A local creek has flooded and you come upon a group of college students on an outing. You want to carry as many of the students to safety in your canoe. What is the most college students you can carry to safety if you weigh 140lb and your canoe weighs 70lb? Assume that you must maintain at least 3\text{in} of freeboard (distance between the water and the top edge of the canoe) and that the college students all weigh 150lb. The unit weight of water = 62.4 lb/ft$^3$.

Set up:

\[
F_{up} = F_{down}
\]

\[
B = W_{total}
\]

\[
B = \gamma V \sqrt{\text{base} \times \text{height}}
\]

\[
\gamma = 62.4 \text{ lb/ft}^3
\]

\[
V = A \times \text{Length} \sqrt{\text{Area}}
\]

\[
\text{Length} = 18\text{ft} \sqrt{\text{Length}}
\]

\[
A = \frac{1}{2} \text{base} \times \text{height} \sqrt{\text{Area}}
\]

\[
\text{height} = 12\text{in} \sqrt{\text{Height}}
\]

\[
\text{base from similar triangles:} \quad \frac{b}{12\text{in}} = \frac{30\text{in}}{15\text{in}}, \quad b = 24\text{in} \sqrt{\text{Base}}
\]

\[
W_{total} = W_{canoe} + 140\text{lb} + W_{people} \sqrt{\text{Total Weight}}
\]

\[
W_{canoe} = 70\text{lb}
\]

\[
W_{people} = n_{people} \times 150\text{lb/person} \sqrt{\text{People}}
\]

Calculate buoyancy force (B), set equal to total wt (W$_{total}$) and solve for number of people (n$_{people}$)

**Soln:**

\[
A = \frac{1}{2} (24\text{in})(12\text{in}) = 144 \text{ in}^2
\]
Canoe

\[ V = (144 \text{ in}^2)(18 \text{ ft})(1 \text{ ft} / 12 \text{ in})^2 = 18 \text{ ft}^3 \]

\[ B = (62.4 \text{ lb/ft}^3)(18 \text{ ft}^3) = 1,123 \text{ lb} \]

\[ 1,123 \text{ lb} = W_{total} \]

\[ 1,123 \text{ lb} = 70 \text{ lb} + 140 \text{ lb} + (n_{people})(150 \text{ lb/person}) \]

\[ n_{people} = 6.09 \]

\[ \sqrt{\sqrt{\text{ }} n_{people} = 6} \]