

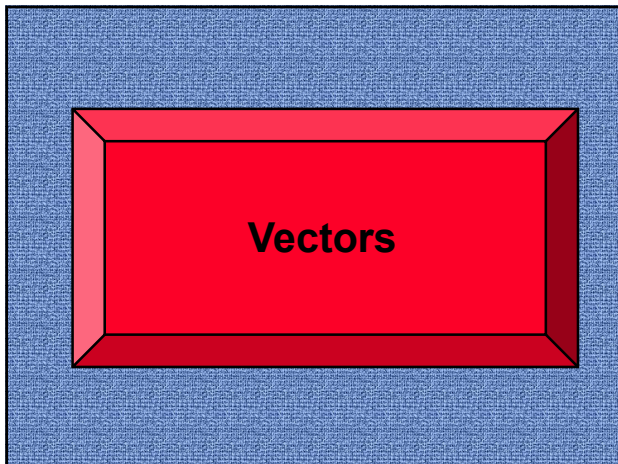
1

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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Vector Components

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

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

$$y = R \sin \theta$$

$$x = R \cos \theta$$

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Vector Addition

$A + B = C$

tip-to-tail method

component method

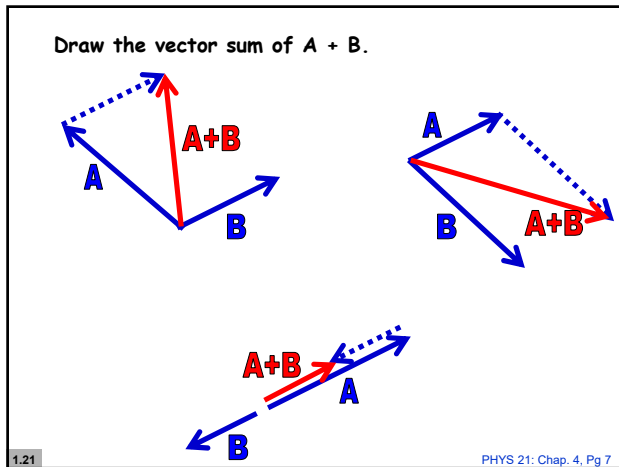
5

Draw the vector sum of $A + B$.

