Senior High School

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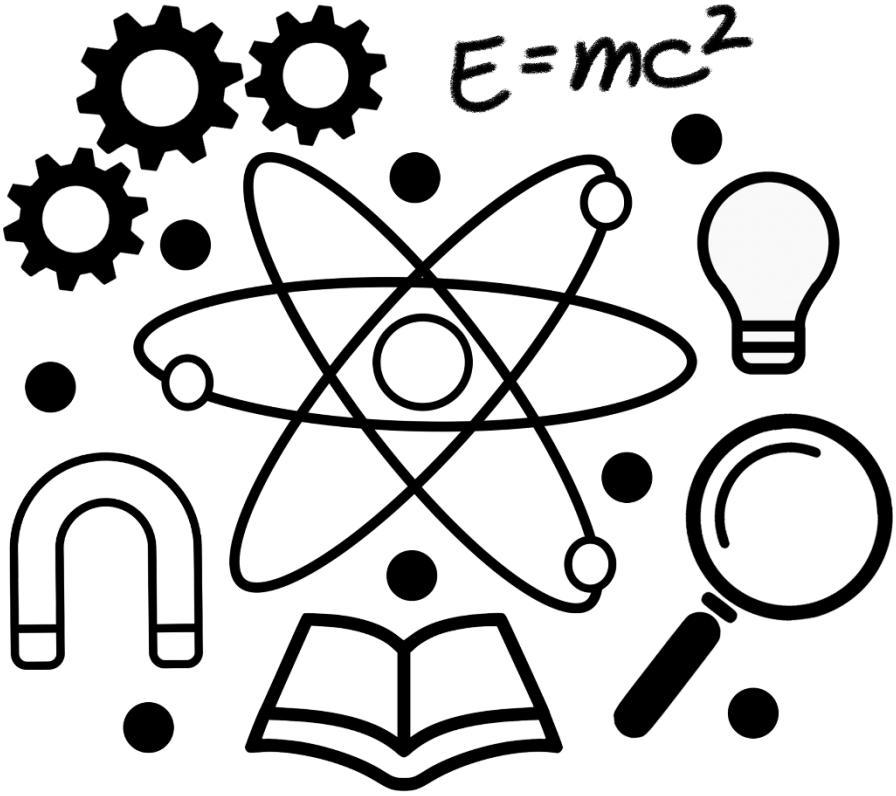
DEPARTMENT OF EDUCATION

General Physics 1

Quarter 1 - Module 2

Vectors and Vector Addition



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Quarter 1 - Module 2: VECTORS AND VECTOR ADDITION
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We value your feedback and recommendation.

Department of Education ● Republic of the Philippines

Table of Contents

Module 2
Vectors and Vector Addition

What This Module is About

This module demonstrates your understanding and skill in solving measurement problems involving vectors and vector addition. This will help you explore the basic concepts on topics that will help you solve vector problems in the succeeding topics in Physics.

This module has two (2) lessons:

- **Lesson 1- Vector and Scalar Quantities**
- **Lesson 2- Components of Vectors**

What I Need to Know

After going through this module, you are expected to:

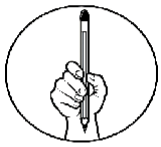
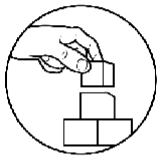
1. Differentiate vector and scalar quantities (**STEM_GP12V-Ia-8**);
2. Perform addition of vectors (**STEM_GP12V-Ia-9**);
3. Rewrite a vector in component form (**STEM_GP12V-Ia-10)**

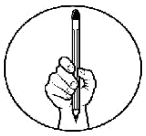
How to Learn from this Module

To achieve the objectives cited above, you are to do the following:

- Take your time reading the lessons carefully.
- Follow the directions and/or instructions in the activities and exercises diligently.
- Answer all the given tests and exercises.

