What Is This Module About?

Do you know what *lines* and *angles* are? This module will tell you what a line is and the different types of lines. It will also tell you what an angle is and how an angle is measured as well as its different types.

Lines and angles are important to us. Everything around us are made up of lines and angles. Many real-life situations can be understood better and problems can be solved more easily if we know all about lines and angles.

This module has four lessons:

Lesson 1 — *Lines and Intersections*
Lesson 2 — *Identifying Angles*
Lesson 3 — *Magic Hands*
Lesson 4 — *The Power of Pythagoras*

What Will You Learn From This Module?

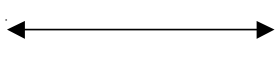
After studying this module, you should be able to:

- tell whether the given lines are parallel, intersecting or perpendicular;
- measure angles using a protractor;
- draw an angle given its measure;
- identify whether the given angle is acute, right, straight or obtuse; and
- use the Pythagorean theorem to solve problems involving angles.

Before you proceed to Lesson 1, try to answer the questions in *Let's See What You Already Know* first to determine what you already know about the topics of this module.

Let's See What You Already Know

A. Tell whether each pair of lines are parallel, intersecting or perpendicular by writing your answer in the blank.

1. 

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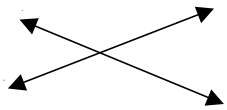
2. 

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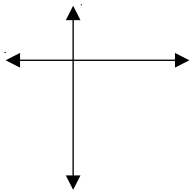
3. 

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4. 

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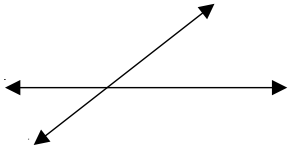
5. 

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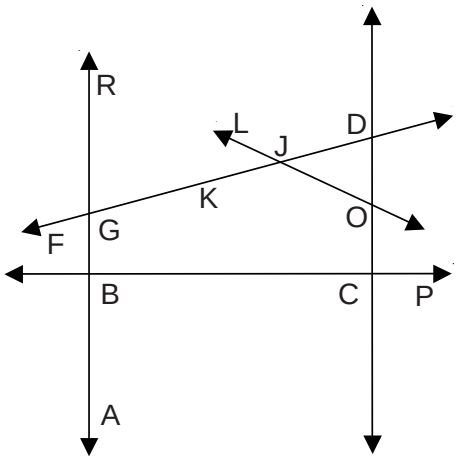
B. From the figure below, measure the given angle listed below by using a protractor and determine whether it is acute, right, obtuse or straight. Write your answers in the lines provided.



Name of Angle	Measurement	Type
1. ∠ DJO	_____	_____
2. ∠ FGR	_____	_____
3. ∠ PCD	_____	_____
4. ∠ LJK	_____	_____
5. ∠ ABR	_____	_____

C. Using your protractor, draw an angle with each given measure.

1. 65°

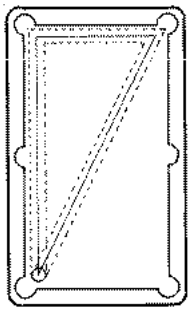
2. 90°

3. 104°

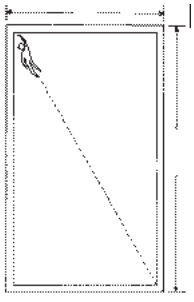
4. 136°

5. 180°

D. Use the Pythagorean theorem to solve the following problems. Show your solutions in the spaces provided.



1. Jake was performing his favorite billiard trick shot. He hit the cue ball and it went to one corner of the table, rolled to the other corner, hit the exact center of the back cushion and hit the eighth ball causing it to drop into one of the holes before returning to its original position. If the dimensions of the table are 6 ft. by 8 ft., how far did the cue ball travel?



2. Manny was swimming diagonally across from one corner of the swimming pool to the opposite corner. If the swimming pool is 50 ft. wide and 120 ft. long, what is the distance covered by Manny?

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on pages 35–36 to find out.

If all your answers are correct, very good! This shows that you already know much about the topics in this module. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you got a low score, don't feel bad. It means that this module is for you. It will help you understand important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

Lines and Intersections

This lesson will discuss what a line is. A pair of lines may be parallel, intersecting or perpendicular. After reading this lesson, you will be able to determine the different types of lines.

The knowledge and skills that you will gain in this lesson will help you solve real-life problems which involve lines.

Look at the Figure 1 below. Have you noticed the different types of lines as shown by the pairs of lines?

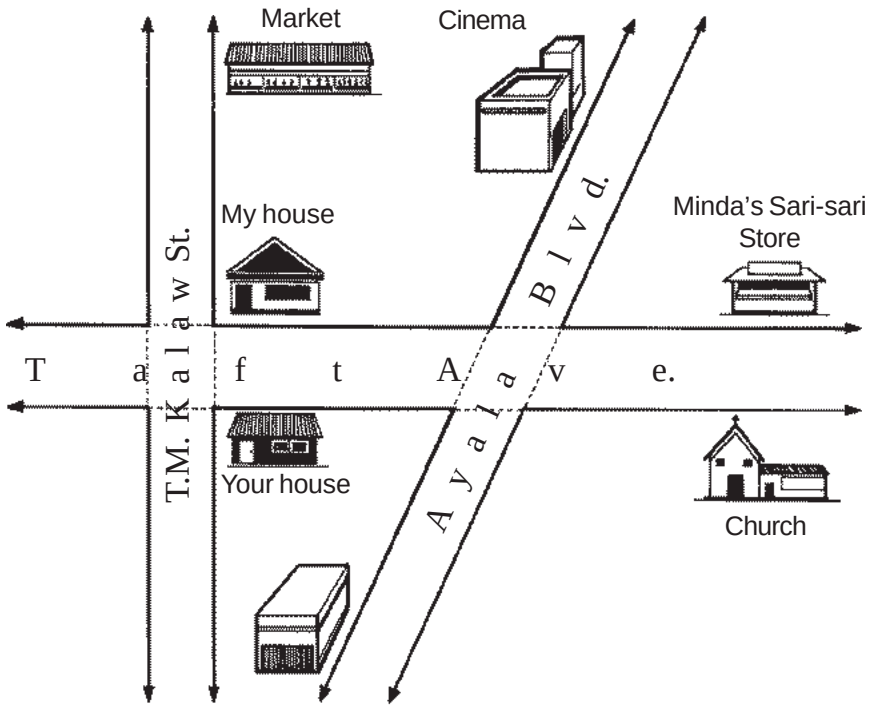


Figure 1

Based on Figure 1, read the following paragraph and answer the question after each one:

1. One Sunday morning, my mother asked me to buy a loaf of bread at Minda's Sari-sari Store. On my way to the store, I saw you on the other side of the street walking hurriedly to attend mass. What street were we passing through? _____

2. On my way back home, I remembered my mother's instruction that I still have to go to the market to buy *longanisa* for our breakfast. So, I dropped by our house, left the loaf of bread on the dining table and proceeded to the market. What streets did I pass through? _____

3. After our breakfast, while helping my sister clean up the kitchen and dining table, several of her friends arrived in our house. They were inviting my sister to see a movie on its first showing at a nearby cinema. My mother allowed my sister to go with her friends. What streets did they pass through to get to the cinema? _____

Are your answers the same as the following? I'm sure they are.

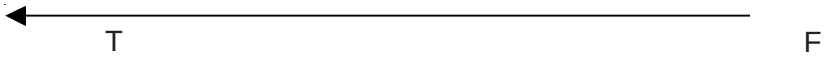
Question in paragraph 1 – Taft Avenue
Question in paragraph 2 – Taft Ave. then T.M. Kalaw St.
Question in paragraph 3 – Taft Ave. then left to Ayala Blvd.

Let's Learn

Each side of Taft Ave. represents a *line*.

A **line** goes on and on in two directions.

Drawn below is an example of a line.



Notice that the line has an arrow at each end. This means that a line goes on and on toward the directions indicated by the arrows.

Take note of the two capital letters below the line. These are used to indicate the name of the line. The line, therefore, is called line TF.

Can you identify the different types of lines in Figure 1on page 5? The lines in Figure 1 are those on each side of T.M. Kalaw St., those on each side of Ayala Blvd. and those on each side of Taft Ave. They are shown below.

