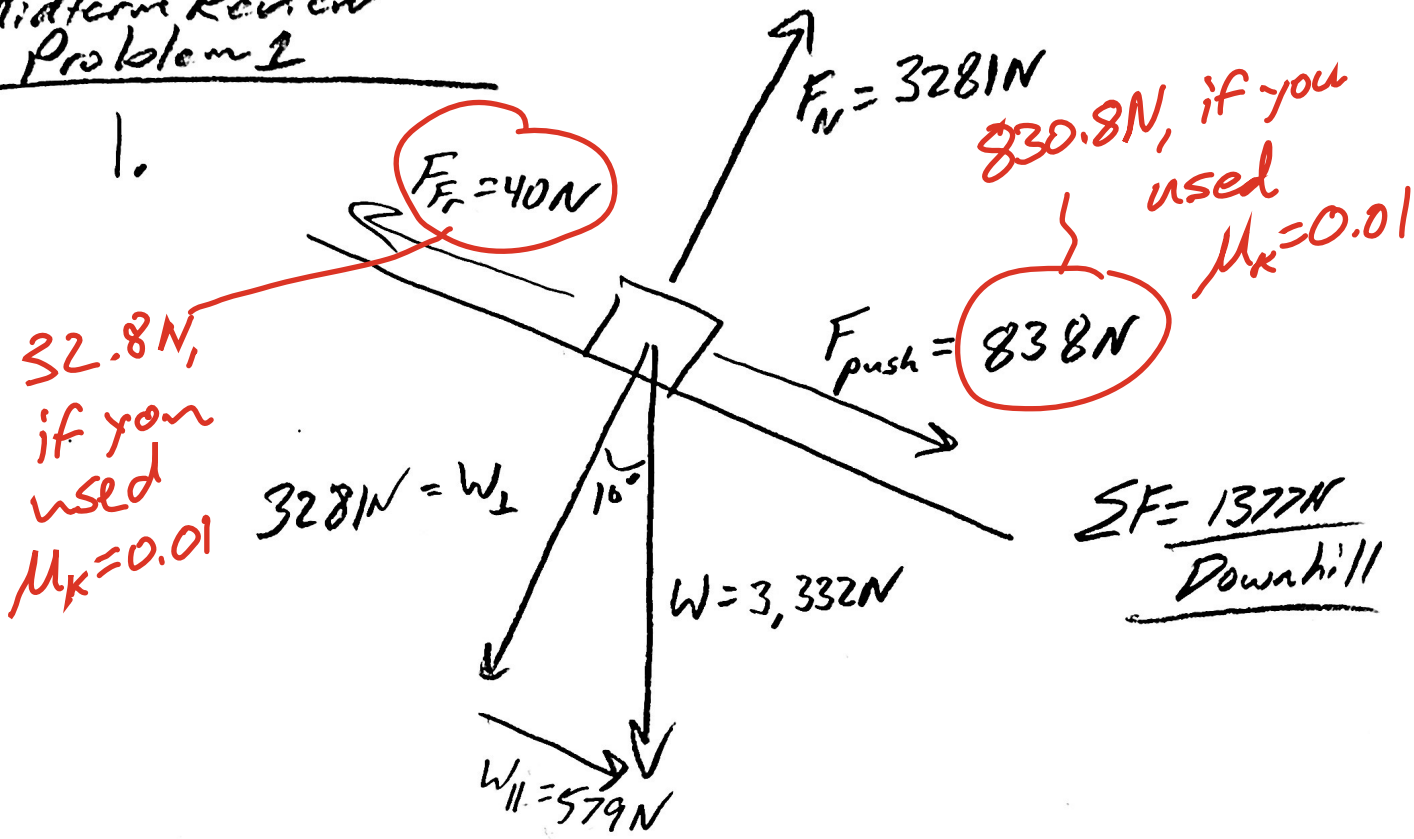
Midterm Review Problem 1

1.