Icons of this Module

	What I Need to Know	This part contains learning objectives that are set for you to learn as you go along the module.
	What I know	This is an assessment as to your level of knowledge to the subject matter at hand, meant specifically to gauge prior related knowledge
	What's In	This part connects previous lesson with that of the current one.
	What's New	An introduction of the new lesson through various activities, before it will be presented to you
	What is It	These are discussions of the activities as a way to deepen your discovery and understanding of the concept.
	What's More	These are follow-up activities that are intended for you to practice further in order to master the competencies.
	What I Have Learned	Activities designed to process what you have learned from the lesson
	What I Can Do	These are tasks that are designed to showcase your skills and knowledge gained, and applied into real-life concerns and situations.



What I Know

Multiple Choice. Select the letter of the best answer from among the given choices. Write your answer in your answer sheet**.**

1. A quantity that have magnitude and direction.
   a. vector b. scalar c. displacement d. velocity
2. A quantity that can be completely described by a single value called magnitude.
   a. vector b. magnitude c. scalar d. velocity
3. All statements are true about vectors, *except*
   a. vectors are quantities with specified magnitude and direction.
   b. vectors are quantities that have magnitude only.
   c. vectors of two or more can be added by component method.
   d. vectors can be added and take the common direction.
4. The following statements are examples of scalars *except*
   a. an ant crawling on top of the table 15 cm.
   b. the troop of soldier walking 20 km to northward direction.
   c. a bunch of flowers weighing 5 kilograms.
   d. a car running fast at 50 km/h.
5. Which of the following is an example of vector quantity?
   a. 25 km/h b. jumping 20 seconds c. 50 grams d. 5cm, East
6. What is the net displacement obtained from two or more vectors?
   a. scalar b. resultant c. sum d. force
7. The following are methods to determine the vector sum or resultant of two or more vectors, *except*
   a. parallelogram. b. tail-to tip. c. component. d. symmetrical.
8. Which of the following statements are true in determining the resultant of two or more vectors acting together in the same direction?
   a. add the given vectors and take the common direction.
   b. subtract the given vectors and take the common direction.
   c. get the product of the given vectors and take the two direction.
   d. add the given vectors and take the two direction.
9. To find the resultant of two vectors with opposite direction, you need to
   a. get the difference and take the direction of the vector with the greater value.
   b. get the sum and take the direction of the vector with the greater value.
   c. get the product and take the direction of the vector with the greater value.
   d. get the product and take the direction of the vector with the smaller value.
10. What is the vector sum of 3 units, East and 5 units, East?
    a. 5 units, East b. 6 units, East c. 7 units East d. 8 units, East

11. Which of the following is true about graphical method in calculating resultant vector?
    a. the vectors to be added are drawn to a convenient scale.
    b. the vectors to be subtracted are drawn according to a convenient scale.
    c. the product of vectors are drawn according to a convenient scale.
    d. the vectors to be subtracted are directly drawn.

12. The formula used in obtaining the magnitude of the resultant in component method.
    a. Pythagorean Theorem b. polygon method c. arc tangent d. trigonometric

13. What is the difference of the two vectors 8 units, East and 5 units, West?
    a. 3 units, West b. 3 units, East c. 4 units, West d. 4 units, East

14. What is the vector sum of vectors $\vec{\mathbf{A}}$ = 10 cm, east and $\vec{\mathbf{B}}$ = 5 cm, East?
    a. 5 cm, East b. 5 cm, West c. 15cm, East d.15cm, West

15. What are the components of vector $\vec{\mathbf{A}}$ = 10 cm, 30º counterclockwise from (+) x-axis?
    a. A_x = 5.00 cm; A_y = 8.66 cm c. A_x = 5.00 cm; A_y = 5.00 cm
    b. A_x = 8.66 cm; A_y = 5.00 cm d. A_x = 8.66 cm; A_y = 8.66 cm

Lesson 1

Vector and Scalar Quantities

What I Need to Know

Physical quantities are all around us. These can be the number of hours we spend in school or in our work, the speed and direction of the jeepney that we ride on everyday, and the amount of food that we buy. How can we express accurately these physical quantities involved?