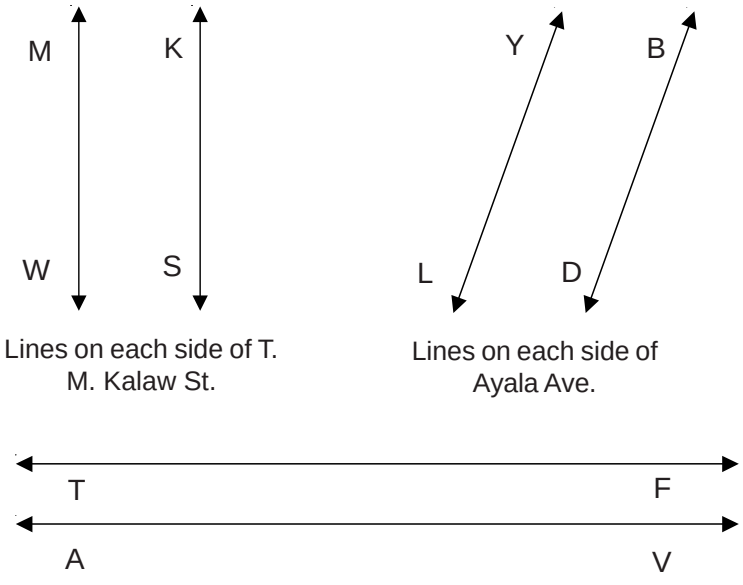
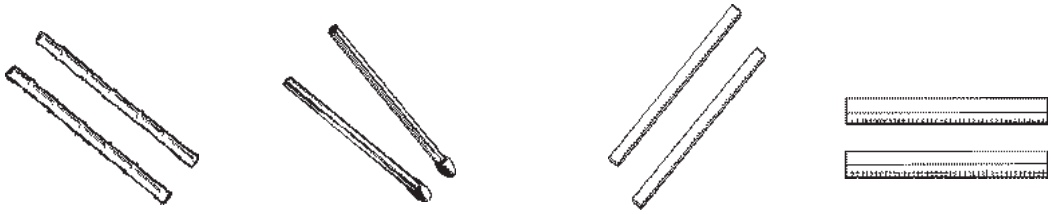


Figure 2

Imagine yourself walking along one side of Taft Ave. while I walk along the other side. Will we bump into each other? No, we won't as long as we walk on the opposite sides.

Let's Try This

Select which pairs of objects given below represent parallel lines. Encircle the letter of your answer.



(a) (b) (c) (d)

If you encircled (a), (c) and (d), you are right.

Look at the objects around you. From the shape of this module you're holding, can you find parallel lines? Look at a rectangular or a square table. Feel the parallel lines with your hands. Look at the door. How many parallel lines can you find? Where else can you find parallel lines? Draw some objects whose sides represent parallel lines.

_____ _____ _____

Let's Learn

The pairs of lines (a), (c) and (d) above are called **parallel lines.** These are pairs of lines that will never meet no matter how long they are extended.

Now, let us go back to Figure 1 on page 5 and take a look at the path my sister and her friends took from our house to the cinema.

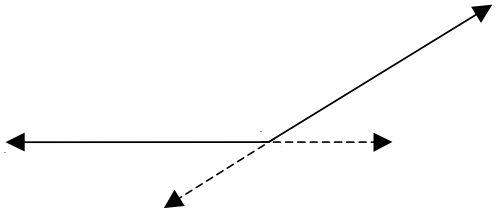
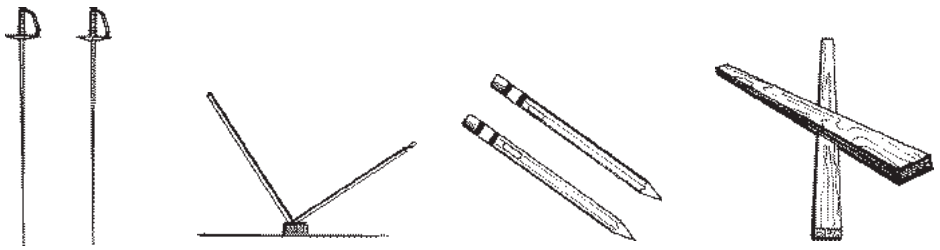


Figure 3

The path they took in going to the cinema can be represented by **intersecting lines** as shown in Figure 3. These pairs of lines meet at a certain point called the **point of intersection.**

Let's Try This

Which of the objects below represent intersecting lines? Encircle the letters of your answers.



(a) (b) (c) (d)

If you answered (b) and (d), you are right.

Look at the things around you. Then draw the pairs of objects that represent intersecting lines.

_____ _____ _____

Let's Learn

Refer again to Figure 1 on page 5 and look at the path I followed from Minda's Sari-sari Store to the market.

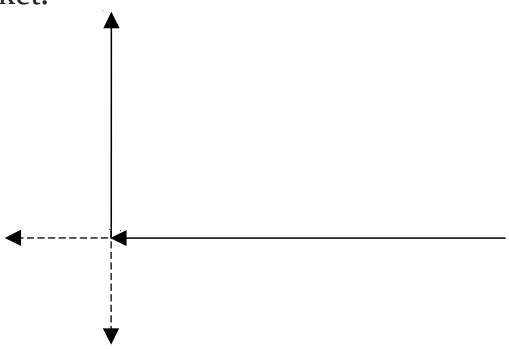


Figure 4

The path I took represents **perpendicular lines** as shown in Figure 4. These are pairs of lines that intersect to form right angles.

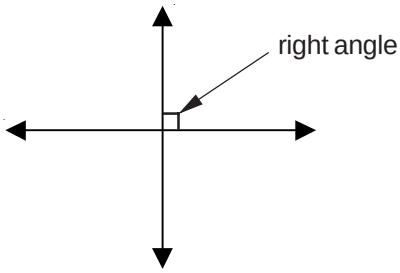


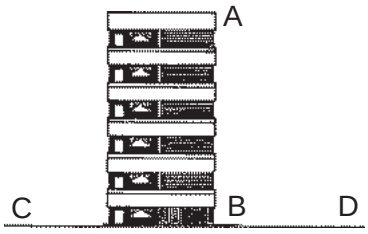
Figure 5

The square drawn at the point of intersection of **perpendicular lines** represents a right angle which you will learn about later in Lesson 3 of this module.

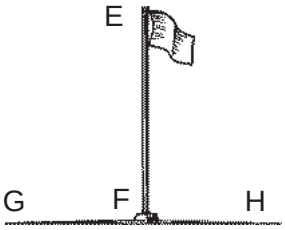
Can you draw a square at the point of intersection in Figure 3? No, you cannot because the lines are not perpendicular. Although they intersect, they are not perpendicular.

Let's Try This

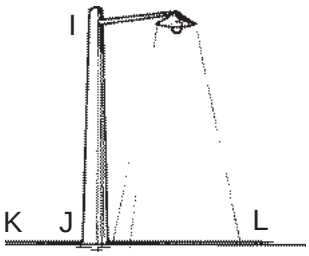
Which among the given lines are perpendicular? Encircle the given lines.



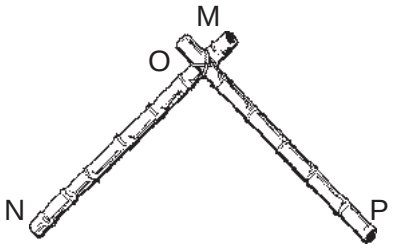
(a) AB and CD



(b) EF and GH



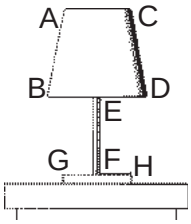
(c) IJ and KL



(d) MN and OP

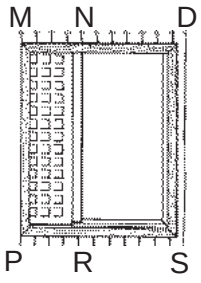
If you encircled (a), (b) and (c), you are correct.

Can you find perpendicular lines in the drawings below? Identify the lines using the blanks provided.



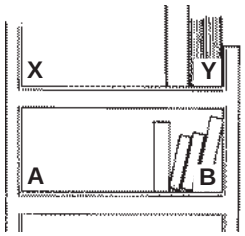
_____

(A)



_____

(B)



_____

(C)

Compare your answers with mine.

a) BD and EF
EF and GH

b) NR and PS
NR and MD

c) XY and YB
XA and AB
YB and AB

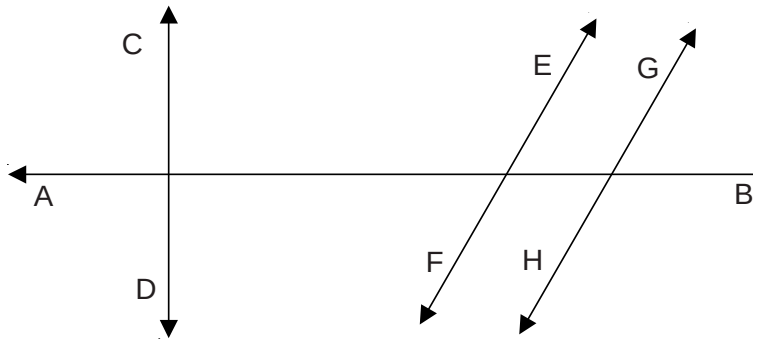
Let us summarize what you have learned in this lesson.

