

Quiz #26

Name: Key

You must show your work to get full credit.

The wood of lodgepole pine crushes at a pressure of 50,752 lbs/ft². A lodgepole pine of height 9 ft has a diameter at the base of ~~9~~ (= .7 ft) and weighs 370 lbs.

1. Let $D(h)$ be the diameter at the base of a lodgepole pine of height h feet. Give a formula for $D(h)$.

$$D(h) = ch$$

$$D(9) = c(9) = .7$$

$$c = \frac{.7}{9} = .07778$$

$$D(h) = \underline{.07778h}$$

2. Let $W(h)$ be the weight of a lodgepole pine of height h feet. Give a formula for $W(h)$.

$$W(h) = ch^3$$

$$W(9) = c(9^3) = 370$$

$$c = \frac{370}{9^3} = .5075$$

$$W(h) = \underline{.5075h^3}$$

3. What is the area of the base a lodgepole pine of height h feet?

$$A(h) = \pi (\text{radius})^2$$

$$= \pi \left(\frac{1}{2}D(h)\right)^2$$

$$= \pi \left(\frac{1}{2}(.07778h)\right)^2 =$$

$$\text{Area is } \underline{.004751h^2}$$

4. What is the pressure on the base of a lodgepole pine of height h ?

$$P(h) = \frac{W(h)}{A(h)} = \frac{.5075h^3}{.004751h^2}$$

$$\text{Pressure is } \underline{106.8h}$$

5. What is the maximum height of a lodgepole pine before it crushes itself from its own weight.

Things go bad when

$$106.8h = 50,752$$

$$h = \frac{50,752}{106.8} =$$

$$\text{Maximum height is } \underline{475.2 \text{ ft}}$$