



4. Find  $\frac{d^2y}{dx^2}$  if  $\sqrt{x} + \sqrt{y} = 8$ .

5. If  $\mathbf{r}(t) = \langle t^3, t^2 \rangle$  represents the position of a particle at time  $t$ , find the angle between the velocity and the acceleration vector at time  $t = 1$ .

6. Consider the curve  $x = t^2 - 10t - 3$ ,  $y = 5t^2 + t$ .

(a) Find the equation of the tangent line at the point (8,4).

(b) At what point(s) is the tangent line to the graph parallel to the line  $7x + 2y = 19$ .

7. Find the point(s) on the curve  $x = 1 - 2 \cos t$ ,  $y = 2 + 3 \sin t$  where the tangent is horizontal or vertical.

8. A balloon is rising at a constant speed of 5 ft/s. A boy is cycling along a straight road at a speed of 15 ft/s. When he passes under the balloon it is 45 ft above him. How fast is the distance between the boy and the balloon increasing 3 s later?

9. A kite 100 ft above the ground moves horizontally at a speed of 8 ft/s. At what rate is the angle between the string and the horizontal decreasing when 200 ft of string have been let out?

10. A trough is 10 ft long and its ends have the shape of isosceles triangles that are 3 ft across the top and have a height of 1 ft. If the trough is filled with water at a rate of  $12 \text{ ft}^3/\text{min}$ , how fast is the water level rising when the water is 6 inches deep?

11. A paper cup has the shape of a cone with height 10 cm and radius 3 cm (at the top). If the water is poured into the cup at a rate of  $2 \text{ cm}^3/\text{s}$ , how fast is the water level rising when the water is 5 cm deep?