Trade of Metal Fabrication	
Module 4:	Structural Steel Fabrication
Unit 5:	Material Support Frame
	Phase 2

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Document Release History

Date	Version	Comments
01/02/07	First draft	
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Module 4 – Structural Steel Fabrication

Unit 5 – Material Support Frame

Duration – 9 Hours

Learning Outcome:

By the end of this unit each apprentice will be able to:

- Read and interpret orthographic projection
- Mark out material, cut, drill, assemble and weld material to fabricate a support frame

Key Learning Points:

Rk **Sk**	**Measurement, marking out.** **Oxy/Fuel cutting, drilling.** **Assembly and welding.** *(For more information see Module 2 Unit 1 and Module 3 Unit 4).*
Rk	**Tools and machinery required for exercise.** *(For more information see Module 1).*
H	Safety precautions – material handling, cutting, drilling, welding. *(For more information see Module3 Unit 1).*
M	**Areas and perimeters of common plane figures.**
P	Well organised work area, standard of work, safety awareness.

Training Resources:

- Fabrication workshop
- Apprentice toolkit, P.P.E. oxy/fuel cutting equipment
- M.A.G.s welding plant and equipment
- Welding consumables
- Material as stated on drawing

Key Learning Points Code:

M = Maths   D = Drawing   RK = Related Knowledge Sc = Science

P = Personal Skills   Sk = Skill   H = Hazards

Area and Perimeter

Area

The area of a surface is the number of square units and parts of square units contained in that surface.

Examples of square units in common use are:

a) A square millimetre denoted by mm²

b) A square metre, denoted by m²

Figure 1, below, shows a square of sides 1 m in length, thus the square formed has an area of one square metre, 1 m².
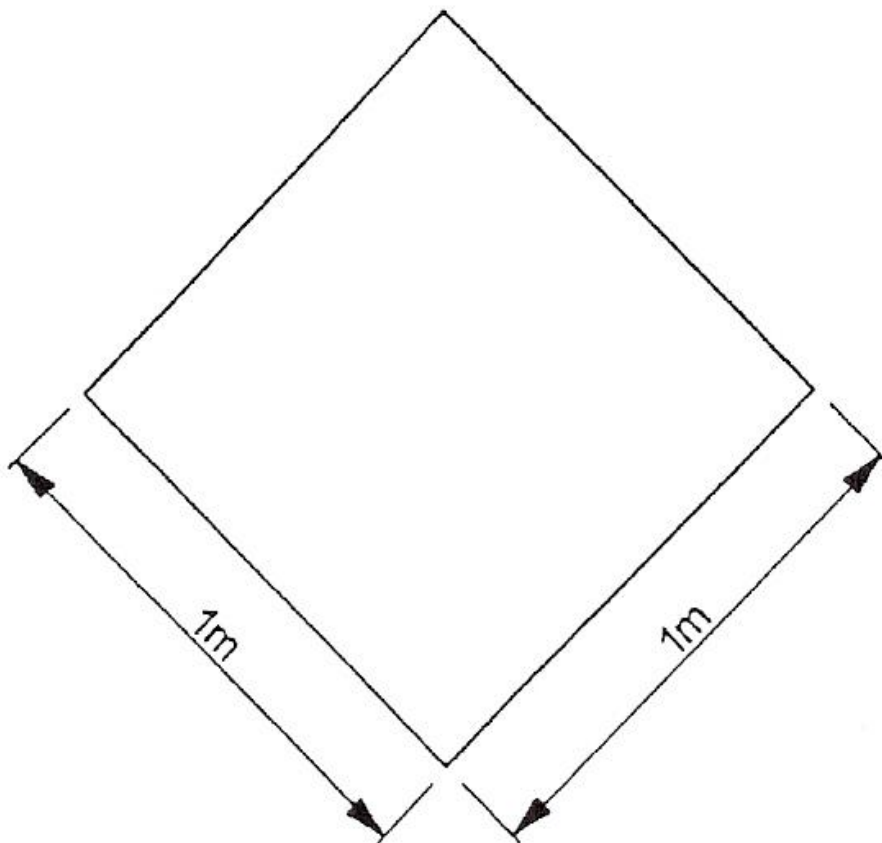

