73.

Problem 17.43 (RHK)

Three children each of weight 82.4 lb *make a log raft by lashing together logs of diameter* 1.05 ft *and length* 5.80 ft. *How many logs will be needed to keep them afloat? We can take the density of the wood to be* 47.3 lb/ft^3.

Solution:

Volume, *v*, of each log will be

$v = \pi d^2 l / 4$, where *d* is the diameter and *l* is the length of each log. Therefore,

$v = \pi \times 1.05^2 \times 5.80 / 4 \text{ ft}^3 = 5.02 \text{ ft}^3$.

Weight of each log, *w*, is

$w = v\rho_{wood} = 5.02 \times 47.3 \text{ lb} = 237.55 \text{ lb}$.

Let the number of logs required for keeping three children each of weight 82.4 lb be *n*. The total weight of the logs and that of the children will be

$W = (3 \times 82.4 + 237.55n) \text{ lb}$.

Density of water in lb/ft^3 is 62.43 lb/ft^3. Buoyant force in water for keeping the logs and the children afloat will be volume of the logs times the density of water in lb/ft^3. We, therefore, have the equation from which n can be solved.

$$247.2 + 237.55n = 5.02 \times 62.43n.$$

We find

$$n = 3.26.$$

Therefore, 4 logs will be needed for making a raft that will keep the three children afloat.