SUBJECT : PHYSICS TOPIC: KINEMATICS WITH CALCULUS TIME: DATE:

1. Velocity v of a particle moving along X-axis varies as v = $\sqrt{(8x-5)}\ m/s$. Find acceleration of the particle.
2. The instantaneous velocity of a particle varies with position x as v = 2x + 7. Assuming that particle was at origin at t = 0, find the relation between x and *t*.
3. For a particle moving along + X-axis, acceleration is given as a = 6x + 5. Find the velocity as a function of position? Given that, initially particle is at origin and moving with velocity 2 m/s.
4. For a particle moving along X-axis, acceleration is given as a = v. Find the position as a function of time. Given that, at t = 0, x = 0 and v = 2.
5. For a particle moving along X-axis, acceleration is given as a = $2v^2$. If the speed of the particle is v_0 at x = 0, then find speed as a function of x.
6. An object moving with a speed of 5m/s is decelerated at a rate given by $\frac{dv}{dt} = -\frac{1}{30}v^2$, where v is the instantaneous speed. The time (in s) when its speed become 3m/s is ………………………
7. The motion of a body in given by the equation $\frac{dv}{dt}$ = 6 - 3v, where v is speed in m/s and *t* is time in second. If the body was at rest at *t = 0* its terminal velocity (In m/s) is …….
8. The acceleration of a particle moving rectilinearly varies with the magnitude of its velocity as a = - $\sqrt{v}$. Find its initial speed (in m/s) if it stops after $t_0 = 4$ from starting.
9. A particle is projected with velocity v_0 along X-axis. The deceleration of the particle is proportional to the square of the distance from the origin, i.e. a = αx^2. The distance at which the particle stops is

   (a) $\sqrt[3]{\frac{3v_0^2}{\alpha}}$ (b) $\sqrt[3]{\frac{v_0^2}{2\alpha}}$ (c) $\sqrt[3]{\frac{3v_0^2}{2\alpha}}$ (d) $\sqrt[3]{\frac{v_0^2}{\alpha}}$
10. The velocity v of a moving particle varies with displacement as x = $\sqrt{v+1}$, the acceleration of the particle at x = 5 unit will be

    (a) $\sqrt{6}$ Unit (b) 24 Unit (c) 240 Unit (d) 25 Unit
11. For the motion of a particle, velocity v depends on displacement x as v = $\frac{20}{3x-2}$. If at t = 0, x = 0, then at what time t, x = 20?

    (a) 7s (b) 14s (c) 28s (d) 35s
12. In the one-dimensional motion of a particle, the relation between position x and time t is given by $x^2 + 2x = t$. Choose the correct statement.

    (a) The retardation of the particle is $\frac{1}{4(x+1)^3}$

    (b) The acceleration of the particle is $\frac{1}{(x+1)^3}$

    (c) The uniform velocity of the particle is $\frac{1}{(x+1)^3}$

    (d) The particle has an acceleration of 4t + 6.

13. **The velocity of a particle moving along positive X-axis varies as v = $\alpha\sqrt{x}$, where α is a constant. If particle is at x = 0 at t = 0, what will be the average velocity of particle during the time, it moves a distance s?**

(a) $\frac{\alpha}{2}\sqrt{s}$ **(b)** $\frac{2}{\alpha}\sqrt{s}$ **(c)** $\alpha\sqrt{s}$ **(d)** $\frac{\sqrt{s}}{\alpha}$

14. **The velocity of a particle moving in the positive direction of the X-axis varies as v = $\alpha\sqrt{x}$, where α is a positive constant. Assuming that at the moment t = 0, the particle was located at the point x = 0, find the time dependence of velocity.**

(a) $v = \frac{\alpha^2 t}{2}$ **(b)** $v = \alpha^2 t$ **(c)** $v = \frac{\alpha t}{2}$ **(d)** v = αt

15. **The deceleration experienced by a moving motor boat, after its engine is cut off is given by $\frac{dv}{dt} = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time t after the cut-off is**

(a) $\frac{v_0}{2}$ **(b)** v_0 **(c)** $v_0e^{-k/t}$ **(d)** $\frac{v_0}{\sqrt{2v_0^2kt+1}}$

16. **If the velocity of a particle is given by v = $(180 - 16x)^{1/2}$ m/s, then its acceleration will be**

(a) 0.5 m/s^2 **(b)** 8 m/s^2 **(c)** -8 m/s^2 **(d)** 4 m/s^2

17. **The displacement x of a particle varies with time t, x = $ae^{-\alpha t} + be^{\beta t}$, where a, b, α and β are positive constants. The velocity of the particle will**

(a) go on decreasing with time **(b)** be independent of α and β

(c) drop to zero when $\alpha = \beta$ **(d)** go on increasing with time

18. **A point moves in a straight line with retardation d which depends on velocity of particle v as d = $C\sqrt{v}$, where C is a positive constant. If initial velocity of the particle is v_0, then total distance travelled by the particle before stopping is**

(a) $\frac{3}{3C}v_0^{1/2}$ **(b)** $\frac{3}{3C}v_0^{3/2}$ **(c)** $\frac{2}{C}v_0^{3/2}$ **(d)** $\frac{v_0}{C}$

19. **A particle moves in the xy-plane and its coordinates are given by x = k sinωt and y = k(1-cosωt), where k and ω are constants. What is the magnitude of acceleration of the particle?**

(a) Zero **(b)** kω **(c)** kω^2 **(d)** k$^2\omega$

20. **The relation 3t = $\sqrt{3x} + 6$ describes the displacement of a particle in one direction, where x is in metre and t in second. The displacement, when velocity is zero, is**

(a) 25 m **(b)** 12 m **(c)** 5 m **(d)** zero

21. **The position vector of a particle is given as r = $(t^2 - 4t + 6)\hat{i} + (t^2)\hat{j}$. The time after which the velocity vector and acceleration vector becomes perpendicular to each other is equal to**

(a) 1s **(b)** 2s **(c)** 1.5 s **(d)** Not possible