PROBLEM SOLVING WITH SHAPES – PRACTICE QUESTIONS
CALCULATOR ALLOWED

1. Two equilateral triangles, each of perimeter 90 cm, are joined together to form a rhombus, pictured below.

Find the perimeter of the rhombus.

\[ 90 \div 3 = 30 \]
\[ 30 \times 4 = 120 \text{ cm} \]

2. Four rectangles of length 2 cm and width 9 cm and four squares of length 4 cm are arranged in the following pattern.

Find the perimeter of the octagon in the middle of the pattern.

\[ 9 + 9 + 4 + 4 + 4 + 4 + 2 + 2 = 38 \text{ cm} \]
3. Pictured below is a shape formed from two identical squares overlapping. The shaded region has width 4 cm and height 9 cm. The shaded region is 25% of the area of one of the squares.

Find the perimeter of the shape.

\[
\text{area of shaded region} = 4 \times 9 = 36
\]
\[
36 \times 4 = 144 \text{ cm}^2 = \text{area of square}
\]
\[
\sqrt{144} = 12 \text{ cm} = \text{length of square}
\]
\[
\text{perimeter} = 12 + 12 + 3 + 8 + 12 + 12 + 3 + 8
\]
\[
= \boxed{70 \text{ cm}}
\]

4. Pictured below is a parallelogram ABCD attached to an isosceles triangle CDE. The perimeter of ABCD is 38 cm. The perimeter of CDE is 25 cm. AD = 12 cm.

Find the length of DE.

\[
38 - 12 - 12 = 14
\]
\[
14 \div 2 = 7 = CD
\]
\[
25 - 7 - 7 = \boxed{11 \text{ cm}}
\]
5.
Pictured below are 10 circles tightly packed inside a rectangle. The circles each have a radius of 6 cm.

Find the area of the rectangle.

\[
\text{height} = 12 \times 2 = 24 \text{ cm} \\
\text{width} = 12 \times 5 = 60 \text{ cm} \\
\text{area} = 24 \times 60 = 1440 \text{ cm}^2
\]

6.
This honeycomb pattern is made by joining together four identical regular hexagons. Each hexagon has a perimeter of 18 cm.

Find the distance around the outer edge of the shape.

\[
18 \div 6 = 3 \text{ cm} \\
14 \times 3 = 42 \text{ cm}
\]
7. Pictured below is a bicycle wheel made of a circular rim and 8 spokes. The wheel has a diameter of 70 cm.

Find the total length of the rim and the spokes, to the nearest centimetre.

\[ \pi \times 70 = 70\pi + 70 \times 4 \]
\[ = 499.911 \ldots \text{ cm} \]
\[ = 500 \text{ cm} \]

8. Pictured below is a rectangle formed of a rectangle (R) and a square (S). The area of S is 16 cm\(^2\) and the perimeter of R is 30 cm.

Find the area of the whole shape.

\[ \sqrt{16} = 4 \text{ cm} \]
\[ 30 - 4 - 4 = 22 \text{ cm} \]
\[ 22 ÷ 2 = 11 \text{ cm} \]
\[ \text{area} = 4 \times 15 \]
\[ = 60 \text{ cm}^2 \]
9. Pictured below is a shape made from six identical rectangles. Each of these rectangles has height 2 cm and width 10 cm.

Find the area of the shaded region.

\[ 18 \times 8 = 144 \text{ cm}^2 \]

10. Pictured below is an indoor cycling track. The track is formed of two semi-circles of diameter 65 metres and a rectangle of width 110 metres.

Marta says "If I cycle around the track 12 times, I will have cycled over 5 kilometres". Is Marta correct?

\[
\text{circumference} = \pi \times 65
\]

\[
65\pi + 110 + 110 = 424.2035225
\]

\[
424.2035225 \times 12 = 5090.44227 \text{ m} > 5 \text{ km}
\]

Marta is correct.
11. A large rectangle is formed from four identical small rectangles.

The perimeter of one small rectangle is 32 cm.

Find the perimeter of the large rectangle.

small rectangle = 3x + 3x + x + x
32 = 8x
x = 4

large rectangle = 2x3x + 2x4x = 14x = 14x

= 56 cm

12. The shape below is formed of a right-angled triangle and a semicircle.

Find the perimeter of the shape, to 1 decimal place.

\[ 22.1^2 - 20.4^2 = 72.25 \]
\[ \sqrt{72.25} = 8.5 = x \]

circumference = \( \frac{\pi x 8.5}{2} \)

answer = \( \frac{\pi x 8.5 + 22.1 + 20.4}{2} \) = 55.9 m
13. The shape below is formed of an equilateral triangle of side length 6 cm and two congruent parallelograms.

The perimeter of the whole shape is 54 cm.

Find the width of one of the parallelograms.

\[ 54 - 6 - 6 - 6 = 36 \text{ cm} \]
\[ 36 \div 4 = 9 \text{ cm} \]

14. The triangle below has perimeter 35 cm.
The square below has area 81 cm².

The triangle and the square are joined to form the pentagon below.

Find the perimeter of the pentagon.

\[ \sqrt{81} = 9 \text{ cm} \]
\[ 9 + 9 + 35 = 53 \text{ cm} \]
15.
ABCD is a rectangle.
E is a point on the line CD.
AE = 26 cm
AB = 45 cm

Find the area of ABCD.

\[ DC = 45 \text{ cm} \]
\[ 45 \div 9 = 5 \]
\[ DE = 5 \times 2 = 10 \text{ cm} \]
\[ EC = 5 \times 7 = 35 \text{ cm} \]

\[ 26^2 - 10^2 = 576 \]
\[ \sqrt{576} = 24 \text{ cm} = AD \]

\[ \text{area} = 24 \times 45 = 1080 \text{ cm}^2 \]
16.
Pictured below is a motor racing track.
The track is made up of two parallel straight lines, three identical semicircles and a larger semicircle.

A race consists of 25 laps of the track.

Work out the total distance of the race, to the nearest kilometre.

\[
\text{big semicircle} = \frac{900\pi}{2} = 450\pi \\
\text{small semicircles} = \frac{300\pi}{2} \times 3 = 450\pi \\
\text{total perimeter} = 9450\pi + 450\pi + 650 + 650 = 4127.433388\text{m} \\
4127.433... \times 25 = 103,185.8347\text{m} = 103\text{km}
\]
17.
Pictured below are two mountains – A and B.
A chairlift runs from the top of Mountain A to the top of Mountain B.
The horizontal distance between the top of the mountains is 912 metres.
The height of Mountain A is 1.3 kilometres.
The length of the chairlift is 988 metres.

Find the height of Mountain B, in kilometres, to 2 significant figures.

\[ 988^2 - 912^2 = 144400 \]
\[ \sqrt{144400} = 380 \text{ m} = x \]

\[ \text{height of B} = 1300 + 380 \]
\[ = 1680 \text{ m} \]
\[ = 1.7 \text{ km} \]