Let's Remember

- A line has arrows at both ends to show that it goes on and on toward both directions. It can be identified by using two capital letters.
- Parallel lines are pairs of lines that will never meet no matter how long they are extended.
- Intersecting lines are pairs of lines that meet at a certain point called the point of intersection.
- Perpendicular lines are pairs of lines that form right angles at their point of intersection.

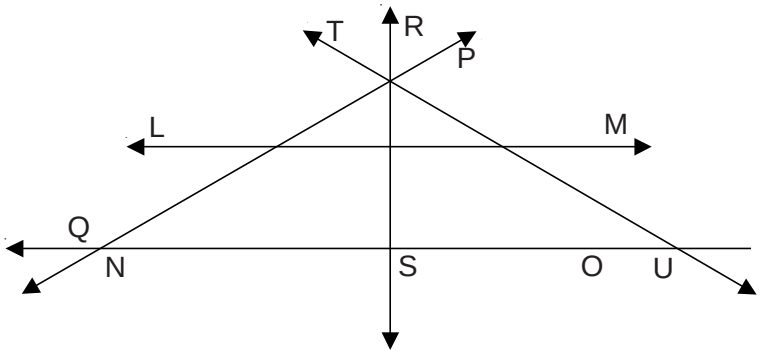
Let's See What You Have Learned

A. Enumerate the pairs of lines in the given figure. Identify whether each pair form parallel, intersecting or perpendicular lines.



Pair of lines	Type
_____	_____
_____	_____
_____	_____
_____	_____

B. Look at the given figure below.



Determine whether each of the given pairs of lines form parallel, intersecting or perpendicular lines.

1. LM and NO _____
2. TU and LM _____
3. RS and LM _____
4. LM and PQ _____
5. RS and NO _____

Compare your answers with those found in the *Answer Key* on page 36. If you got a score of 11 and above, you are doing great. Continue reading this lesson. If you got a score below 11, go back to the parts of Lesson 1 you did not understand very well.

Identifying Angles

In this lesson, you will learn what an angle is. You will also learn the different types of angles and how they are measured.

Knowing about angles is very important because there are problems we may face requiring knowledge of angles and their measurements. This knowledge is also useful in doing our daily activities such as telling time.

Look at the wall clock drawn below:

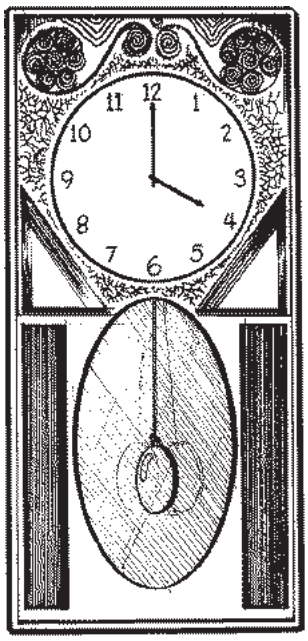


Figure 1

What time is it? _____ It is 4:00.

What do you notice about the hands of a clock? _____

Correct, the hands of a clock intersect at a certain point.

Let's Learn

The hands of a clock intersect or meet at a point. Thus, an **angle** is formed.

Look at the other clocks drawn below. Their hands form different *angles*.

An angle is formed by two lines that intersect at a point called the **vertex.**

Let's Try This

Look at the figures drawn below which consist of different angles.

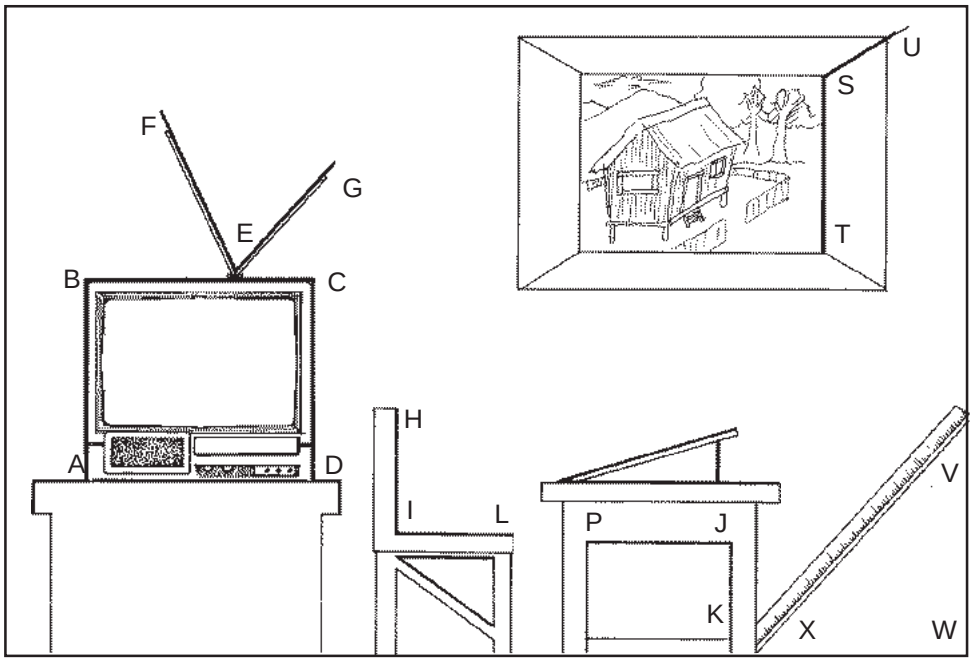


Figure 2

Look at the television set. Its sides form the angles: $\angle ABC$ (read as angle ABC), $\angle BCD$ and $\angle CDA$. What angle is formed by its antenna? Is your answer $\angle FEG$? That's correct.

The vertex of $\angle ABC$ is B and its sides are BA and BC.

The vertex of $\angle BCD$ is C and its sides are CB and CD.

The vertex of $\angle CDA$ is D and its sides are CD and DA.

The vertex of $\angle FEG$ is E and its sides are EF and EG.

Now, answer the following on your own.

1. The wooden stick against the wall forms one angle, $\angle XVW$.

   Its vertex is _____ and sides are _____ and _____.

   Your answers must be V, VX and VW, respectively.

2. The chair and the table form the following angles _____ and _____.

   The vertex of $\angle HIL$ is ____ and its sides are ____ and ____.

   The vertex of $\angle PJK$ is ____ and its sides are ____ and ____.

   Below are the correct answers.

   The vertex of $\angle HIL$ is I and its sides are HI and IL.

   The vertex of $\angle PJK$ is J and its sides are PJ and JK.

3. One side of the picture frame forms an angle: $\angle UST$

The vertex of $\angle UST$ is _____ and sides are _____ and _____.

The answer is:

The vertex of $\angle UST$ is S and its sides are US and ST.

Let's Learn

In the previous discussion, you have learned that angles are named using three capital letters. But they can be named in other different ways.

Look at the angle formed between the ground and the slope of the hill.

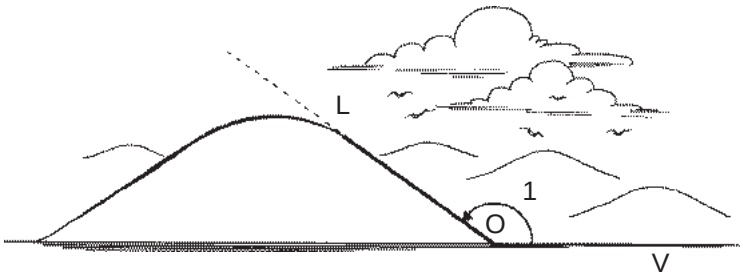


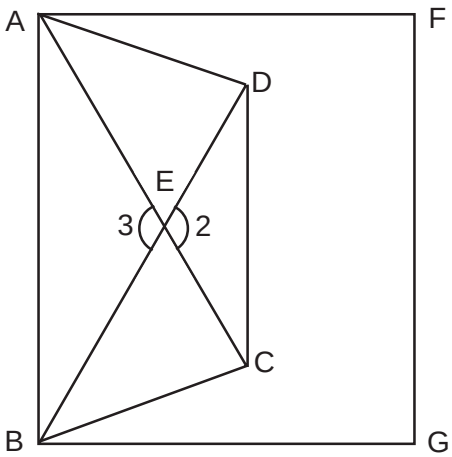
Figure 3

The angle in Figure 3 can be named as $\angle LOV$, $\angle O$ or $\angle 1$.

An angle can be named using three capital letters. The vertex is always represented by the second letter. An angle can also be named using a number.

Let's Try This

Name the different angles in the figure below.



Write your answers below.

_____

_____

Here are the correct answers.

∠ABG, ∠ABD, ∠ABC, ∠DBC, ∠FAB, ∠FAC,
∠FGB, ∠FAD, ∠ADC, ∠ADB, ∠BDC, ∠AED,
∠ACD, ∠DEC, or ∠2, ∠EDC, ∠DCB, ∠BEC,
∠DBG, ∠AEB, or ∠3

If you were able to name at least ten angles correctly, that's very good. If you named less than 10, study the figure again using the angles listed above particularly those which you were not able to identify.

