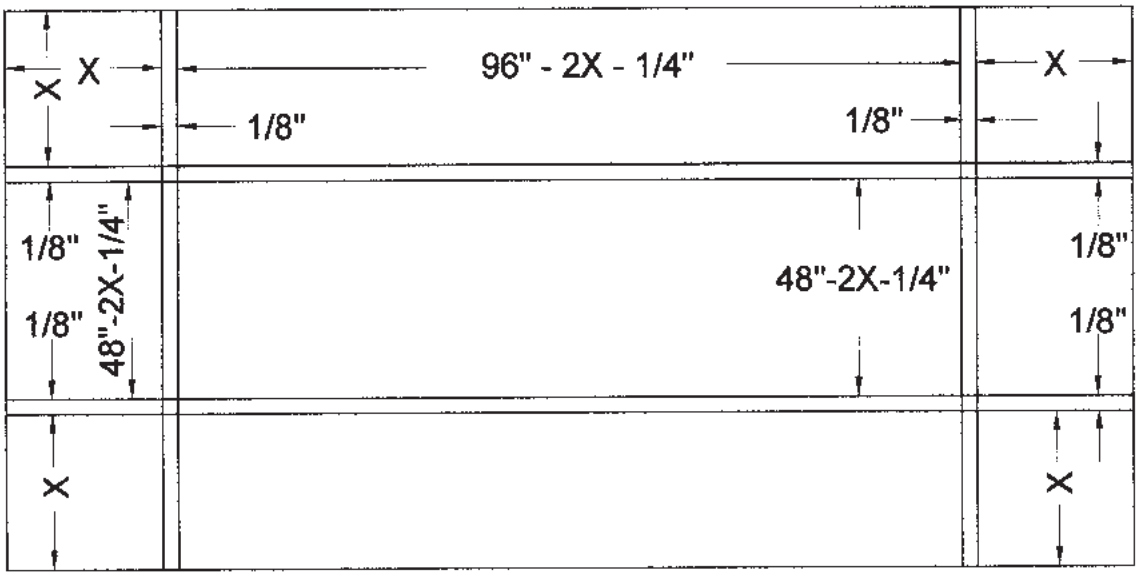
Solution to Problem 107



THE FINAL OUTSIDE DIMENSIONS OF THE LARGEST BOX WILL BE 96"–2X–1/4"

LONG, 48"–2X–1/4" WIDE AND X+1/2" HIGH. THE INSIDE VOLUME WILL BE:

(96"–2X–1/4"–1")(48"–2X–1/4"–1")(X) DUE TO THE THICKNESS OF THE WOOD

THE VOLUME IS THEREFORE

$$(94.75–2X)(46.75–2X)(X) = 4X^3 – 283\ X^2 – 4429.5625\ X$$

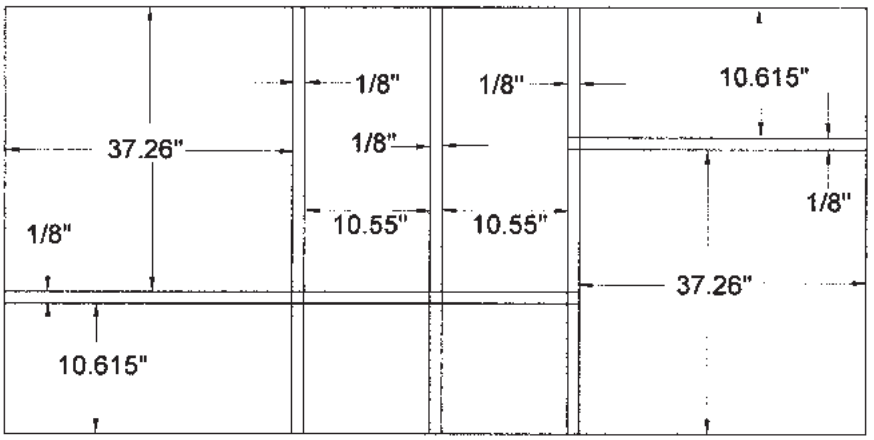
THE DERIVATIVE OF THE VOLUME WITH RESPECT TO X IS

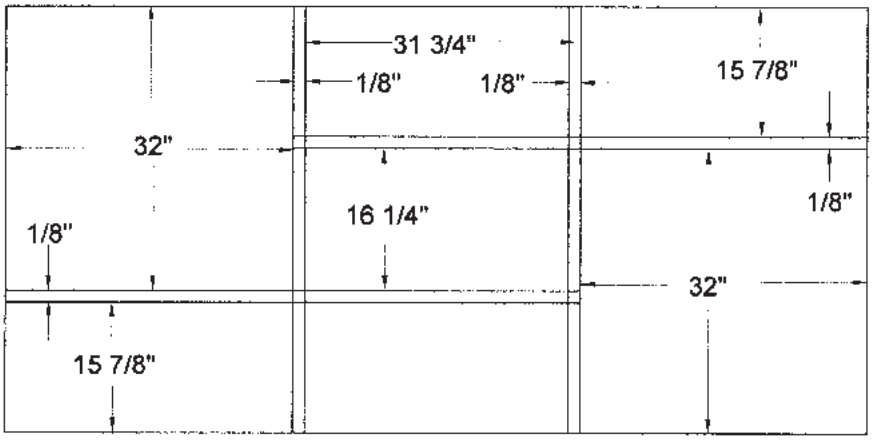
$$12X^2 – 566\ X – 4429.5625,$$ WHICH, IF SET EQUAL TO ZERO, WILL YIELD A MAXIMUM OR MINIMUM VALUE:

$$12X^2 – 566\ X – 4429.5625 = 0,$$ WHICH YIELDS X=9.907 AND 37.26

THE BASE OF THE BOX WILL BE 96" – (2)(9-29/32") – 1/4" = 75 15/16" LONG BY 48" – (2)(9-29/32") – 1/4" = 27 15/16" WIDE. THE DEPTH WILL BE 9-29/32" FOR A VOLUME OF 12.16 CUBIC FEET.

Solution to Problem 108





The alternative solution, X = 37.26, will give you a box with a lid! Its outside dimensions will be 37.26 inhes square by 11.05 inches high. The inside will be 36.76 inches square by 10.55 inches high for a volume of 8.25 cubic feet, and it uses more of the plywood.

(This is not the maximum volume for a box with a lid. A box 32 inches square by $16\frac{7}{8}$ inches on the outside can be made with an inside depth of $15\frac{7}{8}$ inches and 31 inches square. The inside volume will be 8.83 cubic feet.)