

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Worksheet 7.4—Vectors**Show all work on a separate sheet of paper. **No Calculator** unless otherwise specified.**Multiple Choice**1. Which of the following is the magnitude of the vector  $\langle 2, -1 \rangle$ ?

- (A) 1                      (B)  $\sqrt{3}$                       (C)  $\frac{\sqrt{5}}{5}$                       (D)  $\sqrt{5}$                       (E) 5

2. Let  $\vec{u} = \langle -2, 3 \rangle$  and  $\vec{v} = \langle 4, -1 \rangle$ . Which of the following is equal to  $\vec{u} - \vec{v}$ ?

- (A)  $\langle 6, -4 \rangle$                       (B)  $\langle 2, 2 \rangle$                       (C)  $\langle -2, 2 \rangle$                       (D)  $\langle -6, 2 \rangle$                       (E)  $\langle -6, 4 \rangle$

3. Which of the following represents the vector  $\vec{v}$  with a magnitude of 3 and a direction of  $150^\circ$ ?

- (A)  $\left\langle \frac{3\sqrt{3}}{2}, \frac{3}{2} \right\rangle$                       (B)  $\left\langle \frac{3}{2}, \frac{3\sqrt{3}}{2} \right\rangle$                       (C)  $\left\langle -\frac{3\sqrt{3}}{2}, \frac{3}{2} \right\rangle$                       (D)  $\left\langle -\frac{3}{2}, \frac{3\sqrt{3}}{2} \right\rangle$                       (E)  $\left\langle -\frac{3}{2}, -\frac{3\sqrt{3}}{2} \right\rangle$

4. Which of the following is a unit vector in the direction of  $\vec{v} = -\vec{i} + 3\vec{j}$ ?

- (A)  $-\frac{1}{10}\vec{i} + \frac{3}{10}\vec{j}$     (B)  $\frac{1}{10}\vec{i} - \frac{3}{10}\vec{j}$     (C)  $-\frac{1}{\sqrt{10}}\vec{i} + \frac{3}{\sqrt{10}}\vec{j}$     (D)  $\frac{1}{\sqrt{10}}\vec{i} - \frac{3}{\sqrt{10}}\vec{j}$     (E)  $-\frac{1}{\sqrt{8}}\vec{i} + \frac{3}{\sqrt{8}}\vec{j}$

5. Which of the following is a vector quantity?

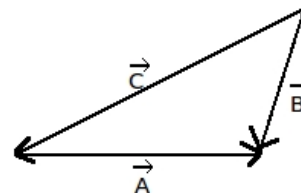
- (A) Energy    (B) Power    (C) Time    (D) Force    (E) Mass

6. Which of the following is a scalar quantity?

- (A) Area    (B) Kinetic Energy    (C) Weight of an object    (D) Wind velocity    (E) Acceleration

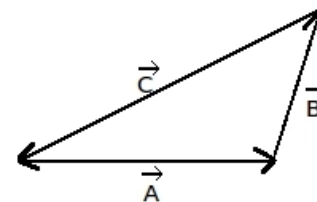
7. Which of the following gives the correct relation among the vectors in the diagram at right.

- (A)  $\vec{A} + \vec{B} = \vec{C}$     (B)  $\vec{B} + \vec{C} = \vec{A}$     (C)  $\vec{C} + \vec{A} = \vec{B}$     (D)  $\vec{A} + \vec{B} + \vec{C} = 0$



8. Which of the following gives the correct relation among the vectors in the diagram at right.

- (A)  $\vec{A} + \vec{B} = \vec{C}$     (B)  $\vec{B} + \vec{C} = \vec{A}$     (C)  $\vec{C} + \vec{A} = \vec{B}$     (D)  $\vec{A} + \vec{B} + \vec{C} = 0$



