Question:

Gravel is being dumped from a conveyor belt at a rate of 30ft^3/min, and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. how fast is the height of the pile increasing when the pile is 10 ft high?

Solution:

Volume of the cone equals:

$$V = \frac{1}{3}\pi \left(\frac{d}{2}\right)^2 h = \frac{1}{12}\pi h^3$$

where d is base diameter, h is height.

Rate of increasing equals:

$$\frac{dV}{dt} = \frac{1}{12}\pi\, 3h^2 \frac{dh}{dt} = \frac{1}{4}\pi h^2 \frac{dh}{dt}$$

Therefore:

$$\frac{dh}{dt} = \frac{\dfrac{dV}{dt}}{\dfrac{1}{12}\pi\, 3h^2} = \frac{30\dfrac{ft^3}{min}\, 4}{\pi\, 100\, ft^2} = 0.382\,\frac{ft}{min}$$

Answer: $0.382\,\frac{ft}{min}$