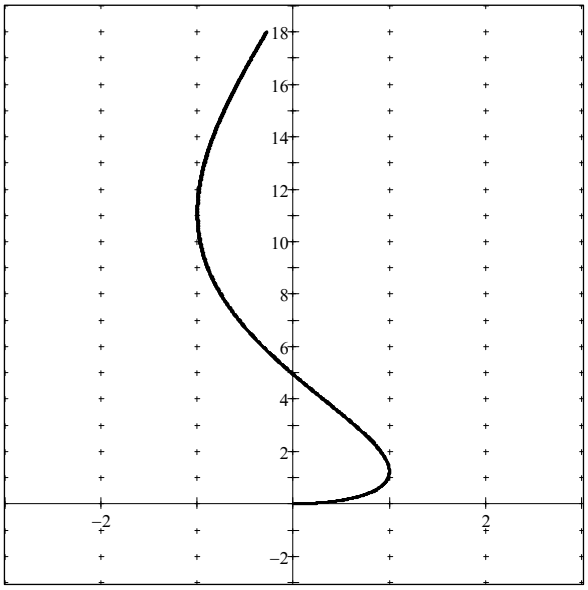
Analysis 1A Name_____

Motion in the Plane

1. A particle moves in the *xy*-plane so that its position at any time $t \geq 0$ is given by

$x = \sin t$

$y = \frac{1}{2}t^2$



a. Find the position vector of the particle at time *t*.

b. Find the velocity vector of the particle at time *t*.

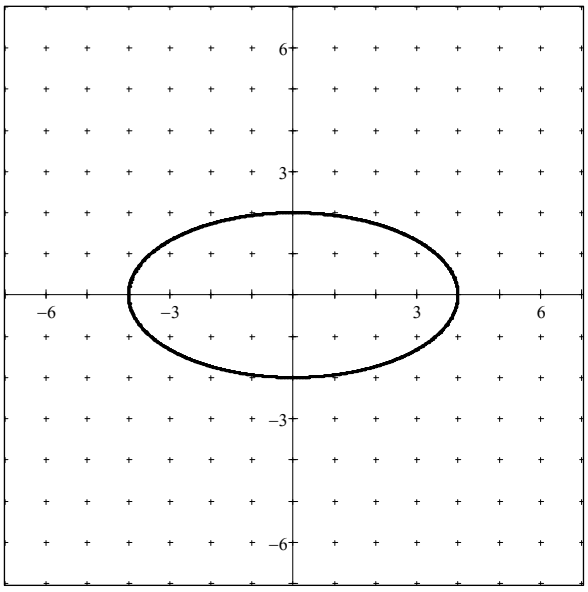
c. Find the acceleration vector of the particle at time *t*.

d. Describe the motion of the particle at time $t = 6$

2. A particle moves in the *xy*-plane so that its position at any time $t \geq 0$ is given by

$x = 4\sin t$

$y = 2\cos t$



Find the speed of the particle when $t = \frac{\pi}{4}$

3. A particle travels in the *xy*- plane so that its position at any time $t \geq 0$ is given by the parametric equations $x = e^t + e^{-t}$ and $y = e^t - e^{-t}$.

a. Find the velocity vector.

b. Find $\lim_{t\to\infty} \frac{dy/dt}{dx/dt}$

c. Eliminate the parameter and show that the particle move one the hyperbola $\frac{x^2}{4} - \frac{y^2}{4} = 1$.

4. A particle moves on the circle $x^2 + y^2 = 1$ so that its position vector at any time $t \geq 0$ is $\left\langle \frac{1-t^2}{1+t^2}, \frac{2t}{1+t^2} \right\rangle$.

a. Find the velocity vector.

b. Is the particle ever at rest? Justify your answer.

c. Give the coordinates of the point that the particle approaches as t increases without bound.