

PHYS 11: Chap. 3, Pg 1

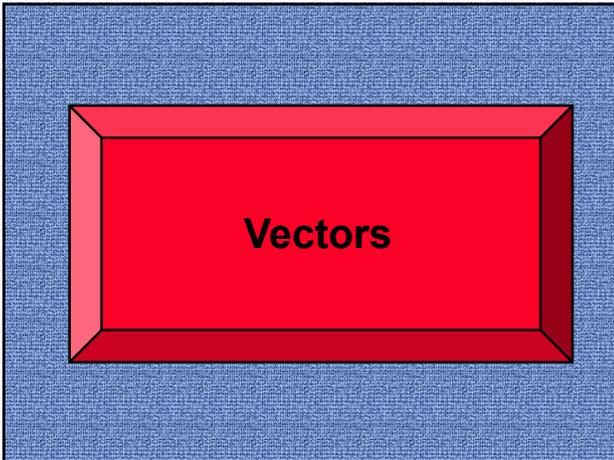
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Chapter 3 - Vectors

- Vectors and scalars
- Vector addition
 - ✓ adding by tip-to-tail method
 - ✓ adding by vector components
- More vector components
 - ✓ components depend on coordinate system
 - ✓ unit vectors to represent components

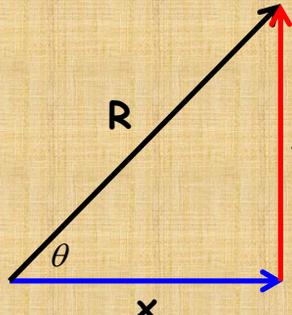
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2



3

Vector Components



$$R = \sqrt{x^2 + y^2}$$

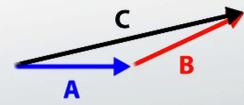
$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

$$y = R \sin \theta$$

$$x = R \cos \theta$$

4

Vector Addition

$$\mathbf{A} + \mathbf{B} = \mathbf{C}$$


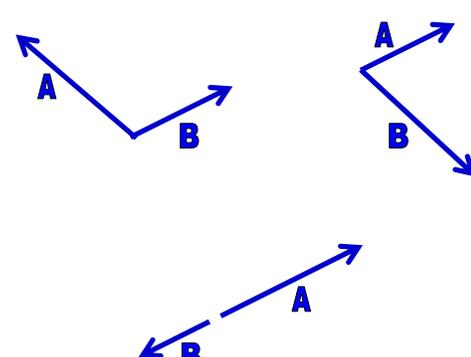
tip-to-tail method



component method

5

Draw the vector sum of $\mathbf{A} + \mathbf{B}$.



1.21

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6

Draw the vector sum of $A + B$.

1.21

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Draw the vector sum of $A + B$.

3.1-3.3

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8

Draw the vector sum of $A + B$.

3.1-3.3

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9

Given vectors A and B , draw the vector $C = 2A - 3B$.

3.8

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10

Determine the numerical values of the x and y components.

$A_x =$ _____
 $A_y =$ _____

$B_x =$ _____
 $B_y =$ _____

$C_x =$ _____
 $C_y =$ _____

3.12-3.15

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11

Determine the numerical values of the x and y components.

$A_x = -3.21$
 $A_y = 3.83$

$B_x = -3.46$
 $B_y = -2.00$

$C_x = 3.54$
 $C_y = -3.54$

What is the vector sum of $A+B+C$ for the three vectors above?

