

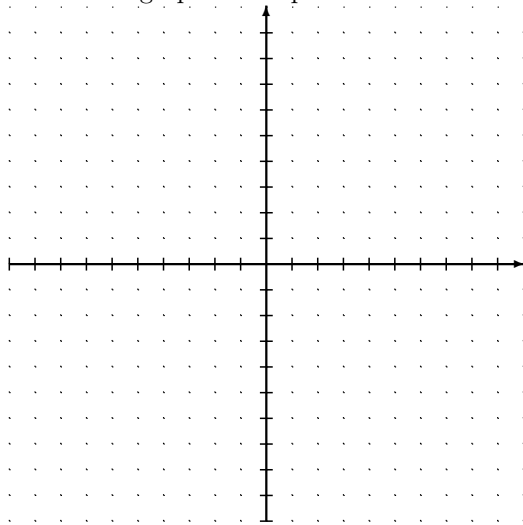
1. The velocity of a particle moving in the  $xy$ -plane is given by  $\langle 3t^2 + 2t - 6, 2 \cos(\pi t) \rangle$

(a) Find the speed at time  $t = 3$

(b) Find the position vector  $\mathbf{r}(t)$  if the particle is at  $(5, -6)$  when  $t = 1$ .

2. The position vector of a particle is given by  $\mathbf{r}(t) = \langle \ln(t + 2), t^2 - 4 \rangle$  for  $-2 < t \leq 2$ .

(a) Sketch the graph of the particle. Indicate direction.



(b) Find the acceleration vector at any time  $t$ .

3. Given  $\frac{d\mathbf{r}}{dt} = 4e^{2t}\mathbf{i} + 6t\mathbf{j}$  Find  $\mathbf{r}(t)$  is  $\mathbf{r}(0) = 5\mathbf{i} - 8\mathbf{j}$ .

A moving particle has the position  $(5, -6)$  at  $t = 1$ , and the velocity vector at any given time  $t > 0$  is given by  $\left\langle 1 - \frac{1}{t^2}, 2 + \frac{1}{t^2} \right\rangle$

4. (a) Find the acceleration vector at time  $t = 3$ .

(b) Find the position vector at time  $t = 3$ .

(c) For what time  $t$ , for  $t > 0$ , does the line tangent to the path of the particle at  $\mathbf{r}(t)$  have a slope of 8?

(d) The particle approaches a line as  $t \rightarrow \infty$ . Find the slope of this line. Show the work that leads to your conclusion.

5. A projectile is launched at a height of 16 feet above the ground with an initial velocity of 70 feet per second at an angle of 30 degrees above the horizontal.

(a) Find the vector valued function for the path.

(b) At what time does it reach the maximum height?

(c) What is the maximum height?

(d) How long will it take to reach the ground (height=0)?

(e) How far (horizontally) will it be from where it was launched?