$$\Sigma F_{||} = ma = 340kg\,(a)$$

$$V^2 = V_0^2 + 2a\Delta x$$

$$(9m/s)^2 = 0 + 2(a)(10m)$$

$$a = 4.05m/s^2$$

$$\Sigma F_{||} = 340kg(4.05m/s^2) = 1377N$$

$$\Sigma F_{||} = F_{push} - F_{Fr} + W_\perp = 1377N$$

$$F_{push} - 40N + 579N = 1377N$$

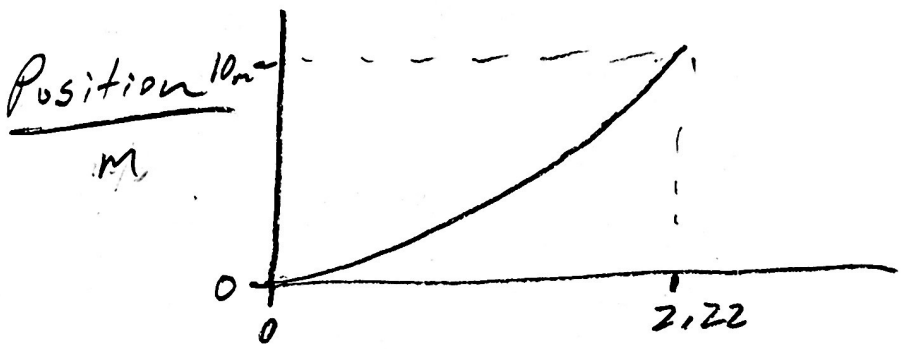
$$F_{push} = 838N$$

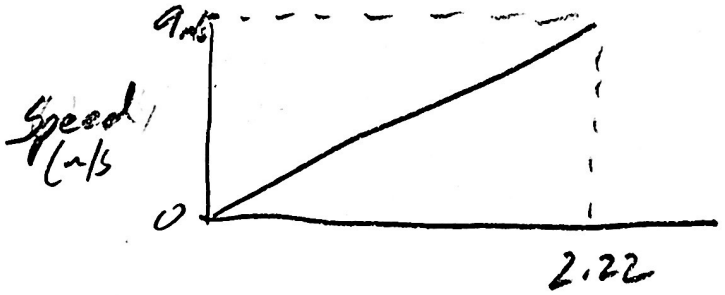
2. • Sled pushes into slope. Slope pushes sled outward (normal forces)
• Earth pulls sled down. Sled pulls Earth up
• Hill pushes sled uphill, sled pushes hill downhill (friction).
• People push hill uphill. Hill pushes people downhill.

