

1. Identify the particle's path for the given parametric equation by finding a Cartesian equation for it. Graph this equation, indicate the portion of the graph traced by the particle and the direction of motion.

(a)

$$x = 2 \cos \pi t, \quad y = 2 \sin \pi t, \quad 0 \leq t \leq 1,$$

(b)

$$x = -\sqrt{t}, \quad y = t, \quad t \geq 0.$$

2. [2008 exam question]
If

$$x^3 + y^3 = 56,$$

find the values of dy/dx and d^2y/dx^2 at the point $(-2, 4)$, using implicit differentiation.

3. Find the linearisation of $f(x) = \cos x$ at $x = \pi/2$.

- (*)4. [2008 exam question]

Consider the family of curves given by

$$f_a(x) = 2x^3 + ax^2 + 1, \quad a, x \in \mathbb{R}.$$

- (a) For fixed a , compute the critical point(s) of each curve.
(b) When varying a , the set of all a -dependent critical points lie on a new curve. Compute the equation of that curve.