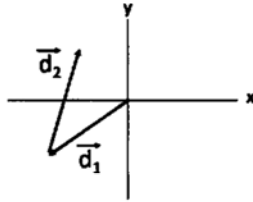




Q.1. Give short answers of the following: (15x2=30)

- i. The two vectors shown in given Fig. lie in an xy plane. What are the signs of the x and y components, respectively, of (a) $\vec{d}_1 + \vec{d}_2$, and (b) $\vec{d}_1 - \vec{d}_2$?



- ii. What do you understand by conservation of angular momentum?
- iii. What are the applications of simple harmonic motion?
- iv. Differentiate between the positive external work and negative external work?
- v. Explain center of mass of system of particles.
- vi. Why does the acceleration of freely falling object not depend on the weight of the object?
- vii. Define rotational motion?
- viii. Differentiate between impulse and momentum?
- ix. How would you differentiate between kinetic friction and static friction?
- x. Define newton's second law of motion.
- xi. The angle turned through by the flywheel of a generator during a time interval t is given by $\phi = at + bt^3 - ct^4$, where a , b , and c are constants. Find the expressions for its angular speed and angular acceleration?
- xii. Define conservative and non-conservative forces.
- xiii. How would you differentiate between inertial and non-inertial frames?
- xiv. What is the difference between Normal force and Gravitational force?
- xv. Can the acceleration of a body change its direction without its velocity changing direction?

Answer the following questions. (3x10=30)

- Q.2. (a) What are the direction cosines? Calculate the value of each (6 Marks)
(b) A 8.5kg object passes through the origin with a velocity of 42m/s parallel to the x -axis. It experiences a constant 19N force in the direction of the positive y -axis. Calculate the velocity of the particle after 15s has elapsed. (4 Marks)
- Q.3. (a) For isolated elastic collisions in one dimension, apply the conservation laws for both the total energy and the net momentum of the colliding bodies to relate the initial values to the values after the collision. (6 Marks)
(b) A 5500kg helicopter accelerates upward at 1.4m/s^2 while lifting a 1200kg car. Calculate (a) the vertical force that air exerts on the helicopter blades and (b) the tension in the upper supporting cable. (4 Marks)
- Q.4. (a) Calculate the transverse velocity $u(t)$ and transverse acceleration $a(t)$ of a string element as a transverse wave moves through its location. (6 Marks)
(b) An oscillating block-spring system has a mechanical energy of 1.18J, an amplitude of 9.84cm, and a maximum speed of 1.22m/s. Find (a) the force constant of the spring, (b) the mass of the block, and (c) the frequency of oscillation. (4 Marks)