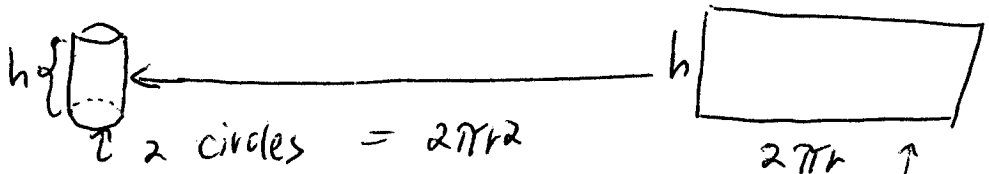
#28) P.208

1) V of cylinder $= 12 \cdot (1.80469) = \underset{\approx}{21.66} = \pi r^2 \cdot h$

(πr^2: area of ○; h: height)

2) dimensions that require minimum amount of construction material

⇒ least area - i.e. surface area !!



length here is circumference of ○!!

$$A = 2\pi r^2 + 2\pi r \cdot h$$

in 1), solve for h say ⇒ $21.66 = \pi r^2 \cdot h \Rightarrow h = \frac{21.66}{\pi r^2}$

$$\Rightarrow A = 2\pi r^2 + \frac{2\pi r}{\pi r^2} \cdot 21.66 = 2\pi r^2 + \frac{2 \cdot 21.66}{r}$$

3) $\frac{dA}{dr} = 4\pi r - \frac{2 \cdot 21.66}{r^2} = 0$ when $4\pi r = \frac{2 \cdot 21.66}{r^2}$

$$\Rightarrow r^3 = \frac{21.66}{2\pi} \Rightarrow r \approx 1.51 \text{ inches}$$

$$\Rightarrow h = \frac{21.66}{\pi r^2} \approx 3.02 \text{ inches}$$

min? take second derivative ⇒

$$\frac{d^2A}{dr^2} = 4\pi + \frac{4 \cdot 21.66}{r^3} > 0 \quad \checkmark \quad \underline{\text{min !!}}$$