

# TRANSPARENCY MASTERS

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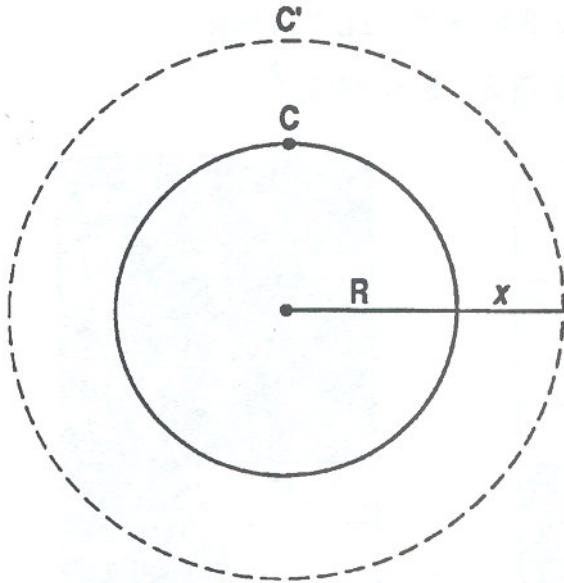
# STEEL BAND PROBLEM



Suppose that we fit a band tightly around the earth at the equator. We wish to raise the band so that it is uniformly supported 10 ft above the earth at the equator. Assuming that the slack is uniform all the way around the equator, the band would be loose enough to:

- A. Walk under?
- B. Crawl under?
- C. Slip your hand under?
- D. Slip a sheet of paper under?
- E. Not even get the sheet of paper under?

# STEEL BAND PROBLEM SOLUTION



$$\begin{aligned}C &= 2\pi R \\C' &= 2\pi(R + x) \\C' - C &= 2\pi(R + x) - 2\pi R \\10 &= 2\pi R + 2\pi x - 2\pi R \\10 &= 2\pi x \\\frac{10}{2\pi} &= x \\x &\approx 1.6\end{aligned}$$

The band would allow a uniform distance of 1.6 ft all the way around the equator. (ENUF' TO CRAWL!)

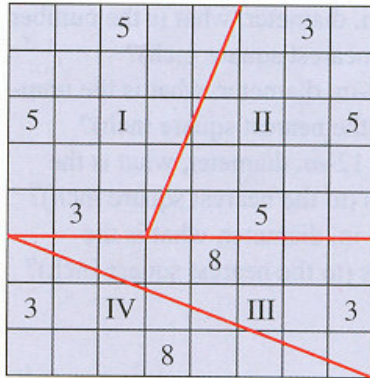
Moreover, wouldn't it be the same around the moon? Or a basketball?

Note the result is independent of  $R$ !!!

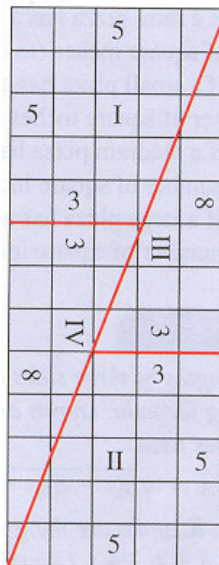
# EXTRA SQUARE INCH

Consider the following 8 in. by 8 in. square.

The area of this square is  $8 \times 8 = 64 \text{ in.}^2$



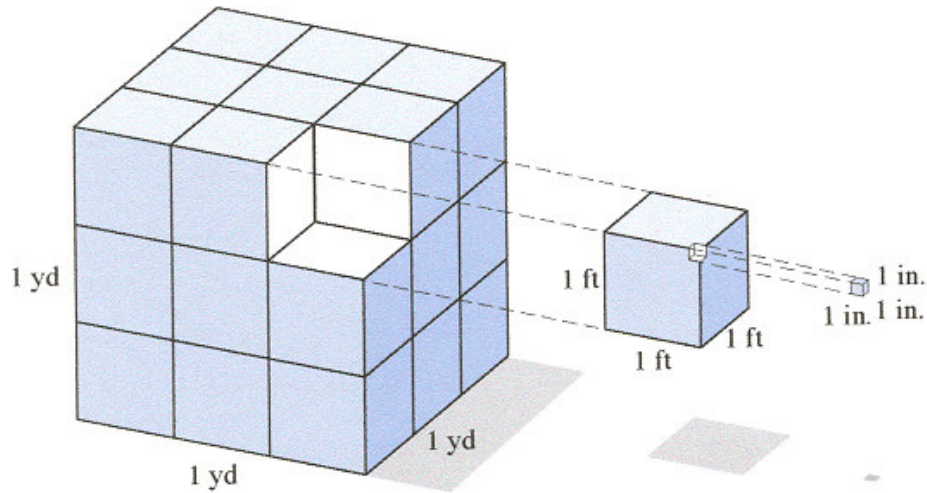
Cut this square into 4 pieces (I, II, III, IV) and rearrange the pieces as shown here. The area of this square is  $5 \times 13 = 65 \text{ in.}^2$



