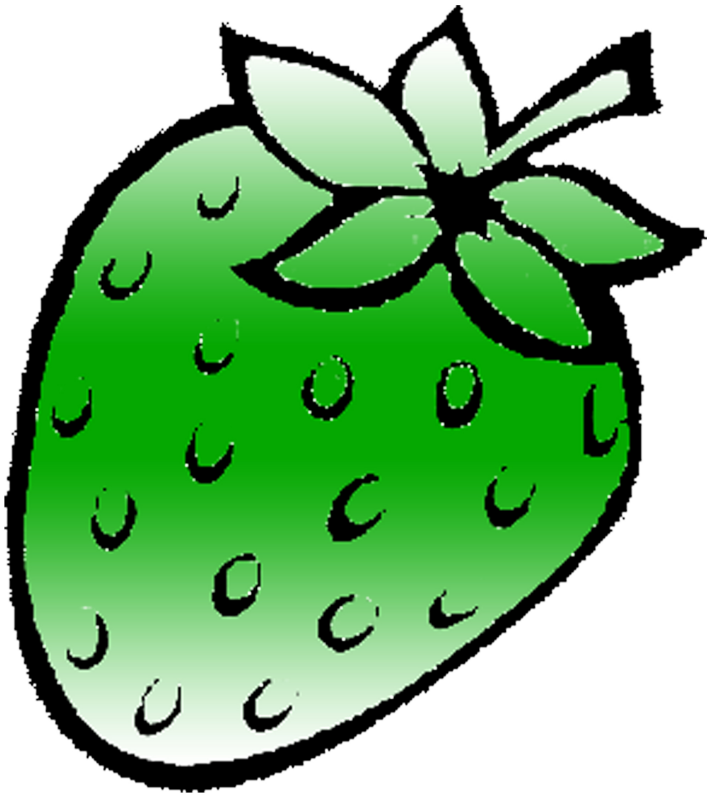
# STRAWBERRY



/strawberrydevelopers

/strawberry_app

## For more visit:

Strawberrydevelopers.weebly.com

# KINEMATICS OF PARTICLES

1. The angular acceleration of a flywheel of diameter 0.6 m, rotating about its centroidal axis is given by $\alpha = \theta/4$ rad/s$^2$ where $\theta$ is in radians. Determine the magnitude of the velocity and magnitude of resultant acceleration of a point on the rim of the flywheel at $\theta = 2$ radians.
   Ans. : assuming at $\theta = 0$, $\omega = 0$, $v = 0.3$ m/s, $a = 0.335$ m/s$^2$

2. A particle moves in the x-y plane with acceleration components $a_X = -3$ m/s$^2$ and $a_Y = -16$ m/s$^2$. If its initial velocity is $v_0 = 50$ m/s directed at $30^0$ to the axis compute the radius of curvature of the path at t=2 seconds.
   Hint : $1/\varsigma = ( V_x a_y - V_y a_x) / ((V_x^2 + V_y^2)^{3/2})$
   Ans. : 88.47 m

3. A train starts from rest on a curved path of radius 800m. Its speed increases uniformly and after 3 minutes it is 72km/hr. Find the tangential, normal and total accelerations after 2 minutes. Ans. : $a_t = 1/9$ m/s$^2$, $a_n = 2/9$m/s$^2$

4. A car starts from rest at t = 0 along a circular track of radius 200m. The rate of increase in speed of the car is uniform. At the end of 60 sec. The speed of the car is 24km/hr. Find the normal and tangential components of acceleration at time t= 30sec.
   Ans. : $a_t = 1/9$ m/s$^2$, $a_n = 1/18$ m/s$^2$

5. A particle moves along a circle of radius 20 cm so that $S = 20\pi t^2$ cm. Find its tangential and normal accelerations after it has completed a revolution.
   Ans. : $a_t = 40\,\pi$ cm/sec$^2$, $a_n = 160\,\pi^2$ cm/sec$^2$

6. A particle moves according to the equation $r(t) = 50\cos 4t^2\ i + 50\sin 4t^2\ j$ where distance are in cm and the time in sec. Find its velocity, tangential and normal accelerations.
   Ans. : v=400cm/s$^2$, $a_t = 400$, $a_n = 3200\ t^2$ cm/sec$^2$

7. The motion of a particles is defined by a relation- $r(t) = 30\sin(2t^2).i + 30\cos(2t^2).j$ Find the velocity, tangential and normal components of accelerations at time t = 3 sec.

