

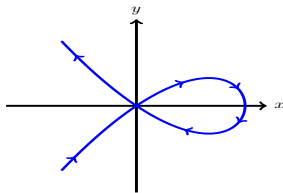
1. [14 points] Indicate if each of the following statements are true or false by circling the correct answer. **Justify your answers.**

a. [2 points] The function $z(t) = \sin(at) + at$ is a solution to the differential equation $z'' + a^2z = a^3t$.

True False

- b. [3 points] The motion of a particle is given by the parametric curve $x = x(t)$, $y = y(t)$ for $0 \leq t \leq 3$ shown below. The arrows indicate the direction of the motion of the particle along the path. If the curve passes only twice through the origin, $x(1) = x(2) = 0$ and

$y(1) = y(2) = 0$ then $\frac{d}{dt} \left(\frac{\frac{dy}{dt}}{\frac{dx}{dt}} \right) > 0$ for $t = 1$.

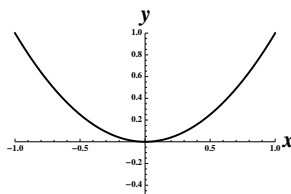


True False

- c. [3 points] Euler's method yields an overestimate for the solutions to the differential equation $\frac{dy}{dx} = 4x^3 + 2x + 1$.

True False

- d. [3 points] The graph of $x = x(t)$ and $y = y(t)$ for $0 \leq t \leq 2$ is given below. If $y'(1) = 0$, then it must be the case that $(x(1), y(1)) = (0, 0)$.



True False

- e. [3 points] If $\int_0^2 f(x)dx$ is an improper integral, then $\int_0^1 f(x)dx$ must also be an improper integral.

True False