Figure 1 - Area of Square

A rectangle is shown in Figure 2. The adjacent (next to) sides are unequal and the opposite sides are equal in length. All corners are square, so the opposite sides are parallel. The area of the rectangle is: 6 x 4 = 24 metres squared = 24m²
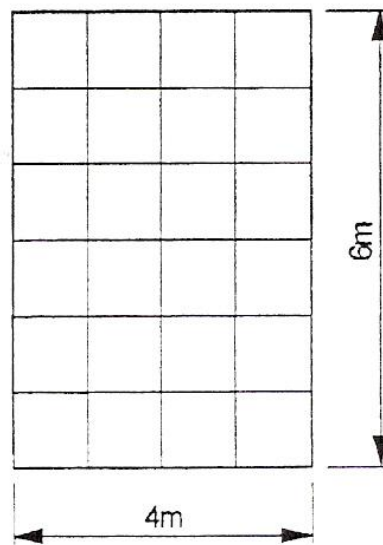

Figure 2 - Area of Rectangular

Area of Rectangle = Length x Breadth

Parallelogram

A parallelogram is a plane four sided figure with uts opposite sides parallel as shown in Figure 3.
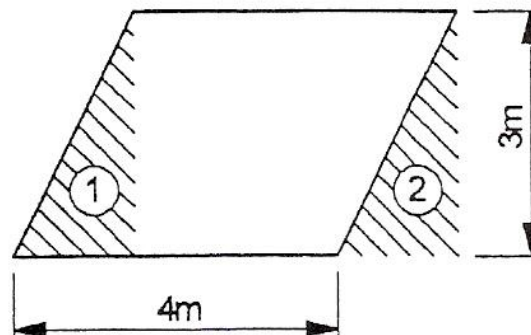

Figure 3 - Parallelogram

Shaded area (1) is equal to the shaded area (2).

Area of Parallelogram   =   Unshaded Area + Shaded Area (1)

Since Shaded Area (1)   =   Shaded Area (2)

Area of Parallelogram   =   Base x Perpendicular Height

                               =   4 x 3

                               =   12m²

Triangle

A triangle is a plane figure bounded by three straight lines. If a diagonal (straight line joining opposite corners) is drawn a parallelogram it will divide the figure into two equal triangles.
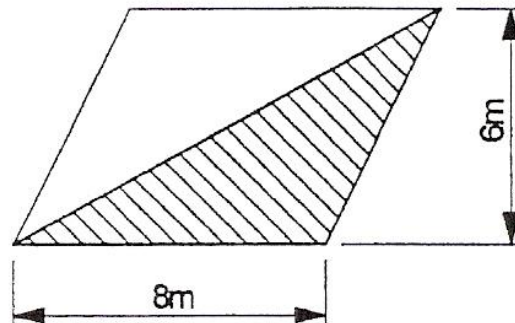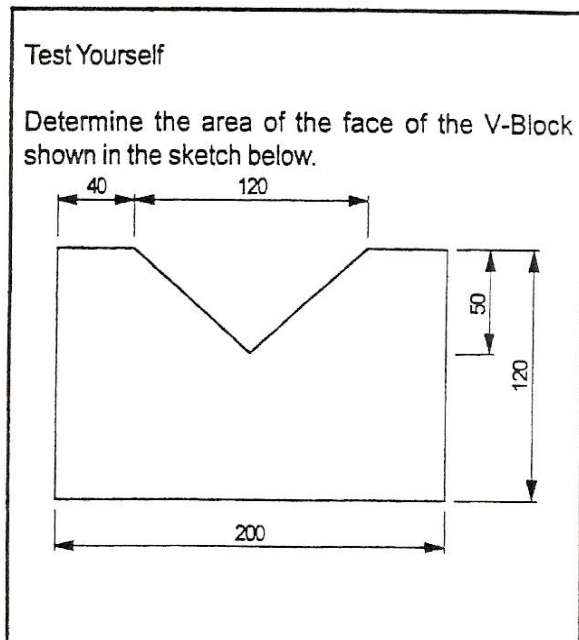

Figure 4 - Triangle

Area of triangle   = ½ x Area of Parallelogram

                                 = ½ base x perpendicular height

                                 = ½ x 8 x 6

                                 = 24m²

Test Yourself

Determine the area of the face of the V-Block shown in the sketch below.

