Carpentry Level I I

Learning Guide-28

Unit of Competence: Carry out measurements and calculation for building structure

Module Title: Carrying out Measurements and calculations for Building structure

LG Code: EIS CRP2 M7 LO2-LG-28

TTLM Code: EIS CRP2 M7 TTLM 0919v1

LO 2: Obtain measurements

Instruction Sheet	Learning Guide #28

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Selecting and applying Method of obtaining the measurement.
- Obtaining Measurement using rule and tape
- Confirming and recording .Measurements, including areas and volumes

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Select and apply Method of obtain the measurement.
- Obtain Measurements using a rule or tape accurate to 1mm.
- Confirm and record Measurements, including areas and volumes.

Learning Instructions:

Read the specific objectives of this Learning Guide.

Follow the instructions described below 3 to 6.

Read the information written in the information “Sheet 1, Sheet 2, and Sheet 3

Accomplish the “Self-check 1, Self-check 2, and Self-check 3 in page -4, 8, and respectively28.

if you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page -29

Do the “LAP test” in page – 29 (if you are ready).

Information Sheet-1	Selecting and applying Method of obtaining the measurement

1.1. Selecting of measurement

Measurement is the transformation of drawn information into descriptions and quantities, undertaken to value, cost, and price construction work, as well as enabling effective management.

It is not just about a quantity surveyor producing a bill of quantities for contractors to price during tendering. It is used in both pre- and post-contract work, helping assess the likely cost of the works, and determining what contractors and subcontractors should be paid for work that has been completed.

figure 1.1 measuring tape

Plans and drawings show things that are to be

Constructed, such as foundations, walls and

Fences. They also show what's already on or near

The site, such as trees, services and neighboring

As well as these tangible items (things

we can actually see or touch), plans and

Drawings also show lots of other important

Information, including levels, gradients, heights And measurements.

1.2 Standard Method of Measurement

Standard Method of Measurement (SMM) is a reference document used to determine a localized technique of construction measurement protocol needed in producing a good Bills of Quantities (BQ) which is then incorporated into the contract document for the project. The preparation of the BQ based on SMM that is reflective of the actual work will actually help the contractor to price the tender realistically. Tendering is a serious business, whereby failure to properly price it at a realistic and profitable level can give a bad impact to the contractor's organization. Thus, it is crucial to

conduct research which aimed to investigate the two edition of the SMM for building works between the SMM1 and SMM2 version in the preparation of the BQs, focusing towards improving the appreciation of the contractors during the course of tender and construction. In view of the above matter, this paper will attempt to identify a few differences on the method of measurement between SMM1 and SMM2 and to analyze the contractors' perception on the application of the SMM in determining the tender realistically and reflective of the work on site..

1.2.1 How to Measure Using a Tape

A tape measure, also called measuring tape, is a type of flexible ruler. Tape measures are made from a variety of materials, including fiber glass, plastic and cloth. They are among the most common measuring tools used today.

Generally speaking, the term "tape measure" refers to a roll-up, self-retracting style tape measure that's designed for carpentry. The actual tape potion of the measure, called the 'ribbon,' is usually constructed from a stiff metallic material that can stiffen when needed but can also roll up for simple use and storage. However, the term covers all types of tape measures – even tailor's tape.

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Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is Standard Method of measurement? (4 points)
2. _____is made up of a flexible metal blade housed in a metal or plasticcase.(2 points)
3. Plans and drawings show things that are to be constructed, such as:- .(4 points)

Note: **Satisfactory rating -5 out of 10 points Unsatisfactory - below 5 out of 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

   _____

2. _____

3. . _____

Information Sheet-2	Obtaining Measurement using rule and tape

2.1 introductions of Measuring rule or Tape

A rule measure: simply stated the “Rule of Ten” or “one to ten” is that the discrimination (resolution) of the measuring instrument should divide the tolerance of the characteristic to be measured into ten parts. In other words, the gage or measuring instrument should be 10 times as accurate as the characteristic to be measured.

A tape measure or measuring tape: is a flexible ruler and used to measure distance. It consists of a ribbon of cloth, plastic, fiber glass, or metal strip with linear-measurement markings. It is a common measuring tool.

When it comes to construction and craftsmanship, taking accurate measurements can be the difference between a great finished product and a subpar one. Luckily, with the proper approach, using a tape measure can be a quick, easy way to get you the information you need about your project. Knowing how to use and read both a retractable measure and a traditional ribbon-style tape measure can be a major asset to anyone working with his or her hands, so learn today and start measuring!

2.2 Reading the Tape measure

Reading, measuring or calculating quantities for building projects the most common used unit of measurement in the construction industry is millimetres (mm). Lengths, widths, depths and heights are usually given in millimetres where larger dimensions are shown, such as the length of boundaries on a site plan, metres (m) will be used.