Let's Learn

Drawn below is a protractor.

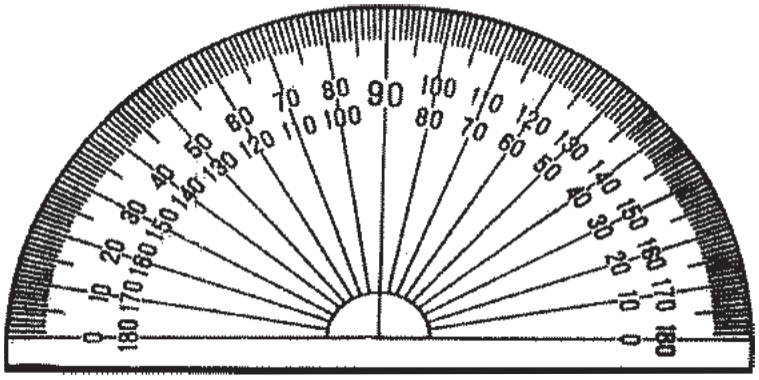


Figure 4

A **protractor** is a device used to measure an angle.

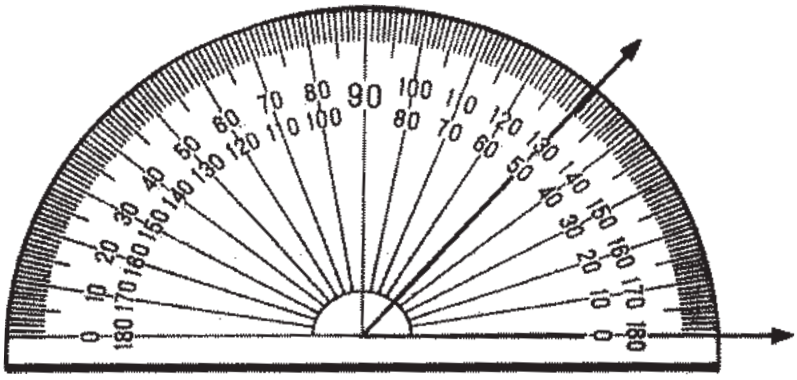
How do we use a protractor to measure an angle?

STEP 1 Place the center mark of the protractor at the vertex of the angle.

STEP 2 Place the zero mark of one scale on one side of the angle.

STEP 3 Refer to this scale to read the mark on the other side of the angle.

The figure on the next page shows how to determine the measure of an angle.

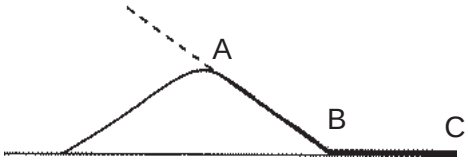


This angle measures 50° (read as fifty degrees). This is written as m $\angle A = 50°$, and is read as "the measure of angle A is fifty degrees."

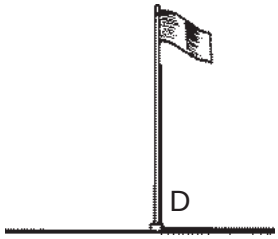
Degree (°) is the unit of measurement for angles.

Let's Try This

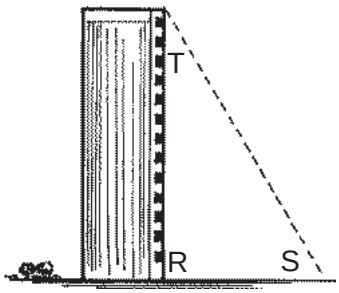
A. Take hold of a protractor and determine the measure of the following angles. The first one is done for you.



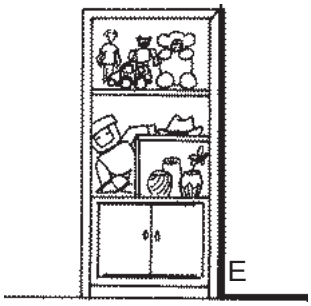
1. m $\angle ABC$ = 144°



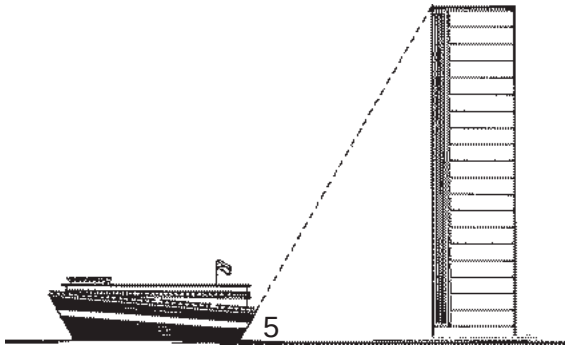
2. m $\angle D$ = ____°



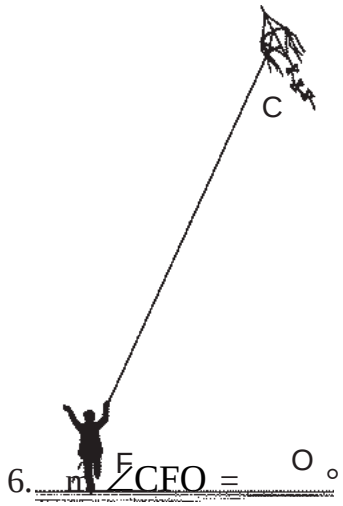
3. m $\angle RST$ = ____°



4. m $\angle E$ = ____°



5. m $\angle$ 5 = ____ °



6. m ∠CFO = _____ °

B. Using your protractor again, measure the angles listed in the drawing of a house below. The first one has been done for you.

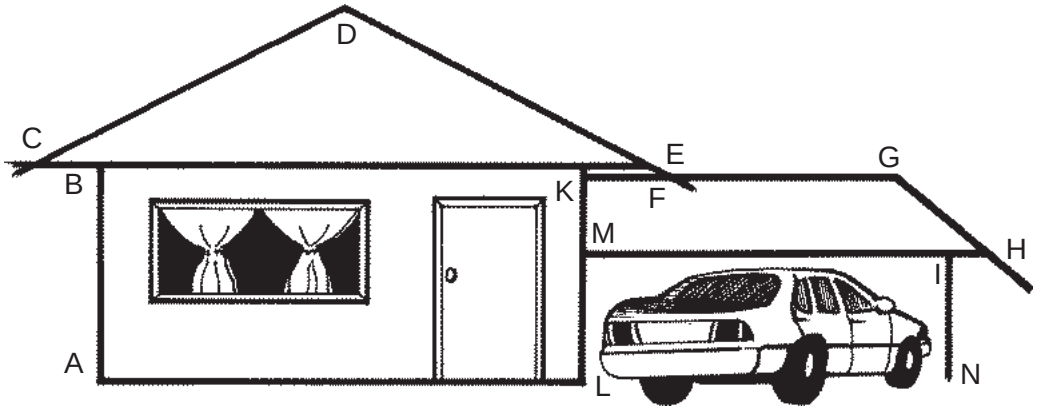


Figure 5

1. m ∠CBA = 90°
2. m ∠BCD = _____
3. m ∠CDE = _____
4. m ∠NIM = _____
5. m ∠GED = _____
6. m ∠HGE = _____
7. m ∠GHM = _____
8. m ∠DEC = _____
9. m ∠KFD = _____

Compare your answers with those in the *Answer Key* on page 36. If you made a mistake on some of the angles, measure those angles again.

C. Now let's try drawing angles given their measures.

1. m ∠D = 35°
2. m ∠X = 28°
3. m ∠4 = 126°

4. m $\angle 5 = 56°$ 5. m $\angle D = 110°$ 6. m $\angle D = 155°$

You can ask your Instructional Manager to check the measurements of the angles you have drawn.

Let's See What You Have Learned

A. Use the given figures below to determine the following:

a. name of the angles;
b. the vertex of the angles;
c. the sides of the angle; and
d. the measurement of the angle.

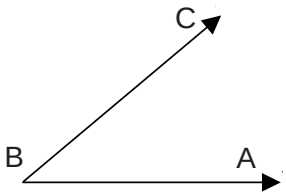


Figure 1

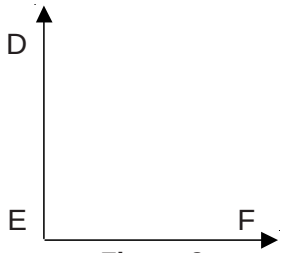


Figure 2

1. a. _____
   b. _____
   c. _____
   d. _____

2. a. _____
   b. _____
   c. _____
   d. _____

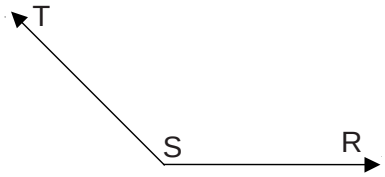


Figure 3

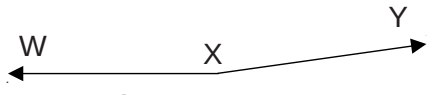


Figure 4

3. a. _____
   b. _____
   c. _____
   d. _____

4. a. _____
   b. _____
   c. _____
   d. _____

B. Use your protractor to draw angles with the given measurements.

1. 45°

2. 65°

3. 108°

4. 125°

5. 167°

Compare your answers with those found in the *Answer Key* on pages 36–37. If you got all the correct answers, very good. If you did not, read this lesson again and I'm sure you will improve your score with more practice.

