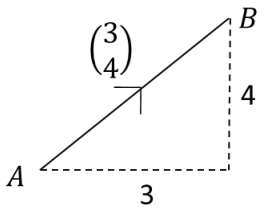
Magnitude of a vector

The magnitude $|a|$ of a vector $\boldsymbol{a}$ is its length.

$$\text{If } \boldsymbol{a} = \begin{pmatrix} x \\ y \end{pmatrix} \quad |\boldsymbol{a}| = \sqrt{x^2 + y^2}$$

Examples:

1.



2. $\boldsymbol{a} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

3. $\boldsymbol{b} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$

Direction of a Vector

The direction of a vector can be found using basic trigonometry.

Examples

1. Find the angle that vector $\boldsymbol{a} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$ makes with the positive x axis.

2. Find the angle that vector $\boldsymbol{b} = \begin{pmatrix} -5 \\ -12 \end{pmatrix}$ makes with $\boldsymbol{j}$.

Unit vector

A unit vector is a vector whose magnitude is 1.

If $\boldsymbol{a}$ is a vector, then the unit vector $\hat{\boldsymbol{a}}$ in the same direction is

$$\hat{\boldsymbol{a}} = \frac{\boldsymbol{a}}{|\boldsymbol{a}|}$$

Example:

Find a unit vector in the direction of $\boldsymbol{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$

Test Your Understanding: Convert the following vectors to unit vectors.

$\boldsymbol{a} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$

Exercise 11C Pg 240/241