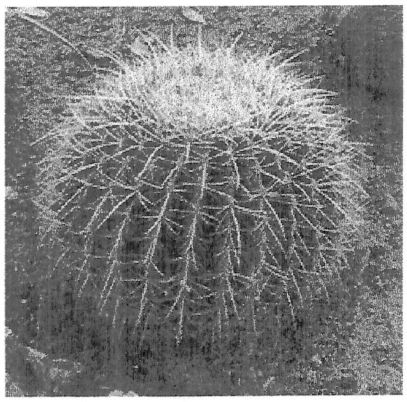
Mathematics 172

Quiz 2 Name: Key

You must show your work to get full credit.



Assume that a type of barrel cactus has a crushing weight of 100 psi. If a cactus which is 10 inches tall weighs 30 pounds and has a base of area 50 in^2, what is the critical height where a barrel cactus will crush itself?

Crushing height is $1666.7 \text{ in} = 138.9 \text{ ft}$

Scale (magnify) by a factor of λ.

magnified weight $= 30\lambda^3$ lbs

magnified base area $= 50\lambda^2$ in^2.

pressure on base $= \frac{\text{weight}}{\text{area}} = \frac{30\lambda^3}{50\lambda^2} = .6\lambda$ lbs/in^2

So the critical magnification factor is when

$.6\lambda = 100$

$\lambda = \frac{100}{.6} = 166.6\overline{7}$.

Thus the critical height is

$\lambda \cdot 10 \text{ in} = 1666.7 \text{ in}.$