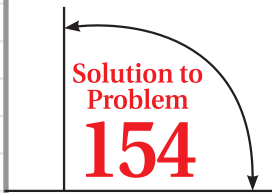
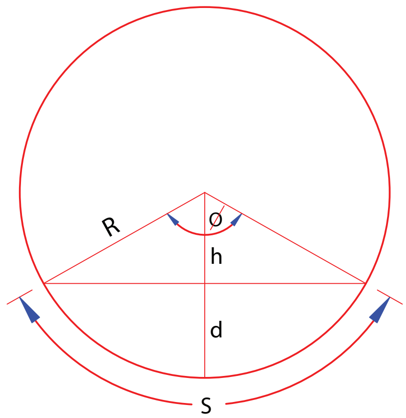
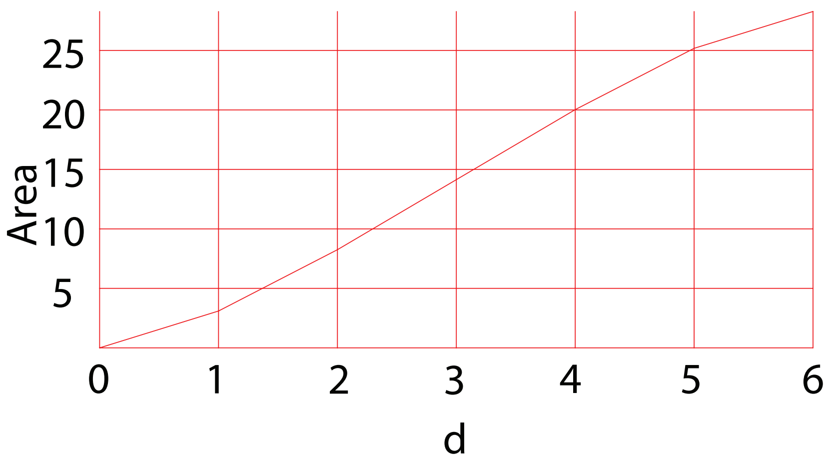
problem corner solution



by Dave Lindell, L.S.





The 1,000 gallon mark will be at a depth, d, for 133.6898 cubic feet, or an end area of 5.3476 square feet

The area of the sector = ½ RS = ½ $R^2 \phi$, ϕ in radians. $\phi = 2 \cos^{-1}(h/R)$

The area of the triangle = ½ chord x h = $(½)(2\sqrt{(R^2 - h^2)}(h)$

Area segment = ½ RS – $h\sqrt{R^2 - h^2})$

$= R^2 \cos^{-1} [(R - d)/R] - (R - d)\sqrt{(2Rd - d^2)}$

This is not directly solvable, but a plot for d=1, d=2, d=3, d=4, and d=5 yields areas of 3.09748, 8.25021, 14.13717, 20.02413, and 25.17685 square feet.

By interpolation between d=1 and d=2, an argument area of 5.3476 sq. ft. gives d=1.4367 which actually yields an area of 5.2011 sq. ft. Interpolating again between d=1.4367 and d=2, an argument area of 5.3476 sq. ft. yields a d=1.4638, but that actually gives an area of 5.3403 sq. ft. One more interpolation between d=1.4367 and d=1.4638 using an argument area of 5.3476 sq. ft. yields a d=1.4652 which gives an area of 5.3476 sq. ft.

The same logic can be applied to the other marks using the same formula. No account need be made for whether the mark is above or below the midpoint.

The marks for 2000, 3000, and 4000 gallons are 2.4226, 3.3180, and 4.2454 feet from the bottom of the dipstick.

Solution to Problem 155

by Benjamin Bloch, Ph.D.

The area of the rectangle is 3 x 5 = 15. The area of the smaller right triangle is ½ x 5 x 2 = 5, and the area of the larger right triangle is ½ x 8 x 3 = 12. These three areas total 15 + 5 + 12 = 32.

The total area of the large right triangle is ½ x 13 x 5 = 32.5.
This is an impossible diagram.