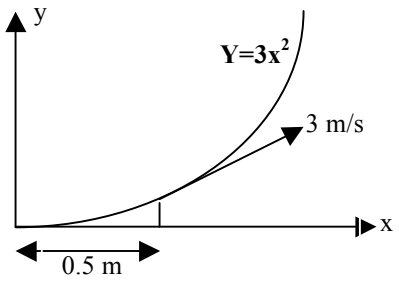
8. A car travels along a depression in a road, the equation of the depression being $x^2 = 200y$. The speed of the car is constant and equal to 72 Km/hour. Find its acceleration when the car is at the deepest point in the depression. What is the radius of curvature of the depression at this point?
   Ans. : $\rho = 100$m, $a = a_n = 4$m/sec$^2$

9. The movement of a particle is defined by $r(t) = t\ i + t^2\ j$ where t is in sec and distances in m. Find the minimum radius of curvature of the path and the velocity and acceleration at this point. (T)
   Ans. : v=1m/sec , $a_n = 2$m/sec$^2$, $\rho = 0.5$m

10. Particle moves in a plane with constant acceleration $a = 2\ i$ m/s$^2$. At t = 0 the velocity of the particle was $V_0 = i + 1.732\ j$ m/s. Find the radius of curvature of its path at t =1sec and the tangential and normal components of the acceleration. (T)
    Ans. : $a_n = 1$m/s$^2$, $a_t = \sqrt{3}$m/s$^2$, $\rho = 12$m

11. A particle moves in xy-plane with velocity components $V_x = (8t - 2)$ & $V_y = 2$. If it passes through point (x,y) = (14 , 4) when t=2sec, determine the equation of the path traced by the particle. Find also the resultant acceleration at t=2 sec.
    Ans. : $x = y^2 - y + 2$, $a = 8$ m/s$^2 \rightarrow$

12. **A particle moves with constant speed of 3m/s along the path $y=3x^2$. Find the acceleration of the particle when x=0.5m. (T)**
**Ans. : $1.7 m/s^2$, $18.45^0$**




13. **A point moves along a path $y=x^2/3$ with a constant speed of 8m/s. What are the x and y components of its velocity when x=3? What is the acceleration of the point at this instant?**
**Ans. : $V_x=3.76 m/s$, $V_y=7.152 m/s$, $a=3.84 m/s^2$**

14. **The position vector of a particle is given by $r = 2t^2 .i+4t^{-2} .j$ (m) where t is in seconds. When t = 1sec, determine : (a) the magnitudes of normal and tangential components of acceleration of the particle and (b) the radius of curvature of the path.**
**Ans. : $a_t=19.68 m/s^2$, $a_n=14.32 m/s^2$ 5.586m**

15. **A skier travels with a constant speed of 6 m/s along the parabolic path $y= x^2 / 20$. Determine his velocity and acceleration at the instant he arrives at A. Neglect the size of the skier in the calculation.**
**Ans. : $a_A=1.27 m/s^2$ $135^0$ with horizontal**

16. **A car is traveling along a circular curve having a radius of 50 m. if its speed is 16 m/s and is increasing uniformly at 8 $m/s^2$, determine the magnitude of its acceleration at this instant.**
**Ans. : 9.50 $m/s^2$**

17. **A jet plane flies along the vertical curve having a radius of 800 m. If is speed is uniformly increased from 180 m/s to 230 m/s in 4 s, determine the magnitude of its acceleration at the instant the plane's speed is 200 m/s.**
**Ans. : 51.5 $m/s^2$**

18. **A point moves along a path $y = 3x^2$ with a constant speed of 8 m/s. What are the x and y components of its velocity when x= 3m. What is the acceleration at this point?**