

Mathematics at the Gardens! 2

Instructions for Teachers

- Venue: Sun Pavilion and Heritage Gardens
- Estimated duration to complete all questions: 2 hr
- Ensure that students bring along a pen, calculator, measuring tape and a string of about 2 metres in length for the trail.
- Ensure that students are well-hydrated before you begin this learning journey.



Answers for Teachers

AT THE SUN PAVILION

1. Acknowledgement Sign

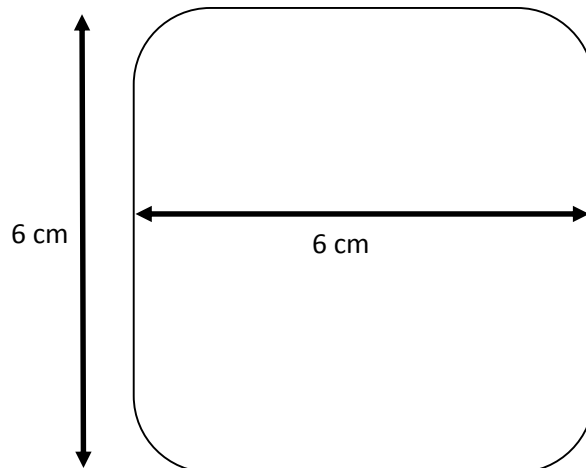
Locate the sign as shown in the photo below.



a. With the help of a measuring tape, measure and record the length of a and b .
 Answer: $a = 60 \text{ cm}$, $b = 60 \text{ cm}$

b. By using 1 cm to represent an actual length of 10 cm, draw an accurate scale diagram of the actual signage.

Answer:



c. Based on your observation, is the given figure a square? Explain your answer.

Answer:

No, a square has 4 vertices (i.e. Vertices are points where 2 or more straight lines meet) but the given figure does not have vertices.

2. Lamp Post

Locate any of the lamp posts at the Sun Pavilion.



Observe the lamp post and identify the portions labelled x and y , as seen in the photo below.



a(i) Using a measuring tape, measure and record the circumference of the thinner portion of the lamp post.

Answer: $x = 24$ cm

a(ii) Hence, calculate the diameter of the thinner portion of the lamp post.

(Take $\pi = \frac{22}{7}$)

Answer:

$$\text{Diameter} = \frac{\text{Circumference}}{\pi} = \frac{24}{\left(\frac{22}{7}\right)} = \frac{84}{11} \text{ cm} = 7.636 \text{ cm}$$

= 7.64 cm (3 significant figures)

b(i) Using a measuring tape, measure and record the circumference of thicker portion of the lamp post.

Answer: $y = 45$ cm

b(ii) Hence, calculate the diameter of the thicker portion of the lamp post.

(Take $\pi = \frac{22}{7}$)

Answer:

$$\text{Diameter} = \frac{\text{Circumference}}{\pi} = \frac{45}{\left(\frac{22}{7}\right)} = \frac{315}{22} \text{ cm} = 14.318 \text{ cm}$$

= 14.3 cm (correct to 3 significant figures)

c. Calculate the ratio of the circumference of the thinner portion of the lamp post to the thicker portion.

Answer:

$$\text{Ratio} = \frac{84}{11} : \frac{315}{22} = \frac{84}{11} \times \frac{22}{315} = \frac{8}{15} = 8 : 15$$

d. Calculate the ratio of the radius of the thinner portion of the lamp post to the thicker portion.

Answer:

$$\text{Ratio} = \frac{24}{2} : \frac{45}{2} = \frac{24}{2} \times \frac{2}{45} = 8 : 15$$

e. By comparing the two ratios from (c) and (d), what conclusion can you draw?

Answer:

Both ratios are the same. The ratio of the radius of 2 circles is the same as the ratio of the circumference of 2 circles.

3. Big Fish Aquarium

At the Big Fish Aquarium, measure and record the length, breadth and height of any glass panel located under the metal railing.



Answer:
 Length = 103 cm, Breadth = 1.3 cm, Height = 75 cm.

a. Calculate the volume of one glass panel.

