

1. Let a curve be described by the parametric equations $x = t^3 + 2t + 5$, $y = t^3 + 6t^2$.

(a) Find the tangent line to the curve when $t = 1$.

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3t^2 + 12t}{3t^2 + 2}$$

$$m = \left. \frac{dy}{dx} \right|_{t=1} = \frac{15}{5} = 3$$

$$(x_0, y_0) = (8, 7)$$

Tangent Line :

$$y - 7 = 3(x - 8)$$

$$y = 3x - 17$$

(b) Find all points where the curve has a horizontal tangent line.

$$\frac{3t^2 + 12t}{3t^2 + 2} = 0$$

$$3t^2 + 12t = 0$$

$$3t(t + 4) = 0$$

$$t = 0 \text{ OR } t + 4 = 0$$

$$t = -4$$

$$t = 0 :$$

$$x = 5, y = 0$$

$$(5, 0)$$

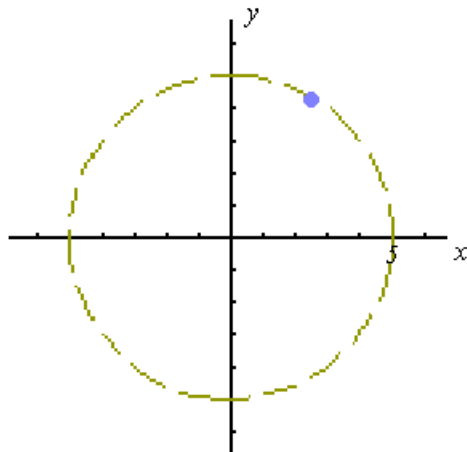
$$t = -4$$

$$x = -67, y = 32$$

$$(-67, 32)$$

2. Consider the point described in polar coordinates by $(r, \theta) = \left(5, \frac{\pi}{3}\right)$.

(a) Plot this point on xy -axes.



(b) Give the rectangular coordinates of this point.

$$x = r \cos \theta = 5 \cos \frac{\pi}{3} = 5 \left(\frac{1}{2} \right) = \frac{5}{2}$$

$$y = r \sin \theta = 5 \sin \theta = 5 \left(\frac{\sqrt{3}}{2} \right) = \frac{5\sqrt{3}}{2}$$

$$(x, y) = \left(\frac{5}{2}, \frac{5\sqrt{3}}{2} \right)$$