

4. (6 points) The shape of a balloon used by a clown for making a balloon animal can be approximated by a cylinder. As the balloon is inflated, assume that the radius is increasing by 2 cm/sec and the height is given by $h = 2r$. At what rate is air being blown into the balloon at the moment when the radius is 3 cm?

5. (8 points) In introductory physics one learns the formula $F = ma$, connecting the force on an object, F , with the mass of the object and the acceleration that the object experiences under the force. One also learns the formula $p = mv$ where p is the momentum of an object, m is the mass, and v is the velocity.

(a) Derive the formula $F = ma$ given that $\frac{dp}{dt} = F$, assuming that the mass is constant and that $p = mv$. Explain your answer.

(b) Derive a formula for the force F if the mass is not assumed to be constant.