Answer:
 Volume = $103 \times 75 \times 1.3 = 10042.5 \text{ cm}^3$

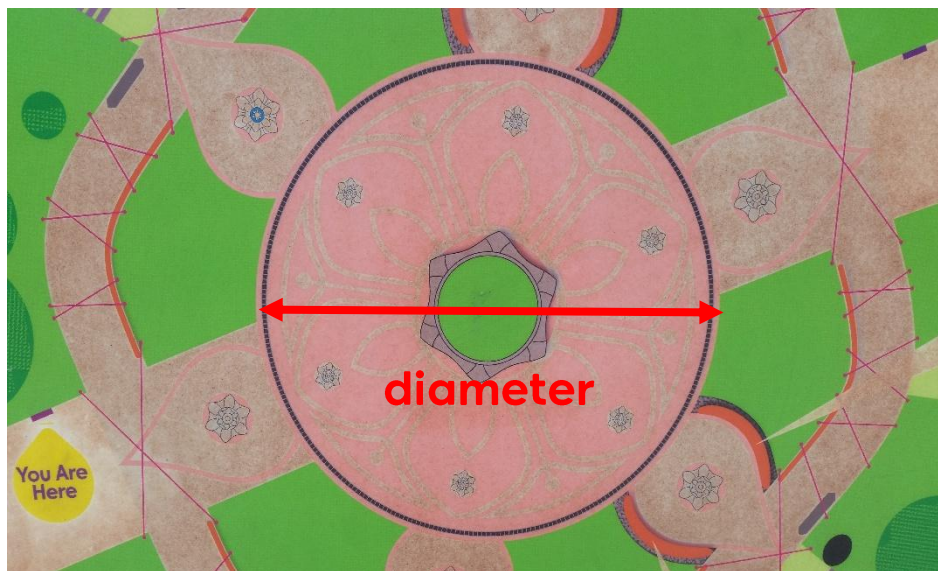
b. If all the glass panels below the metal railing are removed and stacked together, calculate the volume of the new solid formed, assuming all glass panels are of the same dimension.

Answer:
 Total volume = $10042.5 \times 7 \text{ cm}^3 = 70297.5 \text{ cm}^3$

AT THE HERITAGE GARDENS

4. Indian Garden

Locate the map of the Indian Garden.



a. Using a measuring tape and string, measure the circumference of the big pink circle.

Answer:
 Circumference of big pink circle = 93.5 cm

b. Using a measuring tape, measure the diameter of the pink circle.

Answer:
 Diameter of pink circle = 29.8 cm

c. Using the formula for the circumference of a circle, derive the value of π based on the set of data you obtained from (a) and (b).

Answer:

$$\pi = \frac{C}{d} = \frac{93.5}{29.8} = 3.137$$

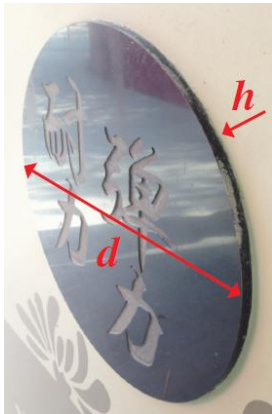
d. Compare the value of π you have calculated based on your set of data and its true value. Explain why the two values are unlikely to be exactly the same. (Hint: true value of π is 3.141592.....)

Answer:

There are slight differences in their values due to circumference and diameter not being measured accurately.

5. Chinese Garden

Locate the following display at the Chinese Garden.



a. Using a measuring tape to find the value of d , calculate the cross-sectional area of this cylindrical-shaped display in square centimetres. ($\pi = 3.14$)

Answer:

$$d = 50 \text{ cm}$$

$$\begin{aligned} \text{Area of this cylindrical shape display} &= \pi r^2 = 3.14 \times 25 \times 25 \\ &= 1962.5 \text{ cm}^2 \end{aligned}$$

b. By measuring the value of h , the thickness of this cylindrical-shaped display, calculate its volume in cubic centimetres.

Answer:

$$h = 1.4 \text{ cm}$$

$$\begin{aligned} \text{Volume of display} &= 1962.5 \times 1.4 \text{ cm}^3 \\ &= 2747.5 \text{ cm}^3 \end{aligned}$$

c. Convert your answer from (b) into cubic millimetres.

Answer:

$$1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm} = 10 \text{ mm} \times 10 \text{ mm} \times 10 \text{ mm}$$

$$1 \text{ cm}^3 = 1000 \text{ mm}^3$$

$$\begin{aligned} \text{Volume of this display} &= 2747.5 \times 1000 \text{ mm}^3 \\ &= 2\,747\,500 \text{ mm}^3 \end{aligned}$$

6. Malay Garden

Locate the map of the Malay Garden.



Using a ruler, measure the length of the various sides of the figure that is made up of red rectangles.

Answer:

a. Using the measurements obtained, calculate the perimeter of the given figure.

$$\text{Perimeter} = (7.8 + 2.1 + 1 + 2.6 + 1 + 8.4 + 10 + 0.9 + 1 + 2.6 + 1 + 0.2 + 2.2 + 9.2) \text{ cm} \\ = 50 \text{ cm}$$

b. Using the measurements obtained, calculate the area of the given figure.

