1. [10 points] Indicate if each of the following is true or false by circling the correct answer. No justification is required.

a. [2 points] If $r = f(\theta)$ is a polar curve and is concave down, then $f''(\theta) < 0$.

True False

b. [2 points] Let $y = f(x)$ be a solution of the differential equation $y' = g(x)$ where $g(x)$ is an increasing function. Then the graph of $f(x)$ is concave up.

True False

c. [2 points] The function $x(t) = e^{-3t} + 2t^2 + \frac{4}{9}$ is a solution to $x'' = 9x - 18t^2$.

True False

d. [2 points] If $\int_0^\infty f(x)\ dx$ and $\int_0^\infty g(x)\ dx$ both diverge, then $\int_0^\infty f(x)g(x)dx$ diverges.

True False

e. [2 points] If $k > 0$ is a constant, then on the interval $a \leq t \leq b$, the arclength of the parametric curve $x = kf(t)$, $y = kg(t)$ is k times the arclength of $x = f(t), y = g(t)$.

True False