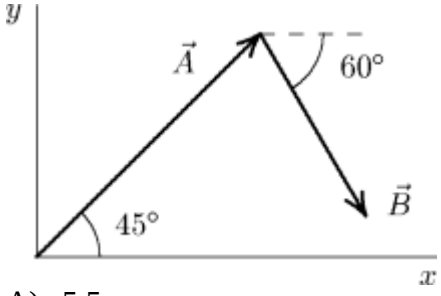
Name: _____ Date: _____

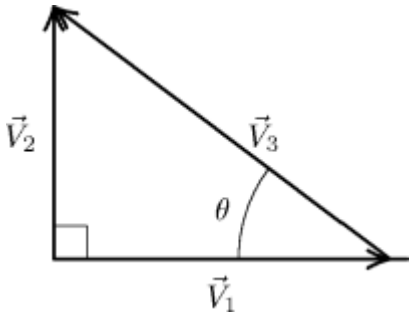
1. Vectors $\vec{A}$ and $\vec{B}$ lie in the *xy* plane. We can deduce that $\vec{A} = \vec{B}$ if:
   A) $A_x^2 + A_y^2 = B_x^2 + B_y^2$
   B) $A_x + A_y = B_x + B_y$
   C) $A_x = B_x$ and $A_y = B_y$
   D) $A_y/A_x = B_y/B_x$
   E) $A_x = A_y$ and $B_x = B_y$

2. In the diagram, $\vec{A}$ has magnitude 12 m and $\vec{B}$ has magnitude 8 m. The *x* component of $\vec{A}+\vec{B}$ is about:



   A) 5.5 m
   B) 7.6 m
   C) 12 m
   D) 14 m
   E) 15 m

3. The vector $\vec{V}_3$ in the diagram is equal to:



   A) $\vec{V}_1 - \vec{V}_2$
   B) $\vec{V}_1 + \vec{V}_2$
   C) $\vec{V}_2 - \vec{V}_1$
   D) $\vec{V}_1 \cos\theta$
   E) $\vec{V}_1 / (\cos\theta)$

4. A certain vector in the *xy* plane has an *x* component of 4 m and a *y* component of 10 m. It is then rotated in the *xy* plane so its *x* component is doubled. Its new *y* component is about:
   A) 20 m
   B) 7.2 m
   C) 5.0 m
   D) 4.5 m
   E) 2.2 m

5. If $\vec{A} = (2\,\text{m})\,\hat{\text{i}} - (3\text{m})\,\hat{\text{j}}$ and $\vec{B} = (1\text{m})\,\hat{\text{i}} - (2\,\text{m})\,\hat{\text{j}}$, then $\vec{A} - 2\vec{B} =$
   A) $(1\text{m})\,\hat{\text{j}}$
   B) $(-1\text{m})\,\hat{\text{j}}$
   C) $(4\,\text{m})\,\hat{\text{i}} - (7\,\text{m})\,\hat{\text{j}}$
   D) $(4\,\text{m})\,\hat{\text{i}} + (1\text{m})\,\hat{\text{j}}$
   E) $(-4\,\text{m})\,\hat{\text{i}} + (7\,\text{m})\,\hat{\text{j}}$

6. In the expressions $\vec{r} = x\,\hat{\text{i}} + y\,\hat{\text{j}}$ for the position vector of a particle and $\vec{v} = v_x\,\hat{\text{i}} + v_y\,\hat{\text{j}}$ for its velocity:
   A) the unit vector $\hat{\text{i}}$ might have a unit of meters
   B) $\hat{\text{i}}$ and $\hat{\text{j}}$ are both variables
   C) $\hat{\text{i}}$ represents a different vector in the two expressions
   D) $\hat{\text{i}}$ and $\hat{\text{j}}$ are parallel to each other
   E) none of the above

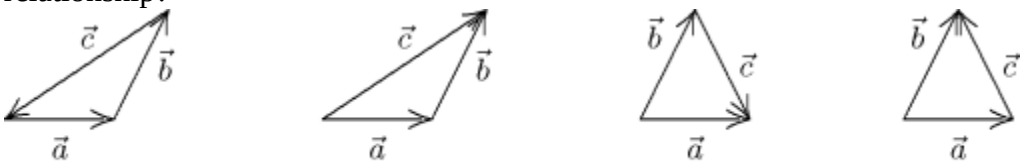
7. The angle between $\vec{A} = (25\,\text{m})\,\hat{\text{i}} + (45\,\text{m})\,\hat{\text{j}}$ and the positive *x* axis is:
   A) 29º
   B) 61º
   C) 151º
   D) 209º
   E) 241º

8. Let $\vec{A} = (2\,\text{m})\,\hat{\text{i}} + (6\,\text{m})\,\hat{\text{j}} - (3\,\text{m})\,\hat{\text{k}}$ and $\vec{B} = (4\,\text{m})\,\hat{\text{i}} + (2\,\text{m}\,\hat{\text{j}} + (1\text{m})\,\hat{\text{k}}$. The vector difference $\vec{D} = \vec{A} - \vec{B}$ is:
   A) $(6\,\text{m})\,\hat{\text{i}} + (8\,\text{m})\,\hat{\text{j}} - (2\,\text{m})\,\hat{\text{k}}$
   B) $(-2\,\text{m})\,\hat{\text{i}} + (4\,\text{m})\,\hat{\text{j}} - (4\,\text{m})\,\hat{\text{k}}$
   C) $(2\,\text{m})\,\hat{\text{i}} - (4\,\text{m})\,\hat{\text{j}} + (4\,\text{m})\,\hat{\text{k}}$
   D) $(8\,\text{m})\,\hat{\text{i}} + (12\,\text{m})\,\hat{\text{j}} - (3\,\text{m})\,\hat{\text{k}}$
   E) none of these

