

1) a) Find the slope ( $dy/dx$ ) of the curve  $r = 2 - \sin 2\theta$  at  $\theta = \frac{\pi}{4}$ .

(b) Find the equation of the tangent line of the curve  $r = 2 - \sin 2\theta$  at  $\theta = \frac{\pi}{4}$ .

(c) Find  $\frac{dr}{d\theta}$  for curve  $r = 2 - \sin 2\theta$  and evaluate it at  $\theta = \frac{\pi}{4}$ . Then interpret what the value of  $\frac{dr}{d\theta}$  means in terms of the movement of the particle. Show the work that leads to your answer.

d) A particle moves along  $r = 2 - \sin 2\theta$  so at time  $t$ , seconds  $\theta = t^2$ , Find the time on the interval  $0 < t < 1$  for which the particle's  $x$ -coordinate is 1.

e) For the particle described in part (d,) find the position vector in terms of  $t$ .

f) Using the position found in part (e), find the velocity vector at  $t = 2$  seconds.