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MATHEMATICS

Quarter 2 - Module 1:
Measurement

AIRs - LM

MATHEMATICS 7
Quarter 2 - Module 1: Measurement
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Quarter 2 - Module 1:
Measurement

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

Target

This module is on measurement. You will explore the development of measurement from nonstandard units to the present international system of units, and learn about English and Metric System of Measurement – using these system to measure objects, convert one measure from one another and used to solve problems in real-life situations.

After going through this module you are expected to:

Learning Competencies:

- approximate the measures of quantities particularly length, weight/ mass, volume, time, angle and temperature and rate **(M7ME-IIa-3)**
- convert measurements from one unit to another in both Metric and English systems **(M7ME-IIb-1)**
- solve problems involving conversion of units of measurement **(M7ME-IIb-2)**

Learning Objectives:

1) describe what it means to measure
2) describe the development of measurement from primitive to the present
3) describe the two standard systems of measures
4) estimate measures of objects
5) convert measures in the English system to the Metric system
6) solve problems involving conversion of units of measurement

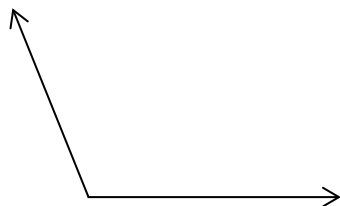Before going on, check how much you know about this topic.

PRE – ASSESSMENT

Directions: Read each statement below carefully. Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following is used to measure an object?
   - A. Ball
   - B. Eraser
   - C. Needle
   - D. Ruler

2. Which of the following is used to measure objects during the early times?
   - A. Body Parts
   - B. Branch
   - C. Stone
   - D. Water

3. Which of the following measures is the most appropriate to use when you measure the length of a book?
   - A. Dakot
   - B. Dangkal
   - C. Dipa
   - D. Hakbang

4. What is the equivalent measure of 1 yard in feet?
   - A. 1
   - B. 2
   - C. 3
   - D. 4

5. Which of the following instruments is used to measure an angle?
   - A. Hourglass
   - B. Protractor
   - C. Ruler
   - D. Thermometer

6. Which of the following units is used to indicate the measure of length?
   - A. Degree
   - B. Gram
   - C. Liter
   - D. Meter

7. What is the measure of the given figure when you estimate?
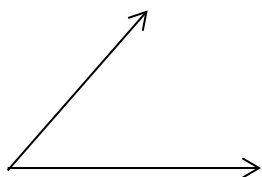
   - A. 50^0
   - B. 90^0
   - C. 150^0
   - D. 180^0

8. Which of the following will describe the measure of the given angle?

   - A. exactly 80^0
   - B. exactly 90^0
   - C. less than 90^0
   - D. more than 80^0

9. What is the result when you convert 50 ^{0}F to ^{0}C?
   - A. 8℃
   - B. 9℃
   - C. 10℃
   - D. 11℃

10. What is the equivalent measure of 25 m to cm?
    - A. 0.25
    - B. 2.5
    - C. 250
    - D. 2500

11. What is the equivalent of 3 days to hours?
    - A. 70
    - B. 71
    - C. 72
    - D. 73

12. Which of the following formula is to be used to convert 25 ℃ to ℉?
    - A. ℉ = 1.8 ℃ + 32
    - B. ℉ = 1.8 ℃ − 32
    - C. ℉ = 8 ℃ + 32
    - D. ℉ = 8 ℃ − 32

13. If a dilis measures 0.2 inch long, then how long is it in centimeters?
    A. 5.08   B. 5.18   C. 6.08   D. 6.18

14. From Agoo, Jason went to San Fernando City. The speed of his motorcycle
    was 240 km in 3 hours. What was the average speed of his travel?
    A. 60   B. 70   C. 80   D. 90

15. How many minutes will it take Nancy to finish her sewing if she is able to do
    this in 2 hours?
    A. 60   B. 120   C. 180   D. 240

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Jumpstart

Activity 1: Body Parts!

What is the appropriate part of your body to use in measuring the objects listed in the table? What was your reason for choosing the part of your body? Measure the object again, but this time use a foot-rule to measure. Compare the measurements and reason out what caused those differences. The first column serves as an example.