Answer:

Area of Rectangle

         = 200 x 120 = 24000mm²

Area of Triangle

         = 120 x 50 x ½ = 3000mm²

Area of Face

         = 24000 – 3000 = 21000mm²

Perimeter and Circumference

The perimeter is the distance around an object. If the figure has straight sides the perimeter is the sum of the lengths of its sides.

Example

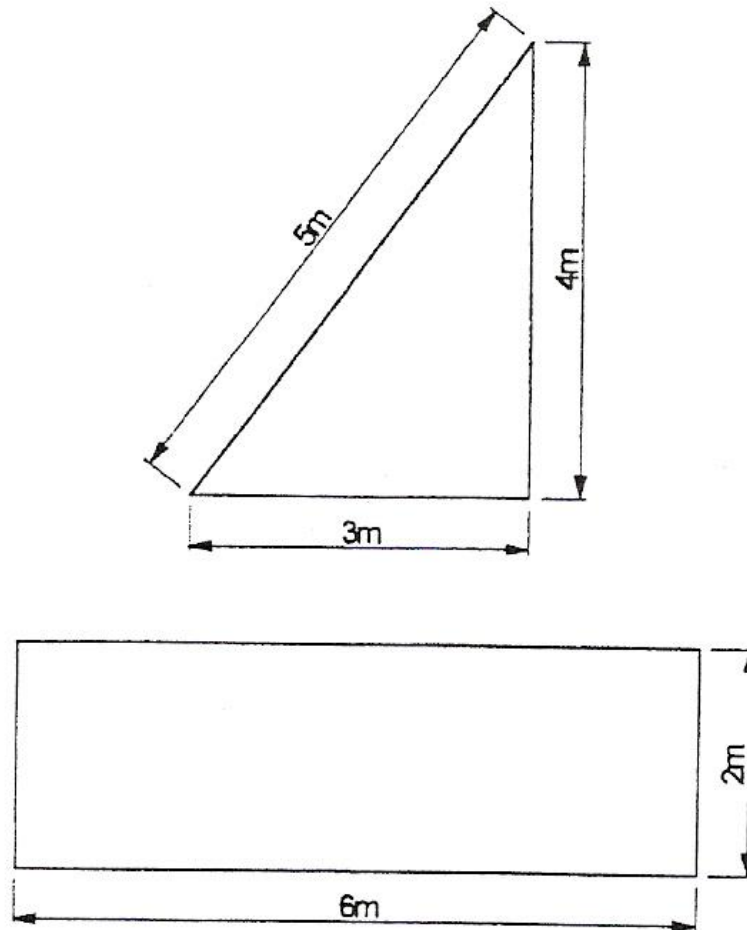Find the perimeter of the triangle and the rectangle shown in Figure 5 below.

Figure 5 - Perimeter and Circumference Example

Perimeter of triangle = 3 + 4 + 5 = 12m

Perimeter of rectangle = 6 + 2 + 6 + 2 = 16m.

The Circle

The perimeter or distance around a circle is known as the circumference.

In the circle shown in Figure 6, 'D' represents the diameter; this is the distance across the circle through its centre labelled 'O'.