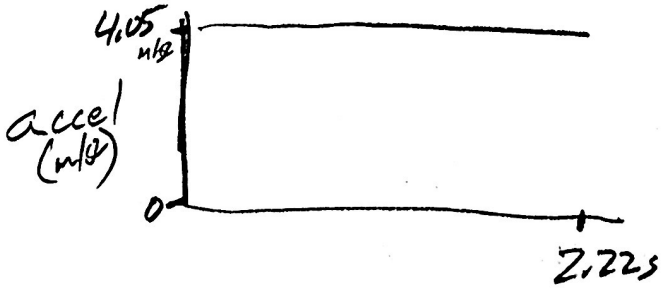
3. $V = V_0 + at$

$9\ m/s = 0 + (4.05\ m/s^2)(t)$

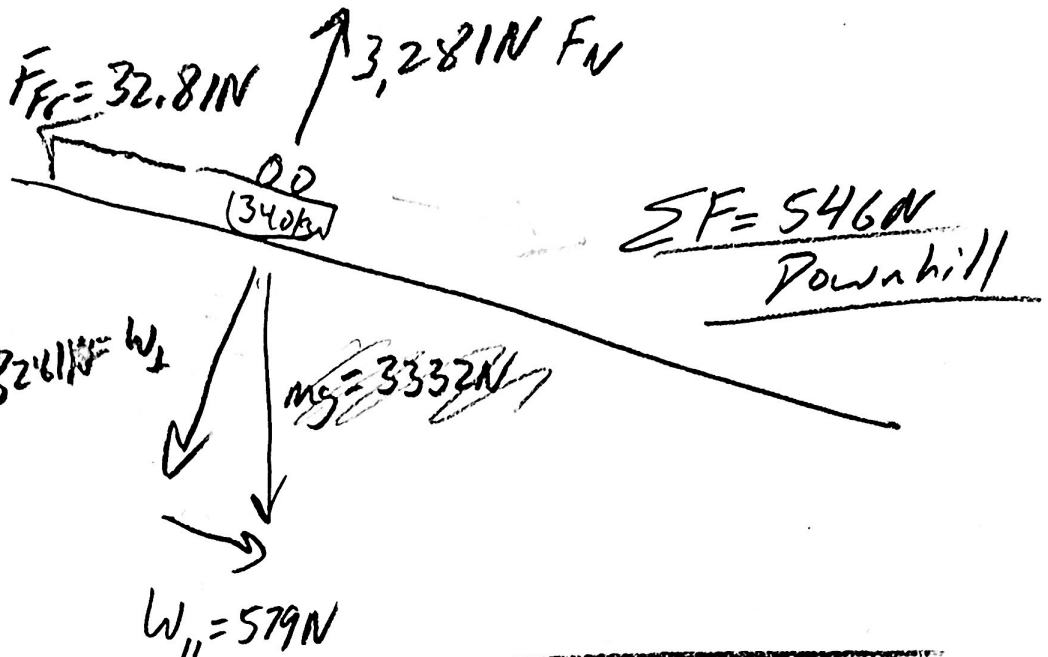
$t = 2.22\ s$







5.



$$\Sigma F_{||} = 579N - 32.81N = 546N$$

Not Necessary until #7 ⟹ $\Sigma F = (340kg)a = 546N$

$$a = 1.61 m/s^2$$

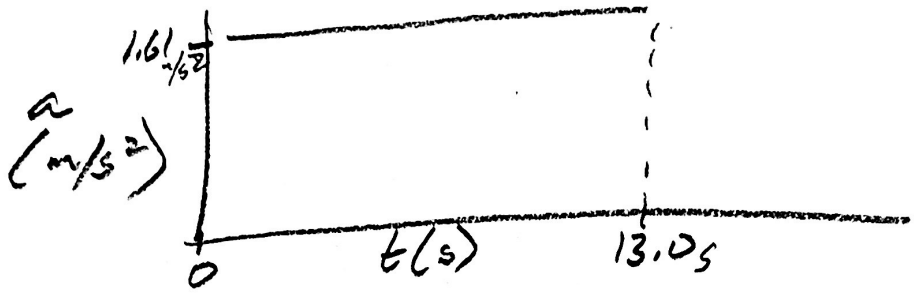
6.
- Hill pushes sled uphill. Sled pushes hill downhill (friction)
- Butts push seat down. seat pushes butts up (Normal force)
- Earth pulls sledders down, sledders pull Earth up (gravity).

7. $\sum F_{\parallel} = ma = 340 kg\,(a)$

$\sum F_{\parallel} = Sum = 579N - 32.8N = 546N$

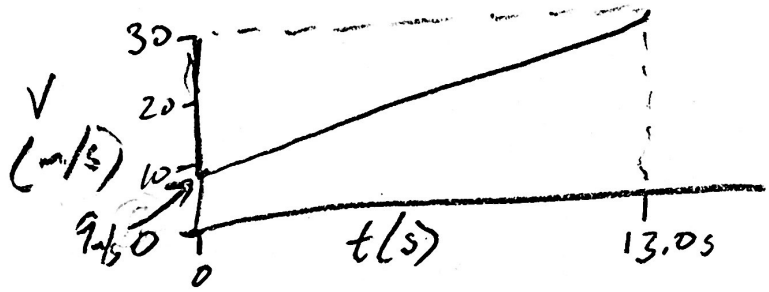
$546N = 340 kg\,(a)$

$a = 1.61 m/s^2$



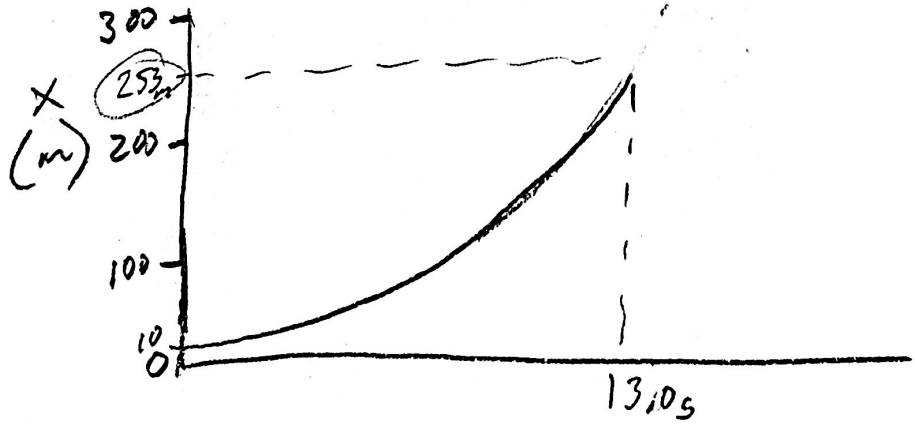
$V = V_0 + at \Rightarrow 30 m/s = 9 m/s + (1.61 m/s^2)\,t$

