**Applied Physics Assignment-1**

**Vectors**

1. A displacement vector in the *xy* plane is 7.3 m long and directed at angle of 30° in Fig.1. Determine (a) the *x* component and (b) the *y* component of the vector.

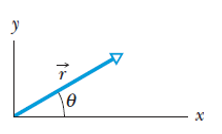
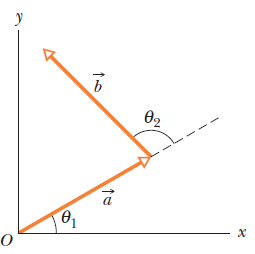
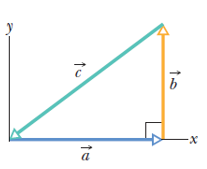
  

Fig-1 Fig-2 Fig-3

1. The two vectors ***a*** and ***b*** in Fig-2 have equal magnitudes of 10m and the angles are θ1= 30 and θ1= 105Find the (a) x and y components of their vector sum ***r*** (b) the magnitude of ***r*** and (c) the angle ***r*** makes with the positive direction of the x axis
2. For the vectors in Fig. 3, with a = 4, b = 3, and c = 5, what are (a) the magnitude and the direction of ***a X b*** , (b) the magnitude and) the direction of ***a X c*** , and (c) the magnitude and the direction of ***b X c*** ?
3. By Considering the above problem -2 find the (a) ***a . b*** (b) ***a X b*** (c) angle between a and b
4. The *x* component of vector ***A*** is 25.0 m and the *y* component is 40.0 m. (a) What is the magnitude of ***A*** (b) What is the angle between the direction of and the positive direction of *x*?
5. A ship sets out to sail to a point 120 km due north. An unexpected storm blows the ship to a point 100 km due east of its starting point. (a) How far and (b) in what direction must it now sail to reach its original destination?
6. Three vectors ***a , b*** and ***c*** each have a magnitude of 50 m and lie in an xy plane. Their directions relative to the positive direction of the x axis are 30°, 195°, and 315°, respectively. What are (i) the magnitude and the angle of the vector ***a+b+c*** , and

(ii) the magnitude and the angle of ***a-b+c***? What are the (iii) magnitude and angle of a fourth vector ***d*** such that ***(a+b ) – (c+d) = 0*** ?

1. Find the angle betwenn the vector A= 2i -3j+5k and the x, y,and z axes, respectively.
2. Calculate the angle between “r” and the positive z-axis. (c) Find the angle between “a” and “b”. where a = 5i +4j -6k , b= -2i +2j+3k and c = 4i+3j+2k , r = a+b+c.
3. Vector A has a magnitude of 6 units, vector B has a magnitude of 7 units, and A.B has a value of 14. What is the angle between the direction of A and B?

**Motion in 1D**

1 The position of a particle moving in an XY direction is given by

r = { (2)t3 -(5)t }i + { (6)-(7t4) }j Calculate (a) r (b) v (c) a when

t = 2sec.|(Ans: r = 6i -106j, v = 19i -224j , a= 24i -336j)

2. A particle had a velocity of 18 m/s in the +X direction and 2.4 sec later its velocity was 30m/s n the opposite direction. What was the average acceleration of the particle during this 2.4sec interval ? (Ans: -20m/s)

3. A rocket ship in free space moves with constant acceleration equal to 9.8 m/s2 (a) if it starts from rest, how long will it take to acquire a speed one – tenth that of light? (b) How far will it travel in so doing? (The speed of light is 3x 108 m/s).

(Ans: t = 3.1 x 106 sec , s = 4.7 x 1013 m )

4. At a construction site a pipe wrench strikes the ground with a speed of 24m/s (a) From what height was it inadvertently dropped? (b) For how long was it falling?

(Ans: s = 29.38 m , t= 2.448sec)

5. A ball thrown straight up takes 2.25 sec to reach a height of 36.8m (a) What was its initial speed ? (b) What is its speed at this height? (c) How much higher will the ball go?(Ans: 27 m/s , 5.25 m/s , 1.45m)

6. A car travels up a hill at the constant speed of 40km/h and returns down the hill at the speed of 60km/h. Calculate the average speed for the round trip.(Ans: 48 km/h)

7. A balloon is ascending at 12.4 m/s at a height of 81.3m above the ground when a package is dropped. (a) With what speed does the package hit the ground? (b) How long did it take to reach the ground?(Ans: +41.8 or – 41.8 m/s , t = 5.53sec)

8. A jumbo jet needs to reach a speed of 360km/h on the runway for takeoff. Assuming a constant acceleration and a runway 1.8km long , what minimum acceleration from rest is required?(Ans: 2.8 m/s)

9. On a dry road a car with good tires may be able to break with a deceleration of 4.92m/s2 (a) how long does such a car, initially traveling at 24.6m/s take to come to rest ? (b) How far does it travel in this time? (Ans: t = 5sec , s = 61.5m)

10. A particle moves along the x axis according to the equation

x = 50 t +10 t2,

where x is in meters and t is in seconds. Calculate

(a) the average velocity of the particle during the first 3 sec of its motion,

(b) the instantaneous velocity of the particle at t = 3 sec, and

(c) the instantaneous acceleration of the particle at t =3sec.

(Ans: 80 m/s , 110 m/s , 20m/s2)