

Physics 301

Homework due 4 September 2024

1) Consider the quantity $dF = (x^2 - y)dx + xdy$.

(a) Explicitly integrate dF over several paths to determine whether or not it is an exact differential.

(b) Explicitly differentiate dF to determine whether or not it is an exact differential.

2) Consider a gas whose pressure is proportional to its (volume)^{-5/3}.

(a) Use the figure below to determine the constant of proportionality.

(b) Calculate the total work done by the gas in compressing it from state "a" to state "b" (see figure below) in a thermally insulated vessel.

3) Consider a system of 4 particles. Two particles are of a type that can take two states (up or down).

These two particles can not simultaneously be in the same state (i.e. both up or both down). The two others are of a type that can take 3 states (A, B, or C). How many states are possible for the combined system?

