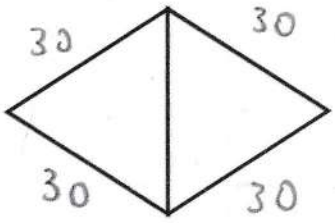
PROBLEM SOLVING WITH SHAPES – PRACTICE QUESTIONS
CALCULATOR ALLOWED

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

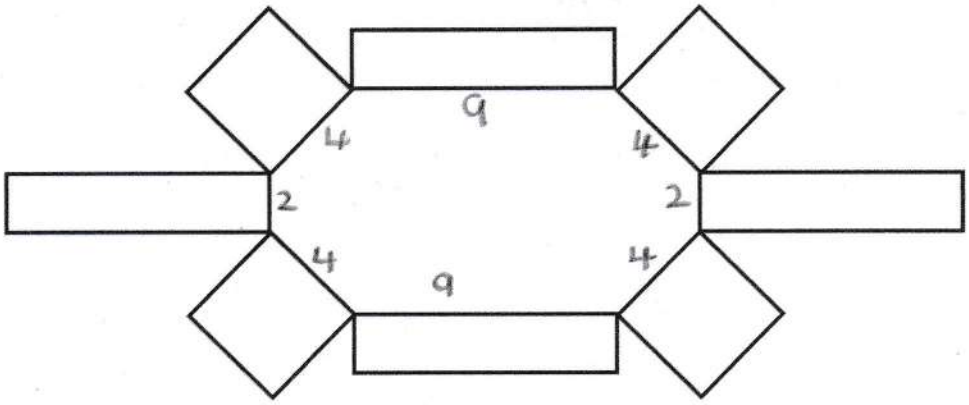


Find the perimeter of the rhombus.

$90 \div 3 = 30$

$30 \times 4 = 120$ 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.

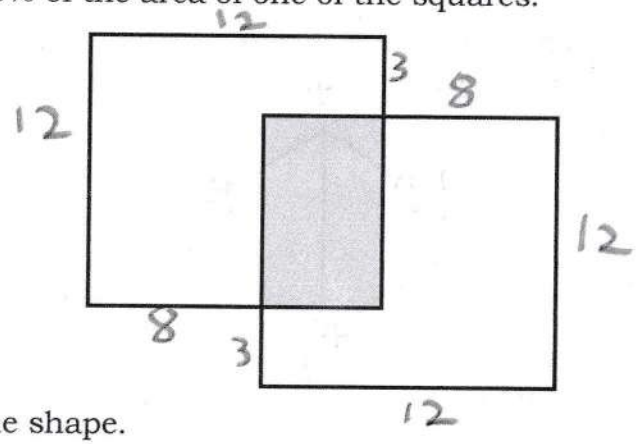


Find the perimeter of the octagon in the middle of the pattern.

$9+9+4+4+4+4+2+2 = 38$ 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.

area of shaded region = $4 \times 9 = 36$

$36 \times 4 = 144 cm^2$ = area of square

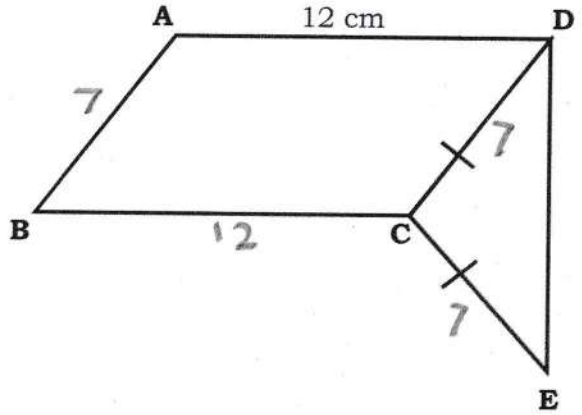
$\sqrt{144} = 12$ cm = length of square

perimeter $= 12+12+3+8+12+12+3+8$

$= \underline{70 \text{ cm}}$

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.



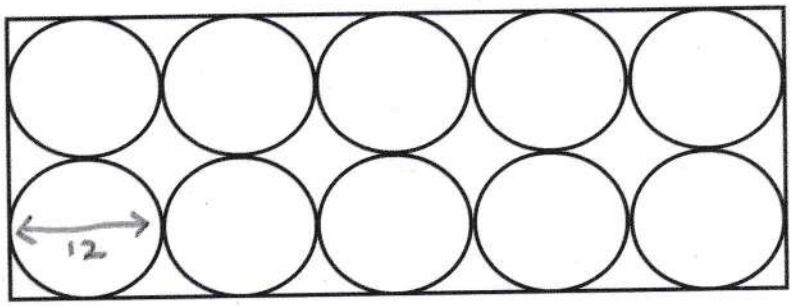
Find the length of DE.