Centimetres are very rarely used. Often the unit itself is not written. For example, everyone just knows that if 3600 is written it means millimetres, whereas if 3.600 is written it means metres

Table 2.1 abbreviation and conversation

Unit	Abbreviation	Example	Conversion
Millimeter	mm	A fence could be 1200 high.	1 mm = 0.001 m
Centimeter	cm	Rarely used in the Construction industry.	1 cm = 10 mm 100 cm = 1 m
Meter	m	A fence could be 14.60 long.	1 m = 1000 mm

2.3 Converting meters and millimeters

Sometimes it's necessary to convert metres to millimetres. One metre is 1000 times Longer than one millimetre, so you just need to remove the decimal point and make Sure there are three figures after the meter

For example

2.657 m becomes 2657 mm

4.32 m becomes 4320 mm.

To convert millimetres to metres, move the decimal point three places to the left to Make the number read as one thousand times smaller.

For example:

2460 mm becomes 2.46 m

12795 mm becomes 12.795 m.

If the number of millimeters is less than 1000, put a zero before the decimal point.

For example: 795 mm becomes 0.795 m.

If the number of millimeters is less than three figures, add zeroes to the left end and Then place the decimal point. For example: 65 mm becomes 0.065 m

8 mm becomes 0.008m

To convert millimetres to metres, move the decimal point three places to the left to Make the number read as one thousand times smaller.

For example:

2460 mm becomes 2.46 m

12795 mm becomes 12.795 m.

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If the number of millimeters is less than three figures, add zeroes to the left end and Then place the decimal point. For example: 65 mm becomes 0.065 m

8 mm becomes 0.008m

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Convert the following meters to millimeters .(8 points)

   A. 256 m

   B. 345 m

   C. 432 m

   D. 222 m

2. What is measuring tape 2 points)

Note: **Satisfactory rating -5 out of 10 points Unsatisfactory - below 5 out of 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____
4. _____
5. _____

Information Sheet-3	Confirming and recording Measurements, including areas and volumes

3.1. Confirming and recording Measurements, including areas and volumes

Confirming measurements

Always check any measurements you've taken before you use them. That way if you've made a mistake, you can correct it before it's too late.

3.1.1. Recording measurements

How you record a measurement will depend on how it's going to be used. Different tasks and different workplaces will have different requirements.

The most important thing is that all measurements, calculations or totals need to be recorded clearly and accurately, including using the correct units. It's important that anyone reading the information can understand it and rely on it.

Fig3.1 recording measurements

3.1.2. Measurements, including areas and volumes

We looked at linear measurements earlier in this guide. Linear measurements can be used as they are, or they can be used to calculate area and volume, the next two most frequently used measurements in the construction industry.

3.1.3. Uses of different measurements

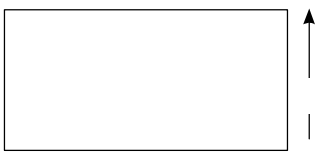
Now is a good time to check what you know already about different types of measurements.

- **Calculations**

Calculating the perimeter of a rectangle

A rectangle is any four-sided figure where all angles are 90°, and opposite sides are of equal length and parallel, as shown here.

W



L

For establishing formulas, we label the longer side L (for length) and the shorter side W (for width). If P stands for the perimeter, we can write:

P (rectangle) = L + W + L + W

= 2L + 2W

= 2(L + W)

Therefore, the formula for calculating the perimeter of a rectangle is:

P (rectangle) = 2(L + W)

Example 2

Find the perimeter of a rectangle whose length is 8 m and whose width is 4 m.

Solution:

Step 1

Draw a diagram

Step 2

Write down the appropriate formula.

P (rectangle) = 2(L + W)

Step 3

Substitute numbers into the formula and calculate the answer.

P (rectangle) = 2(8 + 4) m

= 2(12) m

= 24 m

- **Calculating more complex perimeters**

Most houses aren't just a simple rectangle, but you can use the same method as you just learned to work out their perimeters too.

Fig3.2Calculating more complex perimeters

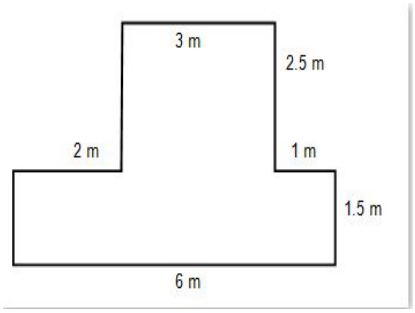


Fig3.3 Perimeter of rectangle

Example 1

Have a look at this example of a house drawing.