The following terms will guide you in doing the activity.

Important Terms to Remember:

> **palm** – the width of one's hand excluding the thumb

> **hand span** – the distance from the tip of the thumb to the tip of the little finger of one's hand with fingers spread apart, about 8 inches

> **forearm length** – the length of one's forearm: the distance from the elbow to the tip of the middle finger

> **thumb width** – about an inch

> **cubit** – about 18 inches

> **hand** – about 4 inches

> **fathom** – about 6 feet

> **yard** – about 3 feet

Table 1

	Shampoo sachet		Sheet of Paper		Table		Bedroom	
	Length	Width	Length	Width	Length	Width	Length	Width
Body part used	thumb-width							
Measurement	4	3						
Standard Tool	foot-rule (ruler)		foot-rule (ruler)		foot-rule (ruler)		foot-rule (ruler)	
Measurement	2.5 inches	2 inches						
Reason for choosing	appropriate body part							
Cause of the difference	The used of foot-rule is more accurate than the thumb-width.							

Activity 2: Fill Me In!

Which word in the list best completes each sentence?

yard	cubit	hand
hands span	thumb width	fathom

1. A _____ is about 6 feet.
2. One foot is about 3 _____.
3. 8 inches is about 1 _____.
4. 18 inches is about 1 _____ .
5. An inch is about a _____.
6. The length of a caterpillar is about 2 _____.
7. The depth of a pool for high diving is about 2 _____.
8. The length of a yardstick is about 2 _____.
9. The height of a man is about 2 _____.
10. A hand span is about 2 _____.

Process Question!

In your perception, which is more appropriate to use in measuring objects? Justify your answer.

Discover

There are two systems of measurement, the English and the Metric Systems.

English System

The English system of measurement is based on the British Imperial System.

Its units evolved from nonstandard units of measure in the medieval times like the foot, yard and inch where:

1 foot = 12 inches

1 yard = 3 feet

For long distances, mile is used.

1 mile = 1760 yards = 5280 feet.

The Metric System

The metric system was introduced in 1970 by a Frenchman named Gabriel Mouton. The metric system has proven to be convenient and ideal to use. Since the system is based on multiples of 10, counting and performing mathematical operations are easier.

Conversion is usually done from one unit to the other.

For example:

Converting Measurements

Conversion is usually done from one unit to the other.

Converting English System to Smaller Unit
For example:

1. Convert 42 inches into feet.

   42 inches $x \; \dfrac{1 \, foot}{12 \, inches} = \dfrac{42 \, feet}{12} = 3\dfrac{6}{12}$ feet **= $3\dfrac{1}{2}$ feet**

2. Convert 3 miles into inches.

   3 miles $x \; \dfrac{5280 \, feet}{1 \, mile} \; x \; \dfrac{12 \, inches}{1 \, foot} =$ **190,080 inches**

Converting English System to Metric System

Equivalent Units in the English and Metric Systems

English System	Multiply by	Metric System
inch (in)	2.54	centimeter (cm)
yard (yd)	0.9144	meter (m)
mile (mi)	1.609	kilometer (km)
pound (lb)	0.4536	kilogram (kg)
gallon (gal)	4.546	liter (L)
Fahrenheit (^{0}F)	$\frac{5}{9}$ (^{0}F – 32)	Celsius (^{0}C)

Examples:

Convert the following measures to metric units.
1. 8 mi to km   2. 90 lb to kg   3. 2 gal to L

Solutions:

1. $8\,mi = 8\,mi \times \frac{1.609\,km}{1\,mi} = \textbf{12.872 km}$

2. $90\,lb = 90\,lb \times \frac{0.4536\,kg}{1\,lb} = \textbf{40.824 kg}$

3. $2\,gal = 2\,gal \times \frac{4.546\,L}{1\,gal} = \textbf{9.092 L}$

Length

Length, a physical quantity, is a measure of distance. The basic unit of length in the SI system is the meter (m). The ruler, meterstick, and tape measure are often used to measure the length of an object.

