**3 Vectors**

1. 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

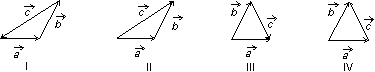
B) operating with displacements according to the rules for manipulating vectors leads to results in agreement with experiments

C) a displacement is obviously not a scalar

D) displacement can be specified by three numbers

E) displacement is associated with motion

2. The vectors ,, and are related by , Which diagram below illustrates this relationship?



A) I. B) II. C) III. D) IV. E) None of these

3. 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

4. A vector of magnitude 20 is added to a vector of magnitude 25. The magnitude of this sum can be:

A) zero B) 3 C) 12 D) 47 E) 50

5. A vector  with magnitude 6 is added to another vector . The magnitude of the resultant vector is 12. The vector :

A) must have a magnitude of at least 6 but no more than 18

B) may have a magnitude of 20

C) cannot have a magnitude greater than 12

D) must be perpendicular to 

E) must be perpendicular to the resultant vector

6. The vector  is:

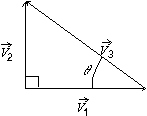
A) longer than 

B) shorter than 

C) in the same direction as 

D) in the direction opposite to 

E) perpendicular to 

7. The vector  in the diagram is equal to:

A) 

B) 

C) 

D)  cos 

E)  /(cos )

8. If = *A*2 + *B*2, then:

A) and  must be parallel and in the same direction

B) and  must be parallel and in opposite directions

C) either  or must be zero

D) the angle between and  must be 60

E) none of the above is true

9. If = *A* + *B* and neither A nor B vanish, then:

A) and are parallel and in the same direction

B) and  are parallel and in opposite directions

C) the angle between and  is 45

D) the angle between and is 60

E)  is perpendicular to 

10. If = *A* + *B* and neither  nor vanish, then:

A) and  are parallel and in the same direction

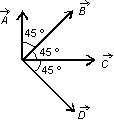
B) and are parallel and in opposite directions

C) the angle between and  is 45

D) the angle between and  is 60

E)  is perpendicular to 

11. Four vectors have the same magnitude. The angle  between adjacent vectors is 45 as shown. The correct vector equation is:



A) 

B) 

C) 

D) 

12. Vectors  and  lie in the *xy* plane. We can deduce that if:

A) *Ax*2 + *Ay*2 = *Bx*2 + *By*2

B) *Ax* + *Ay* = *Bx* + *By*

C) *Ax* = *Bx* and *Ay* = *By*

D) *Ay* /*Ax* = *By* /*Bx*

E) *Ax* = *Ay* and *Bx* = *By*

13. A vector has a magnitude of 12. When its tail is at the origin, it lies between the positive *x* axis and negative *y* axis and makes an angle of 30 with the *x* axis. Its *y* component is:

A)  B)  C) 6 D) –6 E) 12

14. If the *x* component of a vector with magnitude 2, in the *xy* plane, is half as large as the magnitude of the vector, its *y* component is:

A) *A*/2 B) 2*A* C) 3*A*/4

D)  E) 

15. If , then  has magnitude:

A) 10 m B) 20 m C) 30 m

D) 40 m E) 50 m

16. A vector has a component of 10 in the +*x* direction, a component of 10 in the +*y* direction, and a component of 5 in the –*z* direction. The magnitude of this vector is:

A) zero B) 15 C) 20 D) 25 E) 225

17. Let **a** = 2.00 **i**+ 6.00**j** – 3.00**k** The magnitude of **a** is:

A) 5.00 B) 5.57 C) 7.00 D) 7.42 E) 8.54

18. A vector in the *xy* plane has a magnitude of 25 and an *x* component of 12. The angle it makes with the positive *x* axis is:

A) 26 B) 29 C) 61 D) 64 E) 241

19. The angle between **a** = (25 m)**i** + (45 m)**j** and the positive *x* axis is:

A) 29 B) 61 C) 151 D) 209 E) 241

20. The angle between **a** = –(25 m)**i** + (45 m)**j** and the positive *x* axis is:

A) 29 B) 61 C) 119 D) 151 E) 209

21. Let **a** = (2 m)**i** + (6 m)**j** – (3 m)**k** and **b** = (4 m)**i** + (2 m)**j** + (1 m)**k**. The vector sum **c=a+b** equals:

