1. False. This function can only show that an improper integral is convergent. Otherwise, it is inconclusive.

2. True. Think about the phase diagrams.

3. (a) Since $e^{x^3} > x^3$, then $\frac{1}{e^{x^3}} = e^{-x^3} < \frac{1}{x^3}$. By the comparison test, since $\int_1^\infty \frac{1}{x^3} dx$ converges, then so does $\int_1^\infty e^{-x^3} dx$.

   (b) i. $\frac{dT}{dx} = (A - T)^3$.

   ii. Isolate the variables: $\frac{dT}{(A-T)^4} = dx$

   Integrate both sides: $\frac{1}{3(A-T)^3} = x + C$.

   Solve for T: $T(x) = A - \sqrt[3]{\frac{1}{3x+C}}$

   Use initial conditions to find C: $37 = T(0) = 36 - \sqrt[3]{\frac{1}{0+C}} \rightarrow C = -1$