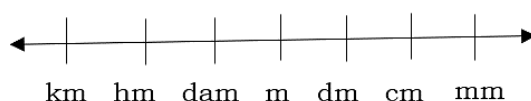*Example 1:* Convert

1. 315 cm to m   2. $1\frac{1}{2}$ km to m

Solutions:

1. 100 cm = 1 m
    $315\,cm \times \frac{1\,m}{100\,cm} = \textbf{3.15 m}$

2. km = 1 000 m
    $\frac{3}{2}\,km \times \frac{1\,000\,m}{1\,km} = \textbf{1 500 m}$

The use of the **Metric Converter** can aid in converting one unit of measure to another.

km hm dam m dm cm mm

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The abbreviations for the metric units of length are located on the number line above. To convert hectometer to decimeter, count the spaces from *hm* to *dm,* and move the decimal point in the same directions as many spaces as indicated in the diagram. Similarly, move 3 spaces to the left or 3 decimal places to the left to convert millimeter to meter. The number of spaces corresponds to the powers of ten needed to convert one unit to another.

Example 2: Convert

      1. 3.15 hm to dm   2.   4582 mm to m

Solutions:

      1. 3.150hm = 3150 dm   2.   4582 mm = 4.582 m

Mass/Weight

Mass and weight are often interchangeably used but their meanings are not exactly the same. ***Weight*** relates to the gravitation pull of the earth upon a mass. Thus, a person's weight on the moon varies with his weight on Earth. ***Mass*** refers to the amount of matter contained in the object. It remains the same regardless of location. However, on the surface of the earth and in everyday life situations, the mass of an object is accurately estimated by weighing it.

In the metric system, the ***gram*** (g) is a unit of mass (commonly known as weight). Another unit is the ***kilogram*** (kg) where:

$$1\ 000\ \text{grams} = 1\ \text{kilogram}$$

Example 3:

   1.   Change 8. 5 kg to grams.   2. Change 757 g to kg.

Solutions:

   1. $8.5\ kg = \dfrac{1\ 000\ g}{1\ kg} = 5.5\ x\ 1\ 000\ g = \mathbf{8,500\ g}$

   2. $757\ g\ x\ \dfrac{1\ kg}{1\ 000\ g} = \dfrac{757}{1\ 000}\ kg = \mathbf{0.757\ kg}$

Time

The unit of time is the ***second*** (s). The second is defined as the time occupied by 9 192 631 770 vibrations of the light emitted by a Cesium – 133 atom. Time is introduced with ***clocks*** and ***calendars***.

The following equivalences are used in time measurement.

Units in Time Measure

Unit	Equivalence in Other Units
I century (C)	100 years (yr)
1 score (S)	20 years (yr)
1 decade (D)	10 years (yr)
1 year (yr)	12 months (mo) or 365 days (da)
1 week (wk)	7 days (da)
1 day (da)	24 hours (hr)
1 hour (hr)	60 minutes (min)
1 minute (min)	60 seconds (s)

Example 4: How many minutes are there in a day?
Solution:

$$1 \text{ day } = 1\,d \; x \; \frac{24\,hr}{1\,d} \; x \; \frac{60\,min}{1\,hr} = \boldsymbol{1440\ min}$$

Temperature

      Temperature refers to the degree of hotness or coldness of a body. The metric unit of temperature is **degree Celsius** (°C). In the Celsius Scale, 0° C is the freezing point of water and 100° C is the boiling point of water. The instrument used for measuring temperature is the **thermometer**. Another unit of temperature is **degree Fahrenheit** (°F). In the Fahrenheit Scale, 32^0 F is the freezing point of water and 212^0 F is the boiling point of water.

Example 5:

1. 50° F to °C
   Solution:
   $$°C \;\; = \frac{5}{9}x \;(°F - 32)$$
   $$= \frac{5}{9}x \;(50 - 32)$$
   $$= \frac{5}{9}x \;18$$
   $$= \boldsymbol{10\ °C}$$

2. 40 °C to °F
   Solution:
   $$°F \;\; = \left(\frac{9}{5} \; x \;°F\right) + 32$$
   $$= \left(\frac{9}{5} \; x \;40\right) + 32$$
   $$= 72 + 32$$
   $$= \boldsymbol{104\ °F}$$

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Volume and Capacity

Volume and capacity are used interchangeably, although strictly speaking, they mean different things. **Volume** refers to how much space a region takes up. It is measured in three dimensions: length x width x height. On the other hand, **capacity** refers to how much a container will hold.

