Learning Goal: I will be able to describe what a vector is and identify the direction and magnitude of various vectors.

Minds On: NSEW / NEWS / SWEN

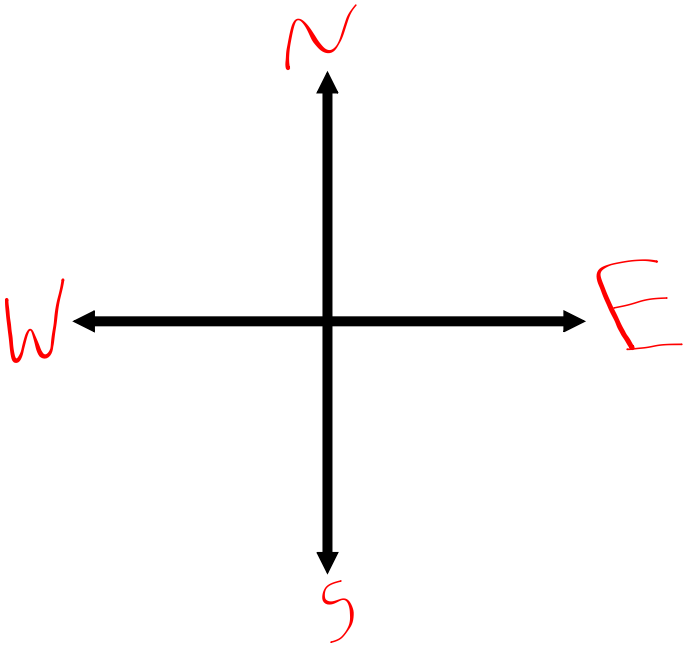
Action: Intro. to Vectors

Consolidation: True or False?

Minds On

NSEW / NEWS / SWEN ...?

What direction are we going?



Action

Note Part I

6.1 An Introduction to Vectors

A scalar is a quantity whose magnitude (or size) can be completely specified by just one number. Examples of scalars include:

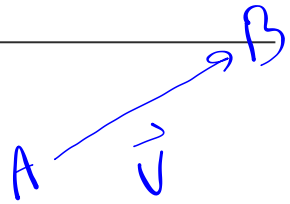
speed, altitude, distance, height,

Some quantities require both a magnitude and a direction for a complete description and are called vectors. Examples of quantities that would need to be described as vectors include:

velocity, displacement, acceleration

We can use a directed line segment to represent a vector. The length of the line segment gives us the magnitude, and the arrowhead gives us the direction.

Notation:



$\overrightarrow{AB}$ represents a vector running from A to B, with its tail at A and head at B.

We can also use a lower case letter to represent the vector. ie: $\vec{v}$

$|\overrightarrow{AB}|$ represents the magnitude of a vector and is always non-negative.

Why do we care about vectors at all?

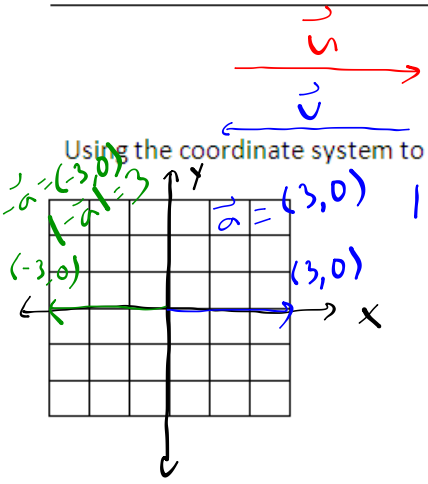
Resultnt position and velocity

Action

Note Part II

Definition of a Vector: A vector is a mathematical quantity having both magnitude and direction.

Opposite Vectors: Two vectors that are opposites have the same magnitude but point in opposite directions.



Using the coordinate system to represent vectors:

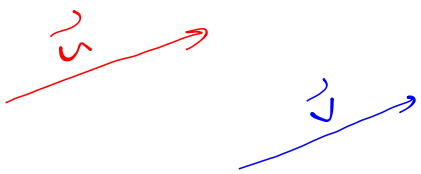
Action

Note Part III

Equal Vectors: Two vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are equal (or equivalent) if and only if:

1. $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are parallel to each other, and the direction from A to B is the same as the direction from C to D.

2. The magnitude of $\overrightarrow{AB}$ equals the magnitude of $\overrightarrow{CD}$, i.e., $|\overrightarrow{AB}| = |\overrightarrow{CD}|$



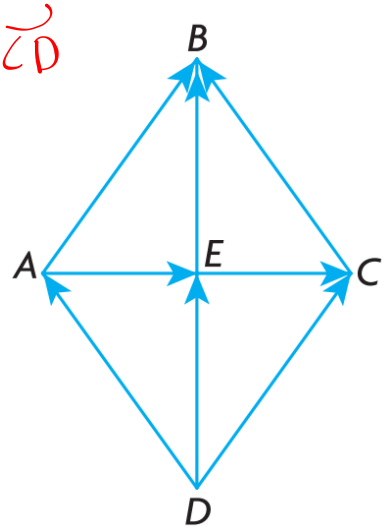
Action

Example

Example: Rhombus ABCD is drawn and its two diagonals AC and BD are drawn as shown below. Name the vectors equal to each of the following:

a) $\overrightarrow{AB} = \overrightarrow{DC}$ b) $\overrightarrow{DA} = \overrightarrow{CB}$ c) $\overrightarrow{EB} = \overrightarrow{DE}$ d) $\overrightarrow{AE} = \overrightarrow{EC}$

$-\overrightarrow{BA} = -\overrightarrow{CD}$



Consolidation

True or False?