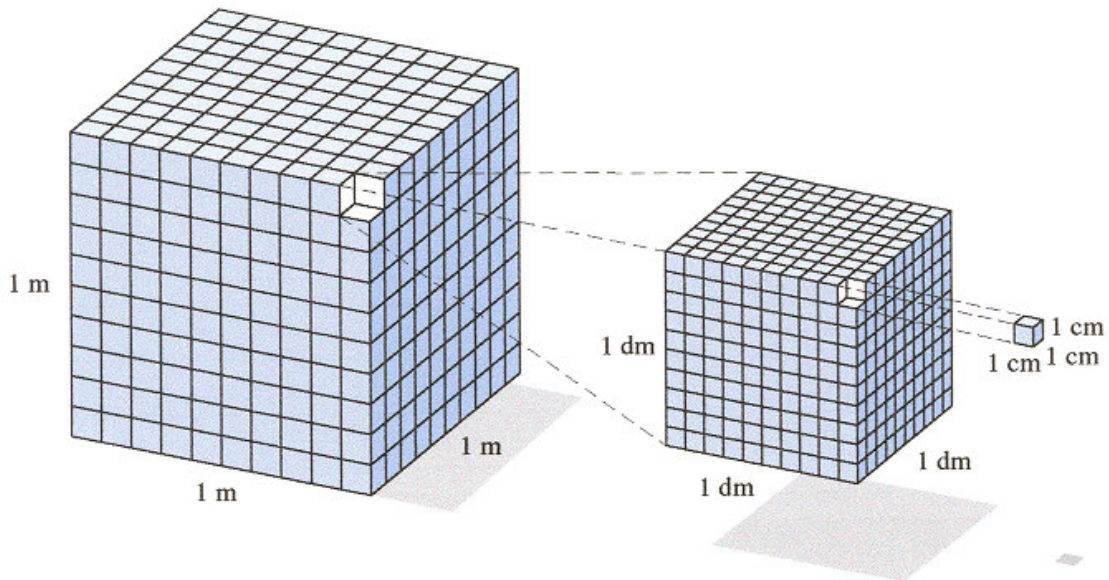
**WHERE DID THE EXTRA SQUARE INCH  
COME FROM?**

# VOLUME AND CAPACITY

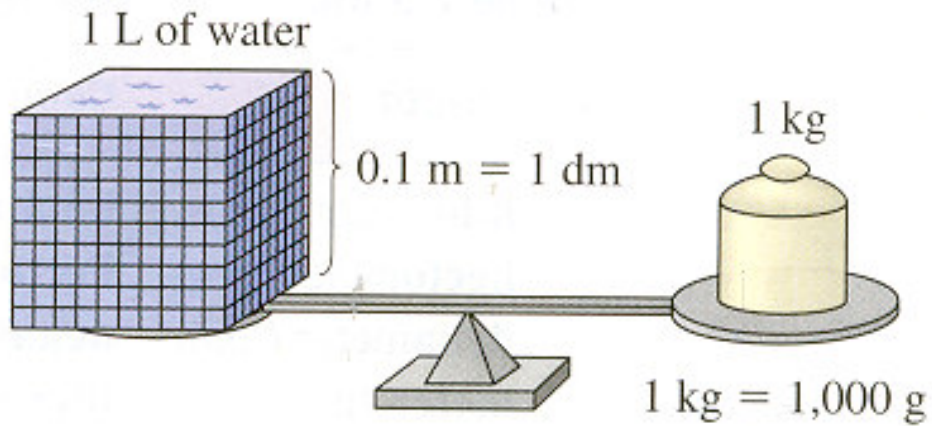
$1 \text{ yd}^3 \approx 200 \text{ gal}$ ,  $1 \text{ ft}^3 \approx 7.5 \text{ gal}$ ,  $1 \text{ gallon} \approx 231 \text{ in.}^3$



$1 \text{ m}^3 = 1,000 \text{ L}$ ,  $1 \text{ dm}^3 = 1 \text{ L}$ ,  $1 \text{ cm}^3 = 1 \text{ cc} = 1 \text{ ml}$



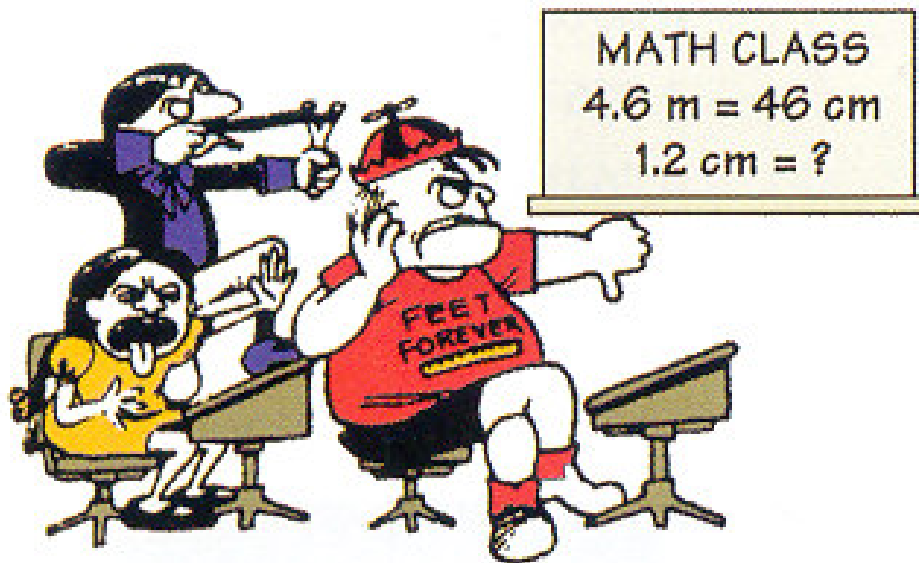
# METRIC SYSTEM



*Length:* meter

*Capacity:* liter

*Weight:* gram



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