NAME_____

Motion Equation Questions 3: Velocity

1.

(a) 1.5 ms^{-1}. Horizontal acceleration is zero.

(b) $v = ?\quad v_0 = +9\ ms^{-1}\quad a = -9.8\ ms^{-1}\quad s = 0\ m$

$v^2 = v_0^2 + 2as$

$\therefore v = \pm\sqrt{v_0^2 + 2as}$

$= \pm\sqrt{9^2 + 2\times -9.8\times 0}$

$= \pm 9\ ms^{-1}$

When he lands he will be moving downwards so his final velocity is 9 ms^{-1} downwards

2.

(a) $v = ?\quad v_0 = 0.0\ ms^{-1}\quad a = -9.8\ ms^{-2}\quad t = 2.5\ s$

$v = v_0 + at$

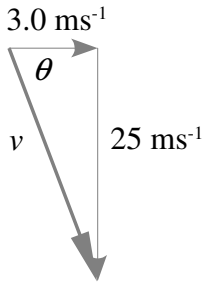
$= 0.0 + -9.8\times 2.5$

$= -25\ ms^{-1}$

The lemming's vertical velocity is 25 ms^{-1} downwards 2.5 seconds later.

(b) The lemming will always be moving at 3.0 ms^{-1} horizontally out to sea (there is no acceleration in horizontal motion)

(c)



$v = \sqrt{3.0^2 + 25^2} = 24.7\ ms^{-1}$

$\theta = \tan^{-1}\left(\frac{25}{3.0}\right) = 83°$

The lemming's velocity at this time is 25 ms^{-1} at 83° below the horizontal.

3.

(a) Vertical:

$v = ?\quad v_0 = +21 \text{ ms}^{-1}\quad a = -9.8 \text{ ms}^{-1}\quad s = 0 \text{ m}$

$v^2 = v_0{}^2 + 2as$

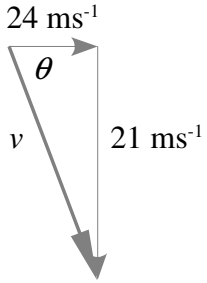
$\therefore v = \pm\sqrt{v_0{}^2 + 2as}$

$= \pm\sqrt{21^2 + 2\times -9.8\times 0}$

$= \pm 21 \text{ ms}^{-1}$

On landing it will be moving downwards so $v_V = -21 \text{ ms}^{-1}$

Horizontal velocity is constant $\therefore v_H = 24 \text{ ms}^{-1}$



$v = \sqrt{24^2 + 21^2} = 32 \text{ ms}^{-1}$

$\theta = \tan^{-1}\left(\frac{21}{24}\right) = 41°$

The lemming's velocity at this time is 32 ms^{-1} at 41° below the horizontal.

(b) 24 ms^{-1} to the right.