The radius is the distance from the centre to a point on the circle. The diameter is always twice the radius. The circumference is always 3.14159254 times the diameter or 3.14 to two decimal places.
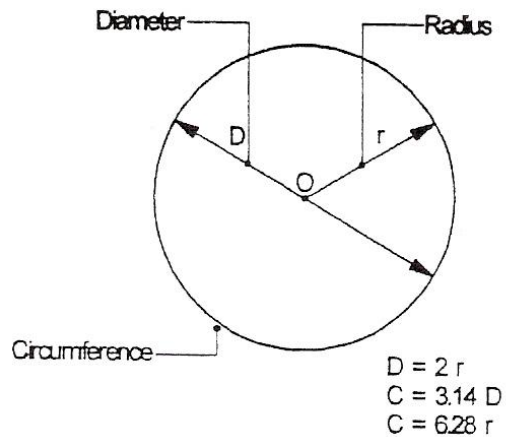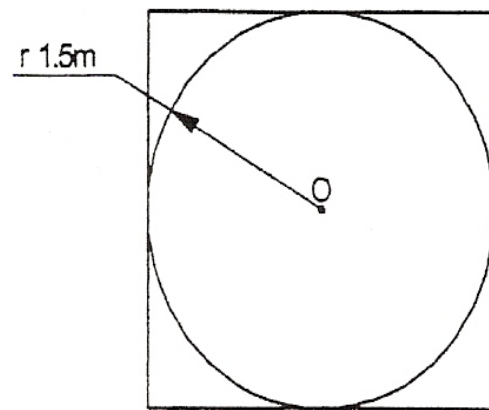

$$D = 2r$$
$$C = 3.14 D$$
$$C = 6.28 r$$

Figure 6 - Circle

Example

The sketch below shows a circle of radius 1.5m inscribed in a square. State:

a) Circle Diameter,

b) Circle Circumference,

c) Perimeter of the Square,

d) Area of the Square in m²

Answer:

a) Diameter $D = 2r = 2 \times 1.5 = 3m$

b) Circumference $= 3.14 \times D$
$$= 3.14 \times 3 = 9.42m$$

c) Perimeter of Square $= 4 \times 3 = 12m$

d) Area of Square $= 3 \times 3 = 9m²$

The relationship between the diameter and circumference of a circle is given the name π. π is a Greek letter pronounced Pie. $\pi = 3.14$.
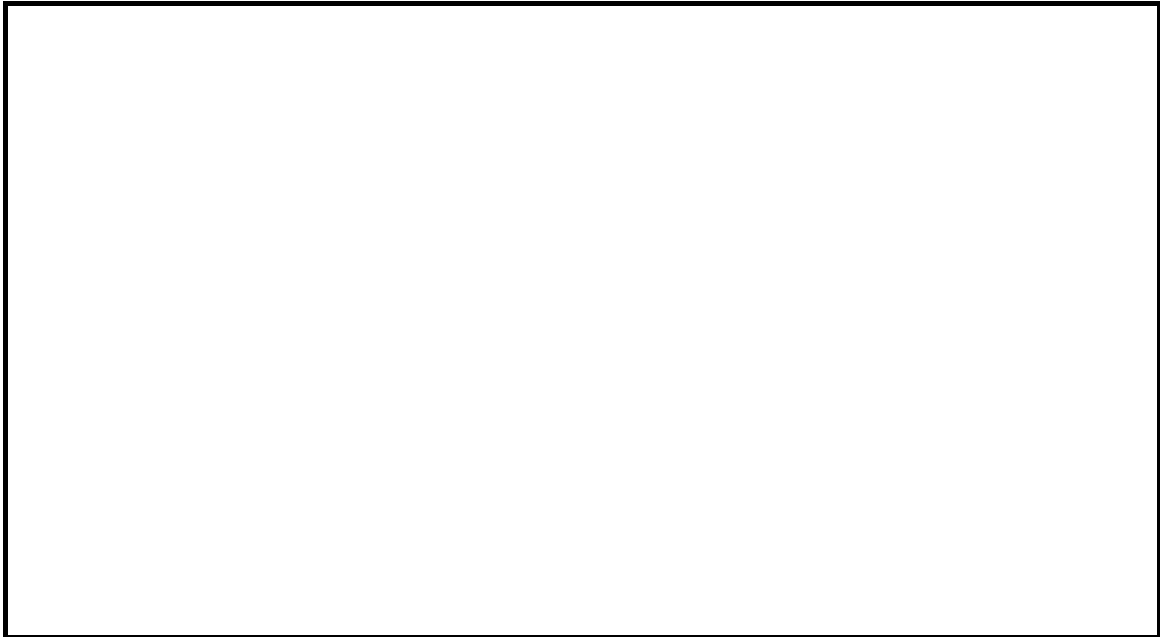
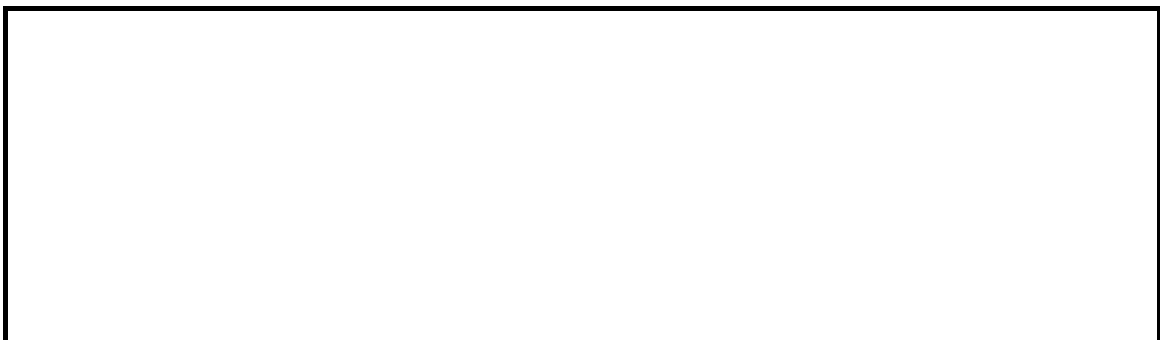$$\text{Circumference} = \pi \times \text{Diameter}$$

