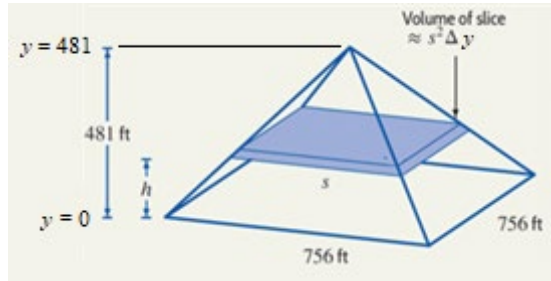


The Work to Build a Pyramid for Ramses Senior



(+2 rhino bonus points)

Ramses Senior has decreed that his pyramid shall be constructed of sandstone, $\rho = 200 \frac{\text{lb}}{\text{ft}^3}$ as described above.



"So let it be written. So let it be done."

y	s
0	_____
481	_____
$\frac{1}{2}(481)$	_____

1. Complete the table and fill in the blanks.

If $y = 0$ ft, then the side length, s , of a cross-section is $s =$ _____ ft.

If $y = 481$ ft, then the side length, s , of a cross-section is $s =$ _____ ft.

Report a formula that relates s to y . A graph may help.

$s =$ _____ Check: If $y = 240.5$ ft = $\frac{1}{2}(481)$ (half the total height), then $s =$ _____ ft.

2. Report the **weight** $F(y)$ of a thin, square s ft by s ft cross sectional slice of height y and thickness Δy .

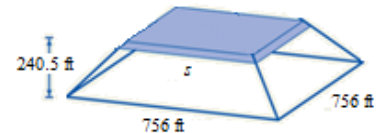
$F(y) =$ _____ (No need for g here.)

3. The very bottom layer at $y = 0$ (ground level) will need to be lifted a distance of 0 ft.
 The layer $y = 10$ ft high will need to be lifted a vertical distance of _____ ft.
 The layer $y = 240.5$ ft high will need to be lifted a vertical distance of _____ ft.
 The very top layer at $y = 481$ ft need will have be lifted a vertical distance of _____ ft.
 In general, the distance any slice that is $y = h$ feet off the ground will need to be lifted a vertical distance of _____ ft.

4. Set up and use FNINT to evaluate the integral that gives the total work done, in foot-pounds, to build the total pyramid.

$$\int_{\boxed{}}^{\boxed{}} (\boxed{}) dy \approx \text{_____} \times 10^{12} \text{ ft lb. Report to 1 decimal place.}$$

5. Ramses Senior thinks that at $h = 240.5$ ft (half the height), then half the work will be done. Do you agree? YES / NO Explain.

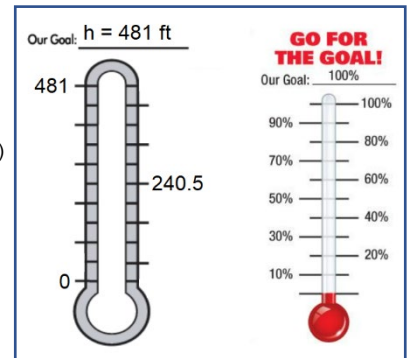


6. a. Set up and use FNINT to evaluate an integral to find the work done to build a truncated pyramid of height $h = 240.5$ ft.

$$\int_{\boxed{}}^{\boxed{}} (\boxed{}) dy \approx \text{_____} \times 10^{12} \text{ ft lb. Report to 2 decimal places}$$

- b. What exact percent of the total work has been completed? _____ % (to 2 decimal places)
 Use the full calculated values of #4 and #6 to find this instead of using rounded values.

7. Nephretiri is commanded to construct and maintain a progress thermometer. She decides to do two, as shown to the right. Use your answer to 6b to shade both thermometers for when $h = 240.5$.



8. Find the formula of $W'(h)$, the rate at which the work is completed at height h .

a. $W'(h) =$ _____

b. At what exact height h is Nephretiri's thermometer rising the fastest? $h =$ _____ ft. (Hint: for what h is $W'(h)$ a maximum?)

c. Your answer to part b is what fraction of the total height of 481 feet? At of the total height $W'(h)$ is a max.

d. Use your grapher to sketch $W'(h)$. Then recopy your sketch on the back.

