Math 9

Learning Guide 2

Linear Measurement

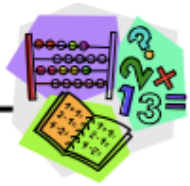
Discuss & Practice:

	Do **WORKSHEET #1** - Linear Measurement: Metric and Imperial
	Do **WORKSHEET #2** - Linear Measurement and Metric Conversions
	Do **WORKSHEET #3** - Converting Between Metric Units
	Do **WORKSHEET #4** – Math for Trades
	Find a partner and complete the "**Linear Measurement Lab**"

Name _____

WORKSHEET #1

Linear Measurement: Metric and Imperial



Linear measurement is when you measure things in a straight line using tools such as a ruler, yardstick or tape measure. The following table shows different types of linear measurement.

Note: Metric and/or imperial units can be used to measure linear measurements.

Examples

One example is provided for each type of linear measurement. Complete the right column of the chart by listing other everyday examples of linear measurement.

Type of Linear Measurement	Examples
Distance	a) distance from home to school b)
Width	a) width of a television b)
Height	a) height of a volleyball net b)
Depth	a) depth of a lake b)
Thickness	a) thickness of your notebook b)
Perimeter	a) distance around the edge of the basketball court b)
Circumference	a) distance around the outside of the centre circle on the hockey rink b)

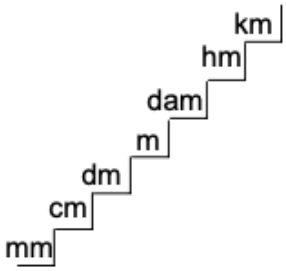
Measuring Length: Metric System

The base unit for length is the **metre (m)**.

Units used to measure length depend on what is being measured. For example,

- distance between towns and cities is measured in kilometres
- width of a textbook is measured in millimetres or centimetres
- height is measured in metres and centimetres.

Metric Staircase



Hint: Use this ACRONYM to help you remember the order of the units:

King
Henry's
Daughter
Betty
Detested
Counting
Money

Measuring Length: Imperial System

Units for measuring length in the imperial system are inches, feet, yards and miles.

12 inches = 1 foot
3 feet or 36 inches = 1 yard
1760 yards or 5280 feet = 1 mile

Symbols/abbreviations:

inch	=	in. or "	1 in. or 1"
foot	=	ft. or '	1 ft. or 1'
yard	=	yd. or yds.	1 yd.
mile	=	mi.	1 mi.

Inches and fractions of inches (e.g., $\frac{1}{8}$ of an inch) are used when measuring small things, such as the length, width and height of a table, desk or book.

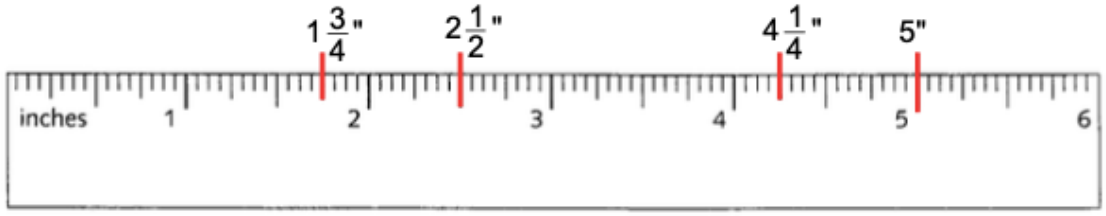
Feet and **yards** are used to take larger measurements, such as the height of a door (ft.) or the distance from the school to the school yard (ft. or yds.).

Miles are used to measure longer distances.

Fractions and the Imperial System

The whole numbers—1, 2, 3, etc.—on an imperial ruler represent an inch. Each inch is divided into 16 smaller parts. The half and quarter inches are shown with the slightly longer line segments.

Examples Look at the inches and fractions of inches identified on the ruler below.



Practice: Estimating and Recording Linear Measurements

1. With a partner, use a metre stick to measure 1 metre of the classroom floor. Mark 1 m with a piece of tape or chalk.

2. Measure and record the height in centimetres of your partner and other students using a metre stick or metric tape measure. Almost everyone in your class will be between 1 and 2 metres tall. Measure and convert to m.

   For example, a student may be 137 cm tall, which is 1.37 m. Another may be 124 cm tall, which is 1.24 m.