$38 - 12 - 12 = 14$

$14 \div 2 = 7 = CD$

$25 - 7 - 7 = \underline{11 \text{ cm}}$

5.
Pictured below are 10 circles tightly packed inside a rectangle.
The circles each have a radius of 6 cm.

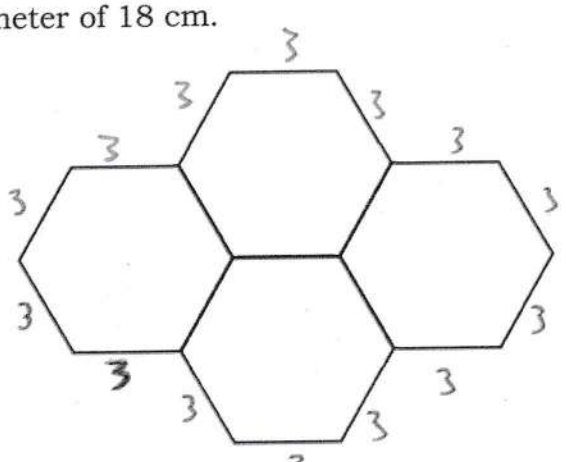


Find the area of the rectangle.

height = 12 × 2 = 24 cm
width = 12 × 5 = 60 cm

area = 24 × 60 = 1440 cm^2

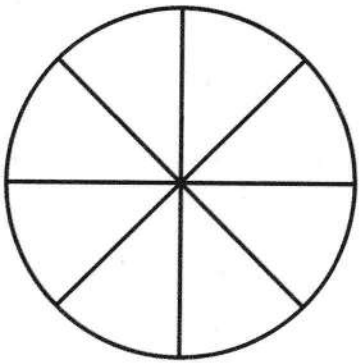
6.
This honeycomb pattern is made by joining together four identical regular hexagons.
Each hexagon has a perimeter of 18 cm.



Find the distance around the outer edge of the shape.

18 ÷ 6 = 3 cm
14 × 3 = 42 cm

7.
Pictured below is a bicycle wheel made of a circular rim and 8 spokes.
The wheel has a diameter of 70 cm.



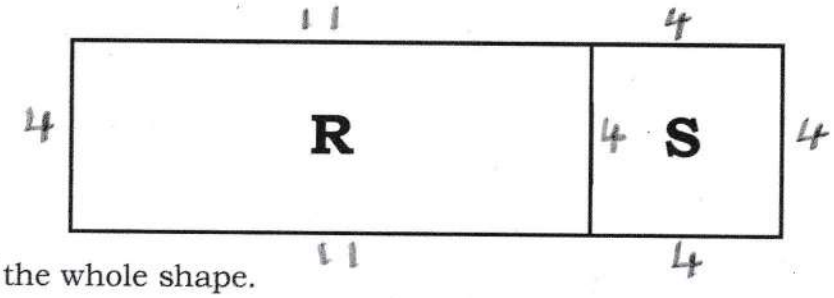
Find the total length of the rim and the spokes, to the nearest centimetre.

$\pi \times 70 = 70\pi + 70 \times 4$

$= 499.911\ldots$ cm

$= 500$ 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.

$\sqrt{16} = 4$ cm

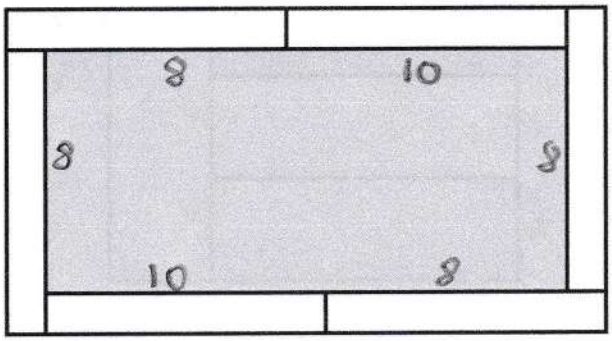
$30 - 4 - 4 = 22$ cm

$22 \div 2 = 11$ cm

area $= 4 \times 15$

$= 60$ cm^2

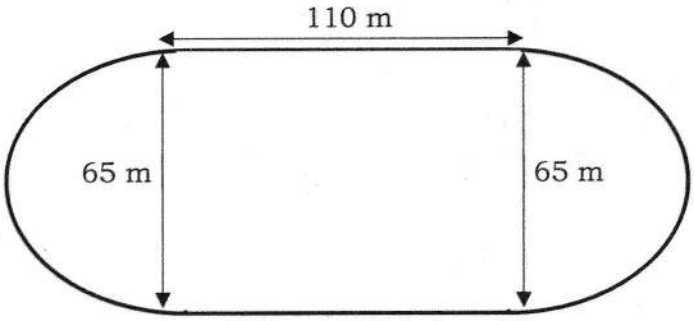
9.
Pictured below is a shape made from six identical rectangles.
Each of these rectangles has height 2 cm and width 10 cm.