Let's Remember

- An angle is formed by two lines that meet at a point called the vertex.
- An angle can be named by using:
  - three capital letters representing its vertex and two sides. The letter representing the vertex is always written in between the other two letters representing the sides.
  - one capital letter representing the vertex.
  - a number.
- A protractor is a device used to measure an angle.
- We follow the steps below to determine the measurement of an angle.
  - **Step 1**. Place the center mark of the protractor at the vertex of the angle.
  - **Step 2**. Place the zero mark of the scale on one side of the angle.
  - **Step 3**. Refer to this scale to read the mark on the other side of the angle.
- The degree (°) is the unit of measurement used for angles.

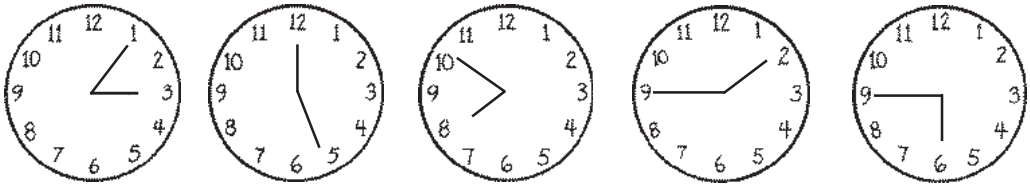
Magic Hands

In this lesson, you will learn about the different types of angles according to their measurements.

The knowledge and skills that you will learn here can be used to solve problems which involve the different types of angles.

Let's Learn

Let us go back to the different types of angles formed by the hands of a clock which were shown in Lesson 2.



1 2 3 4 5

Measure the angles formed by the hands of the clock with your protractor.

m ∠ of clock 1 = _____

m ∠ of clock 2 = _____

m ∠ of clock 3 = _____

m ∠ of clock 4 = _____

m ∠ of clock 5 = _____

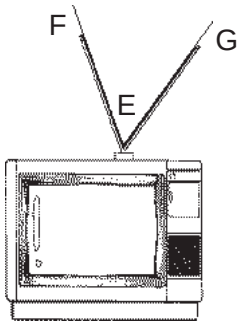
Compare your answers with mine.

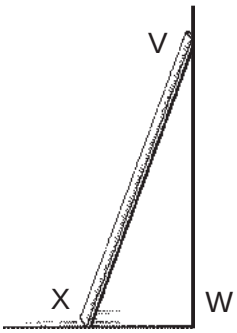
clock 1 = 55° clock 2 = 155° clock 3 = 70°

clock 4 = 145° clock 5 = 90°

Which of the following clocks show angles whose measurements are less than 90°? Are your answers Clock 1 and Clock 3? Then, you're correct. Angles that are less than 90° are called acute angles.

Let's Try This



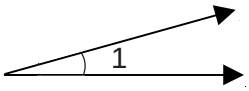


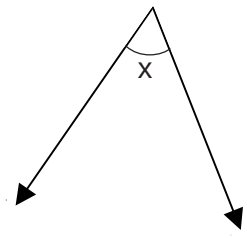
By using the figures above, let us measure the angles named below.

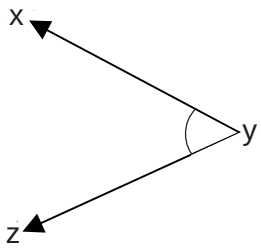
m ∠FEG = _____ m ∠XVW = _____

What can you say about the measurements of the two angles? Are they less than 90°? If you answered yes, then you're correct. And so, they are acute angles.

Here are examples of acute angles. Get their measurements with your protractor.







m ∠1 = _____ m ∠x = _____ m ∠xyz = _____

Compare your answers with mine.

m ∠1 = 15° m ∠x = 55° m ∠xyz = 52°

Given the following measurements, draw only the acute angles in the space provided. Always use your protractor and remember to apply the three steps in getting the accurate measurements of angles.

a. 55° b. 85° c. 93° d. 110° e. 38°

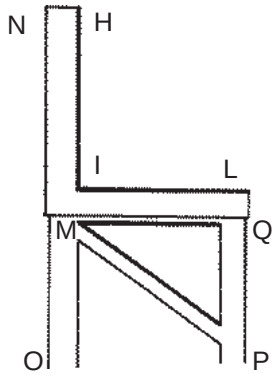
What letters did you draw? If you drew the figures for letters a, b, and e, you're right.

Let's Learn

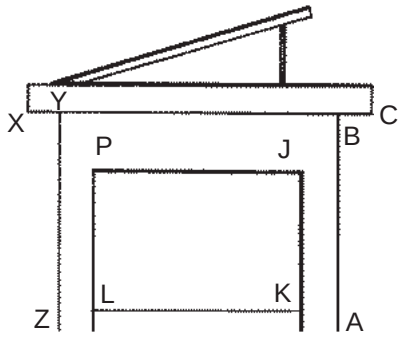
Let's look at the clocks again on page 20. Which of the clocks show an angle that measures 90°? If your answer is Clock 5, you're right. This angle is called a **right angle**. Right angles measure 90°.

Let's Try This

Given the drawings below, list down as many right angles as you can identify.



A



B

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

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

Compare your answers with those in the *Answer Key* on page 37. If you were only able to name three angles or less, study the drawings again. You may also name right angles not marked in the *Answer Key.*

B. Look around you. Can you find objects with right angles? List them down below.

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

Some possible answers are:

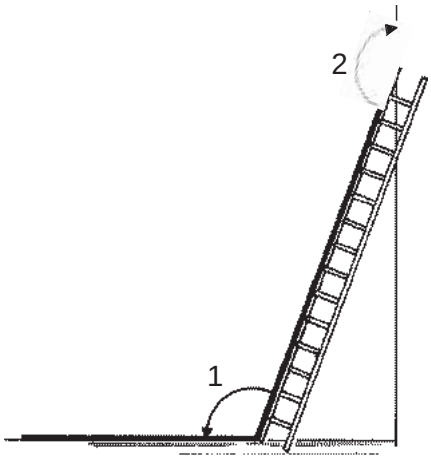
1. corners of a book
2. corners of a table
3. right angles of the door
4. right angles of the window
5. corners of a sheet of paper
6. the perpendicular line of the wall and the floor form a right triangle.
7. corners of a box

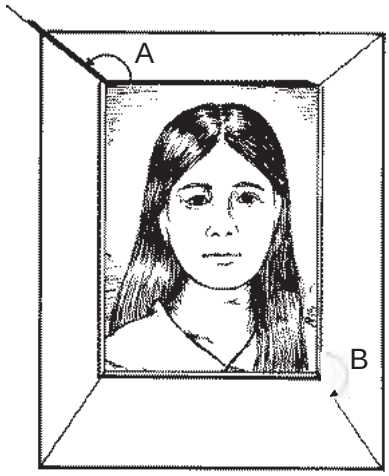
Let's Learn

Let's refer to the clocks shown on page 20 again. The hands of Clock 2 and Clock 4 measured 155° and 145°, respectively. The measurements of these angles are greater than 90° but less than 180°. These angles are called **obtuse angles.**

Let's Try This

A. Let us consider the angles in the following drawings. Use your protractor to get the measurements of the identified angles.





m $\angle 1$ = ___ m $\angle 2$ = ___ m $\angle A$ = ___ m $\angle B$ = ___

Are your answers $\angle 1 = 110°$, $\angle 2 = 160°$, $\angle A = 140°$ and $\angle B = 145°$?

What did you notice about the measurements of the four angles? You're right if you said all of them measure greater than 90° but less than 180°. Therefore, they are all obtuse angles.