3. Measure your stride, then estimate a variety of measurements inside or outside the school by walking lengths and widths. Take measurements using a measuring tool. Compare your estimated and real measurements.

   For example:
   - length and height of playground equipment
   - length and width of basketball, volleyball and badminton courts in the gym
   - diameters of circles in the gym
   - length and width of a classroom, library and hallways
   - length and width of soccer or football field
   - length and width of your school

4. With your classmates, complete a variety of activities that involve estimating and measuring distances. Or, organize a play day involving linear measurements for a group of younger students.

   Examples:
   - ball throws and/or kicks
   - sandpit jumps

5. List common examples of items to measure:

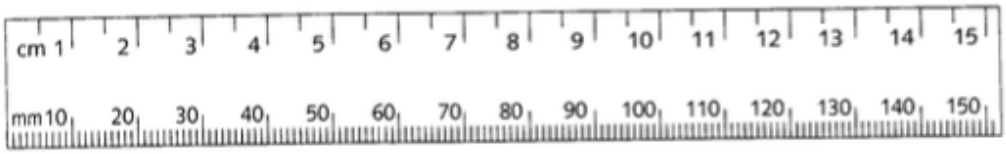
   mm and/or inches, e.g., coin, _____, _____

   cm and/or inches, e.g., thickness of a dictionary, _____, _____

   m and/or yards, e.g., length of school yard, _____, _____

   Discuss your examples with your classmates or teacher.

6. Use the illustration below, or find a metre-stick or other metric measuring tool to answer the following questions.



   a) How many mm in 1 cm?
   b) How many mm between 3 and 4 cm?
   c) How many mm in 4 cm?
   d) How many mm in 10 cm?

7. Measure items in the classroom and record their lengths in mm and cm, for example, a pen, pencil, piece of chalk, your notebook.

Items	Measurement	
	in mm	in cm

8. Complete the table by estimating measurements. Discuss your estimates with classmates. Then measure and compare the actual measurements with your estimations. Include the appropriate units of measurement for each.

Measurement Required	Estimated Measurement	Actual Measurement
Distance from front to back of the room		
Your height or the height of a classmate		
Thickness of a textbook		
Height of your desk or table		
Perimeter of the room		
Depth of a sink (or water fountain)		
Other:		
Other:		

WORKSHEET #2

Linear Measurement and Metric Conversions

Discussion:
What are the **metric units** for measuring length?

How long is a **millimeter (mm), centimeter (cm), meter (m), kilometer (km)?**

What are some good **referents** or objects we can use for estimating these lengths when a ruler isn't available?

Which unit is the most appropriate for measuring…
- a cellular phone's screen size?
- the thickness of a cellular phone?
- the height of your locker?
- the distance to the gym?
- the distance to Mill Bay?
- the length of a kayak?
- the dimensions of a window?

What are the approximate lengths for the examples previously discussed?

Task:
In order to become familiar with these units and actually **see** the lengths, students should practice using rulers and tape measures. Measure the lengths of at least 8 things in the classroom. Be accurate and practice measuring to the nearest cm and mm.

Practice:
Do the worksheet titled "Centimeters and Millimeters".

Discuss Perimeter:
The linear distance around a shape is called **perimeter**. For polygons, perimeter can be found by measuring the length of each side, then adding them together.

Practice:
Do the following worksheet

Line Segment - Ruler

Centimeter: S1

Measure the length of each line segment.

1) ☐ cm

2) ☐ cm

3) ☐ cm

4) ☐ cm

5) ☐ cm

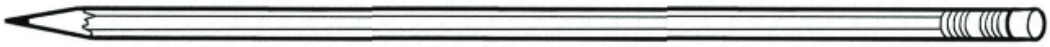
Draw a line segment for each measure.

6) 4 cm

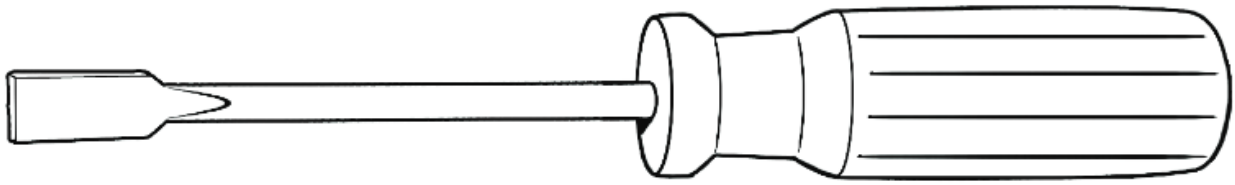
7) 9 cm

8) 6 cm

Use a ruler to measure the objects below.