A) (6 m)i + (8 m)j – (2 m)k B) (–2 m)i+ (4 m)j – (4 m)k

C) (2 m)i – (4 m)j + (4 m)k D) (8 m)i + (12 m)j – (3 m)k

E) none of these

22. Same as above. The vector difference **c=a-b** is:

A) (6 m)i + (8 m)j – (2 m)k B) (–2 m)i+ (4 m)j – (4 m)k

C) (2 m)i – (4 m)j + (4 m)k D) (8 m)i + (12 m)j – (3 m)k

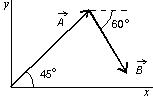
E) none of these

23. If **a** = (1 m)**i** – (3 m)**j** and **b** = (3 m)**j** – (2 m)**k**, then **a+b** =

A) (1 m)i-(2m)k B) (–1 m)k C) (4 m)i – (5 m)j

D) (4 m)i + (1 m)k E) (4 m)i+ (7 m)j

24. In the diagram, **A** has magnitude 12 and **B** has magnitude 8. The *x* component of **A+B** is about:

 A) 5.5 m B) 7.6 m C) 12 m

D) 14 m E) 15 m

25. A certain vector in the *xy* plane has an *x* component of 4 and a *y* component of 10. It is then rotated in the *xy* plane so its *x* component is doubled. Its new *y* component is about:

A) 20 B) 7.2

C) 5.0 D) 4.5 E) 2.2

26. Both vectors **A** and **B** have magnitude *L*. When drawn with their tails at the same point, the angle between them is 30. The value of **A** is:

A) zero B)*L*2 C)  D)2*L*2 E) none of these

27. Let A =2 i + 6 j – 3kand B =4i + 2j+ k. Then A  B equals:

A) 8 i + 12 j –3k B) 12i – 14j – 20k

C) 23 D) 17 E) none of these

28. Two vectors have magnitudes of 10 and 15. The angle between them when they are drawn with their tails at the same point is 65. The component of the longer vector along the line of the shorter is:

A) 0 B) 4.2 C) 6.3 D) 9.1 E) 14

29. Let A =i+ 2j + 2 k and B = 3 i + 4 j . The angle between these two vectors is given by:

A) cos–1(14/15) B) cos–1(11/225) C) cos–1(104/225)

D) cos–1(11/15)

E) cannot be found since A and B do not lie in the same plane

30. Two vectors lie with their tails at the same point. When the angle between them is increased by 20 their scalar product has the same magnitude but changes from positive to negative. The original angle between them was:

A) 0 B) 60

C) 70 D) 80 E) 90

31. If the magnitude of the sum of two vectors is less than the magnitude of either vector, then:

A) the scalar product of the vectors must be negative

B) the scalar product of the vectors must be positive

C) the vectors must be parallel and in opposite directions

D) the vectors must be parallel and in the same direction

E) none of the above

32. If the magnitude of the sum of two vectors is greater than the magnitude of either vector, then:

A) the scalar product of the vectors must be negative

B) the scalar product of the vectors must be positive

C) the vectors must be parallel and in opposite directions

D) the vectors must be parallel and in the same direction

E) none of the above

33. Vectors **A** and **B** each have magnitude *L*. When drawn with their tails at the same point, the angle between them is 30. The magnitude of **A  B** is:

A) *L*2/2 B) *L*2 C)  D) 2*L*2

E) none of these

34. Two vectors lie with their tails at the same point. When the angle between them is increased by 20 the magnitude of their vector product doubles. The original angle between them was about:

A) 0 B) 18 C) 25 D) 45 E) 90

35. Two vectors have magnitudes of 10 and 15. The angle between them when they are drawn with their tails at the same point is 65. The component of the longer vector along the line perpendicular to the shorter vector, in the plane of the vectors, is:

A) 0 B) 4.2 C) 6.3 D) 9.1 E) 14

36. The two vectors 3i – 2j and 2i + 3j – 2k define a plane (it is the plane of the triangle with both tails at one vertex and each head at one of the other vertices). Which of the following vectors is perpendicular to the plane?

A) 4i + 6j+ 13k B) -4i + 6j+ 13k C) 4i - 6j+ 13k

D) 4i + 6j - 13k E) 4i + 6j

37. Let £ =$  ¥ and ** 90, where **is the angle between ¤ and ¥ when they are drawn with their tails at the same point. Which of the following is NOT true?

A)  £  =  $  ¥ sin ** B) –£ = ¥  $

C) £ $ = 0 D) £ ¥ = 0 E) $ ¥ = 0

38. The value of **i  (j k)** is:

A) zero B) +1 C) –1 D) 3 E) 

39. The value of **j  (j k)** is:

A) zero B) +1 C) –1

D) 3 E) 