9. A vector has a component of 10 m in the $+x$ direction, a component of 10 m in the $+y$ direction, and a component of 5 m in the $+z$ direction. The magnitude of this vector is:
   A) zero
   B) 15 m
   C) 20 m
   D) 25 m
   E) 225 m

10. The angle between $\vec{A} = (-25\,\text{m})\,\hat{\text{i}} + (45\,\text{m})\,\hat{\text{j}}$ and the positive x axis is:
   A) 29º
   B) 61º
   C) 119º
   D) 151º
   E) 209º

11. The vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$ are related by $\vec{c} = \vec{b} - \vec{a}$. Which diagram below illustrates this relationship?



   A) A
   B) B
   C) C
   D) D
   E) None of these

12. If $|\vec{A}+\vec{B}|^2 = A^2 + B^2$, then:
    A) $\vec{A}$ and $\vec{B}$ must be parallel and in the same direction
    B) $\vec{A}$ and $\vec{B}$ must be parallel and in opposite directions
    C) either $\vec{A}$ or $\vec{B}$ must be zero
    D) the angle between $\vec{A}$ and $\vec{B}$ must be 60º
    E) none of the above is true

13. A vector in the *xy* plane has a magnitude of 25 m and an *x* component of 12 m. The angle it makes with the positive *x* axis is:
    A) 26º
    B) 29º
    C) 61º
    D) 64º
    E) 241º

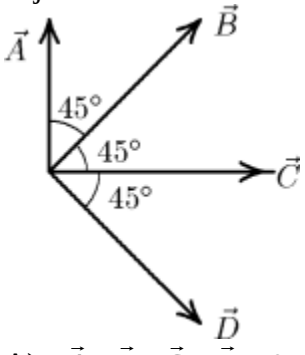
14. Let $\vec{V} = (2.00\,\text{m})\,\hat{\text{i}} + (6.00\,\text{m})\,\hat{\text{j}} - (3.00\,\text{m})\,\hat{\text{k}}$. The magnitude of $\vec{V}$ is:
    A) 5.00 m
    B) 5.57 m
    C) 7.00 m
    D) 7.42 m
    E) 8.54 m

15. If $|\vec{A}+\vec{B}| = A + B$ and neither $\vec{A}$ nor $\vec{B}$ vanish, then:
    A) $\vec{A}$ and $\vec{B}$ are parallel and in the same direction
    B) $\vec{A}$ and $\vec{B}$ are parallel and in opposite directions
    C) the angle between $\vec{A}$ and $\vec{B}$ is 45º
    D) the angle between $\vec{A}$ and $\vec{B}$ is 60º
    E) $\vec{A}$ is perpendicular to $\vec{B}$

16. Let $\vec{A} = (2\,\text{m})\,\hat{\text{i}} + (6\,\text{m})\,\hat{\text{j}} - (3\,\text{m})\,\hat{\text{k}}$ and $\vec{B} = (4\,\text{m})\,\hat{\text{i}} + (2\,\text{m})\,\hat{\text{j}} + (1\,\text{m})\,\hat{\text{k}}$. The vector sum $\vec{S} = \vec{A} + \vec{B}$ is:
    A) $(6\,\text{m})\,\hat{\text{i}} + (8\,\text{m})\,\hat{\text{j}} - (2\,\text{m})\,\hat{\text{k}}$
    B) $(-2\,\text{m})\,\hat{\text{i}} + (4\,\text{m})\,\hat{\text{j}} - (4\,\text{m})\,\hat{\text{k}}$
    C) $(2\,\text{m})\,\hat{\text{i}} - (4\,\text{m})\,\hat{\text{j}} + (4\,\text{m})\,\hat{\text{k}}$
    D) $(8\,\text{m})\,\hat{\text{i}} + (12\,\text{m})\,\hat{\text{j}} - (3\,\text{m})\,\hat{\text{k}}$
    E) none of these

17. A vector of magnitude 3 CANNOT be added to a vector of magnitude 4 so that the magnitude of the resultant is:
    A) zero
    B) 1
    C) 3
    D) 5
    E) 7

18. Four vectors ($\vec{A}$, $\vec{B}$, $\vec{C}$, $\vec{D}$) all have the same magnitude. The angle θ between adjacent vectors is 45° as shown. The correct vector equation is:



    A) $\vec{A}-\vec{B}-\vec{C}+\vec{D}=0$
    B) $\vec{B}+\vec{D}-\sqrt{2}\vec{C}=0$
    C) $\vec{A}+\vec{B}=\vec{B}+\vec{D}$
    D) $\vec{A}+\vec{B}+\vec{C}+\vec{D}=0$
    E) $(\vec{A}+\vec{C})/\sqrt{2}=-\vec{B}$

19. We say that the displacement of a particle is a vector quantity. Our best justification for this assertion is:
    A) displacement can be specified by a magnitude and a direction
    B) operating with displacements according to the rules for manipulating vectors leads to results in agreement with experiments
    C) a displacement is obviously not a scalar
    D) displacement can be specified by three numbers
    E) displacement is associated with motion

20. If $\vec{A}=(6\,\text{m})\,\hat{\text{i}}-(8\,\text{m})\,\hat{\text{j}}$ then $4\vec{A}$ has magnitude:
    A) 10 m
    B) 20 m
    C) 30 m
    D) 40 m
    E) 50 m

Answer Key

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