B. Given the following measurements, draw the obtuse angles with your protractor.

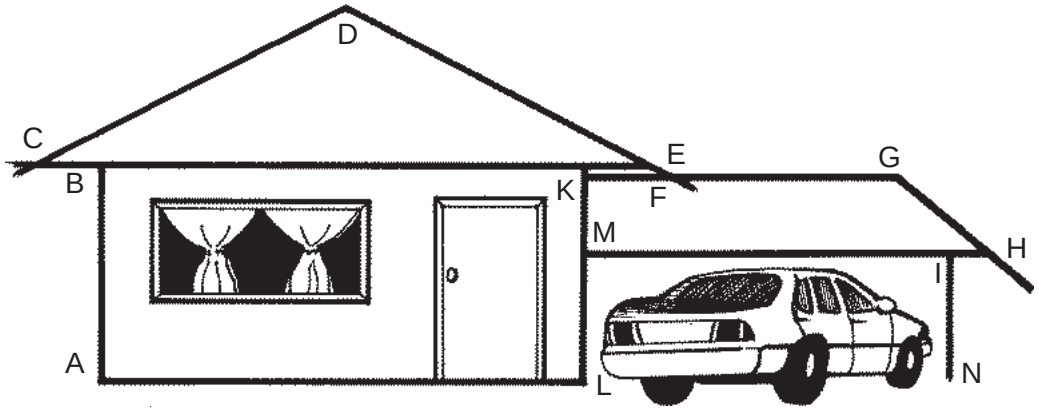
1. 95° 2. 115° 3. 175° 4. 100°

Let's Remember

- Angles are classified according to their measurements.
- An acute angle is an angle whose measurement is less than 90°.
- A right angle measures exactly 90°.
- An obtuse angle is an angle whose measurement is greater than 90° but less than 180°.

Let's See What You Have Learned

A. Determine whether the given angles are acute, right or obtuse based on the drawing below.



1. ∠ABC _____
2. ∠BCD _____
3. ∠CDE _____
4. ∠NIM _____
5. ∠DEG _____
6. ∠FGH _____

7. $\angle GHM$ _____
8. $\angle DEC$ _____
9. $\angle KFD$ _____
10. $\angle LMH$ _____

B. Given the measurements below draw the angles and determine whether they are acute, right or obtuse.

Measurement	Drawing	Type
1. 38°		
2. 90°		
3. 117°		
4. 135°		
5. 75°		

Compare your answers with those found in the *Answer Key* on page 38. If you got at least 12 correct answers, congratulations! You did a very good job. If you did not, read the parts of this lesson which are not yet clear to you. I'm sure that after the second reading, you will do better.

The Power of Pythagoras

In this lesson, you will learn about the **Pythagorean theorem.** It is used to solve the unknown side of a right triangle.

This lesson is important because it will teach you how to solve real-life problems which involve angles. But you need to have background knowledge about the square root of a number to understand this lesson well.

Let us look at the figure drawn below.

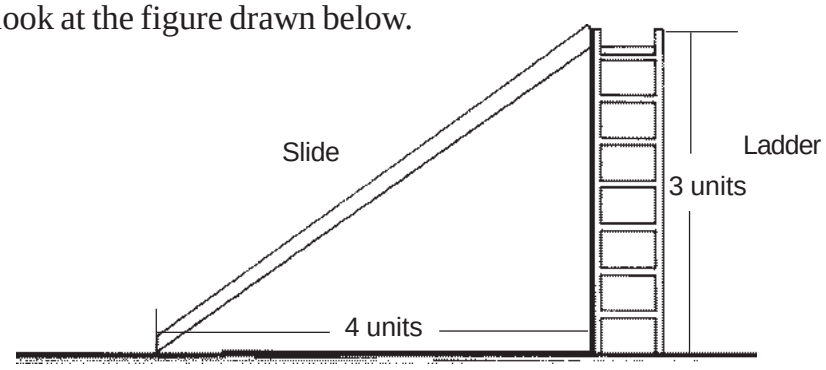


Figure 1

What angle is formed by the ladder and the ground? Did you say right angle? You are correct.

What is the distance from the ground to the top of the slide? How far is the lower end of the slide to lower end of the ladder? The answers are 3 units and 4 units, respectively.

But how can we compute the length of the slide? We can do this by using the Pythagorean theorem given the length of the ladder and the distance from the lower end of the slide to the lower end of the ladder.

Let's Learn

In our activity, the ladder and the ground formed a right angle. Thus, a right triangle was formed together with the slide.

A **right triangle** is a triangle with a right angle. The side opposite the right angle is called **hypotenuse**. The two other sides are called the **legs.**

To compute for the length of a side of a triangle, we use the Pythagorean theorem which states that:

In a right triangle, the square of the hypotenuse is equal to the square of one leg plus the square of the other leg.

"Square the hypotenuse" means multiply the length of the hypotenuse by itself. So, the hypotenuse is called c, then $c^2 = c \times c$.

"Square of the leg" means multiply the length of the leg by itself. So, one of the legs is called *a*, then $a^2 = a \times a$.

Suppose the other leg is called *b*. What is the symbol for the square of the leg? _____ Show the equation for the square of the leg.

Check your answer against mine: $b^2 = b \times b$. Are they the same? I'm sure they are.

Let's Study and Analyze

Refer to Figure 1 on page 26. Let us compute for the length of the slide.

STEP 1 Identify the hypotenuse and the legs of the triangle.

The hypotenuse *c* is the side opposite to the right angle. Therefore, *c* = length of the slide.

The two legs of the triangle are represented by the ladder and the ground. Therefore, *a* = length of the ladder and *b* = distance between the lower end of the slide and the lower end of the ladder.

STEP 2 Use the formula derived from the Pythagorean theorem. If *c* is the hypotenuse of the right triangle and *a* and *b* are its legs, we will then have:

$$c^2 = a^2 + b^2$$

STEP 3 Substitute the given values to the variables (*a*, *b* and *c*) in the formula and solve for the unknown. Recall that:

a = length of the ladder = 3 units
b = distance from the bottom of the ladder to the bottom of the slide = 4 units
c = length of the slide

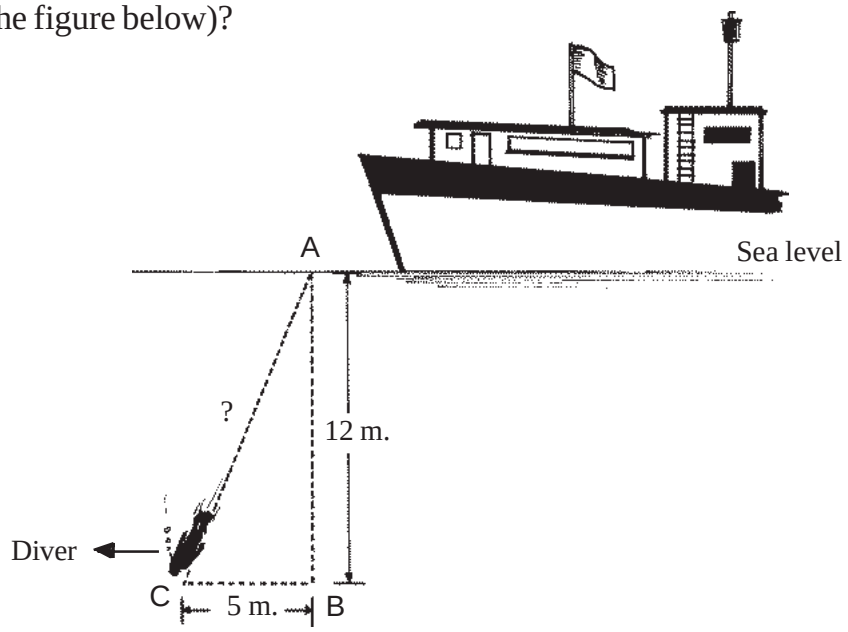
$$\begin{array}{lllll} c^2 & = & a^2 & + & b^2 \\ c^2 & = & 4^2 & + & 3^2 \\ c^2 & = & 16 & + & 9 \\ c^2 & = & 25 & & \end{array}$$

STEP 4 To get the final answer, we need to remove the exponent of the term on the right. We do this by getting the square roots of both terms on the right and left as in:

$$\sqrt{c^2} = \sqrt{25}$$
$$c = 5 \text{ units}$$

So, the lenght of the slide or the hypotenuse of the right triangle is 5 units long.

EXAMPLE 1 How far must a diver swim to be 12 meters below sea level (as shown in the figure below)?



STEP 1 Identify the hypotenuse and the legs of the triangle.

The distance that the diver must travel is the side opposite the right angle. This means that the said distance represents the hypotenuse of the triangle. Therefore c = distance that the diver must travel.

The two legs of the triangle are represented by the distance below sea level and the distance between the diver at Point C and Point B below sea level. Therefore, a = distance below sea level, and b = distance between the diver at Point C and Point B.

STEP 2 Use the formula derived from the Pythagorean theorem.

$$c^2 = a^2 + b^2$$

STEP 3 Substitute the given values to the variables in the formula and solve for the unknown.

