

WelTec Mathematics Series

Metric Measurement Units

Metric linear measure is a way of measuring the distance between two points. For example an electrician would use linear measures to find out how much cable s/he would need. Similarly, a plumber would use linear measures to find the length of a piece of copper pipe.

This hand-out is to get you using linear measures to solve automotive, engineering and other trade related problems. It helps you convert from one unit to another.

Metres

The main unit of linear measure in the trades is the metre (m). A metre is 39.37 inches. Today, the metre is defined to be the distance light travels in $\frac{1}{299,792,458}$ seconds, which is very quick.

Millimetres

Millimetres are a very small measure. A pen is about 150 mm long.
There are 1000 millimetres in 1 metre.
So, millimetres are used to measure lengths accurately.

$$1000\text{mm} = 1\text{m}$$

Example 1

Change the following lengths to metres.

- a) 2340mm b) 568mm

Solution

- a) You have to divide by 1000 to change from **mm** to **m**.
So, $2340\text{mm} \div 1000 = 2.340\text{m}$
- b) Again, you divide by 1000 to change mm to m.
So, $568\text{mm} \div 1000 = 0.568\text{m}$

Question 1

Change the following lengths to metres.

- a) 3470mm b) 389mm

Answer
a) $3470\text{mm} \div 1000 = 3.470\text{m}$
b) $389\text{mm} \div 1000 = 0.389\text{m}$

Example 2

Change the following lengths to millimetres.

- b) 3.125m b) 0.216m

Solution

- c) You have to multiply by 1000 to change from **m** to **mm**.

$$\text{So, } 3.124\text{m} \times 1000 = 3124\text{mm}$$

- d) Again, you multiply by 1000 to change m to mm.

$$\text{So, } 0.216\text{m} \times 1000 = 216\text{mm}$$

Question 2

Change the following lengths to millimetres.

- a) 5.579m b) 0.687m

Answer
c) $5.579\text{m} \times 1000 = 5579\text{mm}$
d) $0.687\text{m} \times 1000 = 687\text{mm}$

Kilometres

You probably know that kilometres are a good unit to measure longer distances. For example, the distance from Auckland to Wellington is about 640 km. That's if you drive on Highway 1.

Metres and Kilometres

There are 1000metres in 1 kilometre.

$$1000\text{m} = 1 \text{ km}$$

Question 3

Change the following lengths to metres.

- a) 6.579 km b) 0.697 km

Answer
e) $6.579\text{km} \times 1000 = 6579\text{m}$
f) $0.697\text{km} \times 1000 = 697\text{m}$

Question 4

Change the following lengths to kilometres.

- a) 5470m b) 289m

Answer
g) $5470\text{m} \div 1000 = 5.470\text{km}$
h) $289\text{m} \div 1000 = 0.289\text{km}$

Example Problem

A structural steel fabricator cuts 25 pieces. Each piece is 162mm long. The metal that these are cut from is a 6.35 metre length of channel iron. Allowing 4 millimetres of waste for each piece, find the length in metres of the channel iron left after all 25 pieces have been cut.

Solution

Method

1. Change the 162millimetres to metres
2. Find the total length of 25 pieces
3. Change the 4 mm of waste to metres
4. Find the total amount of waste
5. Find the amount of channel iron left

Calculations

1. $162\text{mm} = 162 \div 1000\text{m}$
 $= 0.162\text{m}$
2. $25 \times 0.162 \text{ m} = 4.05 \text{ m}$
3. $4\text{mm} = 4 \div 1000\text{m}$
 $= 0.004\text{m}$
4. $25 \times 0.004\text{m} = 0.1\text{m}$
5. $6.35\text{m} - (4.05\text{m} + 0.1 \text{ m}) = \mathbf{2.2\text{m}}$

Question 5

A structural steel fabricator cuts 20 pieces. Each piece is 172mm long. The metal that these are cut from is a 7.35 metre length of channel iron. Allowing 5 millimetres of waste for each piece, find the length in metres of the channel iron left after all 20 pieces have been cut.