Physical quantities are divided into two groups, the first group consists of length, area, volume, mass, speed and time while the second group consists of displacement, velocity, acceleration, and force. Which group do you think gives a clearer picture of quantities? When we describe the speed of the wind, we say its speed is 69 kph; but when we talk about its velocity, we express it as 69 kph, Northwest of Manila. Could you find any difference between these two quantities? Which gives an accurate and precise description of the motion of the wind? Why?

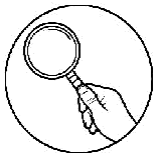
A vector is a quantity that includes information about the size, strength and direction of the motion of an object In this module, you should be able to compare and contrast vector and scalar quantities, represent vectors graphically and perform addition of vectors.

What's New

Activity 1: Do you Know Me!

Directions: Categorize if the given quantity is scalar or vector. Give a reason for your answer.

1. an ant crawling 15 cm on top of the table
2. the troop of soldier walking 20 km to northward direction
3. a bunch of flowers weighing 5 kilogram
4. a car running fast at 50 km/h, east
5. a boy jumping for 20 minutes
6. iced tea contains 90 calories



What Is It

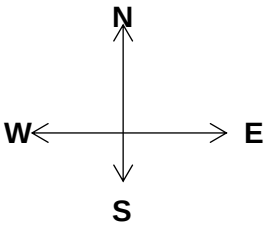
There are physical quantities in physics which are represented by a single number and unit. When we say that the mass of an umbrella is 3 kilograms, such information gives the magnitude and unit of mass. This quantity is called **scalar**. Mass therefore is an example of scalar quantity.

Other quantities, however, cannot be completely specified by a magnitude and unit alone. To describe the velocity of a car by saying that it is 50 kph is incomplete. There is still a need to describe the direction of the motion of the car. This type of quantity which contains both magnitude and direction is called **vector**.

In the Activity 1, numbers 1, 3, 5 and 6 are scalar quantity, because, there is no direction indicated, while numbers 2 and 4 are vector quantity because it contains both magnitude and direction.

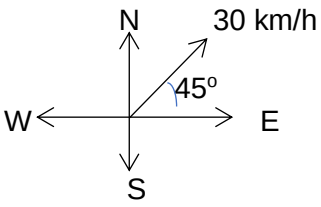
A **scalar** is a quantity that can be completely described by a single value called magnitude. Magnitude means the size or amount and always includes units of measurement. Sometimes a single number does not include enough information to describe a measurement. Giving complete information would mean including instructions to go to two kilometers north, turn right, then go to two kilometers east. The information "Two kilometers north" is an example of a **vector.** (p110 Tom Hsu, Ph.D.)

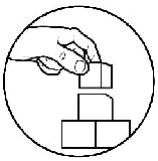
The direction of some vectors is given in terms used by weather forecaster, travelers, map readers and cartographers. The basic reference for angles is the following



N	North	**NE**	Northeast
S	South	**NW**	Northwest
E	East	**SW**	Southwest
W	West	**SE**	Southeast

For example: we draw a vector for a wind blowing at 30km/h in the northeast direction 45^0.





What's More

Since vectors are quantities with specified magnitudes and direction, the most appropriate representation of vectors is the arrow (⟶). Why? This is because the length of the arrow with respect to some chosen scale indicates the magnitude while the arrowhead represents the direction of the vector. A vector is usually represented by a letter with an arrow above it ($\vec{A}$) .The same letter without an arrow indicates the magnitude.

ACTIVITY 2*:* Graphical Representation of Vectors

Objective: To draw the vector that represents your path while walking in your room.

You will need:

ruler protractor pencil meterstick

Procedure

1. Walk around the four corners of your room. Record the direction of your paths.
2. Measure the lengths and the widths of the room in meters.
3. Record the measured lengths and widths with the specified direction.
4. Represent the quantities graphically by using a convenient scale.

