

Units of Measurement: A. The Imperial System

Canada uses the metric system – most of the time! However, there are still places and occasions where the imperial system of measurement is used. People often talk about their height in feet and inches or their weight in pounds. Many recipes measure in cups and teaspoons. Another example is the term ‘two by four’ when talking about lumber. That term means that a plank is roughly two inches thick and four inches wide.

Another place where the imperial system of measurement is often seen is in the grocery store, especially in the meat/fish and fresh produce sections. Prices and weights are often given in both metric and imperial units of measurement. For example, you may see a sign advertising “Potatoes – 89¢ a pound (lb.) **or** \$1.96 per kilogram (kg)”.

The USA uses only a system of measurement related to the imperial one, so items imported from there often do not have a metric equivalent given. Cookbooks frequently use one or the other system of measurement.

For all these reasons, it is important to understand both systems and be able to convert one into the other.

The most common imperial units of measurement are:

Quantity	Unit	Symbol
length	foot	ft.
weight	pound	lb.
volume	gallon	gal.

Here are the most common conversions of imperial units of measurement:

Length	Weight	Volume
1 foot (ft.) = 12 inches (in.)	1 pound (lb.) = 16 ounces (oz.)	1 pint (pt.) = 2 cups
1 yard (yd.) = 3 feet	1 ton = 2000 pounds (lbs.)	1 quart (qt.) = 2 pints
1 mile (mi.) = 5280 feet or 1760 yards		1 gallon (gal.) = 4 quarts

When we convert units in the imperial system, we use a familiar rule:

When we convert a larger unit to a smaller unit, we multiply by the conversion factor.
When we convert a smaller unit to a larger unit, we divide by the conversion factor.

Example 1:

A two by four measures 6 feet 8 inches. How long is it in inches?

Solution:

As 1 foot = 12 inches, the conversion factor is 12. Since we are converting a larger unit (feet) to a smaller unit (inches), we multiply by 12.

$$6 \text{ feet} = 6 \times 12 = 72 \text{ inches.}$$

Then we need to add the 8 inches to the 72 inches.

$$6 \text{ feet } 8 \text{ inches} = 72 + 8 = 80 \text{ inches}$$

Or we can write it in a shortened way, using quotation marks: ' represents feet and '' represent inches.

$$\text{So } 6' \ 8'' = 80''$$

Example 2:

How many pints or cups are in 1 gallon of milk?

Solution:

$$1 \text{ gallon} = 4 \text{ quarts} - 1 \text{ quart} = 2 \text{ pints}$$

$$\text{So } 1 \text{ gal.} = 4 \text{ quarts} \times \text{the conversion factor of } 2 = 8 \text{ pints.}$$

$$1 \text{ pint} = 2 \text{ cups so } 8 \text{ pints} \times \text{the conversion factor of } 2 = 16 \text{ cups.}$$

Example 3:

A piece of wood measures 300 mm, how much is that in inches?

Solution:

$$25.4 \text{ mm} = 1 \text{ inch}$$

We are converting from a smaller unit (mm) to a larger unit (inches), so we divide:

$$300 \text{ mm} \div 25.4 = 11.81$$

So 300 mm is equivalent to 11.8''

Practice 1:

1. Circle the larger of the two units:
a) in. ft. b) mi. yd c) pt. cup
d) lb. oz. e) qt. gal. f) ton lb.

2. Convert the following:
a) 5 lbs = _____ oz. b) 2 mi. = _____ yds. c) 106 ins. = ___ ' ___"
d) 3 gals. = _____ pints e) 60 ins. = ___ ' ___"
f) 1200 lbs. = _____ tons
g) 27 ft. = _____ yds. h) 7 ft = ___ ins. i) 3 yds. = _____"
j) 3 qts. = _____ cups k) 16 pts. = _____ gals. l) 41 oz. = ___ lbs ___oz.

3. Convert the following weights as shown:
a) The baby weighs 120 oz. = _____ lbs _____ oz.
b) Mary wants to lose 48 oz through her new diet = _____ lbs _____ oz.
c) The Olympic weightlifter was able to lift a quarter of a ton = _____ lbs.