$$\begin{aligned}
 &172\text{mm} \div 1000 = 0.172\text{m} \\
 &20 \times 0.172 = 3.44 \text{ m} \\
 &5 \text{ mm} \div 1000 = 0.005 \\
 &20 \times 0.005\text{m} = 0.1 \text{ m} \\
 &7.35 - (3.44 + 0.1) = 3.81\text{m}
 \end{aligned}$$

Answer

Question 6

A structural steel fabricator cuts 30 pieces. Each piece is 165mm long. The metal that these are cut from is a 6.35 metre length of channel iron. Allowing 5 millimetres of waste for each piece, find the length in metres of the channel iron left after all 30 pieces have been cut.

$$\begin{aligned}
 &165\text{mm} \div 1000 = 0.165\text{m} \\
 &30 \times 0.165 = 4.95\text{m} \\
 &5\text{mm} \div 1000 = 0.005\text{m} \\
 &30 \times 0.005\text{m} = 0.15\text{m} \\
 &6.35 - (4.95 + 0.15) = 1.25\text{m}
 \end{aligned}$$

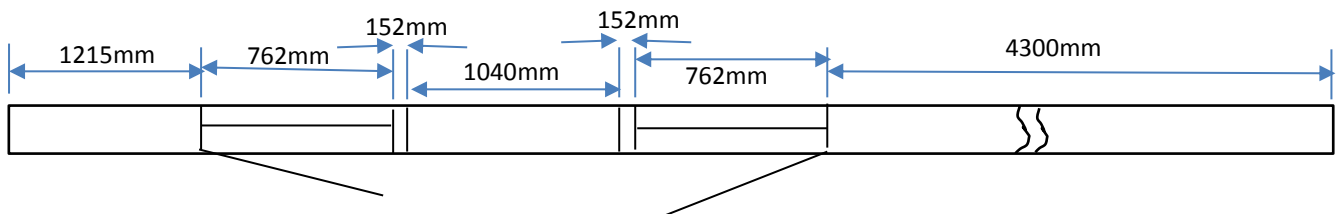
Answer

Extra Problems

To solve the problems below you will have to read all the text carefully and find the numbers you need to use. After that, you will need to sort out a method that will solve the problem. Each method may be different, and will depend on what you have been asked.

Question 7

Find in metres the total length of the wall section shown in the diagram below.



$$\begin{aligned}
 &1215\text{mm} \div 1000 = 1.215\text{m} \\
 &762\text{mm} \div 1000 = 0.762\text{m} \\
 &152\text{mm} \div 1000 = 0.152\text{m} \\
 &1040\text{mm} \div 1000 = 1.040\text{m} \\
 &152\text{mm} \div 1000 = 0.152\text{m} \\
 &762\text{mm} \div 1000 = 0.762\text{m} \\
 &4300\text{mm} \div 1000 = 4.300\text{m} \\
 &\text{Total length} = 1.215 + 0.762 + 0.152 + 1.040 + 0.152 + 0.762 + 4.300 = 8.383\text{m}
 \end{aligned}$$

Answer

Question 8

Three different parts, each of a different material, are made in a manufacturing plant. Use the table below to work out the cost of a production run of 2500 pieces of each part, and fill in the missing numbers.

Part Number	Length in mm	Cost per metre	Cost per piece	Cost for 2500
105-AD	86.00	\$2.20		
106-AD	51.00	\$2.80		
107-AD	90.00	\$3.03		

Part Number	Length in mm	Cost per metre	Cost per piece	Cost for 2500
105-AD	86.00	\$2.20	$0.086 \times \$2.20 =$ 18.92cents	$\$0.1892 \times 2500 =$ \$473.00
106-AD	51.00	\$2.80	$0.051 \times \$2.80 =$ 14.28cents	$\$0.1428 \times 2500 =$ \$357.00
107-AD	90.00	\$3.03	$0.090 \times \$3.03 =$ 27.27 cents	$\$0.2727 \times 2500 =$ \$681.75

Answer