Example 6:

1. Bea has a 2-L bottle of juice. How many glasses can it fill with 210 mL of juice?

Solution:

Convert 2 liters to milliliters.

$2 \text{ L} = \frac{2L}{1} \cdot \frac{1000 \ mL}{1L} = 2000 \ mL$

Divide 2000 mL by 210mL

$\frac{2000 \ mL}{210 \ mL} = 9.52 \approx 9$

Thus, Bea can fill ***9 glasses*** with juice.

2. A $1\frac{1}{2}m \ x \ \frac{3}{4}m \ x \ \frac{1}{2}m$ aquarium is to be filled with water to the brim. How many liters of water are needed?

Solution:

Convert measurements to cm

$1\frac{1}{2}m = \frac{1.5 \ m}{1} \ x \ \frac{100 \ cm}{1 \ m} = \mathbf{150 \ cm}$

$\frac{3}{4}m = \frac{0.75 \ m}{1} \ x \ \frac{100 \ cm}{1 \ m} = \mathbf{75 \ cm}$

$\frac{1}{2}m = 0.5 \ m \ x \ \frac{100 \ cm}{1 \ m} = \mathbf{50 \ cm}$

3. Find the volume of the aquarium.

Solution:

V = 150 cm x 75 cm x 50 cm = 562 500 cm³

Using 1000 cm³ = 1 L, convert to liter.

$562 \ 500 \text{ cm}^3 = \frac{562 \ 500 \ cm^3}{1} \cdot \frac{1 \ L}{1000 \ cm^3} = 562.5 \text{ L}$

So, the aquarium will require **562.5 L** of water.

Rate and Unit Rate

Rate is a comparison of two quantities which have different units. It is written as a fraction.

Example 7:

1. A car traveled 554 kilometers on 62 liters of gasoline. What was the rate?

$$\frac{554 \, km}{62 \, liters} = \frac{277 \, km}{31 \, liters}$$

$227 \div 31 = \mathbf{8.935 \ km/L}$ or $\mathbf{8.90 \ km/L}$

2. Three watermelons are sold for ₱100. What is the rate?

$$\frac{₱100}{3 \, watermelons}$$

₱100 ÷ 3 = ₱33.33 ≈ **₱33.30** per whole piece of watermelon

Measuring Angle

An angle has two sides (rays) that meet at a point (vertex). The sides can extend from their common point as far as necessary.

Often an angle must be measured. Most of the time, angle is measured by a ***protractor***. The unit of protractor is ***degree***.

The measure of an angle is the amount of opening between the sides of the angle. An angle with the greater opening has the greater measure.