Find the area of the shaded region.

$18 \times 8 = 144\ cm^2$

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?

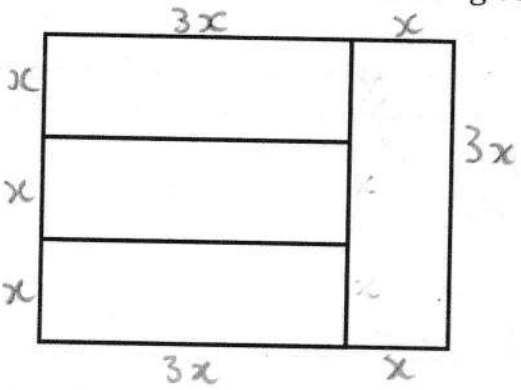
circumference $= \pi \times 65$

$65\pi + 110 + 110 = 424.2035225$

$424.203.. \times 12 = 5,090.44227\ m > 5\ km$

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 $= 3x + 3x + x + x$

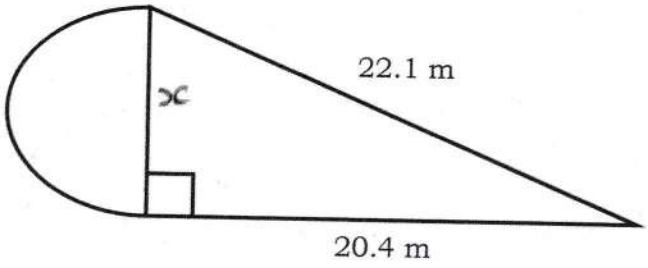
$32 = 8x$

$x = 4$

large rectangle $= 2 \times 3x + 2 \times 4x = 14x = 14 \times 4$

$= 56$ 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.

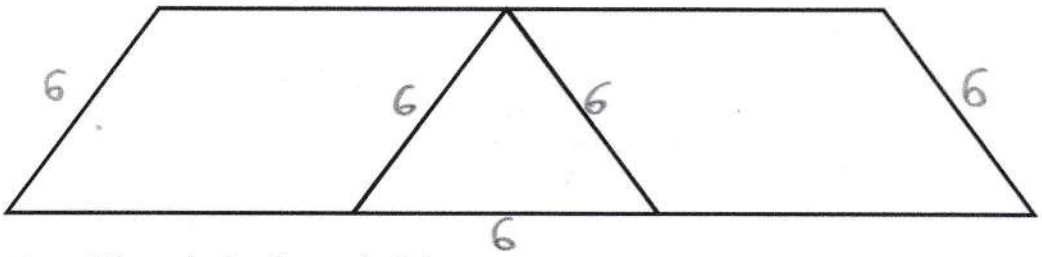
$22.1^2 - 20.4^2 = 72.25$

$\sqrt{72.25} = 8.5 = x$

circumference $= \frac{\pi \times 8.5}{2}$

answer $= \frac{\pi \times 8.5}{2} + 22.1 + 20.4 = 55.9$ 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.

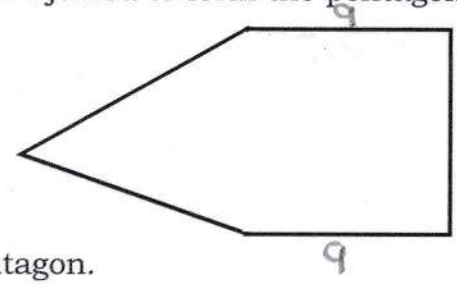
Find the width of one of the parallelograms.