Recall that:

a = distance below sea level = 12 meters
b = distance between the diver at Point C to Point B = 5 meters
c = distance that the diver must travel

$$c^2 = a^2 + b^2$$
$$c^2 = 12^2 + 5^2$$
$$c^2 = 144 + 25$$
$$c^2 = 169$$

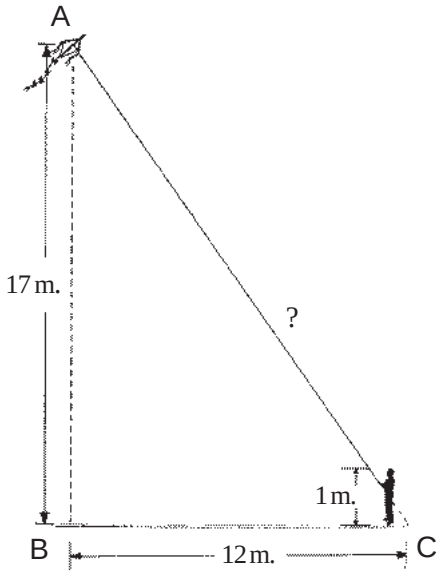
STEP 4 Get the final answer by:

$$\sqrt{c^2} = \sqrt{169}$$
$$c = 13 \text{ units}$$

The diver must therefore travel or the hypotenuse of the right triangle = 13 meters.

Let's Try This

EXAMPLE 2 A boy is flying a kite at a height of 17 meters from the ground. The boy is holding the string of the kite 12 meters away from the point directly below the kite. If the height of the boy is 1 meter, how long is the string of the kite?



STEP 1 Identify the hypotenuse and the legs of the triangle.

The length of the string of the kite to the boy is the side opposite the right angle or the hypotenuse of the triangle.

The two legs of the triangle are represented by the height of the kite from the ground minus the height of the boy and the distance of the boy from Point B. Therefore a = distance of the boy from Point B and b = height of the kite minus the height of the boy.

STEP 2 Use the formula derived from the Pythagorean theorem.

$$c^2 = a^2 + b^2$$

STEP 3 Substitute the given values to the variables in the formula and solve for the unknown.

Recall that:

a = distance of the boy from Point B: ____ m
b = height of the kite minus the height of the boy: ____ – ____ = ____ m
c = length of the string

If we substitute the values in the formula, we then have:

$$c^2 = a^2 + b^2$$
$$= \_\_\_\_\_$$
$$= \_\_\_\_\_$$
$$= \_\_\_\_\_$$

STEP 4 Get the final answer by:

$$\sqrt{c^2} = \sqrt{\quad}$$
$$c = \_\_\_\_\_$$

The length of the string is _____ m.

Compare your answers with mine.

a = 12 m

b = 17 – 1 = 16 m

By substituting the values to the formula, we have:

$$\begin{aligned} c^2 &= a^2 + b^2 \\ &= 12^2 + 16^2 \\ &= 144 + 256 \text{ m} \\ c^2 &= \sqrt{400} \end{aligned}$$

The final answer is:

$$\sqrt{c^2} = \sqrt{400}$$
$$c = 20 \text{ m}$$

Let's Remember

- The Pythagorean theorem states that: In a right triangle, the square of the hypotenuse is equal to the square of one leg plus the square of the other leg.
- If c = hypotenuse of a right triangle and a and b are its legs, then:

$$c^2 = a^2 + b^2$$

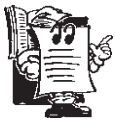
- In solving problems which involve right triangles, we follow the steps below.

STEP 1 Identify the hypotenuse and the legs of the triangle.

STEP 2 Use the formula derived from the Pythagorean theorem.

STEP 3 Substitute the given values to the variables in the formula and solve for the unknown.

STEP 4 Simplify to get the final answer.



Let's Sum Up

- Parallel lines are pairs of lines that will never meet no matter how long they are extended.
- Intersecting lines are pairs of lines that meet at a certain point called the point of intersection.
- Perpendicular lines are pairs of lines that form right angles at their points of intersection.
- An angle is formed by two lines that meet at a point called the vertex.
- Angles can either be acute, right or obtuse.
  - Acute angles—measure less than 90°
  - Right angles—measure exactly 90°
  - Obtuse angles—measure more than 90° but less than 180°
- The Pythagorean theorem states that: In a right triangle, the square of the hypotenuse is equal to the sum of the square of one leg and the square of the other leg.

Let's See What You Have Learned

Use the formula derived from the Pythagorean theorem to solve the following problems.

1. Alice, a landscape architect, designed a flowerbed for a very important client. The flowerbed will take the shape of a right triangle with legs equal to 12 ft. and 9 ft. She wants to place some decorative stones along the hypotenuse of the flowerbed 1 ft. apart. How many stones does she need?

2. Two cars start traveling perpendicularly away from each other from the same place. If one travels 6 km and the other 8 km, how far apart will they be from each other using their bumpers as points of reference?

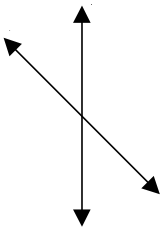
3. A pendulum travelled 30 cm away from a center line. The center line is 40 cm long. What is the distance between the pendulum and one end of the center line?

4. The foot of the ladder leaning against the wall is 5 ft away from the wall and its top is 12 ft. above the ground. What is the length of the ladder?

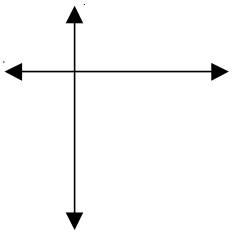
Compare your answers with those found in the *Answer Key* on page 39. If you got them all correctly, that's very good. It means you really understood our discussions. If not, read this lesson again and try to solve similar exercises.

What Have You Learned?

A. Tell whether each pair of lines are parallel, intersecting or perpendicular by writing your anwers in the blank space provided.

1. 

_____

2. 

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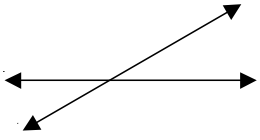
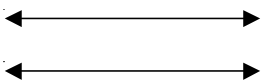
3. 

_____

4. 

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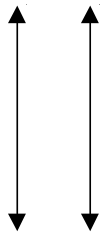
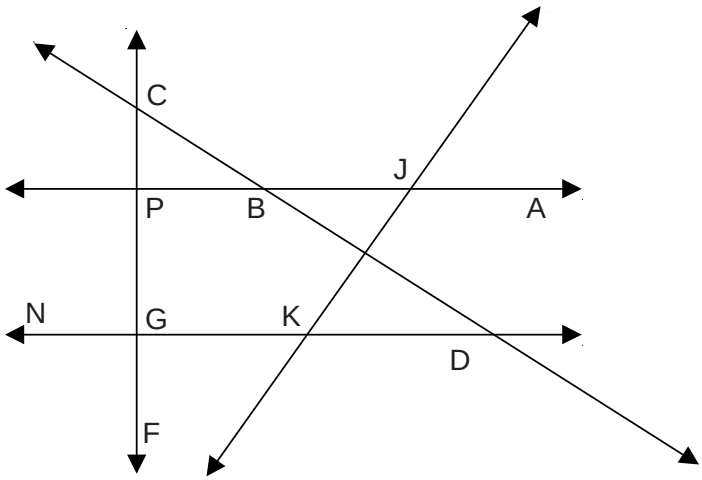
5. 

_____

B. Measure the angles listed below the given figure and determine whether it is acute, right or obtuse. Write your answers in the spaces provided.



Name of Angle	Measurement	Type
1. ∠ABC	_____	_____
2. ∠NGP	_____	_____
3. ∠PCD	_____	_____
4. ∠AJK	_____	_____
5. ∠NGF	_____	_____

C. Using your protractor, draw an angle given its measurement.

1. 75°

2. 80°

3. 100°

4. 36°

5. 45°

D. Use the Pythagorean theorem to solve the following problem.

1. Sally decided to jog from one corner of an open field diagonally to the opposite corner. The field is rectangular in shape; 60m wide by 80m long. How many meters did Sally cover?

2. A flagpole casts a shadow at about 8:00 in the morning 10m from its foot. If the flagpole is 7m high, what is the distance between the tip of the flagpole to the tip of its shadow?

3. During the town fiesta, bamboo poles are put up to hold the strings for the flaglets. If each bamboo pole is 5m high and the string is attached to a piece of bamboo dug in the ground 2m from the foot of the bamboo pole, how many meters of string are needed for each bamboo pole?

Compare your answers with those found in the *Answer Key* on pages 39–40. If your score falls between 18 and 20, congratulations. You did great! You really understood the topics discussed in this module.

However, if you scored between 13 and 17, just review the parts of the module which you did not understand very well; between 10 and 12, review the parts you did not understand and solve other exercises similar to those that were given in the module; and between 1 and 9, study the whole module again.

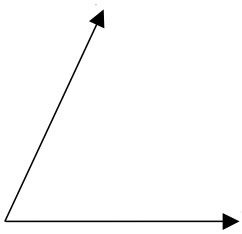
Answer Key

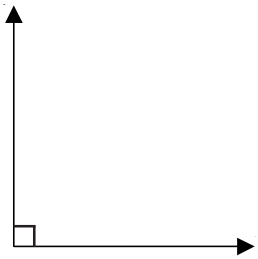
A. Let's See What You Already Know *(pages 1–3)*

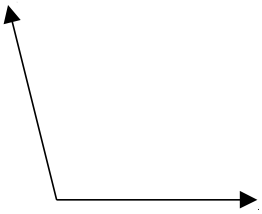
A. 1. parallel
2. intersecting
3. perpendicular
4. parallel
5. intersecting

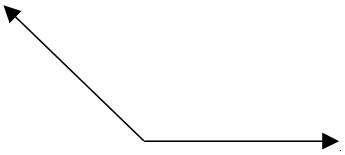
B. 1. 40° acute
2. 105° obtuse
3. 90° right
4. 40° acute
5. 180° straight

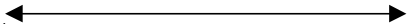
C.

