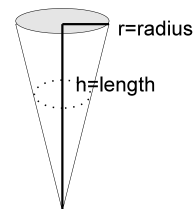
5. [13 points] A cone-shaped icicle is dripping from above the entrance to Dennison Hall. The icicle is melting at a rate of 1.2 cm^3 per hour. At 10:00 a.m., the icicle was 25 cm long and had a 2 cm radius at its widest point. Assume that the icicle keeps the same proportions as it melts. [Note: the volume of a cone is $V = \frac{1}{3}\pi r^2 h$.]



a. [5 points] Determine the rate at which the length of the icicle is changing at 10:00 a.m.

b. [4 points] At what rate is the radius of the icicle changing at 10:00 a.m.?

c. [4 points] Let $V(t)$ and $r(t)$ denote the volume and radius, respectively, of the icicle t hours after 10:00 a.m. Assume that the icicle continued to melt from $t = 0$ (10:00 a.m.) to $t = M$. Circle all of the statements below that must be true if "After the icicle began dripping at 10:00 a.m., it took exactly M hours for the icicle to melt completely." [Circle the entire expression, and be certain that your circled answers are VERY clear!!]

i. $\int_0^M V'(t)\,dt > \int_0^{M/2} V'(t)\,dt$

ii. $\int_0^M V'(t)\,dt = 0$

iii. $\int_0^M V'(t)\,dt = -V(0)$

iv. $\int_0^2 r(t)\,dt = 0$

v. $\int_0^M r(t)\,dt = -2$

vi. $\int_0^M r'(t)\,dt = -2$

vii. $\int_2^0 V'(r)\,dr = M$

viii. $\int_0^M h(t)\,dt = 0$