4. Convert the following heights as shown:
a) The doorway is 6' 2" high = _____ ins.
b) Sally is 64" tall = _____', _____"
c) Fred has grown to 77" = _____', _____"

5. Joe can reach 6' 11" above the ground. He wants to make the basketball team so he has to be able to reach the rim of the basketball hoop. The hoop is 9' 10" above the ground. How far will Joe have to leap to reach that rim? _____', _____"

6. Tim plans to make a shoe-rack for his girlfriend. He has a piece of wood that is 14.5 inches wide. How many cm is equivalent to 14.5"? How many mm? _____cm _____ mm

Answers on the next page

Practice 1 Answers:

- | | | | |
|---|--|--|--|
| 1 | a) ft.
d) lb | b) mi.
e) gal. | c) pt.
f) ton |
| 2 | a) 80 oz.
d) 24 pts.
g) 9 yds.
j) 12 cups | b) 3520 yds.
e) 5' 0"
h) 84 ins.
k) 2 gals. | c) 8' 10"
f) 0.6 tons
i) 108"
l) 2 lbs. 9 oz. |
| 3 | a) 7 lbs. 8 oz. | b) 3 lbs. 0 oz. | c) 500 lbs. |
| 4 | a) 74 ins. | b) 5' 4" | c) 6 ft. 5 ins. |
| 5 | Joe needs to leap 2 ft. 11 ins. | | |
| 6 | Tim is a great guy! $14.5'' = 36.8 \text{ cm}$ or 368 mm | | |

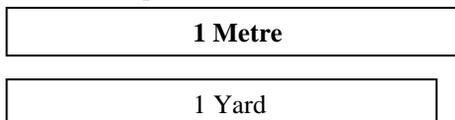
UNITS OF MEASUREMENT: B. THE METRIC SYSTEM

The **metric system** is used in most countries of the world, and the United States is now making greater use of it as well. The metric system does not use inches, feet, pounds, and so on, although units for time and electricity are the same as those you use now.

An advantage of the metric system is that it is easier to convert from one unit to another. That is because the metric system is based on the number 10.

The basic unit of length is the **metre**. It is just over a yard. In fact, $1 \text{ metre} \approx 1.1 \text{ yd}$.

(Comparative sizes are shown)



The other units of length are multiples of the length of a metre: 10 times a metre, 100 times a metre, 1000 times a metre, and so on, **or** fractions of a metre:

$\frac{1}{10}$ of a metre, $\frac{1}{100}$ of a metre, $\frac{1}{1000}$ of a metre, and so on.

Metric Units of Length	
1 kilometre (km)	= 1000 metres (m)
1 hectometre (hm)	= 100 metres (m)
1 dekametre (dam)	= 10 metres (m)
1 metre (m)	
1 decimetre (dm)	= $\frac{1}{10}$ metre (m)
1 centimetre (cm)	= $\frac{1}{100}$ metre (m)
1 millimetre (mm)	= $\frac{1}{1000}$ metre (m)

dam and dm are not used much.

You should memorize these names and abbreviations. Think of *kilo-* for 1000, *hecto-* for 100, and so on. We will use these prefixes when considering units of area, capacity, and mass (weight).

THINKING METRIC

To familiarize yourself with metric units, consider the following.

1 kilometre (1000 metres)

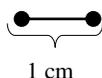
is slightly more than $\frac{1}{2}$ mile (0.6 mi).

1 metre

is just over a yard (1.1 yd).

1 centimetre (0.01 metre)

is a little more than the width of a paper-clip (about 0.4 inch).



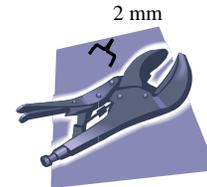
1 inch is about 2.54 centimetres



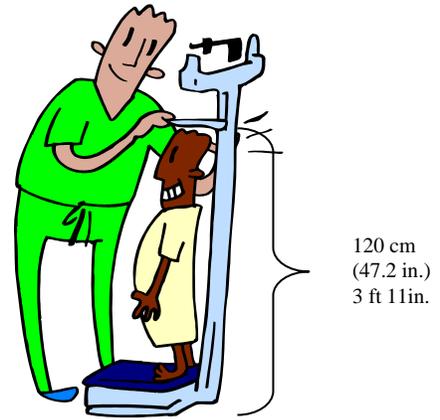
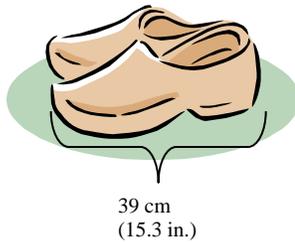
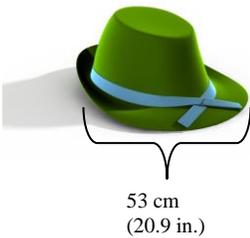
1 millimetre is about the width of a dime



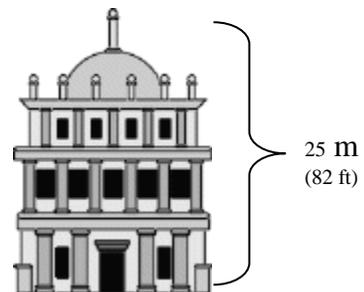
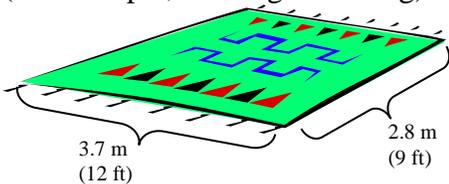
The millimetre (mm) is used to measure small distances, especially in industry.