$$C = \pi D$$

Self Assessment

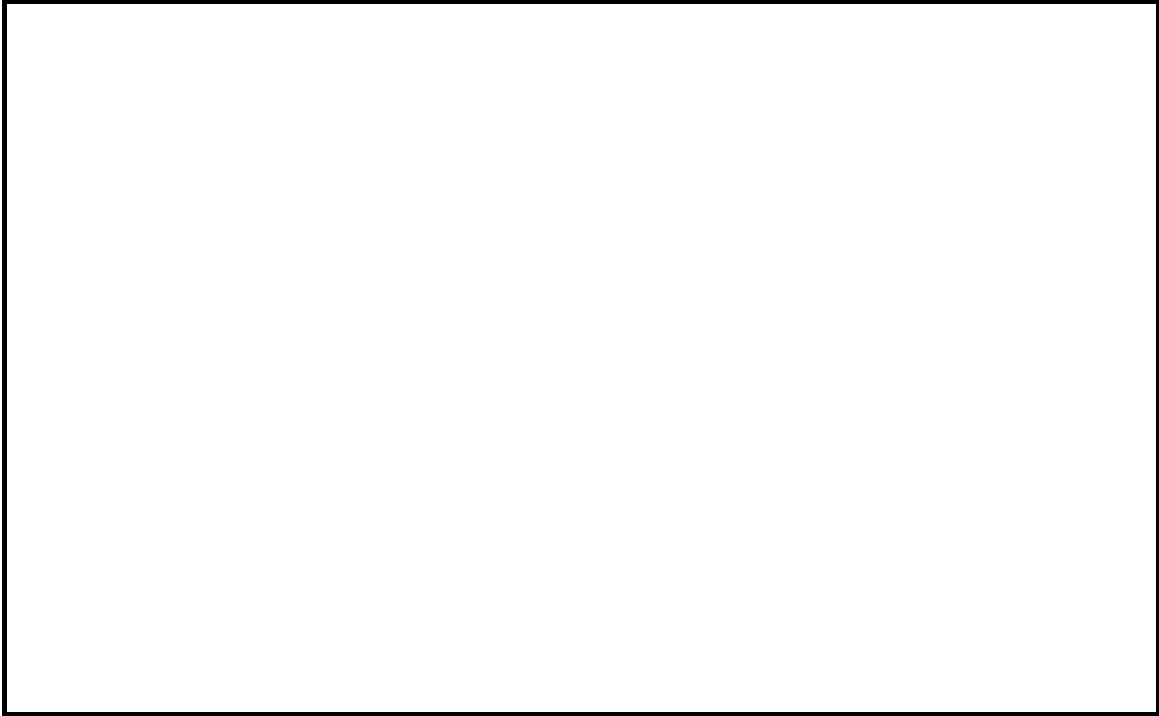Questions on Background Notes – Module 4.Unit 5

