102. (First problem in **Cluster 1**)
Using the coordinate system employed in §4-5 and §4-6, we have $v_{0x} = v_x > 0$ and $v_{0y} = 0$. Also, $y_0 = h > 0$, $x_0 = 0$, $y = 0$ (when it hits the ground at $t = 3.00$)), and $x = 150$, with lengths in meters and time in seconds.

(a) The equation $y - y_0 = v_{0y}t - \frac{1}{2}gt^2$ becomes $-h = -\frac{1}{2}(9.8)(3.00)^2$, so that $h = 44.1$ m.

(b) The equation $v_y = v_{0y} - gt$ gives the y-component of the "final" velocity as $v_y = -(9.8)(3.00) = 29.4$ m/s. The x-component of velocity (which is constant) is computed from $v_x = (x - x_0)/t = 150/3.00 = 50.0$ m/s. Therefore,

$$|\vec{v}| = \sqrt{v_x^2 + v_y^2} = \sqrt{50^2 + 29.4^2} = 58.0 \text{ m/s} .$$