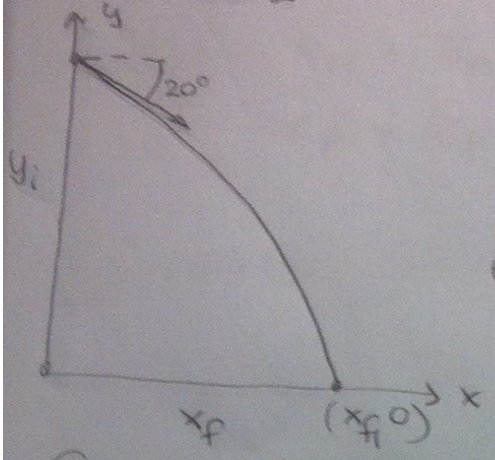
Problem 1




$t = 3$

$V_0 = 8\ m/s$, $\theta = 20°$ } $|V_{0x}| = (\cos 20)\ 8\ m/s$, $|V_{0y}| = (\sin 20)\ 8$

(A) $x_f = v_{0x} t + x_i = v_{0x} t$

$x_f = [8 \cos 20]\ 3 = 22.55\ m$

(b)

$y_i = ?$ , $y_f = 0$

$y_i + v_{0y} t - \frac{1}{2} g t^2 = y_f$

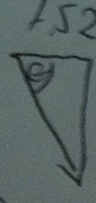
$y_i - 8(\sin 20)3 - 4.9(3)^2 = 0$

$y_i = 52.3\ m$ ANS (b)

(c) $v_f = v_{fx}\,\hat{i} + v_{fy}\,\hat{j}$

$v_{fx} = v_{ix} = v_0 \cos 20 = 8 \cos 20 = 7.52$

$v_{fy} = v_{iy} - g t = -8 \sin 20 - 9.8 \cdot 3 = 32.14$




$\tan\theta = \frac{32.14}{7.52}$

$\theta = 76.83°$

$v_f = \sqrt{32.14^2 + 7.52^2} = 33$

ANS: $33\ m/s$ at $76.83°$ w. horizontal

Problem 2

2

(M) $x_M = v_M t + x_{Mi} = v_M t = 15t$

(P) $x_P = v_P t + \frac{1}{2} a_P t^2 + y_{Pi} = \frac{1}{2} a_P t^2 = t^2$

ANS (A) $x_M = x_P$ when police overtakes motorist

$15t = t^2$

$t^2 - 15t = 0$

$t(t-15) = 0$

$t = 0$; $t = 15$ It takes 15s for (P) to overtake (M)

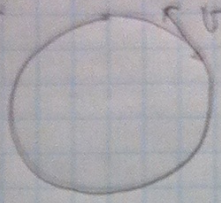
ANS (B) $v_P = v_{Pi} + a t = 0 + 2\,m/s^2 \cdot 15s = 30\,m/s$

$v_P = 30\,m/s$ when (P) overtakes (M)

ANS (C) $y_{Pf} = y_{Pi} + v_{oPi} + \frac{1}{2} a t^2 = \frac{1}{2} \cdot 2 (15)^2\,m = 225m$

$y_{Pf} - y_{Pi} = 225m$

ANS 3




$v_0 = 2\ m/s$

$r = 20\ m$

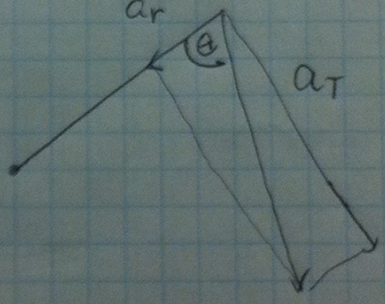
A) $v_0 = \frac{2\pi r}{T} \rightarrow T = \frac{2\pi r}{v_0} = \frac{40\pi\ m}{2\ m/s} = 20\pi\ s$

B) $|a_r| = \frac{v^2}{r} = \frac{2^2}{20} = \frac{4}{20}\ m/s^2 = \frac{1}{5}\left(m/s^2\right)$

C) $a_T = 0.6\ m/s^2$ when $v = 4\ m/s \rightarrow a_r = \frac{16}{20}$

$a_r = 0.8\ m/s^2$

$a = \sqrt{a_T^2 + a_r^2} = \sqrt{16 + (0.8)^2} = 4.08\ m/s^2$




$\tan\theta = \frac{a_T}{a_r}$

$\tan\theta = \frac{4}{0.8}$

$\tan\theta = 5$

$\theta = 78.7°$

ANS $|\vec{a}| = 4.08\ m/s^2$ at $78.7°$ to the radius!

Problem 4

$\Delta x = 5\,m$

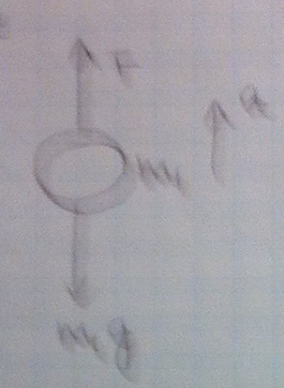
$v_f = 880\,m/s$

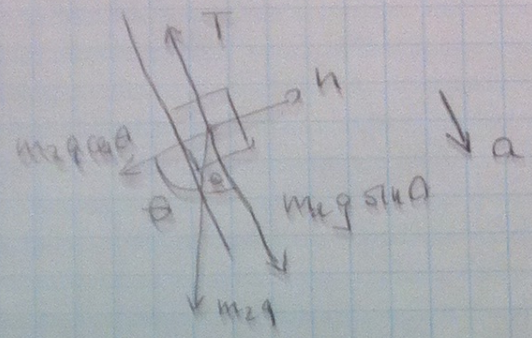
$m = 25.8\,kg$

$$F = ma = m\left(\frac{v_f^2 - v_i^2}{2\Delta x}\right) = 25.8 \cdot \frac{880^2}{10}\,N$$

$F = 1997952\,N$ //

ANS: 1.997 MN or $1.997 \times 10^6\,N$. $\approx 2 \times 10^6\,N$.




$F = m_1 g = m_1 a$

$m_2 g \sin\theta - T = m_2 a$

$n - m_2 g \cos\theta = 0$

$m_2 g \sin\theta = m_2 a = m_1 g = m_1 a$

$T = m_2 g \sin\theta - m_2 a$

$\frac{m_2 g \sin\theta = m_1 g}{m_1 + m_2} = a$

$\frac{m_2 \sin\theta = m_1}{m_1 + m_2} g = a$

$3.71 = a$ ANS (A)

$T = 6 \cdot g \cdot \sin 57 = 6 \cdot 3.71 = 27\ N$ ANS (B)

$v_f = at = 3.71 \cdot 2\ (m/s) = 7.42\ m/s$