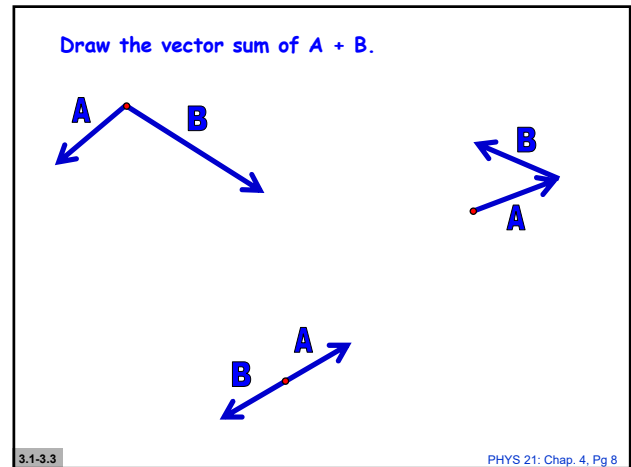
1.21

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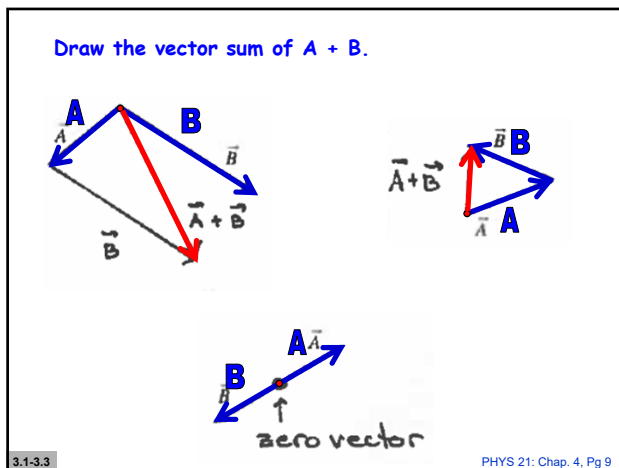
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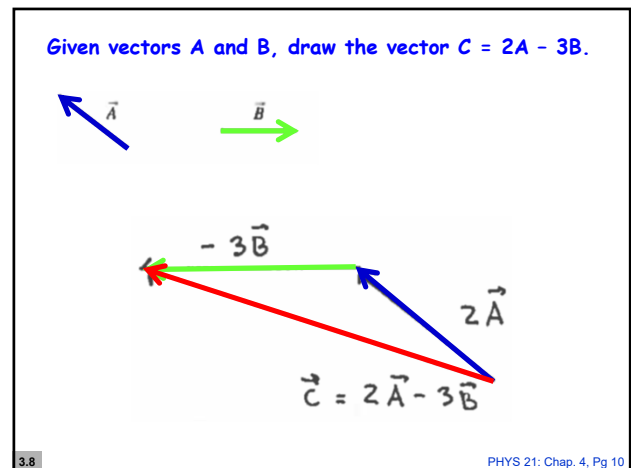
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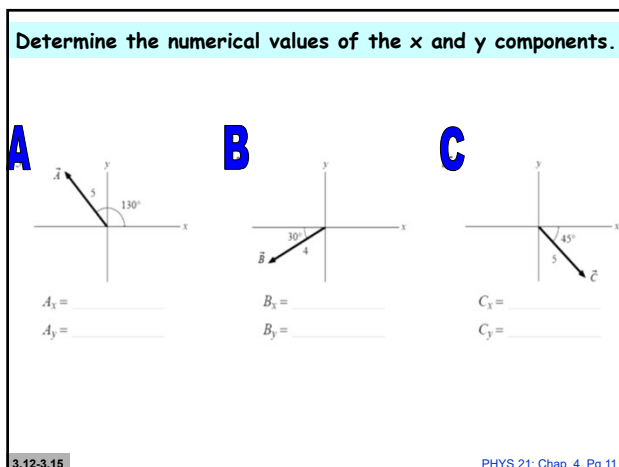
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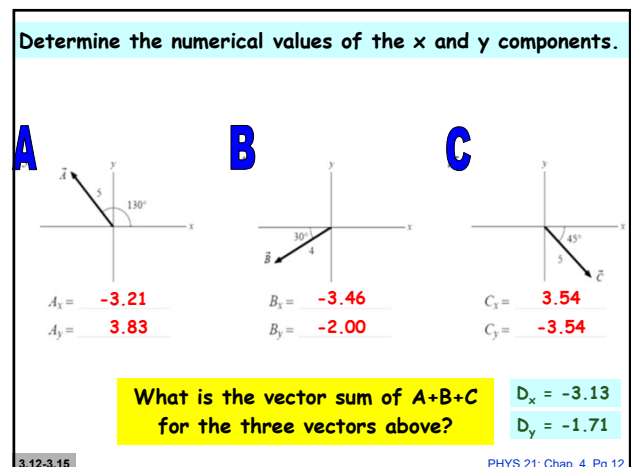
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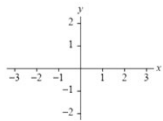


12

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

$$A_x = 3$$

$$A_y = -2$$

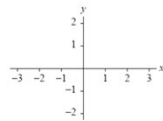


$$A = \underline{\hspace{2cm}}$$

$$\theta = \underline{\hspace{2cm}}$$

$$B_x = -2$$

$$B_y = 2$$

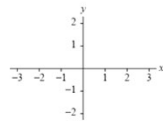


$$B = \underline{\hspace{2cm}}$$

$$\theta = \underline{\hspace{2cm}}$$

$$C_x = 0$$

$$C_y = -2$$



$$C = \underline{\hspace{2cm}}$$

$$\theta = \underline{\hspace{2cm}}$$

3.18-3.20

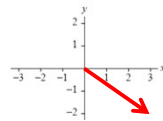
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Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