$D_x = -3.13$
 $D_y = -1.71$

3.12-3.15

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Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

$A_x = 3$
 $A_y = -2$

$A =$ _____
 $\theta =$ _____

$B_x = -2$
 $B_y = 2$

$B =$ _____
 $\theta =$ _____

$C_x = 0$
 $C_y = -2$

$C =$ _____
 $\theta =$ _____

3.18-3.20 PHYS 21: Chap. 4, Pg 13

13

Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

$A_x = 3$
 $A_y = -2$

$A =$ **3.61**
 $\theta =$ **-33.7°**

$B_x = -2$
 $B_y = 2$

$B =$ **2.83**
 $\theta =$ **135°**

$C_x = 0$
 $C_y = -2$

$C =$ **2.0**
 $\theta =$ **-90°**

3.18-3.20 PHYS 21: Chap. 4, Pg 14

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Unit Vector Notation

\hat{i} - unit vector = 1 in the +x direction
 \hat{j} - unit vector = 1 in the +y direction
 \hat{k} - unit vector = 1 in the +z direction

The proper terminology is to use the "hat" instead of the arrow. So we have \hat{i} -hat, \hat{j} -hat, and \hat{k} -hat which are used to describe any type of motion in 3D space.

Write vectors J and K in unit vector notation.

$J = 2\hat{i} + 4\hat{j}$
 $K = 2\hat{i} - 5\hat{j}$

Adding vectors this way is easy!

$\vec{A} = 8\hat{i} - 4\hat{j} + 3\hat{k}$
 $\vec{B} = -2\hat{i} + 5\hat{j}$
 $\vec{C} = \vec{A} + \vec{B} = 6\hat{i} + \hat{j} + 3\hat{k}$

3.22-3.25 PHYS 21: Chap. 4, Pg 15

15

Write these vectors in component form. (e.g., $3\hat{i} + 2\hat{j}$)

22.

$\vec{A} =$ _____

23.

$\vec{B} =$ _____

24.

$\vec{C} =$ _____

What is the sum of the three vectors above?
Write the answer in component form.

3.22-3.25 PHYS 21: Chap. 4, Pg 16

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Draw and label the vectors on the axes.

"unit" vectors: $\hat{i}, \hat{j}, \hat{k}$

19. $\vec{A} = -\hat{i} + 2\hat{j}$

20. $\vec{B} = -2\hat{j}$

21. $\vec{C} = 3\hat{i} - 2\hat{j}$

3.19-3.21

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Draw and label the vectors on the axes.

"unit" vectors: $\hat{i}, \hat{j}, \hat{k}$

19. $\vec{A} = -\hat{i} + 2\hat{j}$

20. $\vec{B} = -2\hat{j}$

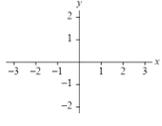
21. $\vec{C} = 3\hat{i} - 2\hat{j}$

3.19-3.21

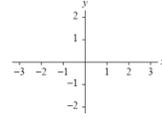
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Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

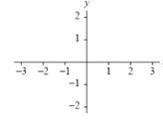
26. $\vec{A} = 2\hat{i} + 2\hat{j}$ 27. $\vec{B} = -2\hat{i} + 2\hat{j}$ 28. $\vec{C} = 3\hat{i} + \hat{j}$



$A =$ _____
 $\theta =$ _____



$B =$ _____
 $\theta =$ _____



$C =$ _____
 $\theta =$ _____

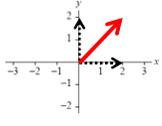
"unit" vectors: $\hat{i}, \hat{j}, \hat{k}$

3.26-3.28 PHYS 21: Chap. 4, Pg 19

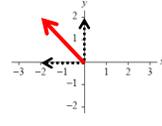
19

Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

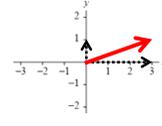
26. $\vec{A} = 2\hat{i} + 2\hat{j}$ 27. $\vec{B} = -2\hat{i} + 2\hat{j}$ 28. $\vec{C} = 3\hat{i} + \hat{j}$



$A =$ **2.83** _____
 $\theta =$ **45°** _____



$B =$ **2.83** _____
 $\theta =$ **135°** _____



$C =$ **3.16** _____
 $\theta =$ **18.4°** _____

"unit" vectors: $\hat{i}, \hat{j}, \hat{k}$

3.26-3.28 PHYS 21: Chap. 4, Pg 20

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