Questions:

1. What is the length? To what direction?
2. What is the width of your room? To what direction?
3. Draw your results graphically using a specified scale.

What Is It

SCALAR ADDITION

Adding scalar quantities is similar to ordinary addition. We add together the quantities express in the same units. Look at the example.

Example:

If the mass (m1)=25 g and another mass (m2)=50 g their sum is m=m1 + m2

Thus, m= 25 g + 50 g

m= 75 g

However, you must be careful about how the given magnitude are expressed. If there are two different units, you need to convert the unit before adding.

Example:

If mass (m_1)= 25 g and another mass (m_2)= 5 kg. What is the total mass of an object?

Thus, convert g to kg so that,

$$25\text{ g} \times \frac{1\ kg}{1000\ g} = 0.025\text{ kg}$$

Therefore, m = m_1 + m_2
= 0.025 kg + 5 kg
= 5.025 kg (total mass of an object)

VECTOR ADDITION

Now that we know how to represent vectors graphically, we are now ready to add two or more vectors. A vector sum is also termed as resultant, represented by $\vec{\mathbf{R}}$.

To determine the resultant, $\vec{\mathbf{R}}$, of two or more vectors acting together in the same direction, add the given vectors and take the common direction. On the other hand, to find the resultant of two vectors with opposite direction, get the *difference* and take the direction of the vector with the greater value.

For example, we are asked to determine the vector sum of the following vectors:

1. $\vec{A}$ = 2 units, East
   $\vec{\mathbf{B}}$ = 4 units, East

2. $\vec{A}$ = 2 units, East
   $\vec{B}$ = 4 units, West

Solutions:

2 units 4 units →

($\vec{R}$) Resultant →

6 units, East

2 units → ← 4 units

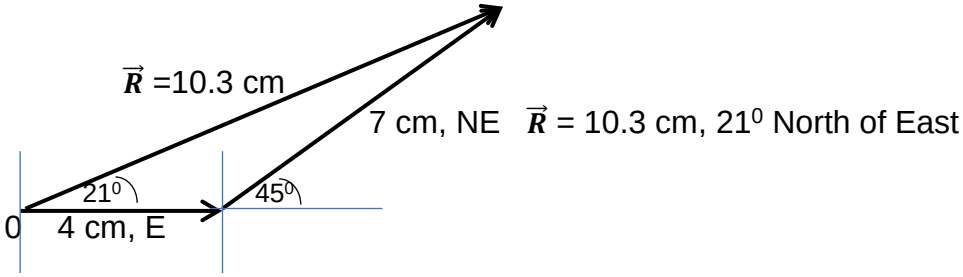
($\vec{R}$) Resultant

← 2 units, West

To add two or more vectors acting in different directions, we shall use the **tail-to tip** method, that is, we draw the tail of the second vector at the head or tip of the first vector. The resultant, $\vec{R}$ **,** is determined by connecting the tail of the first vector to the tip of the second vector. The direction of $\vec{R}$ shall be determined using a protractor.

Take a look at the example:

Carlito was observing an ant crawled along a tabletop. With a piece of chalk, he followed its path. He determines the ant's displacements by using a ruler and protractor. The displacements were as follows: 4cm east and change its direction 7cm 45^0 north of east.



The ant went 4 cm east and change direction 7cm, 45^0 Northeast.

What I Have Learned

ACTIVITY 3.1 Answer as directed**:**

Differentiate vector from scalar quantity.

ACTIVITY 3.2 Graphing of Vectors

Represent the following vectors graphically:

A: 4 units, 45^o Northeast

B: 4 units, 30^o South of West

C: 40 units, 45^o counterclockwise from the (+) x-axis.

D: 50 units, 30^o clockwise from the (-) y-axis

ACTIVITY 3.3 Scalar Addition

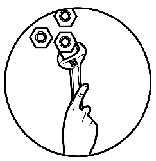
In separate paper, solve the following problem with complete solution.