Solution:

Perimeter of rectangle = 2(L + W)

= 2(6 + 4) m

= 20 m

3.1.4. Linear measurements

Calculating linear measurements is very similar to calculating the perimeter of an area, except you calculate only the length of the object or area required instead of the total perimeter.

For example, a carpenter needs to measure up a specific area in a new house where timber skirting is to be fixed. On the following drawing, the dotted lines indicate where timber skirting is to be fixed.

fig3.4Linear measurements

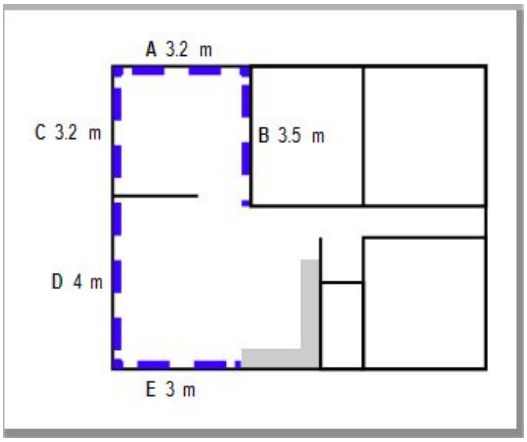


Fig3.5 linear measurement

To calculate the linear measurement, ie the total length of skirting required, you simply add up each of the lengths. So that looks like:

A 3.2 + **B** 3.5 + **C** 3.2 + **D** 4 + **E** 3

= 16.9 Lm (lineal metres)

The total can then be rounded off to 17 Lm of timber skirting required.

- **Calculating the circumference of a circle**

Whenever a circle is drawn, no matter the size, it's always the case that the circumference is approximately 3.1416 times the diameter. We refer to this figure as 'pi', the Greek letter π. The formula for finding the circumference of a circle is:

$C = \pi \times d$

where: C = circumference

d = diameter

π = 3.1416

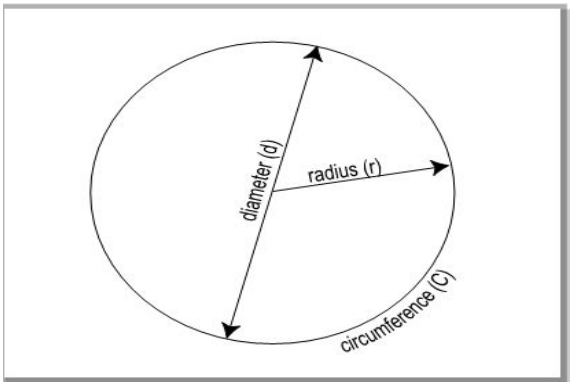


Fig3.6. circle

So, if the radius (r) in the circle shown here is 30 mm, then the diameter (d) would be 60 mm (ie 2 × 30 mm).

Example 1

Find the circumference of a grinding disc of diameter 50 mm.

Solution:

Step 1

Draw a diagram.

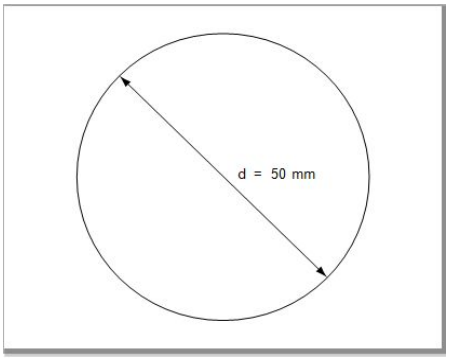


Fig3.7 circle

Step 2

Write down the appropriate formula.

$C = \pi \times d$

Step 3

Substitute numbers into the formula and calculate the answer.

C = 3.1416 × 50 mm

=157.08 mm

Example 2

Find the circumference of a circle of radius 35 mm.

Solution:

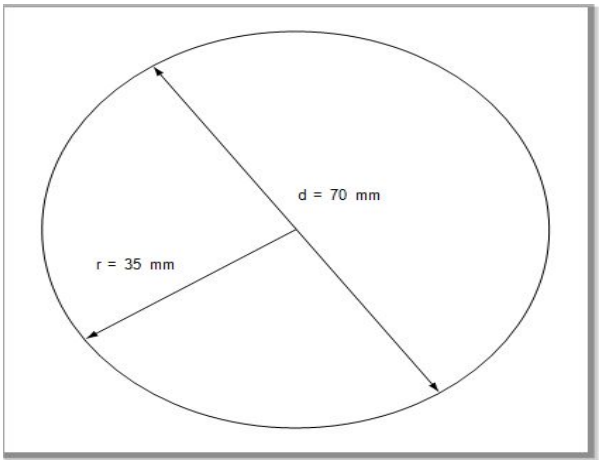


Fig3.8. circle

The radius = 35 mm

The diameter = 2 × 35 mm

= 70 mm

Now C =π× d

= 3.1416 × 70 mm

= 219.9 mm

- **Calculating the area of a rectangle**

The formula for finding the area of a rectangle is:

A (rectangle) = L × W

where: A = number of square units in the area

L = length

W = width

This is a 10 millimetre square

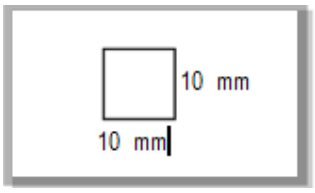
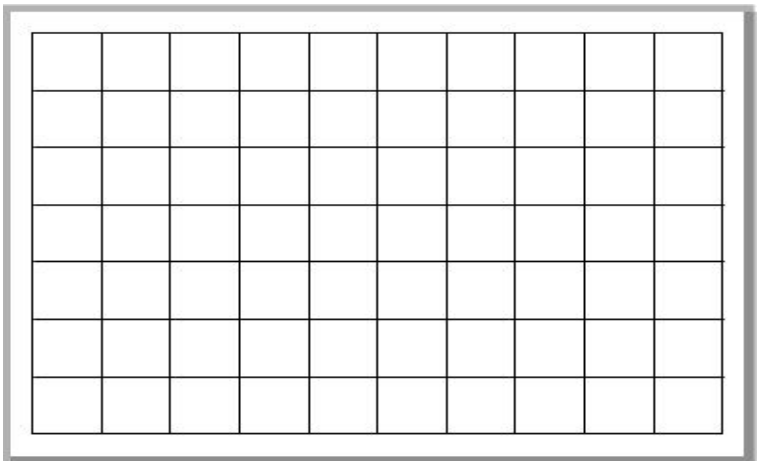


Fig3.9. rectangle

This rectangle is 100 mm by 70 mm. So, if 100 × 70 = 7000, then the area of this rectangle is 7000 m^2.



Note: Length and width might also be called base and height, or length and breadth, depending on what the rectangle represents.

The length and the width must be measured in the same units.

Example 1

Find the area of a concrete floor which is 5000 mm in length and has a width of 3000 mm.

Solution

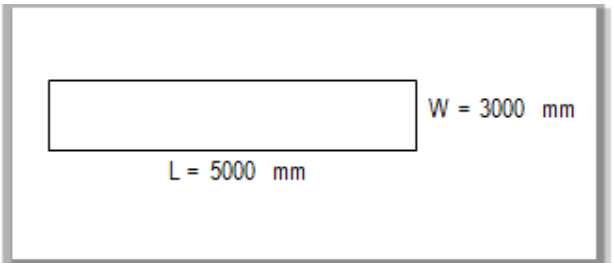


Fig 3.10 rectangle

A(rectangle) = L × W

= (5000 × 3000) mm^2

=15 000 000 mm^2

=15 m^2

Example 2

Find the area of a brick wall which is 2.5 m long and 0.5 m high.

Solution

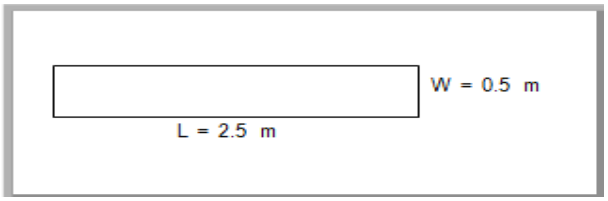


Fig 3.11 rectangle

A(rectangle) = L × W

= (2.5 × 0.5) m^2

=1.25 m^2

- **Calculating the area of a circle**

The formula for calculating the area of a circle is:

A (circle) = πr^2

= 3.1416 × r × r or $\frac{\pi}{4} d^2$

Example 1

Find the area of a circle with a radius of 100 mm.

Solution

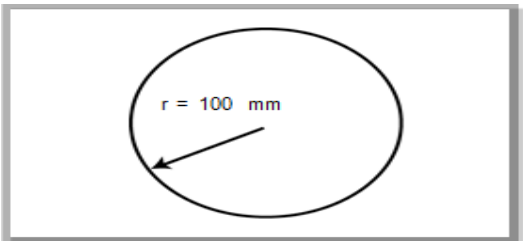


Fig 3.12 rectangle

A (circle) = πr^2

= (3.1416 ×100 ×100) mm^2

= 31 416 mm^2

Example 2

Find the area of a circle with a diameter of 7 m.