Answer:

$$\text{Area} = [(2.6 \times 1) + (13.1 \times 7.8) + (2.2 \times 3.7) + (1 \times 2.6)] \\ = 115.52 \text{ cm}^2$$

c. Locate any of the sheltered circular seating areas at the Malay Garden.



(i) Measure the diameter of the circular seat. Hence, calculate the area of the circular seat. ($\pi = 3.14$)

Answer:

$$\text{Diameter of circular seat} = 279 \text{ cm}$$

$$\text{Radius of circular seat} = \frac{279}{2} = 139.5 \text{ cm}$$

$$\text{Area of circular seat} = 3.14 \times 139.5 \times 139.5 = 61,105.185 \text{ cm}^2$$

(ii) By measuring the circumference of the purple pillar, calculate the area of the circular seat (top portion, made of wood). Elaborate on the steps taken to derive the final answer. ($\pi = 3.14$)



Answer:

Circumference of pillar = 62 cm

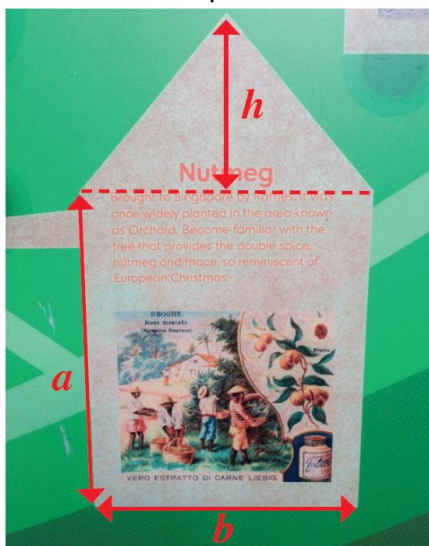
Radius of circular cross-section of pillar = $\frac{62}{2\pi} = \frac{62}{2 \times 3.14} = 9.872$ cm

Cross-sectional area of pillar = $3.14 \times 9.872 \times 9.872 = 306.01$ cm²

Area of circular seat that is covered with wood = $61105.185 - 306.01$ cm²
 = 60,799.175 cm²

7. Colonial Garden

Locate the map of the Colonial Garden.



a. Using a measuring tape or ruler, measure and record the values of a , b and h .

Answer:

$a = 17.2$ cm

$b = 14.3$ cm

$h = 8$ cm

b. Hence, calculate the area of the given figure. Show all your workings clearly.

Answer:

$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 14.3 \times 8 \text{ cm}^2$$

$$= 57.2 \text{ cm}^2$$

$$\text{Area of rectangle} = 14.3 \times 17.2 \text{ cm}^2$$

$$= 245.96 \text{ cm}^2$$

$$\text{Area of figure} = (57.2 + 245.96) \text{ cm}^2$$

$$= 303.16 \text{ cm}^2$$

c. Locate the following display at the Colonial Garden.



(i) Using your measuring tape, measure the various dimensions of the picture frame. Hence, calculate the area of the white border surrounding the picture.

Answer:

$$\text{Area of picture including border} = 22.2 \times 34.2 \text{ cm}^2 = 759.24 \text{ cm}^2$$

$$\text{Area of picture excluding border} = 33.2 \times 20.8 \text{ cm}^2 = 690.56 \text{ cm}^2$$

$$\text{Area of white border} = 759.24 - 690.56 \text{ cm}^2 = 68.68 \text{ cm}^2 = 68.7 \text{ cm}^2$$

(ii) By looking at the picture closely, state the year written on the collectible trade cards. Calculate the number of years that have passed since the year recorded on the card.

Answer:

$$\text{Number of years that have passed} = 2014 - 1902 = 112$$

d. Locate this display case at the Colonial Garden.



(i) Using a measuring tape, measure the length and breadth of the rectangular structure $ABCD$. Hence, calculate its area.

Answer:

$$\text{Area} = 92 \times 64.6 \text{ cm}^2 = 5,943.2 \text{ cm}^2$$

(ii) Using a measuring tape, measure the dimensions of the 2 glass panels, E and F and calculate its total area.

Answer:

$$\begin{aligned} \text{Total area} &= 2 \times 54.3 \times 38.5 \text{ cm}^2 \\ &= 4,181.10 \text{ cm}^2 \end{aligned}$$

(iii) Calculate the percentage of the rectangular structure that is covered by glass.

Answer:

$$\text{Percentage of rectangular structure covered by glass} = \frac{4181.1}{5943.2} \times 100\%$$

$$= 70.35\%$$

$$= 70.4\%$$

Reflection

Explain briefly, the difficulties encountered when attempting this Mathematics trail.

State briefly what you have learnt from this Mathematics trail.

This activity sheet was developed in collaboration with Temasek Secondary School.