1. Give an example of how to find the area of a particular shape and give the formula.

   E.g. Rectangle

2. Write down the formula for finding the area of a triangle.

Self Assessment

3.   Draw a Circle 80mm diameter and show the;

       a. Radius

       b. Diameter

       c. Circumference.

4.   Draw and show the Perimeter of;

       a. Right - Angled Triangle.

       b. Rectangle.

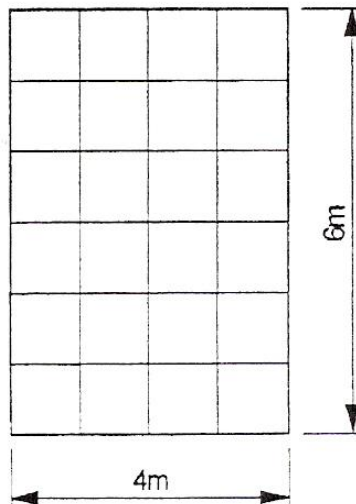# Answers to Questions 1-4. Module 4.Unit 5

1.

Area of Rectangle:

The adjacent sides are unequal and the opposite sides are

equal in length. All corners are square, so the opposite sides

are parallel.

The area of the rectangle is: 6 x 4 = 24 meters squared = 24m²

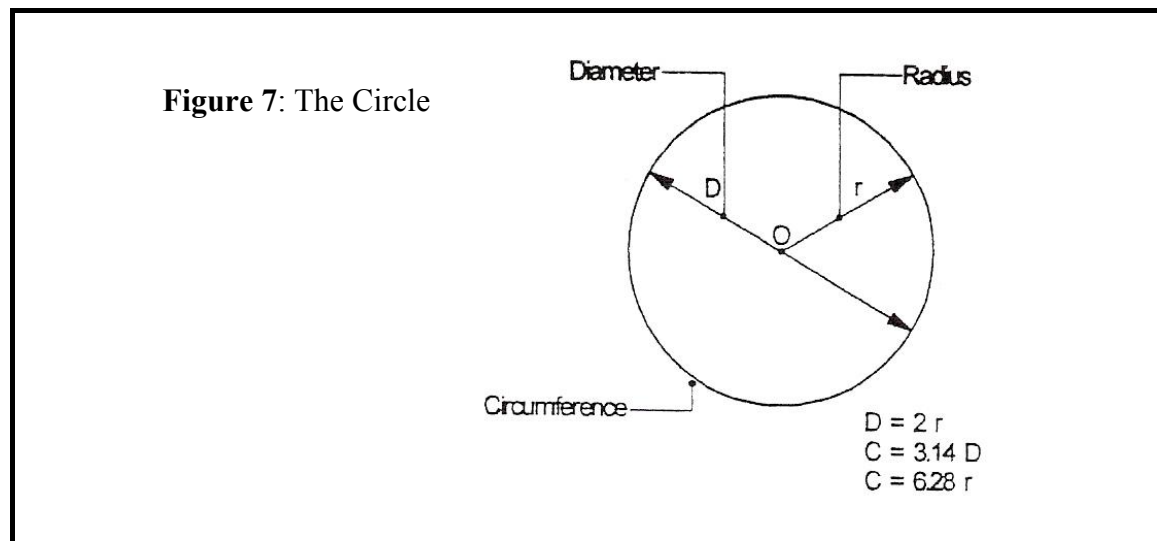**Figure 6:   Area of Rectangular**
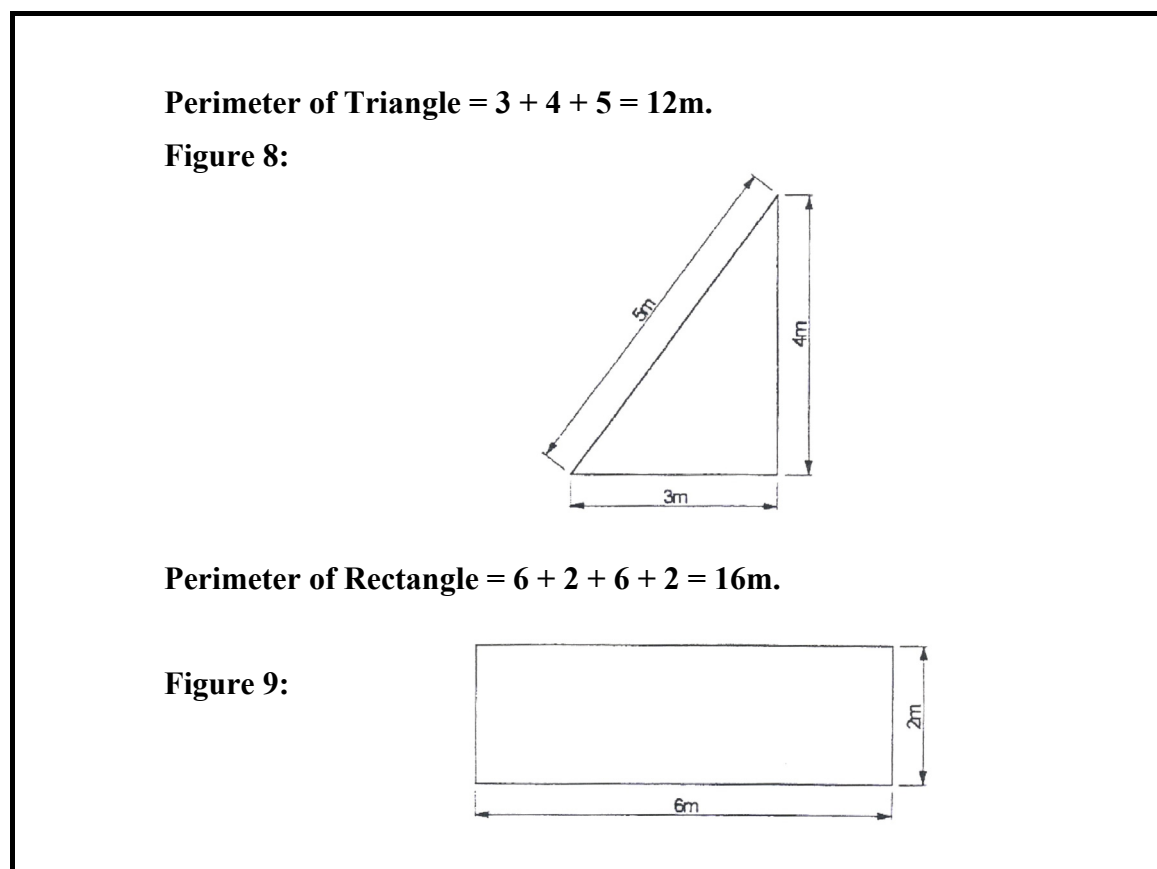
Area of Rectangle = Length x Breadth

6m

4m

2.

Area of a Triangle:

Formula: **½ Base x Vertical Height.**

3.

Figure 7: The Circle

$D = 2r$
$C = 3.14\ D$
$C = 6.28\ r$

4.

Perimeter of Triangle = 3 + 4 + 5 = 12m.

Figure 8:

Perimeter of Rectangle = 6 + 2 + 6 + 2 = 16m.

Figure 9:

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