$54 - 6 - 6 - 6 = 36$ cm

$36 \div 4 = 9$ cm

14.
The triangle below has perimeter 35 cm.
The square below has area 81 cm^2.

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

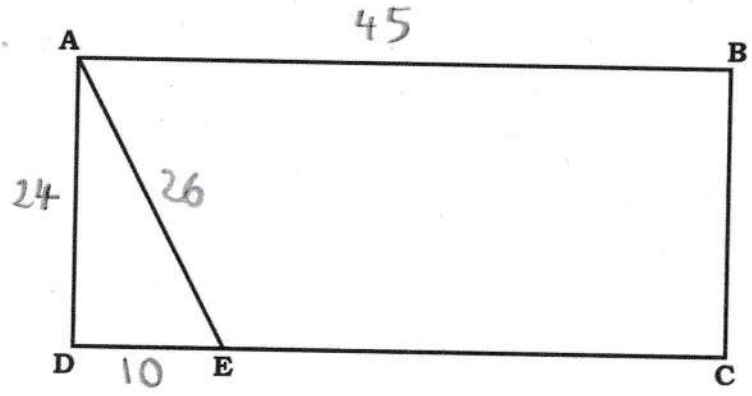


Find the perimeter of the pentagon.

$\sqrt{81} = 9$ cm

$9 + 9 + 35 = 53$ cm

15.
ABCD is a rectangle.
E is a point on the line CD.
AE = 26 cm
AB = 45 cm
DE : EC = 2 : 7.



Find the area of ABCD.

$DC = 45cm$

$45 \div 9 = 5$

$DE = 5 \times 2 = 10\,cm$

$EC = 5 \times 7 = 35\,cm$

$26^2 - 10^2 = 576$

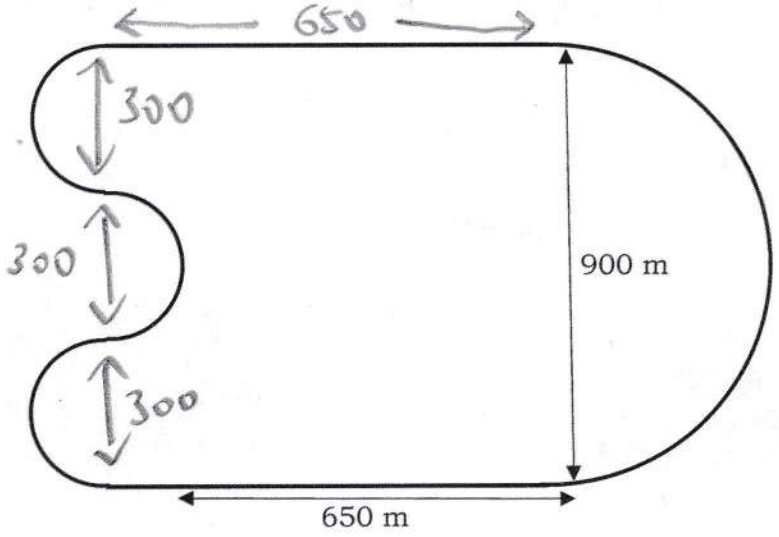
$\sqrt{576} = 24\,cm = AD$

$area = 24 \times 45 = \underline{1080\,cm^2}$

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.

big semicircle = $\frac{900\pi}{2} = 450\pi$

small semicircles = $\frac{300\pi}{2} \times 3 = 450\pi$

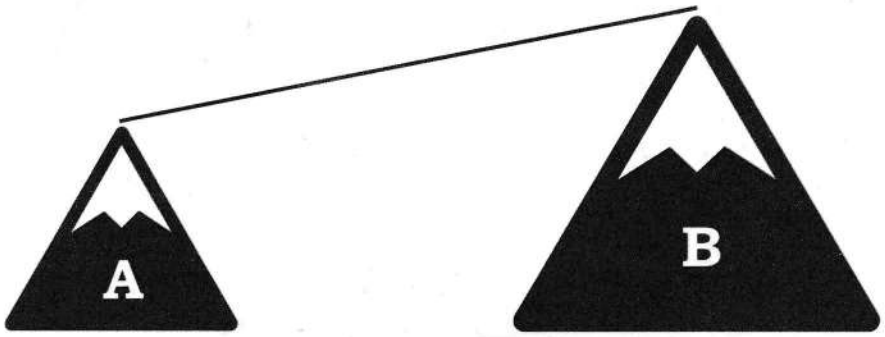
total perimeter = $450\pi + 450\pi + 650 + 650$

$= 4127.433388\text{ m}$

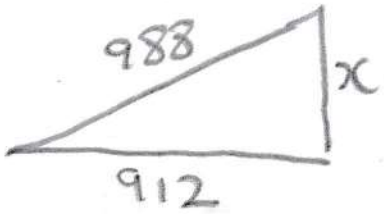
$4127.433\ldots \times 25 = 103,185.8347\text{ m}$

$= \underline{103\text{ km}}$

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.



$988^2 - 912^2 = 144400$

$\sqrt{144400} = 380\ m = x$

height of B = 1,300 + 380

= 1,680 m

= 1.7 km