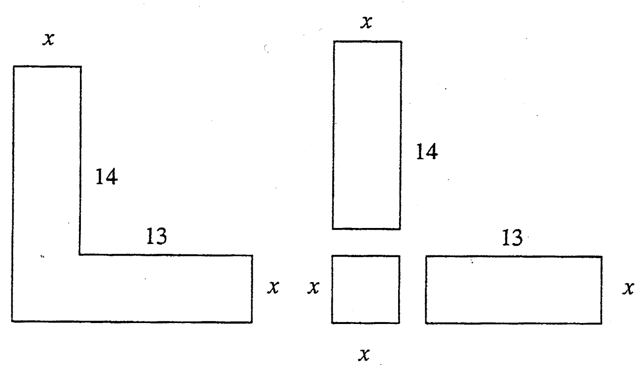
66. The shaded area can be broken down into three rectangles as shown in the on the next page. So $160 = 14x + x^2 + 13x \Leftrightarrow x^2 + 27x - 160 = 0 \Leftrightarrow (x-5)(x+32) = 0 \Leftrightarrow$ $x - 5 = 0$ or $x + 32 = 0$. Thus $x = 5$ or $x = -32$. Since x represents a length, it must be positive, so x is 5 in.



69. Let x be the length of one side of the cardboard, so we start with a piece of cardboard x by x. When 4 inches are removed from each side, the base of the box is $(x-8)$ by $(x-8)$. Since the volume is 100 in^3, we get $4(x-8)^2 = 100 \Leftrightarrow x^2 - 16x + 64 = 25 \Leftrightarrow x^2 - 16x + 39 = 0 \Leftrightarrow$ $(x-3)(x-13) = 0$. So $x = 3$ or $x = 13$. But $x = 3$ is not possible, since then the length of the base would be $3 - 8 = -5$, and all lengths must be positive. Thus $x = 13$, and the piece of cardboard is 13 inches by 13 inches.

70. Let r be the radius of the can. Now using the formula $V = \pi r^2 h$ with $V = 40\pi$ cm^3 and $h = 10$, we solve for r. Thus $40\pi = \pi r^2(10) \Leftrightarrow 4 = r^2 \Rightarrow r = \pm 2$. Since r represents radius, $r > 0$. Thus $r = 2$, and the diameter is 4 cm.

74. (a) Using $h_0 = 96$, half the distance is 48, so we solve the equation $48 = -16t^2 + 96 \Leftrightarrow$ $-48 = -16t^2 \Leftrightarrow 3 = t^2 \Rightarrow t = \pm\sqrt{3}$. Since $t \geq 0$, it takes $\sqrt{3} \approx 1.732$ sec.

(b) The ball hits the ground when $h = 0$, so we solve the equation $0 = -16t^2 + 96 \Leftrightarrow$ $16t^2 = 96 \Leftrightarrow t^2 = 6 \Rightarrow t = \pm\sqrt{6}$. Since $t \geq 0$, it takes $\sqrt{6} \approx 2.449$ sec.

75. We are given $v_o = 40$ ft/s

(a) Setting $h = 24$, we have $24 = -16t^2 + 40t \Leftrightarrow 16t^2 - 40t + 24 = 0 \Leftrightarrow$ $8(2t-3)(t-1) = 0 \Leftrightarrow t = 1$ or $t = 1\frac{1}{2}$. Therefore, the ball reaches 24 feet in 1 second (on the ascent) and again after $1\frac{1}{2}$seconds (on its descent).

(b) Setting $h = 48$, we have $48 = -16t^2 + 40t \Leftrightarrow 16t^2 - 40t + 48 = 0 \Leftrightarrow$ $2t^2 - 5t + 6 = 0 \Leftrightarrow t = \frac{5 \pm \sqrt{25-48}}{4} = \frac{5 \pm \sqrt{-23}}{4}$. However, since the discriminant $D < 0$, there are no real solutions, and hence the ball never reaches a height of 48 feet.

(c) The greatest height h is reached only once. So $h = -16t^2 + 40t \Leftrightarrow 16t^2 - 40t + h = 0$ has only one solution. Thus $D = (-40)^2 - 4(16)(h) = 0 \Leftrightarrow 1600 - 64h = 0 \Leftrightarrow$ $h = 25$. So the greatest height reached by the ball is 25 feet.

(d) Setting $h = 25$, we have $25 = -16t^2 + 40t \Leftrightarrow 16t^2 - 40t + 25 = 0 \Leftrightarrow$ $(4t-5)^2 = 0 \Leftrightarrow t = 1\frac{1}{4}$. Thus the ball reaches the highest point of its path after $1\frac{1}{4}$ seconds.

(e) Setting $h = 0$ (ground level), we have $0 = -16t^2 + 40t \Leftrightarrow 2t^2 - 5t = 0 \Leftrightarrow$ $t(2t-5) = 0 \Leftrightarrow t = 0$ (start) or $t = 2\frac{1}{2}$. So the ball hits the ground in $2\frac{1}{2}$seconds.