Solution

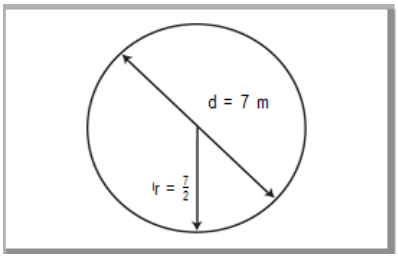


Fig 3.13 circle

Since the diameter = 7

then the radius = $\frac{7}{2} = 3.5$

then the radius = = 3.5

A(circle) = πr^2

= (3.1416 × 3.5 × 3.5) m^2

= 38.485 m^2

- **Calculating the area of a triangle**

The formula for calculating the area of a triangle is

$$\text{Area} = \text{half of base} \times \text{height}$$

$$A = \frac{1}{2}(B \times H)$$

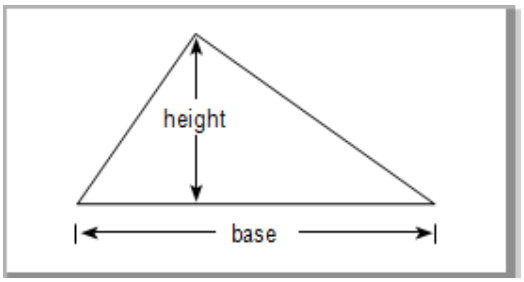


Fig 3.13 triangle

The base of a triangle may be on any of the three sides, but the height must be relative to the base at ninety degrees

Example 1

Find the area of a triangle with a base of 16 m and a height of 5 m.

Solution:

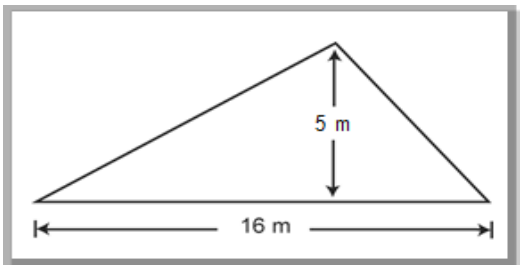


Fig 3.14 triangle

$$A\,(\text{triangle}) = \frac{1}{2}(B \times H)$$

$$= \frac{1}{2}(16 \times 5)\,m^2$$

$$= \frac{1}{2}(80)m^2$$

$$= 40\,m^2$$

Example 2

Find the area of a triangle with a base of 43 mm and a height of 12 mm.

Solution:

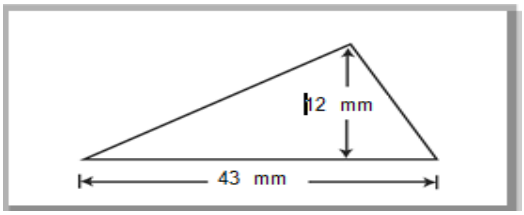


Fig 3.15.triangle

$$A(\text{triangle}) = \frac{1}{2}(B \times H)$$

$$= \frac{1}{2}(43 \times 12)\,mm^2$$

$$= \frac{1}{2}(516)\,mm^2$$

=

$$= 258\,mm^2$$

Example 3

Find the area of the triangle below.

Solution:

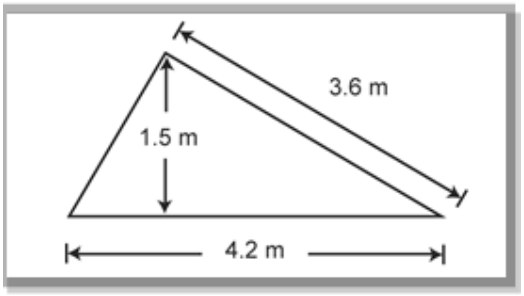


Fig 3.16.triangle

$$A(\text{triangle}) = \frac{1}{2}(B \times H)$$

$$= \frac{1}{2}(4.2 \times 1.5)\,m^2$$

$$= \frac{1}{2}(6.3)\,m^2$$

$$= 3.15\,m^2$$

Example 4

Find the area of the triangle below.

Solution:

Because this is a right-angled triangle, the side marked 5 mm also represents theheight.

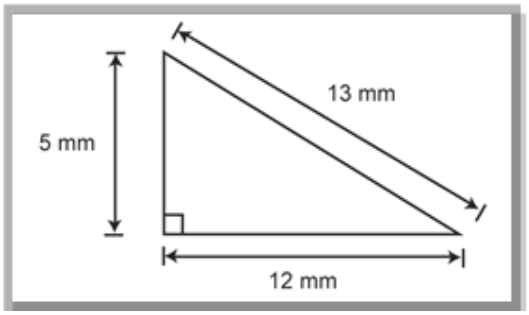


Fig 3.17.triangle

$$A\,(\text{triangle}) = \frac{1}{2}(B \times H)$$

$$= \frac{1}{2}(12 \times 5)\,mm^2$$

$$= \frac{1}{2}(60)\ mm^2$$

$$= 30\,mm^2$$

- **Calculating the area of a trapezium**

A trapezium is a four-sided flat shape with straight sides. One pair of its opposite sides will be in parallel. In the trapezium pictured below, the parallel sides are indicated.

