94 At the 18th green of the US Open you need to make a 20.5 ft putt to win the tournament. When you hit the ball, giving it an initial speed of 1.5 m/s, it stops 6.00 ft short of the hole.

(1) Assuming a uniform acceleration, what should the initial velocity of a put be to ensure success?

(2) Determine the initial speed required to make the 6.00 ft put.

Conversion

$$\frac{1\,m}{3.281\,ft}$$

$$20.5\,ft\left(\frac{1\,m}{3.281\,ft}\right) = 6.25\,m$$

$$6.00\,ft\left(\frac{1\,m}{3.281\,ft}\right) = 1.83\,m$$

(1) solution

putt length = 6.25m

putt short by 1.83m

Actual length traveled = 6.25m - 1.83m = 4.42m

$x_f = 4.42\,m$

$x_i = 0\,m$

$\Delta x = 4.42\,m$

$V_i = 1.57\,m/s$

$V_f = 0\,m/s$

$a = ?$

$$V_f^2 = V_i^2 + 2a\Delta x$$

$$\frac{V_f^2 - V_i^2}{2\Delta x} = a$$

$$\frac{0 - (1.57\,m/s)^2}{2\,(4.42\,m)} = -2.79E\text{-}1\,m/s^2$$

$$-0.279\,m/s^2$$

$\Delta x = 6.25\,m$

$V_f = 0$

$V_i = ?$

$a = -0.279\,m/s^2$

$V_f^2 = V_i^2 + 2a\Delta x$

$V_i^2 = V_f^2 - 2a\Delta x$

$V_i = \sqrt{V_f^2 - 2a\Delta x}$

$V_i = \sqrt{(0\,m/s)^2 - 2(-0.279\,m/s^2)\,6.25\,m}$

$= 1.87\,m/s$

(2) Solution

$\Delta x = \cancel{6.00}\ 1.83\,m$

$a = -0.279\ m/s^2$

$V_i = ?$

$V_f = 0\ m/s$

$V_f^2 = V_i^2 + 2a\Delta x$

$V_i = \sqrt{V_f^2 - 2a\Delta x}$

$V_i = \sqrt{0\ m/s^2 - 2(-0.279\ m/s^2)\ 1.83\,m}$

$= 1.01\ m/s$