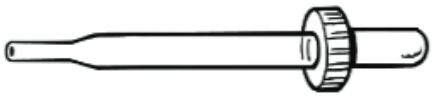
_____ inches



_____ inches

_____ inches

_____ centimeters



_____ centimeters

_____ centimeters

Metric Units of Length

100 centimeters or 100 cm. = 1 meter or 1 m. 1,000 m. = 1 kilometer or 1 km.

Find the measurement of each item to the nearest meter to finish the sentence.

1. I am about _____ m. tall.
2. The door in my house is about _____ m. tall.
3. The living room wall is about _____ m. wide.

Find the equivalent measurement.

4. 100 cm. = _____ m.
5. 1,000 m. = _____ km.
6. 500 cm. = _____ m.
7. 7,000 m. = _____ km.
8. 1,000 cm. = _____ m.
9. 10,000 m. = _____ km.
10. 100,000 m. = _____ km.
11. 20 km. = _____ m.
12. 40 km. = _____ m.
13. 65 km. = _____ m.

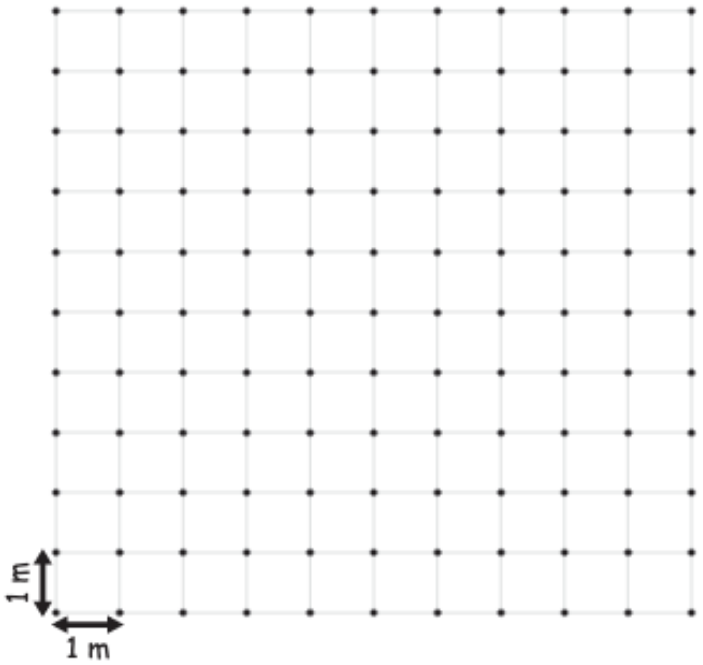
Find the equivalent metric and U.S. Customary units of length for each of the following.

14. 4 in. = about _____ cm.
15. 8 cm. = about _____ in.
16. 6 in. = about _____ cm.
17. 23 cm. = about _____ in.
18. 1 ft. = about _____ cm.
19. 28 cm. = about _____ in.
20. 1 yd. = about _____ cm. or close to _____ m.

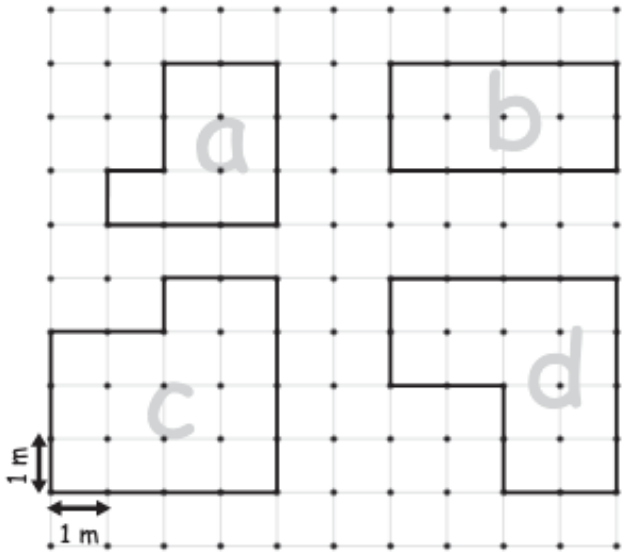
Fill in each box with the correct measurement.