9. A straight river flows west to east at a speed of 3 meters per minute. A man on the south bank of the river, capable of swimming at 6 meters per minute in still water, wants to swim across to the point directly opposite the bank. He should swim in a direction of  
(A) due north (B)  $30^\circ$  west of north (C)  $30^\circ$  east of north (D)  $60^\circ$  east of north (E) south

10. The angle between  $\vec{i} + \vec{j}$  and  $\vec{i}$

(A)  $\frac{\pi}{6}$  (B)  $\frac{\pi}{4}$  (C)  $\frac{\pi}{3}$  (D)  $\frac{\pi}{2}$  (E)  $\frac{5\pi}{6}$

11. Consider a vector  $\vec{F} = 4\vec{i} - 3\vec{j}$ . The vector which is perpendicular to  $\vec{F}$  is

(A)  $4\vec{i} + 3\vec{j}$  (B)  $-4\vec{i} + 3\vec{j}$  (C)  $-3\vec{i} + 4\vec{j}$  (D)  $3\vec{i} - 4\vec{j}$  (E)  $3\vec{i} + 4\vec{j}$

12. The unit vector along  $\vec{i} + \vec{j}$  is

(A)  $\vec{i} + \vec{j}$  (B)  $\frac{\sqrt{2}}{2}\vec{i} + \frac{\sqrt{2}}{2}\vec{j}$  (C)  $\frac{1}{2}\vec{i} + \frac{1}{2}\vec{j}$  (D)  $\sqrt{2}\vec{i} + \sqrt{2}\vec{j}$  (E) none of these

**Short Answer**

13. Show that  $\overrightarrow{AB}$  and  $\overrightarrow{CD}$  are equivalent by showing that they represent the same vector:  
 $A = (-4, 7)$ ,  $B = (-1, 5)$ ,  $C = (0, 0)$ , and  $D = (3, -2)$

14. Given the points,  $A = (-2, 2)$ ,  $B = (3, 4)$ ,  $C = (-2, 5)$ , and  $D = (2, -8)$ , find the indicated vector in  $\vec{u} = \langle a, b \rangle$  chevron form, then find the magnitude,  $|\vec{u}|$  of the vector.

(a)  $\overrightarrow{BC}$

(b)  $4\overrightarrow{AC}$

(c)  $3\overrightarrow{BD} - 2\overrightarrow{AC}$

15. Given the vectors  $\vec{u} = \langle 1, 3 \rangle$ ,  $\vec{v} = \langle 2, 4 \rangle$ , and  $\vec{w} = \langle 2, -5 \rangle$ , find the following vectors in  $\vec{i}, \vec{j}$  form. Find the magnitude of each new vector.

(a)  $\vec{v} + \vec{w}$

(b)  $-\vec{w} + \frac{1}{2}\vec{v}$

(c)  $2\vec{u} - 3\vec{v}$

16. Find a unit vector in the direction of  $-2\vec{i} + 3\vec{j}$ . Write your answer in **both** chevron and  $\vec{i}, \vec{j}$  form.

17. Find the horizontal and vertical components of the vector with the given length and direction, then write the vector in  $\vec{i}, \vec{j}$  form.

(a)  $|\vec{v}| = 50, \theta = \frac{7\pi}{6}$       (b)  $|\vec{u}| = 13, \theta = 330^\circ$       (c) (Calculator)  $|\vec{r}| = 900, \theta = 125^\circ$

18. Find the magnitude and direction (in degrees) of the following vectors.

(a)  $\vec{u} = \left\langle -\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right\rangle$       (b) (Calculator)  $\vec{v} = -9\vec{i} - 40\vec{j}$

19. (Calculator) Corny the jet pilot heads his jet due east. The jet has a speed of 440 mph relative to the air. The wind is blowing due north with a speed of 35 mph.

(a) Express the velocity of the wind as a vector in component form.

(b) Express the velocity of the jet relative to the air as a vector in component form.

(c) Find the true velocity of the jet as a vector.

(d) Find the true speed and direction of the jet.