Prove that an object dropped from a building does not reach the halfway point of its fall in half the total drop time.

* Assume drop time of 10s.

At half drop time:

$t = 5s$

$v_1 = 0 m/s$

$a = 9.8 m/s^2$

$d = v_1 t + \frac{1}{2} a t^2$

$d = (0)(5) + \frac{1}{2}(9.8)(5)^2$

$d = 122.5m$

$= 120m$

At whole drop time:

$t = 10s$

$v_1 = 0 m/s$

$a = 9.8 m/s^2$

$d = v_1 t + \frac{1}{2} a t^2$

$d = (0)(10) + \frac{1}{2}(9.8)(10)^2$

$d = 490m$

At $t = 5s$, $d = 120m$

At $t = 10s$ $d = 490m$

$$120 \neq \frac{490}{2}$$

$\therefore$ an object dropped from a building does not reach the halfway point at half the time.

A ball is thrown straight up in the air, with an initial velocity of 3.5 m/s [up]. At some point later, it has a velocity of 14.2 m/s [down]. Determine the ball's displacement.

$v_1 = 3.5\,m/s$ [up]

$v_2 = 14.2\,m/s$ [down]

$= -14.2\,m/s$ (1)

$d = ?$

$a = -9.8\,m/s^2$

(1)

$v_2^2 = v_1^2 + 2ad$ (1)

$(-14.2)^2 = (3.5)^2 + 2(-9.8)d$

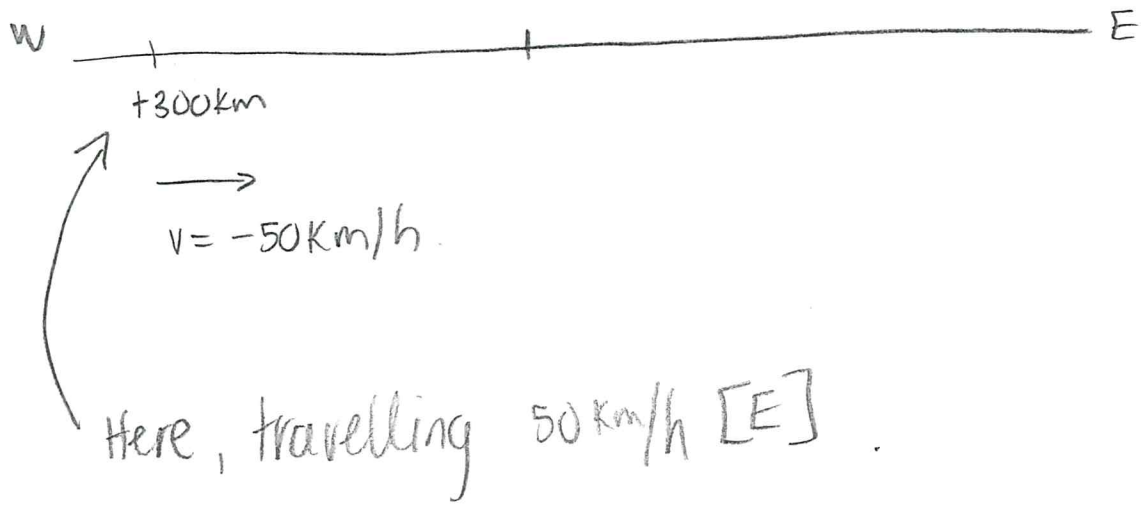
$201.64 = 12.25 - 19.6d$

$189.39 = -19.6d$

$d = -9.662755102\,m$

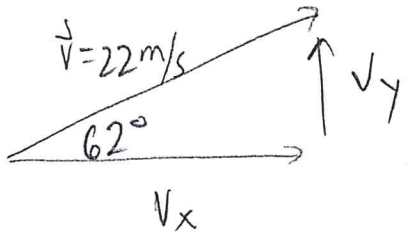
$d = -9.7\,m$ (1)

Consider the west direction to be positive. A person is moving at -50 km/h, at a place +300 km from the starting point. Describe where she is and which way she is travelling.



Here, travelling 50 km/h [E].

In a children's soccer game, one of the children kicks the ball from the ground, giving it an initial velocity of 22 m/s at an angle of 62° to the horizontal. Determine the initial vertical and horizontal velocity components.



$V_y = V\sin\theta$

$V_y = (22)\sin 62°$

$V_y = 19.4248\ m$

$V_y = 19\ m$ [up]

$V_x = V\cos\theta$

$V_x = (22)\cos 62$

$V_x = 10.328\ m$

$V_x = 10\ m$ [forward]