3 m 60 cm	=	cm	311 cm	=	m cm
2 m 72 cm	=	cm	205 cm	=	m cm
9 m 15 cm	=	cm	999 cm	=	m cm
15 m 12 cm	=	cm	1,111 cm	=	m cm
22 m 80 cm	=	cm	1,650 cm	=	m cm
31 m 31 cm	=	cm	1,890 cm	=	m cm

Draw 4 different figures with a perimeter of 12 m.



Use the 4 figures to answer the questions.



(a) What is the perimeter of figure a?

(b) What is the perimeter of figure b?

(c) What is the perimeter of figures b and d altogether?

(d) Which 3 figures have the same perimeter?

(e) You want to put up a fence around all 4 figures.
If the price of doing so is 100 dollars per meter,
how much would you have to pay?

Rectangle - Perimeter

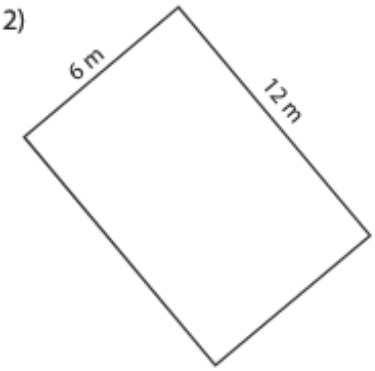
ES1

Find the perimeter of each rectangle.

1)

Perimeter = ⬚

2)



Perimeter = ⬚

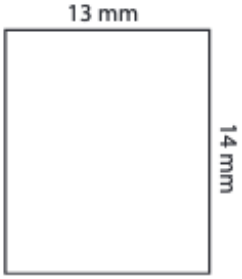
3)

Perimeter = ⬚

4)

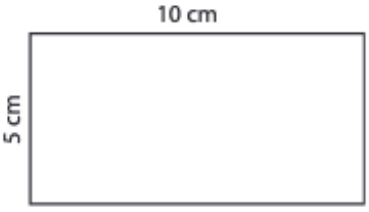
Perimeter = ⬚

5)



Perimeter = ⬚

6)



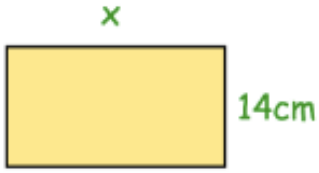
Perimeter = ⬚

Question 8: The perimeter of each shape is given. Find the length of the missing side

(a)

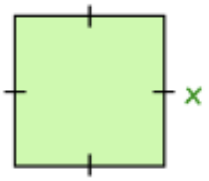
Perimeter = 26cm

(b)



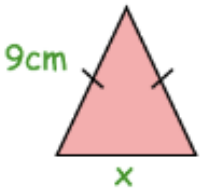
Perimeter = 80cm

(c)



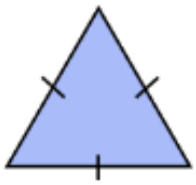
Perimeter = 20cm

(d)



Perimeter = 25cm

(e)

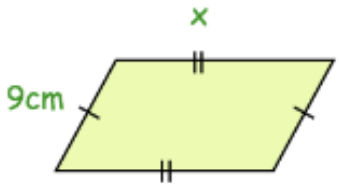


Perimeter = 36cm

(f)

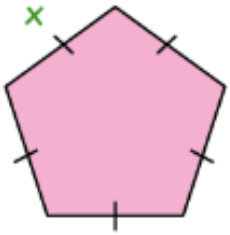
Perimeter = 79cm

(g)



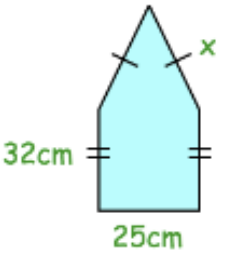
Perimeter = 45cm

(h)



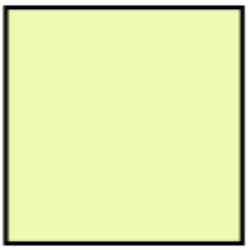
Perimeter = 2m

(i)



Perimeter = 163cm

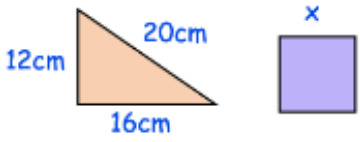
Apply



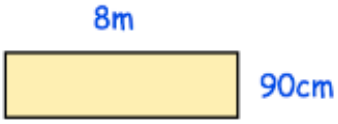
Question 1: The square is drawn accurately
Find the perimeter of the square.

