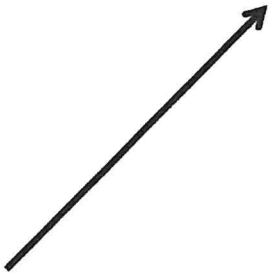
PHYSICS 11

MATH FOR PHYSICS III.

VECTOR = an oriented ray
= a physical quantity that has a magnitude AND direction

Vector:



How can we express that a given quantity is a vector quantity?

- Use a scalar notation and add information about direction:

Examples:

- Use vector notation and remember to include units:

Examples:

Rules for vector notation:

- Symbol for the quantity has an arrow
- Boxed brackets
- Comma separating the x- and the y-component
- Units follow the brackets

GRAPHICAL REPRESENTATION OF VECTORS

Magnitude of a vector:

- **Use the Pythagorean theorem**
- **Use "double absolute value" notation or a symbol of the quantity without the vector arrow**

Example 1: Find the magnitude of $\overrightarrow{v} = [23,68]\ km/h$

Direction of a vector:

- **Information about a vector's direction is included in vector notation:**

Example2: State the direction of $\overrightarrow{d} = [3, -5]m.$

<u>Always include a sketch of a vector to state its direction correctly!</u>

- Use trigonometry to find the angle measure in degrees. Always consider a right angle at the x-axis.

- **Information about a vector's direction is explicitly stated**
- 15 km 45° S of W
- 25 m E 30° N

Direction of a vector:	Vector notation:	Magnitude of a vector:
$\theta = \tan^{-1}\frac{\lvert a_y \rvert}{\lvert a_x \rvert}$	$\vec{a} = [a_x, a_y]$	$\lVert\vec{a}\rVert = \sqrt{a_x^2 + a_y^2}$

Vector:

- Remember that the vector components are also vectors:

AN OPPOSITE OF A VECTOR:

OPERATIONS WITH VECTORS

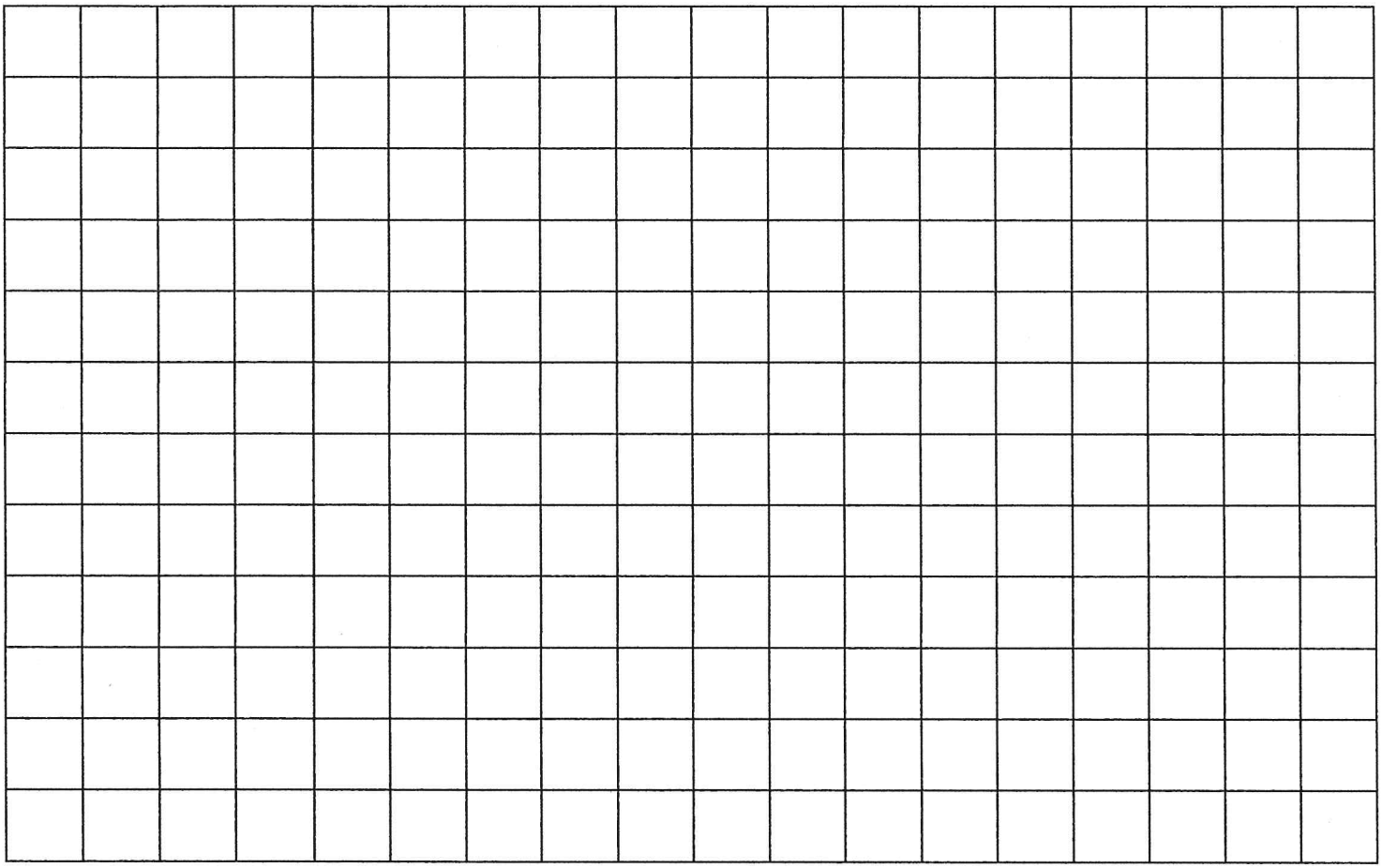
- Addition
- Subtraction
- Scalar multiplication
- Dot product
- Cross product

VECTOR ADDITION

Example:

a) Add $\vec{d}_1 = [4, -3]\text{m}$, $\vec{d}_2 = [2,7]\text{m}$ and $\vec{d}_3 = [-5,2]\text{m}$. **State the final vector in vector notation.**

1. **Graphical = "head to tail"'**



b) Find the magnitude AND direction of the vector:

2. **Algebraic** – decompose each vector into it components if the vectors are not given in vector notation. Add all x-components, add all y-components and state the final vector in vector notation.

$\vec{d}_1 = 5\ m\ N45°W$, $\vec{d}_2 = 12$ m S and $\vec{d}_3 = 14$m 60° E of S.

b) Find the magnitude AND direction of the vector:

SUBTRACTION OF VECTORS

- Subtracting a vector is identical to adding an opposite vector.
- The order in which vectors are subtracted matters.

Example1: Subtract $\vec{d}_1 = [4, -3]\text{m}$ form $\vec{d}_2 = [2,7]\text{m}$.

Example2: Subtract $\vec{d}_2 = [2,7]\text{m}$ from $\vec{d}_1 = [4, -3]\text{m}$.

SCALAR MULTIPLICATION OF A VECTOR