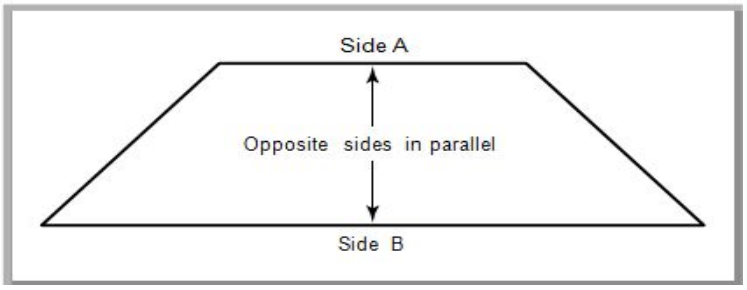


Fig 3.18 A trapezium

The area of a trapezium equals half the sum of the parallel sides, times the height between them. As a formula, this is:

A= A+B ×H

Example

In this trapezium,

$$A = \frac{1}{2}(4 + 12) \times 8$$
$$= \frac{1}{2}(16 \times 8)$$
$$= \frac{1}{2}(128)$$
$$= 64\,mm^2$$

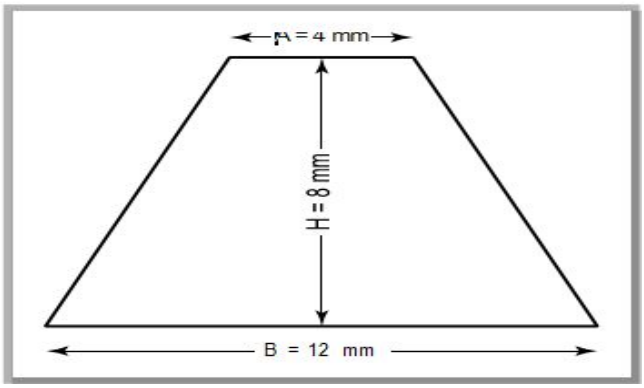


Fig 3.19 trapezium

- **Calculating the area of compound shapes**

With contemporary home designs, you often have to

calculate the area of more complex shapes in both interior and exterior areas. All homes have windows and doors; some may have triangular sections on roofs, while others may include design features in a range of shapes and sizes.

To calculate the area of more complex shapes, you need to divide them into shapes whose area can be calculated more easily, eg rectangles or squares.

Fig3.20 compound shapes

Take a look at this floor plan. It's an L-shape which makes it difficult to calculate the area.

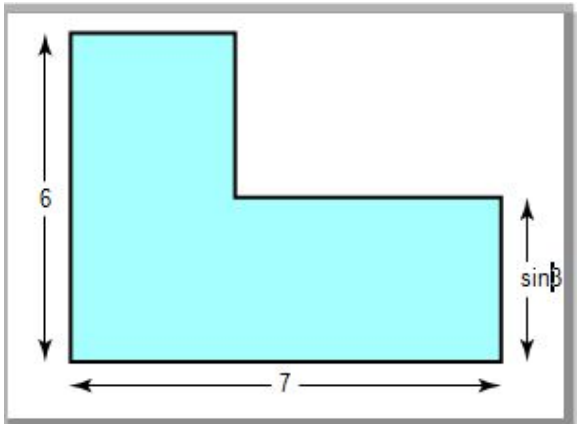


Fig 3.21. floor plan

Divide the floor into sections of shapes that are easier to work with. With this shape, there are two ways you can do that.