1. If area A_1=20 cm^2 and area A_2=36 cm^2, the total is $A= A_1 + A_2$
2. If the mass (m_1) = 15 kg and the second mass (m_2) = 250 g. Find the total mass $m= m_1 + m_2$. Convert kilograms to grams.

ACTIVITY 3.4. Vector Addition

In separate paper. Solve the given vectors and find the resultant**,** $\vec{R}$, with exact direction.

1. $\vec{\mathbf{A}}$ = 7 units, East
   $\vec{\mathbf{B}}$= 3 units, East
2. $\vec{\mathbf{A}}$= 8 units, East
   $\vec{\mathbf{B}}$= 4 units, West
3. $\vec{\mathbf{A}}$= 2 units, East
   $\vec{\mathbf{B}}$= 8 units, West
4. $\vec{\mathbf{A}}$= 5 units, 45^o North of East
   $\vec{\mathrm{B}}$= 4 units, due South



What I Can Do

ACTIVITY 4*. Anything that Moves!*

Observe any object that moves in your immediate surroundings and make a vector representation of its movement. Show at least two movements of a certain object and then find its resultant**.**

Your teacher will give you the rubric for rating your output.

Lesson 2

Components of Vectors

What's In

In the previous lesson, you added vectors using diagram and with the use of ruler and protractor, you determine the resultant, $\vec{R}$. This method results may give a limited accuracy of outcome. A more accurate but general method of adding vectors is getting first its component. When you draw a vector on a graph, distance along the x or y- axes represents the strength of the vector in the x- and y- directions. A vector at an angle has the same effect as two smaller vectors aligned with the x- and y- direction.

What I Need to Know

At the end of this lesson, you should be able to:

1. Rewrite the vector in component form.
2. Determine the resultant vector using component method.

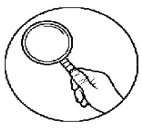
What's New

Activity 1. Draw Me!

Using a cartesian coordinate system, draw separately the following vectors with its tail at origin, O.

1. $\vec{A}$= 10 units, 30^o counterclockwise from (+) x-axis

2. $\vec{B}$= 25 units, 45^o clockwise from (-) x-axis



What Is It

Components of Vectors

The component of a given vector makeup the set of vectors whose vector sum is the given vector. By definition, the components of vector $\vec{A}$ is $\overrightarrow{A_x}$ + $\overrightarrow{A_y}$, that is, $\overrightarrow{A_x}$ is the component along the x-axis, and $\overrightarrow{A_y}$ is the component along the y-axis. Similarly with vector $\vec{B}$, it has $\overrightarrow{B_x}$ and $\overrightarrow{B_y}$ components.

In calculating the magnitude of the components of the vector, we need the magnitude and the direction of the vector. Drawing it on a cartesian plane, an angle theta (θ) is measured from the positive(+) x-axis, then apply the definition of trigonometric function (SOHCAHTOA).

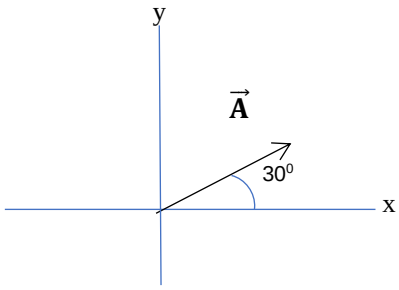
$\frac{Ax}{A} = \cos\theta$ and $\frac{Ay}{A} = sin\ \theta$

$A_x = A\cos\theta$ and $A_y = A\sin\theta$

Finding the components of the vectors in Lesson 2 Activity 1, we have:

1. $\vec{\mathbf{A}}$= 10 units, 30º counterclockwise from (+) x-axis
   Solution:

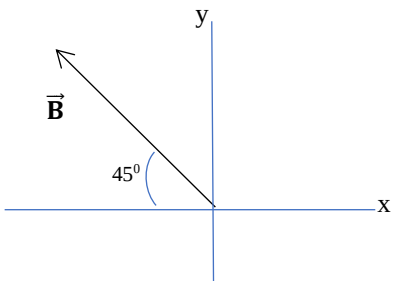
$\overrightarrow{A_x}$ = A cos 30º
= 10 units (0.866)
= 8.66 units



$\overrightarrow{A_y}$ = A sin 30º
= 10 units (0.5)
= 5 units

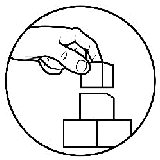
2. $\vec{\mathbf{B}}$ = 25 units, 45º clockwise from (-) x-axis

Solution:



$\overrightarrow{\mathbf{B_x}}$ = -B cos 45º
= -25 units (0.707)
= -17.68 units

$\overrightarrow{\mathbf{B_y}}$ = B sin 45º
= 25 units (0.707)
= +17.68 units



What's More

Adding Vectors by Component Method

The following procedures are applied in adding several vectors in terms of their components:

1. Resolve the initial vectors into their components in the x and y directions.
2. Add the component in the x direction to give $\overrightarrow{\mathbf{R_x}}$ and add the components in the y direction to give $\overrightarrow{\mathbf{R_y}}$. The following formulas help explain the second procedure:

$\overrightarrow{\mathbf{R_x}}$ ⟶ x-component of $\vec{R}$
$\overrightarrow{\mathbf{R_x}}$ = $\overrightarrow{A_x}$ + $\overrightarrow{\mathbf{B_x}}$ + $\overrightarrow{\mathbf{C_x}}$ + ……
= sum of the x-components

$\overrightarrow{\mathbf{R_y}}$ $\longrightarrow$ y-component of $\vec{R}$

$\overrightarrow{\mathbf{R_y}} = \overrightarrow{A_y} + \overrightarrow{\mathbf{B_y}} + \overrightarrow{\mathbf{C_y}} + \ldots\ldots$

= sum of the y-components

3. Find the magnitude and direction of the resultant $\vec{R}$ from the components $\overrightarrow{\mathbf{R_x}}$ and $\overrightarrow{\mathbf{R_y}}$. Using Pythagorean Theorem,

$$R = \sqrt{a^2 + b^2} = \sqrt{\mathbf{R_x} + \mathbf{R_y}}$$

The direction of R can be found the values of the component by trigonometry. This is given by:

$$\tan\theta = \frac{R_y}{R_x} \qquad \text{or} \qquad \theta = \arctan\frac{R_y}{R_x}$$

The angle θ may be situated in any of the four quadrants depending on the directions of $\overrightarrow{\mathbf{R_x}}$ and $\overrightarrow{\mathbf{R_y}}$. There are four possible cases and those are shown below;

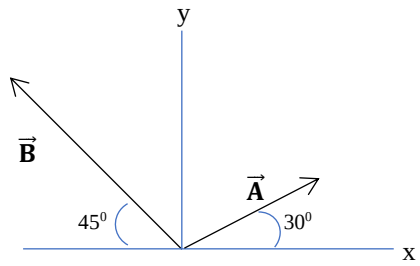
Rx	Ry	Position of $\vec{R}$	How θ is Measured
+	+	1st quadrant	counterclockwice from (+) x-axis
-	+	2nd quadrant	clockwise from (-) x-axis
-	-	3rd quadrant	counterclockwise from (-) x-axis
+	-	4th quadrant	clockwise from (+) x-axis

Example:

Given: $\vec{\mathbf{A}}$ = 10 units, 30^0 counterclockwise from (+) x-axis

$\vec{\mathbf{B}}$ = 25 units, 45^0 clockwise from (-) x- axis

Solution:



The figure shows $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ relative to the rectangular coordinate system

The components of $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are already solved in the previous page, thus a summary is given below:

Summary of the components of $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$, the following data are given

x-component	**y-component**
$\overrightarrow{A_x}$ = 8.66 units	$\overrightarrow{A_y}$ = 5 units
$\overrightarrow{B_x}$ = -17.68 units	$\overrightarrow{B_y}$ = 17.68 units

Therefore, to determine $\overrightarrow{R_x}$ and $\overrightarrow{R_y}$, we have

$\overrightarrow{R_x} = \overrightarrow{A_x} + \overrightarrow{B_x}$
= 8.66 units + (-17.68 units)
= - 9.02 units
The negative sign indicates that $\overrightarrow{R_x}$ is directed to the left

$\overrightarrow{R_y} = \overrightarrow{A_y} + \overrightarrow{B_y}$
= 5 units + 17.68 units
= +22.68 units
The positive sign indicates that $\overrightarrow{R_y}$ is directed upward

The magnitude of the resultant is obtained by using the following formula

$R = \sqrt{(R_x)^2 + (R_y)^2}$
$= \sqrt{(-9.02\ units)^2 + (22.68\ units)^2}$
$= \sqrt{81.36\ units \quad + 514\ units}$
$= \sqrt{595.74\ units}$
R = 24.41 units

The direction of the resultant is evaluated using the following formula

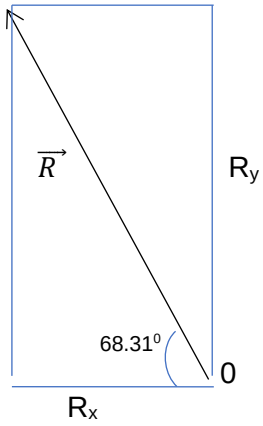
$$\tan \theta = \frac{\mathbf{R_x}}{\mathbf{R_y}}$$

$$\theta = \arctan \frac{\mathbf{R_x}}{\mathbf{R_y}}$$

$$\theta = \arctan \frac{22.68 \text{ units}}{-9.02 \text{ units}}$$

= arctan 2.51

$\theta = 68.31^0$



$\overrightarrow{\mathbf{R}}$ = 24.41 units, 68.31^0 clockwise from the (-) x-axis

Activity 2: Let's Practice!

Illustrate and determine the Resultant, $\overrightarrow{\mathbf{R}}$, of two vectors using the component method. Use separate sheet of paper and scientific calculator.

Given:

$\vec{\mathbf{A}}$ = 15 m, 45° counterclockwise from (+) x-axis

$\vec{\mathbf{B}}$ = 30 m, 30° clockwise from (-) x- axis

What I Have Learned

Activity 3: Your Turn!

A. Explain shortly the components of a vector.

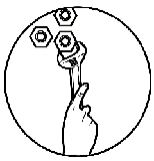
B. Rewrite the following vectors in is component form.

1. $\vec{C}$ = 6 cm, North
2. $\vec{\mathbf{A}}$ = 7 km, 30º East of North
3. $\vec{\mathbf{E}}$ = 10 km, 45º Northwest

C. Find the resultant R of the given vector below using component method.

$\vec{\mathbf{G}}$ = 50 mm, 30º North of West

$\vec{\mathbf{H}}$ = 55 mm, 45º Southwest



What I Can Do

Activity 4: Let's Test your Understanding!

(Adapted from Young & Freedman University Physics exercise page 23.)

How far are you from your starting point if you first travelled 4 km due West, then turn 4 km due South and turn 2 km due East? What is the direction from where you started to where you ended up? Illustrate your path in a clean sheet of paper.

Assessment (Posttest)

Multiple Choice. Select the letter of the best answer from among the given choices.

1. Which of the following statements is true in determining the resultant of two or more vectors acting together in the same direction?
   a. Add the given vectors and take the common direction.
   b. Subtract the given vectors and take the common direction.
   c. Get the product of the given vectors and take the two directions.
   d. Add the given vectors and take the two directions.

2. The following are true about vectors, *except*
   a. vectors are quantities with specified magnitude and direction.
   b. vectors are quantities that have magnitude only.
   c. vectors of two or more can be add by component method.
   d. vectors can be added and take the common direction.