1. If two vectors have the same magnitude, they are equal. F

2. If two vectors are equal, they have the same magnitude. T

3. If two vectors have the same direction, they are equal. F

4. If two vectors are equal, they have the same direction. T

5. If two vectors have the same magnitude and direction, they are equal. T

6. If two vectors are opposite, they have the same magnitude. T

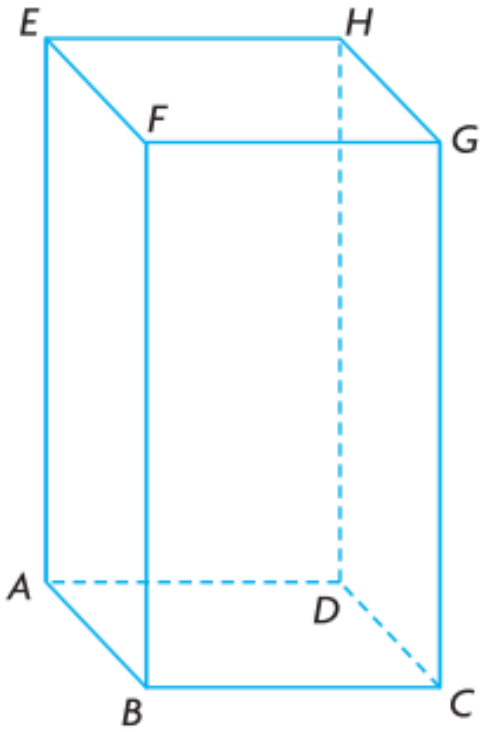
7. If two vectors are opposite, they have different directions. T

8. If two vectors are parallel, they are either equal or opposite. F

9. If two vectors have the same magnitude, they are either equal or opposite. F

Consolidation

True or False?



$\overrightarrow{AB} = \overrightarrow{DC}$ ✓

$|\overrightarrow{EF}| = |\overrightarrow{HG}|$ ✓

$\overrightarrow{EB} = \overrightarrow{HC}$ ✓

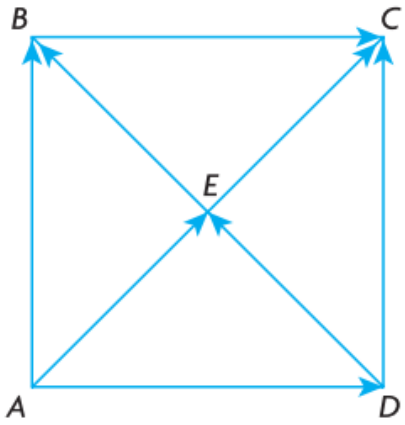
$\overrightarrow{EC} = \overrightarrow{FD}$ ✗

$\overrightarrow{EB} = -\overrightarrow{CH}$

Consolidation

Equals, Opposites, ...

ABCD is a vector square

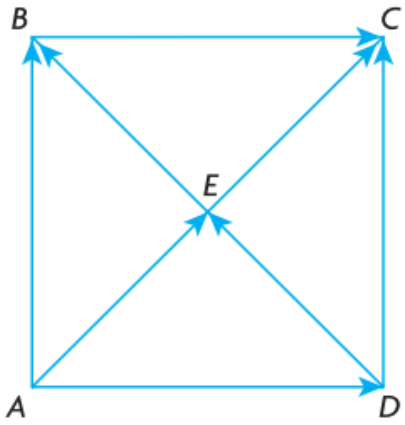


State four pairs of equivalent vectors

Consolidation

Equals, Opposites, ...

ABCD is a vector square

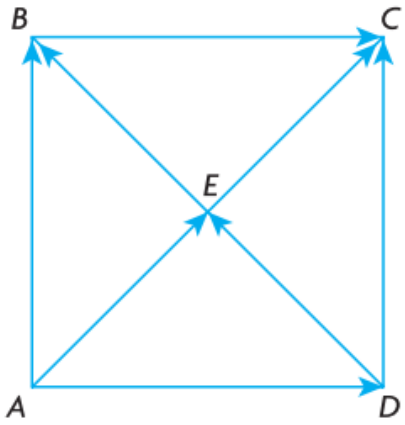


State four pairs of opposite vectors

Consolidation

Equals, Opposites, ...

ABCD is a vector square



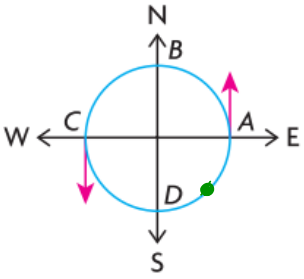
State two pairs of vectors with equal magnitudes, but whose directions are perpendicular to each other.

Consolidation

Pg. 281 #10

$t \times s = \frac{d}{t} \times t$ $t = \frac{d}{s}$

A



10. James is running around a circular track with a circumference of 1 km at a constant speed of 15 km/h. His velocity vector is represented by a vector tangent to the circle. Velocity vectors are drawn at points A and C as shown. As James changes his position on the track, his velocity vector changes.

a. Explain why James's velocity can be represented by a vector tangent to the circle.

b. What does the length of the vector represent?

c. As he completes a lap running at a constant speed, explain why James's velocity is different at every point on the circle.

d. Determine the point on the circle where James is heading due south.

e. In running his first lap, there is a point at which James is travelling in a northeasterly direction. If he starts at point A how long would it have taken him to get to this point?

f. At the point he has travelled $\frac{3}{8}$ of a lap, in what direction would James be heading? Assume he starts at point A.