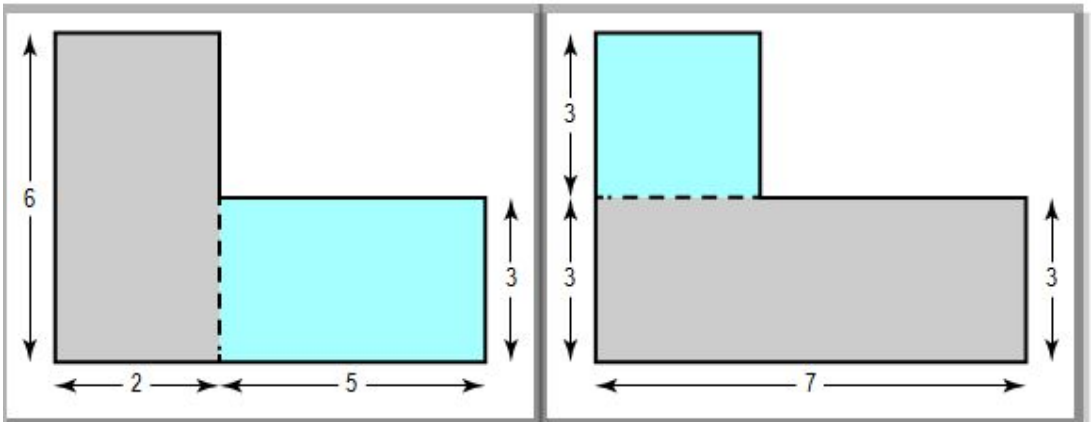
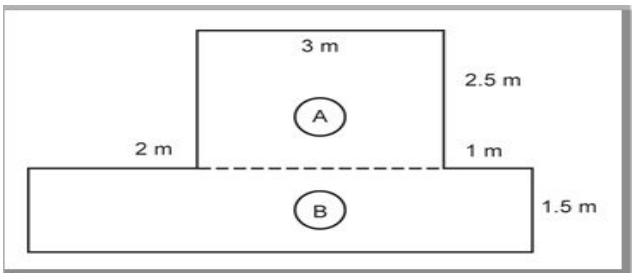


Fig 3.22.floor plan

By dividing this complex shape into two simple shapes, it's now much easier to calculate the total area

Example 1

Find the area of this shape.



Solution:

Area of rectangle A = width × height

= (3 × 2.5) m^2

= 7.5 m^2

Area of rectangle B = width × height

= (6 ×1.5) m^2 (since the width = 2 + 3 +1 m)

=9 m^2

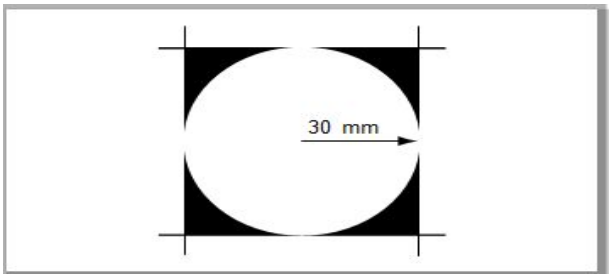
Total area of rectangles = A + B

= (7.5 + 9) m^2

=16.5 m^2

Example 2

Find the area of the shaded region in this shape.



Solution:

Since the circle has a radius of 30 mm, its diameter must be 60 mm.

Furthermore, since the diameter of the circle extends to the sides of the square, then the sides of the square must also be 60 mm long.

Area of square = W ×H

= (60 × 60) mm

= 3600 mm^2

Area of circle = πr^2

= 3.1416 × 30 × 30 mm

= 2827.44 mm^2

Area of shaded region = area of square - area of circle

= (3600 - 2827.44) mm^2

= 772.56 mm^2

When the area of part of a region or shape is subtracted from the area of the overall region or shape, the answer is known as the **net surface area**. This is used for things like calculating the number of bricks required for a wall minus the area of the openings (windows and doors), or the paving required for a courtyard minus the area of garden beds.

- **Calculating volume**

Calculations of volume in building and construction are used to determine things like the:

• volume of soil to be excavated from the foundation for footings

• volume of soil to be removed from a sloping site to provide a level area to build on

• amount of material required as fill, eg under floor slabs

• quantity of materials required for a particular job, eg cubic metres of sand for use in bricklayer's mortar

• volume of concrete needed for strip footings and slabs.

Fig 3.23. volume

- **Calculating the volume of a prism**

A prism is a solid shape with two identical ends that are the same size and shape and parallel to each other. Rectangles and squares are the most common prism shapes you'll deal with in building and construction. To calculate the volume of a prism, you

multiply its area by its height. As a formula, it is:

$$V = A \times H$$

Volume is always in cubic metres (m^3).

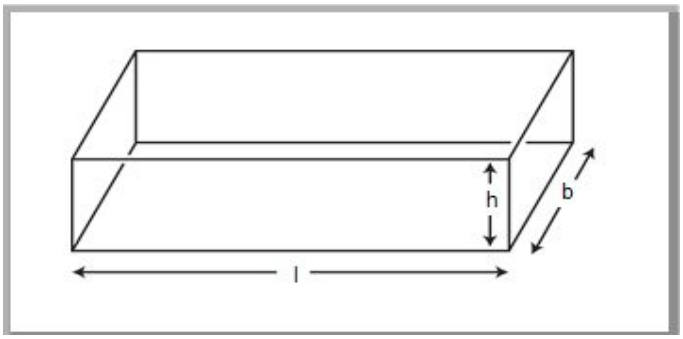


Fig 3.25. prism

For a rectangular solid, since the base is a rectangle:

A (rectangle) = L × W

So V (rectangular solid) = L × W × H

Rectangular prism

Fig 3.26. Volume rectangular solid

You'll often need to calculate the volume of a rectangular solid. For example, let's look at a project where a large home theatre room is being built as an extension to an existing home. The new room is a rectangular shape, and you have to work out how much concrete will be required for the slab.

