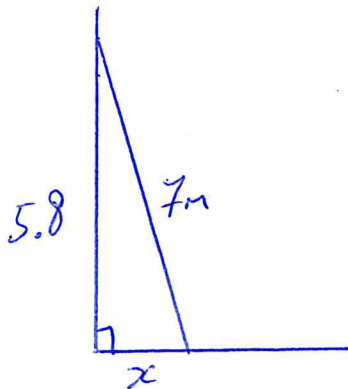
Marks: / 45

Show all working.

Question 1

[3 marks]

A ladder has its base on level ground and its top resting against a vertical wall. If the ladder is 7 metres in length and reaches 5.8 metres up the wall, how far, to the nearest cm is the foot of the ladder from the base of the wall?



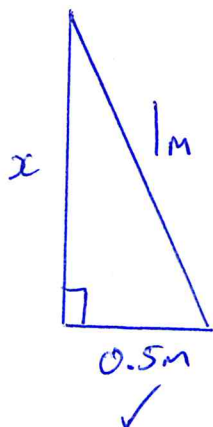
$$\begin{aligned}x &= \sqrt{7^2 - 5.8^2} \\&= 3.92\text{m}\end{aligned}$$

Question 2

[3 marks]

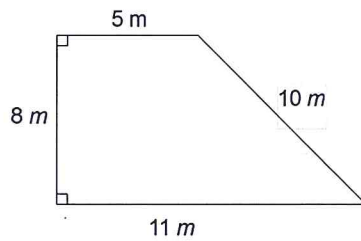
A rod of length 1 metre just fits inside a cylindrical container of base radius 25cm.

Determine the height of the container, to the nearest cm.



$$\begin{aligned}x &= \sqrt{1^2 - 0.5^2} \\&= 0.866\text{m} \\&= 87\text{cm}\end{aligned}$$

(a)



Dan wants to fence this area of his backyard.

(i) How many metres of fencing will he need?

34m ✓

Dan also wants to improve that soil with compost. He intends adding one bag for every 20 m^2 .

(ii) How many bags of compost will he need?

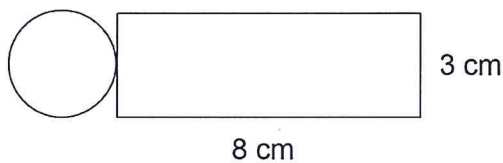
$$A = \frac{5+11}{2} \times 8 \checkmark$$

$$= 64 \text{ m}^2 \checkmark$$

he will need 4 bags ✓

(b) Calculate, stating your answers correct to two decimal places, where appropriate:

(i) the area and (ii) the perimeter of the following figure.