For example: The measure of ∠X is greater than the measure of ∠Y.
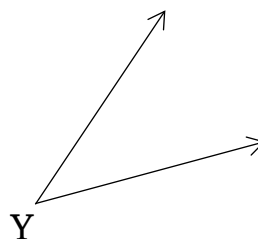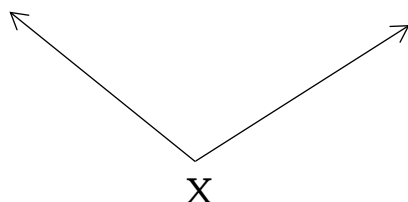
To find the measure of an angle, place the center point of the protractor over the vertex of the angle. Then align the mark labeled 0 on the either side of the scale with one side on the angle. This has been done for ∠BXC shown below.
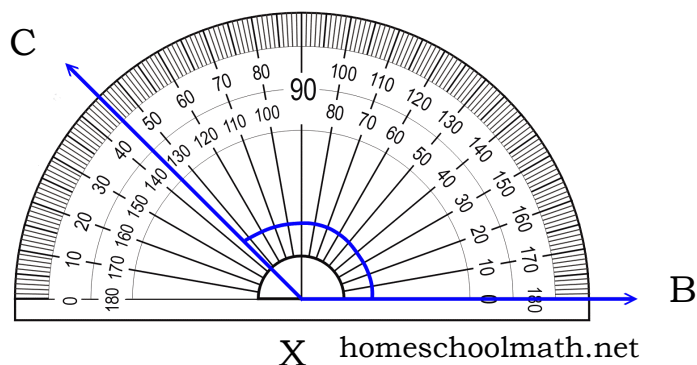
Using the inner scale of the of the protractor, you can see that ∠X is a 135⁰angle. Thus, the degree of ∠BXC is 135, written as m∠BXC = 135.
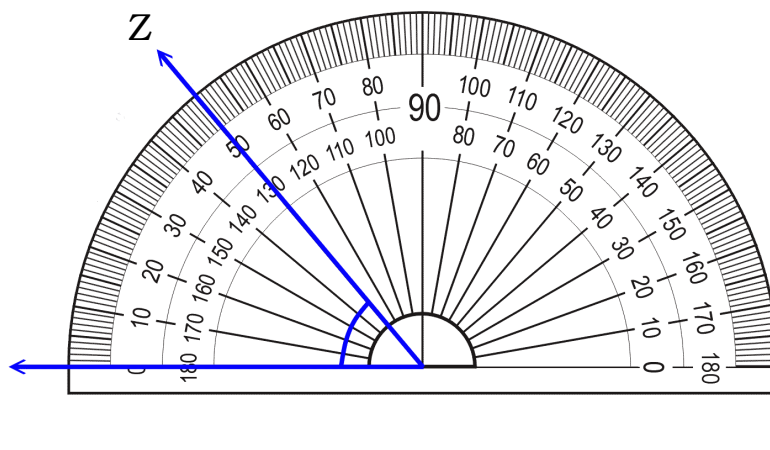
Example 8:

Make a 50^0 angle using a protractor.
Solution:

Place the center point of the protractor over the vertex of the proposed angle XYZ. Align that marked labelled 0 on the left side of the scale with side YX. Align YZ with the scale marked 50.

Thus, ∠**XYC = 50.**

![Explore icon] ***Explore***

Activity 3: Complete Me!

Direction: Complete the following conversion. Write your answer on the blank. Show your solutions on a separate sheet of paper.

1. _____ sec = 19 min   6. _____ mm = 13 cm

2. _____ cm = 89 m   7. _____ days = 2 months

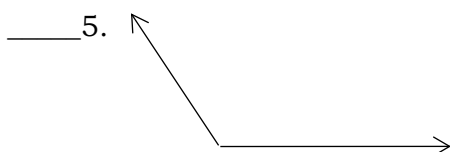3. _____ m = 5 km   8. _____ g = 2.2 kg
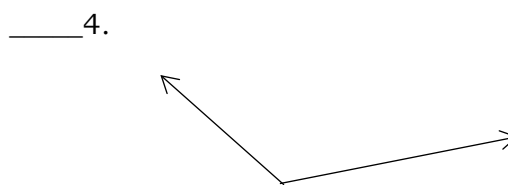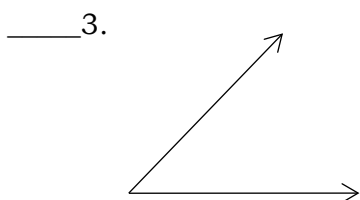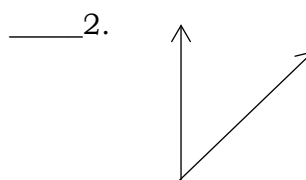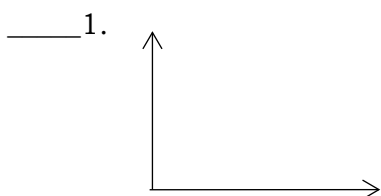
4. _____ yds = 7 mi   9. _____ °F = 34 °C

5. _____ days = 3 wk   10._____°C = 85 °F

Activity 4: Measure Me!

Direction: Use your protractor to measure the angles given below. Write your answer on the space before each number.

