Quiz 34   Name: _____Key_____
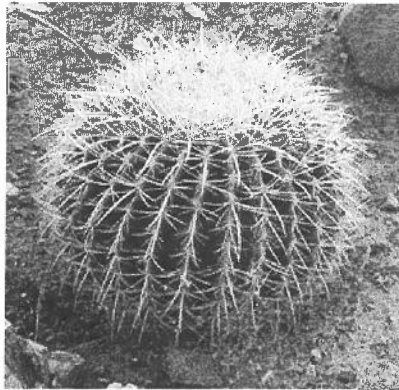
You must show your work to get full credit.

Assume that a type of barrel cactus has a crushing weight of 101 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 _____

Let

h = height

A = ~~area~~ of base

w = weight.

Then there are constants c_1, c_2 so that

$w = c_1 h^3$.

when $h = 10$, $w = 30$ so

$30 = c_1 (10)^3$ $c_1 = \frac{30}{10^3} = .03$

Thus $w = .03 h^3$.

— $A = c_2 h^2$ when $h = 10$, $A = 50$ so

$50 = c_2 10^2$ $c_2 = \frac{50}{10^2} = .5$.

— For a cactus of height h the average pressure on base is

Pressure $\frac{weight}{Area} = \frac{.03 h^3}{.5 h^2} = .06 h$ psi

The crushing pressure is 101 psi so solve

$.06 h = 101$

$h = \frac{101}{.06} = 1683.$ ft.