1. 

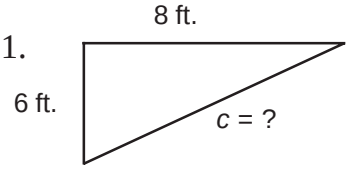
2. 

3. 

4. 

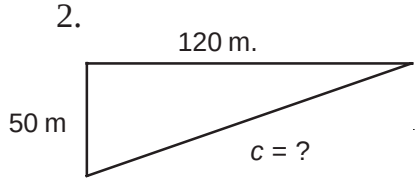
5. 

D.

1. 

$c^2 = a^2 + b^2$
$c^2 = 8^2 + 6^2$
$c^2 = 64 + 36$
$\sqrt{c^2} = \sqrt{100}$
$c = 10$ ft.

The ball travelled the three sides of a right triangle it formed, so the distance travelled is 8 ft + 6ft + 10 ft = 24ft in all.

2. 

$c^2 = a^2 + b^2$
$c^2 = 50^2 + 120^2$
$c^2 = 2500 + 14400$
$\sqrt{c^2} = \sqrt{16900}$
$c = 130$ m

Manny covered the distance of 130 m, the length of the diagonal crossing the swimming pool.

B. Lesson 1

Let's See What You Have Learned (pages 10–11)

A. CD and AB—perpendicular lines; AB and EF—intersecting lines; AB and GH—intersecting lines; EF and GH—parallel lines; CD and EF—intersecting lines; CD and GH—intersecting lines

B. 1. parallel
2. intersecting
3. perpendicular
4. intersecting
5. perpendicular

B. Lesson 2

Let's Try This (pages 16–17)

A. 1. 144°
2. 90°
3. 60°
4. 90°
5. 60°
6. 60°

B.

1.	90°	4.	90°	7.	40°
2.	30°	5.	120°	8.	30°
3.	125°	6.	210°	9.	30°

Let's See What You Have Learned (pages 18–19)

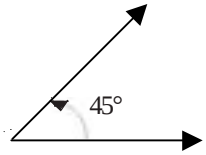
A. 1. a. $\angle$ABC or $\angle$CBA
b. B
c. BA, BC
d. 40°

2. a. ∠DEF or ∠FED
   b. E
   c. ED, EF
   d. 90°

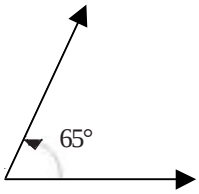
3. a. ∠RST or ∠TSR
   b. S
   c. SR, ST
   d. 135°

4. a. ∠WXY or ∠YXW
   b. X
   c. XW, XY
   d. 172°

B. 1.



2.



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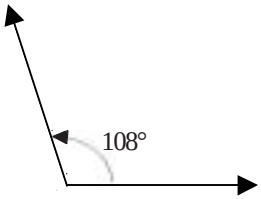
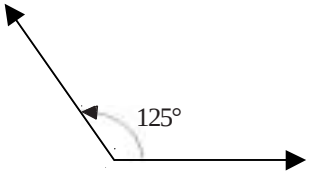
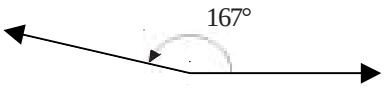


4.



5.



C. Lesson 3

Let's Try This (page 22)

A. 1. ∠QMO
   2. ∠MQP
   3. ∠NMQ
   4. ∠HIL

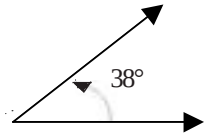
B. 1. ∠PJK
   2. ∠LPJ
   3. ∠ABC
   4. ∠XYZ

Let's See What You Have Learned (pages 24–25)

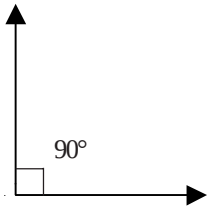
A.

1.	right	6.	obtuse
2.	acute	7.	acute
3.	obtuse	8.	acute
4.	right	9.	acute
5.	obtuse	10.	right

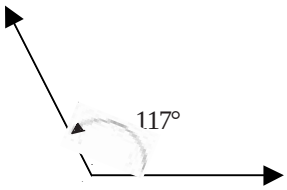
B. 1. acute



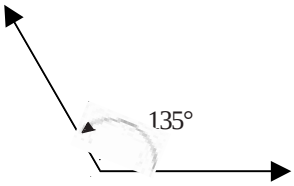
2. right



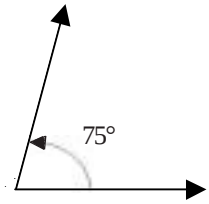
3. obtuse



4. obtuse

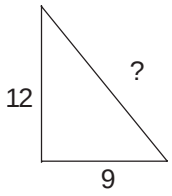


5. acute

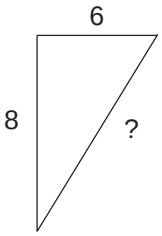


D. Lesson 4

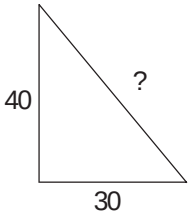
Let's See What You Have Learned (pages 31–32)

1. 

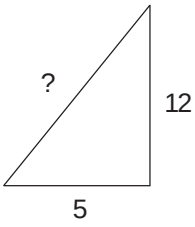
$c^2 = 12^2 + 9^2$
$c^2 = 144 + 81$
$\sqrt{c^2} = \sqrt{225}$
$c = 15$

2. 

$c^2 = 6^2 + 8^2$
$c^2 = 36 + 64$
$\sqrt{c^2} = \sqrt{100}$
$c = 10$ km

3. 

$c^2 = 40^2 + 30^2$
$c^2 = 1{,}600 + 900$
$\sqrt{c^2} = \sqrt{2{,}500}$
$c = 50$ cm

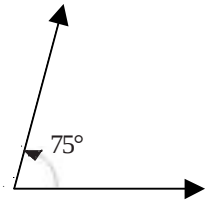
4. 

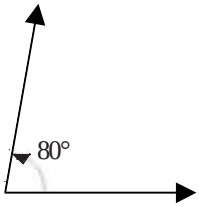
$c^2 = 5^2 + 12^2$
$c^2 = 25 + 144$
$\sqrt{c^2} = \sqrt{169}$
$c = 13$ ft.

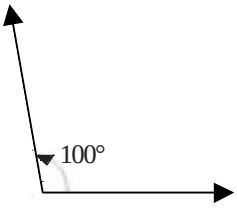
E. What Have You Learned? *(pages 32–34)*

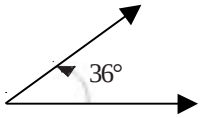
A. 1. intersecting
2. perpendicular
3. intersecting
4. parallel
5. parallel

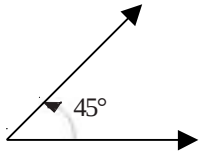
B. 1. 142°—obtuse
2. 90°—right
3. 58°—acute
4. 125°—obtuse
5. 90°—right

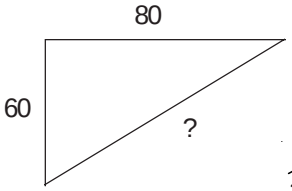
C. 1. 

2. 

3. 

4. 

5. 

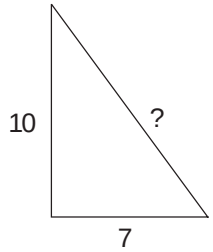
D. 1. 

$c^2 = 80^2 + 60^2$

$c^2 = 6{,}400 + 3{,}600$

$\sqrt{c^2} = \sqrt{10{,}000}$

$c = 100$ m

2. 

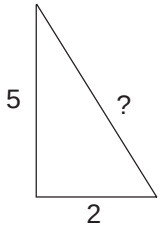
$c^2 = 7^2 + 10^2$

$c^2 = 49 + 100$

$c^2 = 149$

$\sqrt{c^2} = \sqrt{149}$

$c = 12.20$ m

3. 

$c^2 = 5^2 + 2^2$

$c^2 = 25 + 4$

$c^2 = 29$

$\sqrt{c^2} = \sqrt{29}$

$c = 5.38$ m

References

Sia, Lucy O., et al. *21st Century Mathematics, Second Year.* Quezon City: Phoenix Publishing House, Inc. Reprinted 2000.

Capitulo, F. M. *Algebra, a Simplified Approach.* Manila: National Bookstore, 1989.