_____1.

_____2.

_____3.

_____4.

_____5.

Activity 5: Process Me!

Direction: Read and solve the given questions. Show your solutions on a separate sheet of paper. (with the aid of a calculator)

A. Convert the following lengths with the desired units.

    1. 18 inches to feet   2. 3 miles to yard

B. Convert the following lengths with the desired units.

    1. 38 m to mm   2. 1.5 km to m

C. Convert the following measures to metric units.

    1. 50 lb to kg   2. 90 ^{0}F to ^{0}C

D. Problem Solving:

    1. A blue whale is 110 feet long. Express its length in meters.

    2. Alex sold a box of egg pie with a cost of ₱180.00. What was the rate if the whole egg pie cut into 12 slices?

Deepen

Directions:
Read and analyze the problem then answer the question/s. Show your solutions on a separate sheet of paper. (with the aid of a calculator)

1. Maxine went to Rosario, La Union. He left his house and travelled at an average speed of 60 kph. How many minutes will it take for the car to reach the school which is 8 km away from the house?

2. A spherical fish bowl has a radius of 21 cm. How many ml of water is needed to fill half the bowl?

3. Two friends, Ana and Marie, run in marathons. Ana finished a 21-km marathon in Cebu while Marie finished a 15-mile marathon in Los Angeles. Who between the two ran a longer distance? By how many meters?

Rubric for Problem Solving

4	3	2	1
Used an appropriate strategy to come up with a correct solution and arrived at a correct answer	Used an appropriate strategy to come up with a solution, but a part of the solution led to an incorrect answer	Used an appropriate strategy but came up with an entirely wrong solution that led to an incorrect answer	Attempted to solve the problem but used an inappropriate strategy that led to a wrong solution

![Gauge icon](pencil writing in a circle) ***Gauge***

Assessment:

Directions: Read each statement below carefully. Select the letter of the correct

answer. Write your answer on a separate sheet of paper.

1. What is the SI prefix that means 10?

    A. centi   B. deca   C. hecto   D. kilo

2. Which is the appropriate unit to measure the amount of water in an eye dropper?

    A. dm   B. g   C. L   D. ml

3. What non-standard unit of measurement is about 3 feet?

    A. cubit   B. hand   C. palm   D. yard

4. What do you call a thousand grams?

    A. decagram   B. gram   C. kilogram   D. milligram

5. What is the equivalent measure of 25 m to cm?

    A. 0.25   B. 2.5   C. 250   D. 2500

6. What is the equivalent to 4.5 days to hours?

    A. 98   B. 108   C. 118   D. 128

7. How many millimeters are there in 10.56 centimeters?

    A. 0.1056   B. 1.056   C. 105.6   D. 1056

8. What is the possible measurement of the given angle below?

    A. 55^0

    B. 89^0

    C. 125^0

    D. 142^0

9. How many degree Celsius are there in 21 degree Fahrenheit?

    A. -6.11^0 B. -6.01^0 C. 6.0^0 D. 6.11^0

10. How many degree Fahrenheit are there in 15 degree Celsius?

    A. 56^0 B. 57^0 C. 58^0 D. 59^0

11. How many inches are there in 2000 millimeters? (Round off your answer to the

nearest hundredth.)

    A. 78.24   B. 78.74   C. 79.24   D. 79.78

12. What is the perimeter of a rectangular playground if the width is 5 m and the length is three times longer?

    A. 40 m   B. 45 m   C. 50 m   D. 55 m

13. Joseph went to Manila with his motorcycle. His motorcycle travelled 250 km on 100 liters of gasoline. What was the rate?

    A. 2.5 kpl   B. 2.6 kpl   C. 2.7 kpl   D. 2.8 kpl

14. Anton went to Balaoan, La Union. His car is traveling 75 kilometers per hour. How many meters does the car travel in one minute?

    A. 1,000   B. 1,150   C. 1,250   D. 1,350

15. The height of water in a cylindrical container is 15 cm. What is the height of this quantity of water if it is poured into a cylindrical container of radius 2cm?

    A. 3.70   B. 3.75   C. 3.80   D. 3.85

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