VECTORS

**SET I**

1. State which of the following are vectors.

(a) weight (c) specific heat (e) density (g) volume (i) speed

(b) calorie (d) momentum (f) energy (h) distance (j) magnetic field

Intensity (k) Electric field

2. An automobile travels 3 km due north, then 5 km northeast. What

is the resultant displacement ?

3. Find the sum or resultant of the following displacements:

A, 10 m northwest; B, 20 m 30° north of east; C, 35 m due south.

4. An airplane moves in a north-westerly direction at 125 km/h

relative to the ground, due to the fact there is a westerly wind of

50 km/h relative to the ground. How fast and in what direction

would the plane have travelled if there were no wind?

5.The minute hand of a wall clock measures 10 cm from its axis to

tip. What is the displacement vector of its tip (a) from a quarter

after the hour to half past,(b) the next half hour , and (c) in the

next hour.

6. Given **r1** = 3**i** - 2**j** + **k**, **r2** = 2**i** - 4**j** - 3**k, r3** = - **i** + 2**j** + 2**k**, find the

magnitude of (a) **r3** , (b) **r1** + **r**2 + **r3** , (c) 2**r1**- 3**r2** -- 5**r3** .

7. A 100 kg weight is suspended from the center of a rope as shown

in the adjoining figure. Determine the tension T in the rope.

8. Find the angle between **A** = 2**i** + 2**j** -**k** and **B** = 6**i** - 3**j** + 2**k** .

9. Determine the value of a so that **A** = 2**i** + a**j** + **k** and **B** = 4**i** - 2**j** - 2**k**

are perpendicular.

10. Find the projection of the vector **A** = **i** - 2**j** + **k** on the vector

**B** = 4**i** - 4**j** + 7**k** .

11. Find the work done in moving an object along a vector

**r** = 3**i** + 2**j** - 5**k** if the applied force is **F** = 2**i** - **j** - **k**.

12. If **A** = 2**i** - 3**j** - **k** and **B** = **i** + 4**j** - 2**k**, find (a) **A x B**, (b) **B x A**,

(c) (**A + B**) x (**A - B**).

13. Determine a unit vector perpendicular to the plane of

**A** = 2**i** - 6**j** - 3**k** and **B** = 4**i** + 3**j** – **k**

14. A particle moves along a curve whose parametric equations are

x = e−3, y = 2cos 3t, z = 2sin3t, where t is the time.

(a) Determine its velocity and acceleration at any time.

(b) Find the magnitudes of the velocity and acceleration at t = 0.

15. A particle moves along the curve x = 2t2, y = t2 - 4t, z = 3t - 5,

where t is the time. Find the components of its velocity and

acceleration at time t = 1 in the direction( **i** - 3**j** + 2 **k**.).

16. A particle moves so that its position vector is given by

**r** = cosωt **i** + sin ωt **j** where ω is a constant. Show that (a) the

velocity **v** of the particle is perpendicular to **r,**(b) the acceleration

**a** is directed toward the origin and has magnitude proportional to

the distance from the origin, (c) **r** x **v** = a constant vector.

17. The acceleration of a particle at any time t 0 is given by

**a**= 12 cos 2 t **i**- 8 sin 2 t **j** + 16 t **k**.

If the velocity **v** and displacement **r** are zero at t =0, find **v** and **r** at

any time.

18. Find the total work done in moving a particle in a force field given

by **F** = 3xy **i** - 5z **j** + 10 x **k** along the curve x =t2+1, y = 2 t2, z = t3

from t =l to t=2.

19. Find the work done in moving a particle once around a circle C in

the xy plane, if the circle has center at the origin and radius 3 and

if the force field is given by

**F** = (2x--y+z) **i** + (x+y-z2) **j** + (3x-2y+4z) **k .**

**SET II**

20. A particle is moving on a circular track with constant speed *v*. The change in its velocity after it has described an angle of 60○ is

(a) *v* (b) *v* (c) *v* (d) 2 *v* .

21. The angle between two vectors A and B is . Resultant of these two vectors , R make angle with A. Which of the following is/are true ?

(a) A = 2B (b) A = B (c) R = 2A cos( (d) R = 2A cos(

22. If A = i + 2 j + 2k and B = 3 i + 6 j + 2k, then the vector in the

direction of A and having magnitude of B is

(a) 7( i + 2 j + 2k) (b) ( i + 2 j + 2k)

(c) ( i + 2 j + 2k) (d) ( i + 2 j + 2k)

23. If A = 2i + 2 j + 3k, B = − i + 2 j − k, C =3 i + j , then A + a B is

perpendicular to C if a is equal to

(a) 2 (b) 4 (c) 6 (d) 8.

24. The displacement x(t) of a particle from its equilibrium position is

described by x = A cos(ω t + ), where A, ω and are constants.

The ratio of velocity and acceleration of the particle at t=0 is

(a) (b) (c) (d)

25. A particle is moving along the positive branch of the curve y= x2/2

where x = t2/2, x and y are measured in meters and t is in seconds.

At t= 2 s, the velocity of the particle is

(a) ( 2i -4j ) m/s (b) ( 4i + 2j ) m/s

(c) ( 2i +4j ) m/s (d) ( 4i -2j ) m/s

26. The retardation experienced by a moving motor boat after the

engine is cut off is given by = −k *v*2 , where k is a constant. If v0 is

the magnitude of velocity at cut off, the magnitude of velocity at

time t after cut off is

( a) v0 (b) v0/2 (c) v0  (d) v0/(2k + 1)1/2

27. A particle moves in a straight line under the retardation bv2. If

the initial velocity is u, the distance covered by it in t seconds is

(a) ln(but) (b) ln(1+but) (c) ln(but) (d) ln(1−but)