Area

$$\square = 3 \times 8 = 24 \text{ cm}^2 \checkmark$$

$$\bigcirc = \pi \times 1.5^2 = 7.069 \text{ cm}^2 \checkmark$$

$$\text{Total area} = 31.07 \text{ cm}^2 \checkmark$$

Perimeter

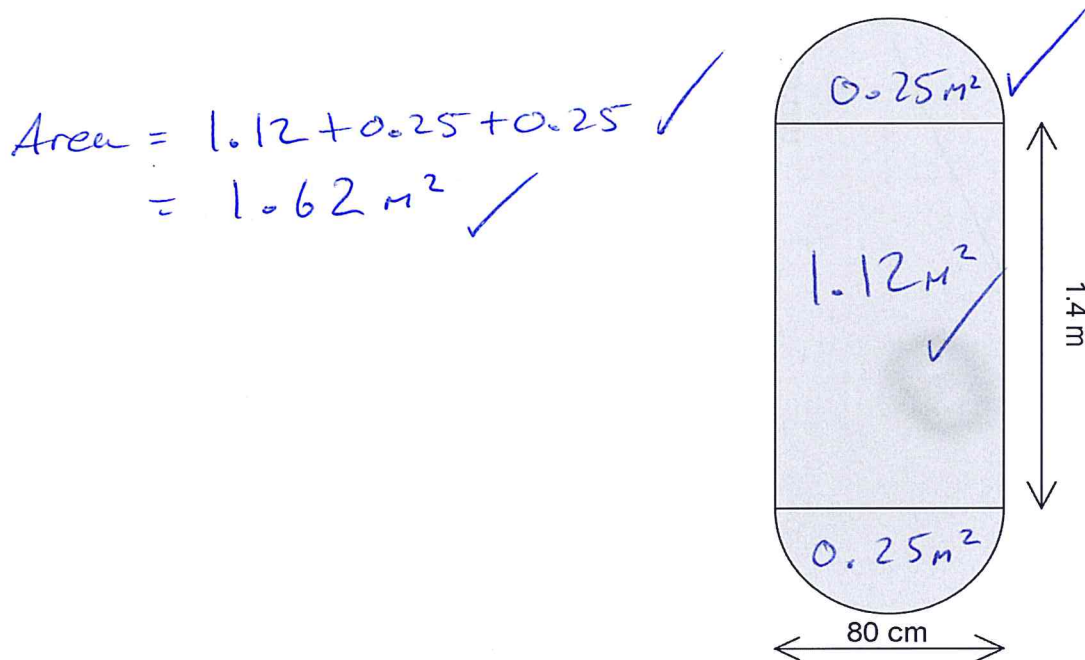
$$\square = 22 \text{ cm} \checkmark$$

$$\bigcirc = 9.425 \text{ cm} \checkmark$$

$$\text{Total perimeter} = 31.43 \text{ cm} \checkmark$$

- (a) The top of a water tank is drawn below. It is made from three sheets of material which are 80 cm wide. One sheet is rectangular and the other two are semi-circular.

Calculate the area of the top of the tank.



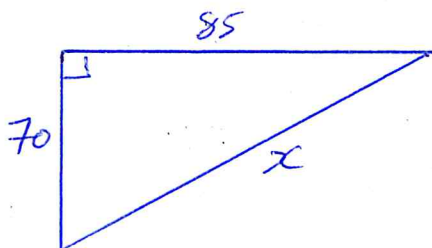
- (b) Su Lin and Sami discovered that their television needed to be between 46" and 55". The size of televisions refers to the lengths of the diagonals of the rectangular screens. (4 marks)

- (i) State the minimum size in centimetres. [1" is approximately 2.5 cm]

$$46 \times 2.5 = 115 \text{ cm}$$

- (ii) One television that Su Lin and Sami considered was 85 cm wide and 70 cm high. Determine the size (in cm) of this television.

Comment on the suitability of this television for Su Lin and Sami.



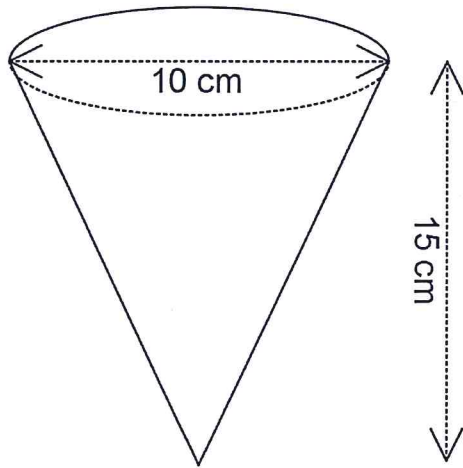
$$x = \sqrt{85^2 + 70^2}$$

$$= 110 \text{ cm} \quad \checkmark$$

$$55 \times 2.5 = 137.5 \text{ cm}$$

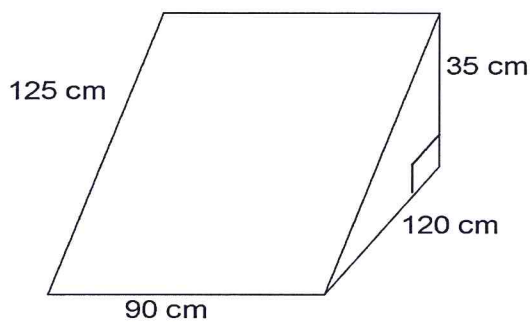
This TV is too small as they wanted 115 cm as a minimum. ✓

- (c) At Millie's birthday party three of the children filled their party hats with sand. Each of the cone-shaped hats was 10 cm wide and 15 cm high. How much sand did each hat hold?



$$\begin{aligned}
 \text{Volume} &= \frac{\pi r^2 h}{3} \quad / \\
 &= \frac{\pi \times 5^2 \times 15}{3} \quad / \\
 &= 392.7 \text{ cm}^3 \quad /
 \end{aligned}$$

- (d) A wheelchair ramp in the shape of a triangular prism is pictured below. It will be painted on all faces. Determine the total surface area of the ramp.