3. A quantity that can be completely described by a single value called magnitude.
   a. vector b. magnitude c. scalar d. velocity

4. The following are examples of scalars, *except*
   a. an ant crawling on top of the table 15 cm.
   b. the troop of soldier walking 20 km to northward direction.
   c. a bunch of flowers weighing 5 kilograms.
   d. a car running fast at 50 km/h.

5. A quantity that has magnitude and direction.
   a. vector b. scalar c. displacement d. velocity

6. What is the vector sum of 3 units, East and 5 units, East?
   a. 5 units, East b. 6 units, East c. 7 units, East d. 8 units, East

7. To find the resultant of two vectors with opposite direction, you need to;
   a. get the difference and take the direction of the vector with the greater value.
   b. get the sum and take the direction of the vector with the greater value.
   c. get the product and take the direction of the vector with the greater value.
   d. get the product and take the direction of the vector with the smaller value.

8. These methods are used to determine the vector sum or resultant of two or more vectors, except
   a. parallelogram b. polygon c. component d. symmetrical

9. Which of the following is true about graphical method in calculating resultant vector?
   a. The vectors to be added are drawn according to a convenient scale.
   b. the vectors to be subtracted are drawn according to a convenient scale.
   c. the products of vectors are drawn according to a convenient scale.
   d. the vectors to be subtracted are directly drawn.

10. The formula used in obtaining the magnitude of the resultant in component method.
   a. Pythagorean Theorem b. polygon method c. arc tangent d. Trigonometric

11. Which of the following is an example of vector quantity?

a. 25 km/h b. jumping 20 seconds c. 50 grams d. 5 cm, East

12. What is the resultant of two vectors 8 units, east and 5 units, West?

a. 3 units, West b. 3 units, East c. 4 units, West d. 4 units, East

13. What is the vector sum of vectors $\vec{\mathbf{A}}$ = 10cm, east and $\vec{\mathbf{B}}$ = 5cm, east?

a. 5 cm, East b. 5 cm, West c. 15 cm, East d.15 cm, West

14. The net displacement obtained from two or more vectors.

a. scalar b. resultant c. sum d. force

15. What are component of vector $\vec{\mathbf{A}}$ = 10 cm, 30º counterclockwise from (+) x-axis?

a. A_x = 5 cm; A_y = 8.66 cm
b. A_x = 8.66 cm; A_y = 5 cm
c. A_x = 5 cm; A_y = 5 cm
d. A_x = 8.66 cm; A_y = 8.66 cm

Pretest

1 .A
2. C
3. B
4. B
5. D
6. B
7. D
8. A
9. A
10. D
11.A
12. A
13.B
14. C
15. B

Posttest

1 .A
2. B
3. C
4. B
5. A
6. D
7. A
8. D
9. A
10. A
11.D
12. B
13.C
14. B
15. B

Lesson 2

Activity 2

X-Components	y-components
Ax = 10.61 m	Ay = 10.61 m
Bx = -25.98 m	By = 15.00 m
Rx = -15.37 m	Ry = 25.61m

R = 29.87 m ; ϴ = 59.03º measured clockwise from -x-axis

Activity 3

A. Component of vector is the set of vectors whose vector sum is the given vector.

B. 1. Cx = 0; Cy = 6 cm
 2. Ax = 1.078 km; Ay = 6.91 km
 3. Ex = 5.25 km; Ey = 8.51 km

C.

Lesson 1 ACTIVITY 1
1. Scalar – magnitude only
2. Vector- with magnitude and direction
3. Scalar – magnitude only
4. Vector- with magnitude and direction
5. Scalar – magnitude only
6. Scalar – magnitude only

Activity 3.3
1. 56 cm^2
2. 15.26 kg or 15,250 g

Activity 3.4
1. 10 units, East
2. 4 units, East
3. 6 units, West
4. 4 units due East

Key Answer

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