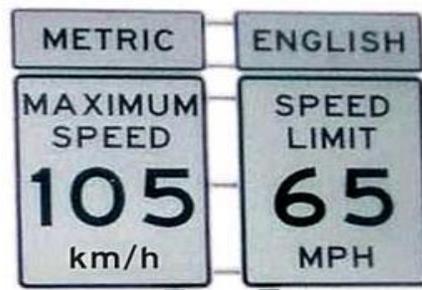
The **centimetre (cm)** is used for body dimensions and clothing sizes, mostly in places where inches were previously used.



The **metre (m)** is used to measure larger objects (for example, the height of a building) and for shorter distances (for example, the length of a rug)



The **kilometre (km)** is used to measure longer distances, mostly in situations in which miles were previously used.



MENTAL CONVERSION AMONG METRIC UNITS

When you change from one unit to another you **can move only the decimal point**, because the metric system is **based on 10**. Look at the table below:

	1000	100	10	1	0.1	0.01	0.001
Units	km	hm	dam	m	dm	cm	mm

Example:

Complete: **8.42 mm = _____ cm**

Think: To go from mm to cm will mean I will have **fewer** cm than mm because cm are larger than mm. So I move the decimal point one place to the left.

$$8.42 \text{ mm} \quad 0.842 \quad \text{so, } 8.42 \text{ mm} = 0.842 \text{ cm}$$

Example:

Complete: **1.886 km = _____ cm**

Think: To go from km to cm means that there will be **many more** cm than there were km because cm are smaller than km. So I move the decimal place to the right 5 places.

$$1.886 \text{ km} \quad 1.88600 \quad \text{so, } 1.886 \text{ km} = 188\,600.0 \text{ cm}$$

Example:

Complete: **1 m = _____ cm**

Think: To go from m to cm ... m are bigger, and cm smaller... so, there will be **more** cm than I started with. I can move the decimal place to the right 2 places.

$$1 \text{ m} = 1.00 \text{ m} \quad 1.00 \text{ cm} \quad \text{so, } 1 \text{ m} = 100 \text{ cm}$$

Make metric conversions mentally as much as possible.

The most commonly used units of metric measurement are:

km m cm mm

Practice 2:

Complete. Do as much as possible mentally. Avoid using a calculator!

1. a) $1 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

2. a) $1 \text{ hm} = \underline{\hspace{2cm}} \text{ m}$

3. a) $1 \text{ dam} = \underline{\hspace{2cm}} \text{ m}$

b) $1 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

b) $1 \text{ m} = \underline{\hspace{2cm}} \text{ hm}$

b) $1 \text{ m} = \underline{\hspace{2cm}} \text{ dam}$

4. a) $1 \text{ dm} = \underline{\hspace{2cm}} \text{ m}$

5. a) $1 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

6. a) $1 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$

b) $1 \text{ m} = \underline{\hspace{2cm}} \text{ dm}$

b) $1 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

b) $1 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

7. $6.7 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

8. $9 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

9. $98 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

10. $0.233 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

11. $8921 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

12. $6770 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

13. $56.66 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

14. $5.666 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

15. $5666 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

16. $435 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

17. $477 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

18. $3.45 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$

19. $6.88 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

20. $6.88 \text{ m} = \underline{\hspace{2cm}} \text{ dm}$

21. $1 \text{ mm} = \underline{\hspace{2cm}} \text{ cm}$

22. $1 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

23. $1 \text{ km} = \underline{\hspace{2cm}} \text{ cm}$

24. $2 \text{ km} = \underline{\hspace{2cm}} \text{ cm}$

Answers on the next page

Practice 2 Answers

1. a) 1000	2. a) 100	3. a) 10
1. b) 0.001	2. b) 0.01	3. b) 0.1
4. a) 0.1	5. a) 0.01	6. a) 0.001
4. b) 10	5. b) 100	6. b) 1000
7. 6700	8. 9 000	9. 0.98
10. 0.00233	11. 8.921	12. 6.77
13. 0.05666	14. 0.005666	15. 566 600
16. 43500	17. 4.77	18. .00345
19. 688	20. 68.8	21. 0.1
22. .00001	23. 100 000	24. 200 000