Question 2: A rectangle has a perimeter of 18cm.
Write down a possible pair of values for its length and width

Question 3: The triangle and square have the same perimeter.
Find x



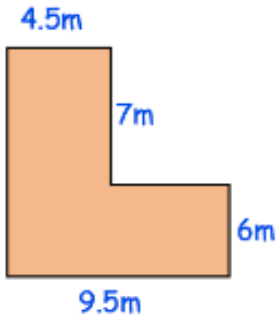
Question 4: Shown is a rectangle.
Work out the perimeter of the rectangle.



Question 5: The length of a rectangular field is 60m greater than the width of the field.
The field has a length of 310m.
Find the perimeter of the field.

Question 6: Felicity wants to place a wooden fence around her vegetable garden.
Each metre of fencing costs £5.80

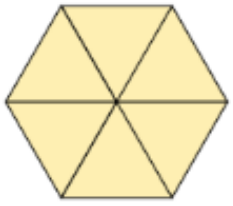
Work out the cost of the new fence



Question 7: Below is a coffee table.
The length of the table is 40cm more that the width of the table.
The perimeter of the table is 3.8m

Find the size of the length and width of the table

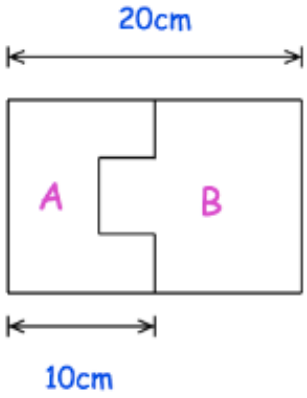
Question 8: Shown is an equilateral triangle with side length of 8cm.
Six of the triangles are put together to make a larger shape.
Find the perimeter of the larger shape.



Question 9: A square has an area of $36cm^2$
Find the perimeter of the square.

Question 10: Andy says that all rectangles with an area of $24cm^2$ have the same perimeter
Show that Andy is wrong.

Question 11: A rectangle is divided into two shapes, A and B



(a) Which of these statements is true?

- The area of A is greater than the area of B
- The area of A is less than the area of B
- The area of A is the same as the area of B

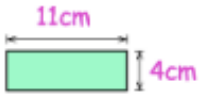
(b) Which of these statements is true?

- The perimeter of A is greater than the perimeter of B
- The perimeter of A is less than the perimeter of B
- The perimeter of A is the same as the perimeter of B

Question 12: An isosceles triangle has a perimeter of 73cm
An equilateral triangle has a perimeter of 51cm
The triangles are put together to make a kite.

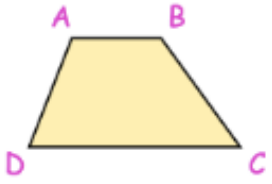
Work out the perimeter of the kite.

Question 13: Three congruent rectangles, are placed together to make the shape below.



Find the perimeter of the shape.

Question 14: ABCD is a trapezium
AD is twice the length of AB
BC is 3cm longer than AD
DC is 19cm longer than AB
The perimeter of the trapezium is 49cm



Find the length of AB

WORKSHEET #3

Converting Between Metric Units

1) 64.96 meters to centimeters _____
2) 2,180 centimeters to meters _____
3) 8.45 meters to millimeters _____
4) 7,144,800 millimeters to meters _____
5) 59.26 kilometers to meters _____
6) 69,270 meters to kilometers _____
7) 3.52 centimeters to millimeters _____
8) 251,800 millimeters to centimeters _____
9) 153.87 kilometers to centimeters _____
10) 1,600 centimeters to kilometers _____
11) 3.79 kilometers to millimeters _____
12) 44,900 millimeters to kilometers _____
13) 5.94 meters to centimeters _____
14) 7,300 centimeters to meters _____
15) 27.59 meters to millimeters _____
16) 1,571,400 millimeters to meters _____
17) 65.74 kilometers to meters _____
18) 91,970 meters to kilometers _____
19) 4.4 centimeters to millimeters _____
20) 92,700 millimeters to centimeters _____