$$A_x = 3$$

$$A_y = -2$$

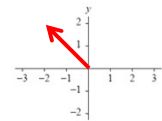


$$A = \underline{3.61}$$

$$\theta = \underline{-33.7^\circ}$$

$$B_x = -2$$

$$B_y = 2$$

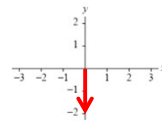


$$B = \underline{2.83}$$

$$\theta = \underline{135^\circ}$$

$$C_x = 0$$

$$C_y = -2$$



$$C = \underline{2.0}$$

$$\theta = \underline{-90^\circ}$$

3.18-3.20

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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!

$$\vec{A} = 8\hat{i} - 4\hat{j} + 3\hat{k}$$

$$\vec{B} = -2\hat{i} + 5\hat{j}$$

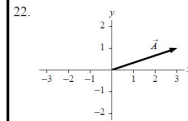
$$\vec{C} = \vec{A} + \vec{B} = 6\hat{i} + \hat{j} + 3\hat{k}$$

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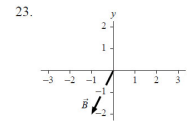
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Write these vectors in component form.

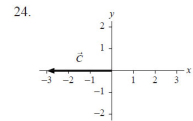
(e.g., $3\hat{i} + 2\hat{j}$)



$$\vec{A} = \underline{\hspace{2cm}}$$



$$\vec{B} = \underline{\hspace{2cm}}$$



$$\vec{C} = \underline{\hspace{2cm}}$$

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

3.22-3.25

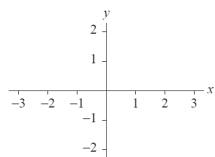
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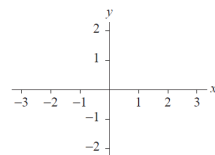
Draw and label the vectors on the axes.

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

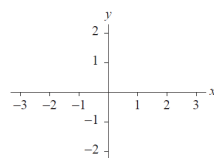
20. $\vec{B} = -2\hat{j}$



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



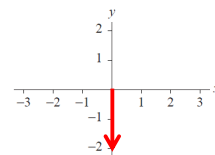
21. $\vec{C} = 3\hat{i} - 2\hat{j}$



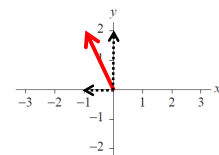
Draw and label the vectors on the axes.

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

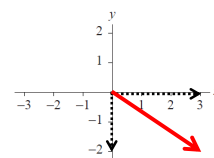
20. $\vec{B} = -2\hat{j}$



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



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



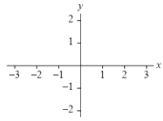
3.19-3.21

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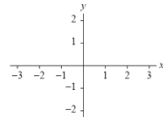
Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

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



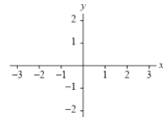
$A =$ _____
 $\theta =$ _____

27. $\vec{B} = -2\hat{i} + 2\hat{j}$



$B =$ _____
 $\theta =$ _____

28. $\vec{C} = 3\hat{i} + \hat{j}$



$C =$ _____
 $\theta =$ _____

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

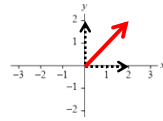
3.26-3.28

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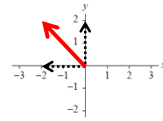
Draw the vector and label its angle. Then find the magnitude and direction of the vector in each case.

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



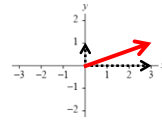
$A =$ **2.83**
 $\theta =$ **45°**

27. $\vec{B} = -2\hat{i} + 2\hat{j}$



$B =$ **2.83**
 $\theta =$ **135°**

28. $\vec{C} = 3\hat{i} + \hat{j}$



$C =$ **3.16**
 $\theta =$ **18.4°**

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

3.26-3.28

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