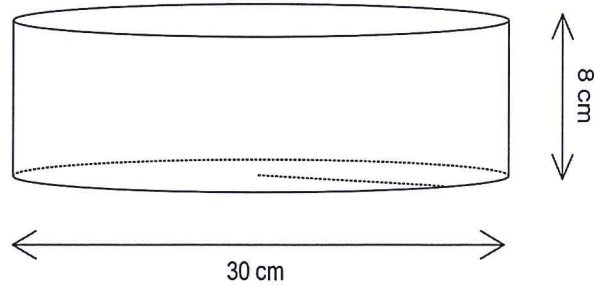


$$\begin{aligned}
 90 \times 125 &= 11250 \text{ cm}^2 \quad / \\
 90 \times 120 &= 10800 \text{ cm}^2 \quad / \\
 90 \times 35 &= 3150 \text{ cm}^2 \quad / \\
 120 \times 35 &= 4200 \text{ cm}^2 \quad + \quad / \\
 \hline
 \text{TSA} &= 29400 \text{ cm}^2 \quad /
 \end{aligned}$$

Question 5

[2,2,1,3:8 marks]

Jan has baked a Christmas cake which is cylindrical in shape, 30 cm wide and 8 cm high.



- (a) Jan wishes to place paper trimming right around the outside of the cake. Her trimming is 8 cm wide. What is the minimum length that it should be?

$$\pi D = \pi \times 30 = 94.3 \text{ cm}$$

- (b) Jan is going to ice the cake on the top and around the outside (not on the bottom).

- (i) How much of the cake will need to be iced?

$$94.3 \times 8 + \pi \times 15^2 = 1461.26 \text{ cm}^2$$

- (ii) If Jan needs 100 g of sugar for each 1000 cm² of icing that she makes, how much sugar will she need?

$$\frac{1461.26}{1000} = 1.46$$

$$1.46 \times 100 = 146 \text{ g}$$

- (c) Jan is going to divide the cake up evenly between the eight people at the Christmas lunch. How much cake will each person get?

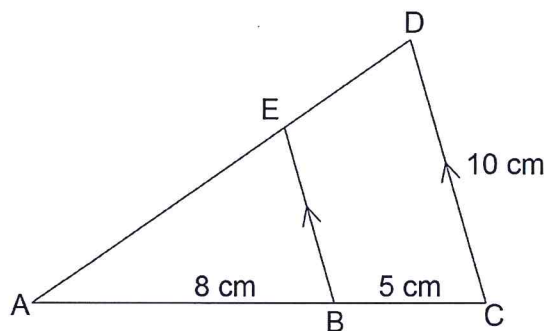
[Assume the thickness of the icing does not need to be considered.]

$$\begin{aligned}\text{Volume of whole} &= \pi r^2 h \\ &= \pi \times 15^2 \times 8 \\ &= 5654.87 \text{ cm}^3 \quad \checkmark\end{aligned}$$

$$\frac{5654.87}{8} = 706.9 \text{ cm}^3 \quad \checkmark$$

Question 6

[3,3:6 marks]



- (a) Prove that $\triangle EAB \sim \triangle DAC$.

Using AAA

$\angle A$ belongs to both \checkmark
As EB and DC are parallel with one another:
 $\angle B = \angle C \quad \checkmark$
 $\angle E = \angle D \quad \checkmark$

- (b) Determine the length of EB .

$$\frac{8}{13} = \frac{x}{10}$$

$$13x = 80 \quad \checkmark$$

$$x = \frac{80}{13} \quad \checkmark \quad x = 6.15 \text{ cm} \quad \checkmark$$