You already know that the formula used to calculate the area of a rectangle is **A = L × W**. The formula you use when calculating the volume of a rectangular solid is:

V = L × W × H

The slab in the new room has a length of 7 m, and a width of 3 m. Its height will be 170

mm, to fit with the existing house. To calculate the volume, your working out would be as follows.

$V = L \times W \times H$

$= 7 \times 3 \times 0.17$

$= 3.57\ m^3$

Example 1

Calculate the volume of the rectangular box shown here.

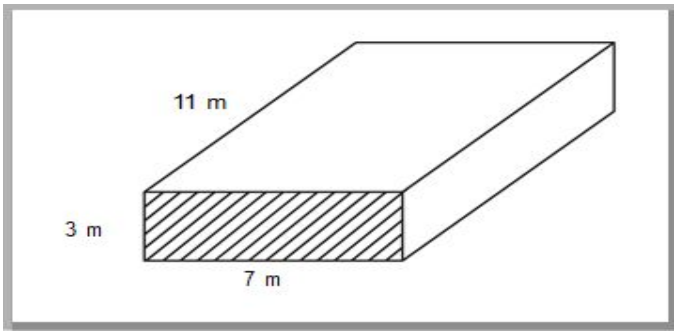


Fig2.27 rectangular box

Solution:

$V(\text{rectangular solid}) = L \times W \times H$

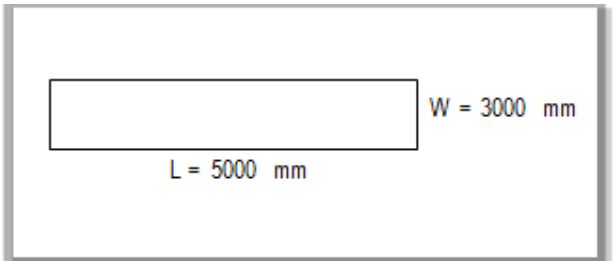
$=3\times7\times11 m^3$

$= 231 m^3$

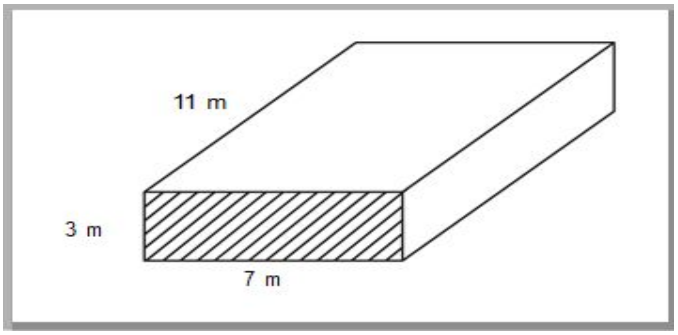
Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Find the area of a concrete floor which is 5000 mm in length and has a width of 3000 mm. (4 point)



2. how to Calculate the volume of the rectangular box . (4 point)



Note: **Satisfactory above_4 out of 8 points** **Unsatisfactory - below 4out of 8 point**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

1._____

2._____

Operation Sheet 1	**obtaining Measurements using a rule or tape techniques**

Techniques for obtaining Measurements using a rule or tape Procedure:-

Steps1 Prepare yourself before for the work

Step 2: Prepare measurement tools

Step 3: start measurement with given distance

Step 4: read carefully without sagging

Step 5: finally summit you're reading to your teacher

Step 6: collect and store measuring tools

By using the above procedure do the following LAP test

LAP Test	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hour.

Task1 obtaining Measurements using a rule or tape

List of Reference Materials

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1. https://www.youtube.com/watch?v=1ZownXypwUU
2. https://www.youtube.com/watch?v=hRDjZHvb4QQ
3. https://www.youtube.com/watch?v=hRDjZHvb4QQ

Annex I

Answer keys for learning guide -27

Answer key

Self-check

Information Sheet-1

1. Standard Method of Measurement (SMM) is a reference document used to determine a localized technique of construction measurement

2. Measuring tape

3. Foundations, walls and Fences

Information Sheet-2

1. A,256000
   B, 345000

   C, 432000

   D, 222000

2. Measuring tape: is a flexible ruler and used to measure distance**.**

Information Sheet-3

1. A (rectangle) = L × W

= (5000 × 3000) mm^2

=15 000 000 mm^2

=15 m^2

2. V (rectangular solid) = L × W ×H

=3×7×11m^3

= 231m^3

The trainers prepare TTLM

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