AP Physics C

Practice Problems: “Vectors”

Multiple Choice Questions

1. The components of vector \( \vec{A} \) are given as follows:
   \( A_x = 10.5 \quad A_y = 15.2 \)
   What is the magnitude of the vector?
   A. 10.5                 B. 15.2              C. 18.5              D. 25.7              E. 4.7

2. The components of vector \( \vec{A} \) are given as follows:
   \( A_x = 5.6 \quad A_y = -4.7 \)
   What is the angle between vector \( \vec{A} \) and positive direction of x-axis?
   A. 320˚                    B. 180˚                    C. 90˚                    D. 127˚                    E. 230˚

3. The components of vectors \( \vec{A} \) and \( \vec{B} \) are given as follows:
   \( A_x = 5.1 \quad B_x = -2.6 \)
   \( A_y = -5 \quad B_y = -4.3 \)
   What is the magnitude of vector sum \( \vec{A} + \vec{B} \)?
   A. 5.1         B. 2.5           C. -9.3            D. 9.6           E. -3.8

4. The magnitude of vector \( \vec{A} \) is 8.6. Vector lies in the fourth quadrant and forms an angle of 37˚ with the x-axis. What are the components of vector \( \vec{A} \)?
   A. \( A_x = 8.6 \quad A_y = -8.6 \)
   B. \( A_x = -6.9 \quad A_y = 5.2 \)
   C. \( A_x = -6.9 \quad A_y = -5.2 \)
   D. \( A_x = 6.9 \quad A_y = 5.2 \)
   E. \( A_x = 6.9 \quad A_y = -5.2 \)
5. Find the magnitude of vector $\vec{C} = \vec{A} - \vec{B}$. Use all the information presented by the graph.
   A. 5.7           B. 6.9             C. 7.4             D. 8.6               E. 9.7

6. Find the dot product of two vectors $\vec{A} \cdot \vec{B}$. Use all the information presented by the graph.
   A. 8.6           B. 3.5             C. -11.6          D. -17.5           E. 9.4

7. Two vectors are given as follows:
   $\vec{A} = -2i - 5j + 2k$       $\vec{B} = -4i - 2j - 3k$

   What is the angle between the vectors?
   A. 114°           B. 67°             C. 41°             D. 132°             E. 94°
Vectors $\vec{A}$ and $\vec{B}$ are shown. Vector $\vec{C}$ is given by $\vec{C} = \vec{B} - \vec{A}$. Please refer to this figure for problems 8-9.

8. The magnitude of $\vec{C}$ is closest to
   a) 3.9    b) 5.9    c) 6.8    d) 7.7    e) 8.4

9. The angle, measured from the x-axis to vector $\vec{C}$, in degrees, is closest to:
   a) 20°    b) 34°    c) 67°    d) 70°    e) 82°

10. The components of vector $\vec{Z}$ are given as follows:
    $Z_x = 10.7$    $Z_y = 8.3$
    What is the magnitude of the vector?
    a) 7.8    b) 9.5    c) 14.2    d) 16    e) 13.6

11. The components of vector $\vec{Q}$ are given as follow:
    $Q_x = 23.5$    $Q_y = 18.6$
    What is the measure of the angle, in degrees, that the resultant vector makes with the x-axis?
    a) 38.4°    b) 47.9°    c) 56.3°    d) 62°    e) 74.7°
12. The components of vectors \( \vec{U} \) and \( \vec{V} \) are given as follow:

\[
\begin{align*}
U_x &= -8.6 & V_x &= 10.7 \\
U_y &= 9.4 & V_y &= 4.1
\end{align*}
\]

What is the magnitude of the vector sum \( \vec{U} + \vec{V} \)?

a) 9.8  
 b) 13.7  
 c) 14.6  
 d) 15.3  
 e) 16.9

13. Which of the following statements is true?

a) A scalar quantity can be added to a vector  
b) It is possible for the magnitude of a vector to equal zero even though one of its components is non-zero  
c) Scalar quantities are path dependent, while vectors are not.  
d) Scalar quantities and vector quantities can both be added algebraically  
e) A scalar contains magnitude and direction while a vector does not.

Questions 14-16:

Two vectors are given as follows:

\[
\begin{align*}
\vec{A} &= -3\hat{i} + 6\hat{j} - 5\hat{k} \\
\vec{B} &= -2\hat{i} + 3\hat{j} + \hat{k}
\end{align*}
\]

14. The vector dot product \( \vec{A} \cdot \vec{B} \) equals:

a) -12  
 b) 10  
 c) 14  
 d) 19  
 e) 20

15. The difference between vectors \( \vec{A} \) and \( \vec{B} \) is:

a) \(-\hat{i} + 9\hat{j} - 4\hat{k}\)  
b) \(-\hat{i} + 3\hat{j} - 6\hat{k}\)  
c) \(-3\hat{i} + 3\hat{j} - 6\hat{k}\)  
d) \(-5\hat{i} + 9\hat{j} - 4\hat{k}\)  
e) \(-6\hat{i} + 18\hat{j} - 5\hat{k}\)

16. The magnitude of the sum of the vectors \( \vec{A} \) and \( \vec{B} \) is most nearly:

a) 6.8  
 b) 7.4  
 c) 9.0  
 d) 10.4  
 e) 11
17. The components of vector \( \vec{E} \) are as follows:
\[ E_x = -34.8 \quad E_y = -23.6 \]

What is the measure of the angle, in degrees, formed by vector \( \vec{E} \) and +x-axis?

a) -145.9 \hspace{1cm} b) 214.1 \hspace{1cm} c) 34.1 \hspace{1cm} d) 145.9 \hspace{1cm} e) 195.7

Vectors \( \vec{A} \) and \( \vec{B} \) are shown. Vector \( \vec{C} \) is given by \( \vec{C} = \vec{A} + \vec{B} \). Refer to this figure for problems 18-19.

18. What is the magnitude of vector \( \vec{C} \)?

a) 4.7 \hspace{1cm} b) 11.9 \hspace{1cm} c) 14.3 \hspace{1cm} d) 16.7 \hspace{1cm} e) 17.2

Three Vectors are given as shown. Refer to this figure for numbers 19-21.
19. In the figure above, the magnitude and direction of the vector product $\vec{A} \times \vec{B}$ are closest to:
   a) 20, directed out of the plane.
   b) 20, directed into the plane.
   c) 13, directed out of the plane.
   d) 13, directed into the plane.
   e) 13, directed on the plane.

20. The magnitude and direction of the vector product $\vec{C} \times \vec{B}$ are closest to:
   a) 23, directed into the page.
   b) 23, directed out of the page.
   c) 23, directed on the plane.
   d) 39, directed into the page.
   e) 39, directed out of the page.

21. The scalar dot product of $\vec{A} \cdot \vec{B}$ is closest to:
   a) 15
   b) 10
   c) 17
   d) 21
   e) 25

22. Two vectors are given as follows:
   $\vec{A} = -2i - 5j + 2k$
   $\vec{B} = -5i - 2j - 3k$

   Find the magnitude of the following vector: $\vec{A} \times \vec{B}$.
   A. 12
   B. 43
   C. 18
   D. 26
   E. 31
Answer Key.

   1.  C
   2.  A
   3.  D
   4.  E
   5.  D
   6.  C
   7.  B
   8.  D
   9.  A
  10.  E
  11.  A
  12.  B
  13.  C
  14.  D
  15.  B
  16.  E
  17.  A
  18.  C
  19.  D
  20.  E
  21.  A
  22.  E