

Discovery Exercise for Exact Differential Equations

The buoyancy B of a hot air balloon is a function of the temperature T of the air inside the balloon and the volume V of the balloon.

1. If the air temperature changes while the volume stays constant, the resulting change in buoyancy is given by:

$$dB = \frac{\partial B}{\partial T} dT$$

Explain why. Your explanation should focus on the meaning of that partial derivative.

2. If the volume changes while the air temperature stays constant, what is the resulting change in buoyancy?
3. If the temperature and volume both change, what is the total resulting change in buoyancy?