Exam A - Solution - See ExamB for explanation:

(1) $a = \frac{\Delta V}{\Delta t} = \frac{638 m/s}{2.67 s} = 238 m/s^2$

$a = \frac{\Delta V}{\Delta t} = \frac{-638 m/s}{2.65 s} = -242 m/s^2$

(2) Find velocity & position at $t = 3s$

$V = at = 1 m/s^2 \cdot 3s = 3 m/s$

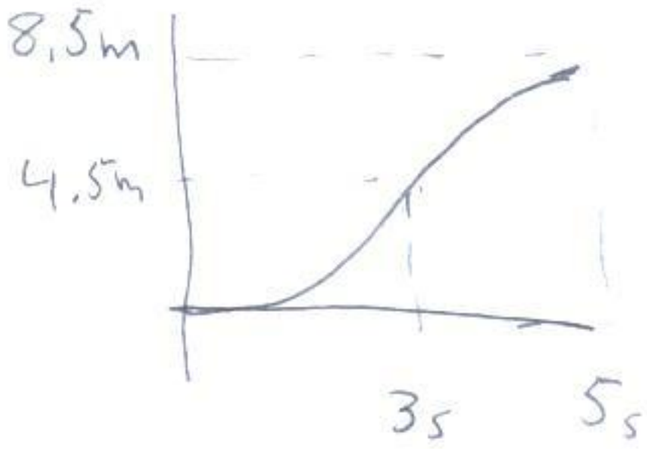
$x = \frac{1}{2} a t^2 = \frac{1}{2} 1 m/s^2 (3s)^2 = 4.5 m$

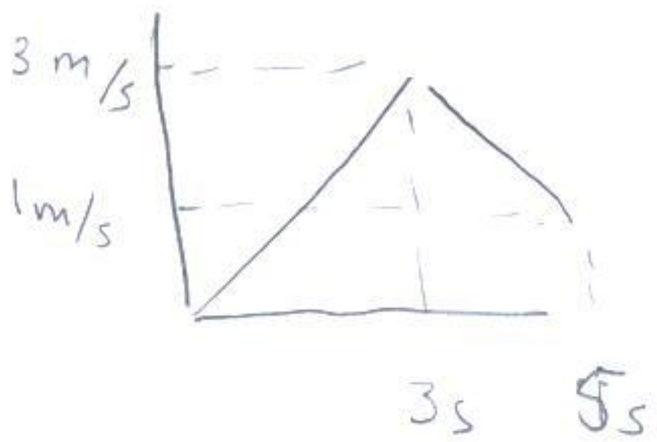
Then at 5

$V = V_0 + at = 3 m/s + (-1 m/s^2) \cdot 2s = 1 m/s$

$x = x_0 + v_0 t + \frac{1}{2} a t^2 = 4.5 m + 3 m/s \cdot 2s + \frac{1}{2} (-1 m/s^2) (2s)^2$

$= 4,5 m + 6m - 2m = +8.5 m$





(3) $\vec{v}_0 = \begin{pmatrix} 8.1\cos 43^\circ \\ 8.1\sin 43^\circ \end{pmatrix} = \begin{pmatrix} 5.92\ m/s \\ 5.52 m/s \end{pmatrix}$

Then when it reaches its maximum

B. $v_y = v_{oy} + (-g)t = 0$

$t = \frac{v_{oy}}{g} = \frac{5.92\ m/s}{9.8\ m/s^2} = 0.604s$

A. $y(t) = \cancel{y_0}^{0} + v_{oy}t + \frac{1}{2}(-g)t^2$

$y(0.604s) = (5.52\ m/s)(0.604s) + \frac{1}{2}(-9.8)(0.604s)^2$

$y = 1.546m$

C. $y(t_*) = -6.4m$

$\cancel{y_0}^{0} + v_{oy}t_* - \frac{1}{2}g t_*^2 = -6.4m$

$5.52\ m/s\ t_* - \frac{1}{2}(9.8\ m/s^2)t_*^2 = -6.4m$

$t_* = -0.71,\ \underline{1.837}$

D. $\vec{v} = \vec{v}_0 + \vec{a}t$

$\vec{v} = \begin{pmatrix} 5.92\ m/s \\ 5.52\ m/s \end{pmatrix} + \begin{pmatrix} 0 \\ -9.8\ m/s^2 \end{pmatrix}(1.837s)$

$\vec{v} = \begin{pmatrix} 5.92\ m/s \\ -12.08\ m/s \end{pmatrix}$ $\quad v = \sqrt{v_x^2 + v_y^2} = 13.45\ m/s$

E. $\tan\phi = \dfrac{-12.08\ m/s}{5.92\ m/s} \Rightarrow \quad \phi = -63.9^\circ$

F. Range $\quad \Delta X = V_{ox}\, t$

$$\Delta X = \left(5.92 \frac{m}{s}\right)(1.837\ s) = 10.875\ m$$

(4) $$a = \left(\frac{m_8 - (m_3 + m_2)}{m_8 + m_3 + m_2}\right) g$$

$$a = \frac{3}{13} g$$

$$T = m_2 g + m_2 a$$

$$T = (2\ kg)g + (2\ kg)\frac{3}{13} g$$

$$T = \left(2 + \frac{6}{13}\right) kg \cdot g = 24.0\ N$$

(5) $$a = \frac{m_1 g}{2m_1 + \frac{m_2}{2}} = \frac{4.9\ kg}{2(4.9\ kg) + \frac{20\ kg}{2}} \cdot 9.8\ m/s^2$$

$$a = 2.42\ m/s^2$$

$$T = \frac{m_2}{2} a = \frac{20\ kg}{2} \cdot 2.42\ m/s^2 = 24.2\ N$$

(6) The same as Exam B