Physics 100A – Exam I

1) Part I: $V_I = 20\ m/s$ $t_I = 2\ min \times \left(\frac{60\ s}{min}\right) = 120\ s$

Part II $V_{o\,II} = 20\ m/s$ $a_{II} = -0.5\ m/s^2$ $V_{f\,II} = 0$

a) $x_I = V_I t = (20)(120) = 2{,}400\ m$

b) $V_{f\,II} = V_{o\,II} + a_{II} t$

$0 = 20 - 0.5\,t$ $t = \frac{20}{0.5} = 40\ s$

c) $x_{II} = V_{o\,II} t + \frac{1}{2} a_{II} t^2$

$x_{II} = (20)(40) - \frac{1}{2}(0.5)(40)^2 = 400\ m$

d) $x_{total} = 2400 + 400 = 2800\ m$

$t_{total} = 120 + 40 = 160\ s$

$V_{avg} = \frac{x_{total}}{t_{total}} = \frac{2800}{160} = 17.5\ m/s$

2)

a) $y = y_0 + v_{oy} t - \frac{1}{2} g t^2$

$1 = 0 + 8 \sin 40^\circ \, t - \frac{1}{2}(9.8) t^2$

$1 = 5.14 t - 4.9 t^2$

$-4.9 t^2 + 5.14 t - 1 = 0$

$$t = \frac{-5.14 \pm \sqrt{(5.14)^2 - 4(-4.9)(-1)}}{2(-4.9)} = \frac{5.14 \pm 2.616}{9.8}$$

$$t = \begin{cases} 0.26 \text{ s} \\ 0.79 \text{ s} \end{cases}$$ ← This one since it is in the way down.

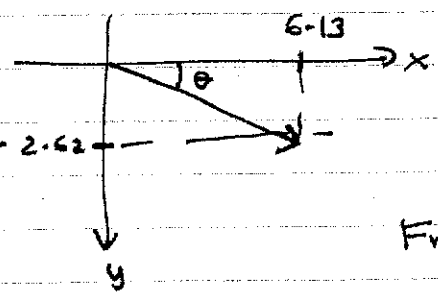
b) $v_{ox} = v_o \cos\theta_o = (8) \cos 40^\circ = 6.13 \text{ m/s}$

$v_{oy} = v_o \sin\theta_o - g t =$

$v_y = 5.14 - (9.8)(0.79) = -2.62 \text{ m/s}$

c) $v = \sqrt{v_{ox}^2 + v_{oy}^2} = \sqrt{(6.13)^2 + (-2.62)^2}$

$v = 6.67$

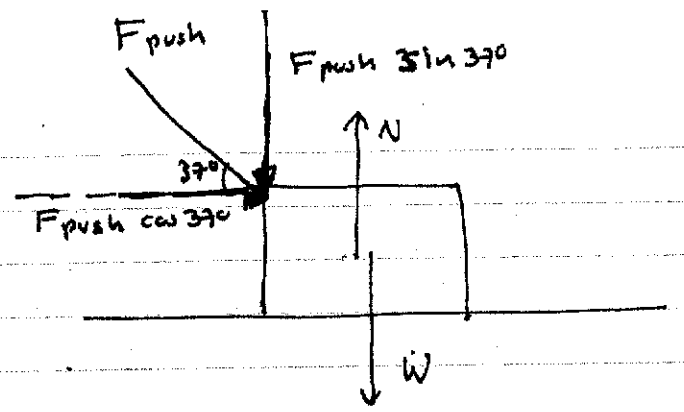


$\theta = \tan^{-1}\left(\frac{2.62}{6.13}\right)$

$\theta = 23.1^\circ$

From x-axis $360 - 23.1 = 337^\circ$

3)



x

a) $F_{push} \cos 37° = ma$

$$F_{push} = \frac{ma}{\cos 37°} = \frac{(5)(2.2)}{\cos 37°}$$

$F_{push} = 13.8\ N$

b) y

$$-F_{push} \sin 37° + N - W = 0$$

$$N = W + F_{push} \sin 37° = mg + F_{push} \sin 37°$$

$$N = (5)(9.8) + (13.8) \sin 37°$$

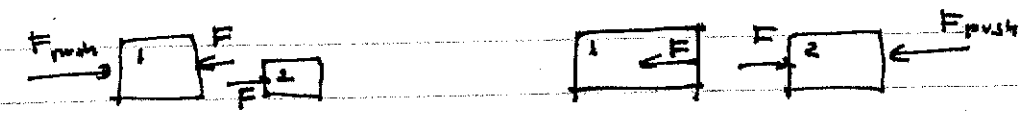
$$N = 57.3\ N$$

c) Part a) the same

Part b) changes N increases

1) D
2) C
3) C
4) B
5) B
6) A
7) E
8) C
9) B
10) C

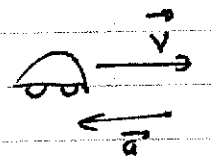
4) Multiple Choice $a = \frac{F_{push}}{(m_1+m_2)}$ in both cases

1) 

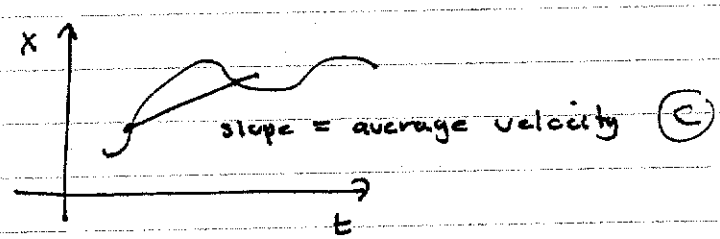
$F = m_2 a$ $\quad$ $F = m_1 a$

The case on the right gives a larger value since $\underline{m_1 > m_2}$

(C) Larger when applied from the right

2) 

The car is slowing down (C)

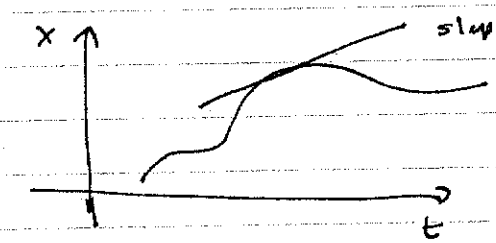
3) 

(C)

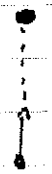
1) 

Velocity is the same but pointing down

Speed is the same (D)

4) 

(B)

5) 

$v_y = 0$ at the highest point

$a = g$ acceleration always down (B)

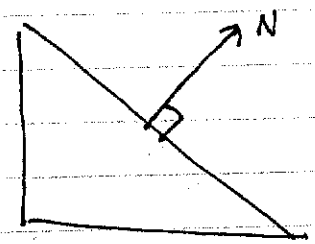
6) If elevator is moving with constant speed $\underline{a = 0}$

$\underline{N = mg}$ (A)

7) $V = \sqrt{V_x^2 + V_y^2}$

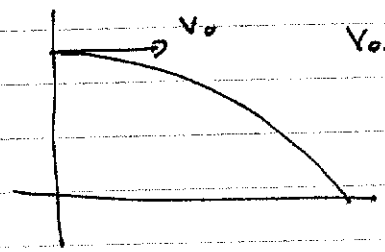
Since it is the sum of squares, positive quantities, the only way for V to be zero is if both V_x and V_y are zero

(E)

8) 

Perpendicular to the plane

(C)

9) 

$V_{ox} = V_0$ Horizontal velocity remains constant

(B)