Unit	
cm	10 mm
m	100 cm
km	1000 cm

UNIT CONVERSION
Move decimal <--- 1 mm to cm
Move decimal <--- 2 cm to m
Move decimal <--- 3 m to km
Move decimal ---> 3 km to m
Move decimal ---> 2 m to cm
Move decimal ---> 1 cm to mm

WORKSHEET #4

MATH FOR TRADES

Linear measurement

#1

Barry owns a sheet metal company (Metal Sheet Incorporated) and he is making duct work for a heating system in a new video production studio under construction. The ducts are 0.79 metres wide by 0.45 metres deep. What is the depth of the ducts in centimetres?

#2

The length of the duct work that Barry, our sheet metal tradesperson, has to create for the video production studio is 193 yards. How many feet of the duct does Barry have to order to complete the job?

#3

Jakob is a carpenter who creates forms for concrete columns. The measurements for the column are in millimetres but Jakob would rather work in inches so he decides to translate the millimetres to inches. The columns are rectangular and are 400 mm by 250 mm. What are the measurements of the column in inches?

#4

Elias is a cabinetmaker from Sweden who is now an apprentice in Canada. He has been asked to order material for the job and it totals 427 feet of 1″ x 4″ wood. As he is used to working in metric he wants to change that to metres. How many metres of 1″ x 4″ is he going to need?

Linear Measurement Lab

Name: _____ Date: _____
Partner(s):_____
_____

Purpose:
In this lab you will practice estimating lengths, using referents to measure lengths, and finally using tools to measure the actual lengths of things around the school. You will then be able to compare your results to see which units you are most familiar with and also which units you may need to think about or practice in the future.

Materials:
The following supplies are needed in order to complete this lab:

Pencil (for recording Observations)
Pen (for writing Conclusion)
Lab Report with "Linear Measurements Table"
Paper (for writing answers to questions in the Conclusion)
Ruler
Tape Measure
Large Paper Clip

Procedure:
1. **Estimate** or make a logical guess for the length of the hallway in the Math department (exit door to far wall/glass display case). Record this as an observation in the "Linear Measurements Table" under Estimate on the following page.

2. Using your stride as a **referent** for meters, measure the number of strides of the Math department hallway. Record this in the table under Referent Measure.

3. Carefully **measure** the distance of the hallway using the tape measure. This is best accomplished by placing the tape on the floor with one partner holding the zero mark at the door and the other reading the distance on the tape at the far end of the hallway. Be accurate! Record this measurement in the table under Actual Measure.

4. Repeat steps 1-3 for each item in the table. Be sure to *think* and *use the most appropriate unit* and the *most appropriate referent* of your choice for the length being measured. Do not skip steps. Thinking of an estimate is an important part of the process in learning about measurement!

5. Answer the Conclusion questions on a separate sheet of paper and attach to this lab report. Please answer all parts using full sentence answers.

Observations:
Use the table below to record your quantitative (measurable) observations.

Linear Measurements Table

Item	Estimate (include units)	Referent Measure (with name of referent)	Actual Measure (with units)
Math dept. hallway	_____ m	_____ strides	_____ m
Width of desk			
Width of classroom door			
Length of a large paperclip (as is)			
Height of this Linear Measurements Table			
Length of an outdoor bench at front of FKSS			
Width of the outdoor basketball court			
Distance between posts in one field goal			

Conclusion:
1. Compare your estimates and measures using referents to your actual measurements. Were any estimates within 3 units of the actual measure? Which ones were the closest? Which ones were the least accurate?

2. How did you find your ability to estimate? Were you good at visualizing distances or did you find it difficult?

3. Which units of measurement are you more familiar with (mm, cm, m)? Were the shorter lengths easier to estimate or were the longer ones easier? Why do you think you are more familiar with those units?

4. What could you do, in the future, to improve your skills of estimating?

5. Why would estimating lengths, widths, and distances be a useful skill to have? Give examples of when these skills could be needed.