$t = 13.0 s$

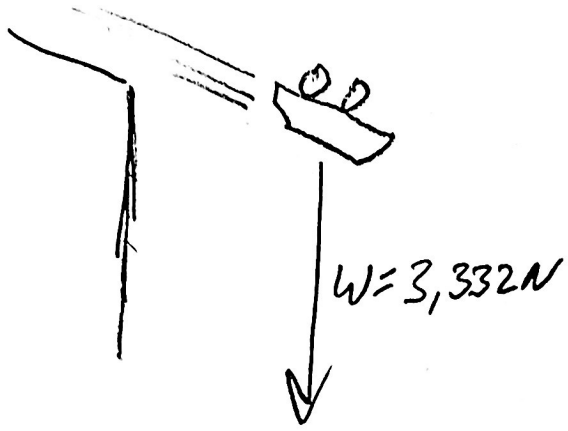


$\Delta x = V_0 t + \frac{1}{2} a t^2 = 9 m/s\,(13s) + \frac{1}{2}(1.61 m/s^2)(13s)^2$

$\Delta x = 253 m$



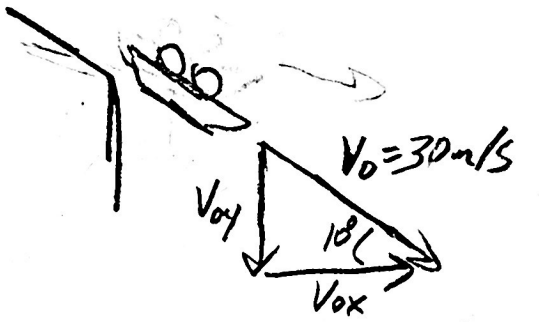
8.



$\Sigma F = 3{,}332N$ Downward

9. • Earth pulls them down; They pull Earth up (gravity)

10.

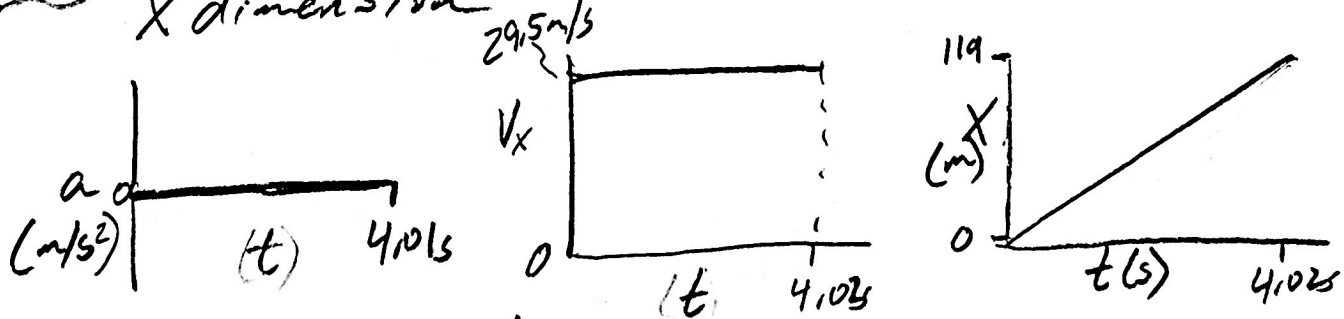


$V_{0y} = -(30 m/s (\sin 10°)) = -5.21 m/s$

$V_{0x} = 29.5 m/s$

* Do #11 first

X dimension



No accel in X dimension $\Rightarrow d = rt \Rightarrow d = 29.5 m/s (4.02s) = 119m$

From #11

11. In the y dimension, we have...

$v_{0y} = -5.21\ m/s$

$y_0 = 100\ m$

$y = 0\ m$

$a_y = -9.8\ m/s^2$

$v_y = ?$

$\Delta t = ?$

$v_y^2 = v_{0y}^2 + 2a_y \Delta y$

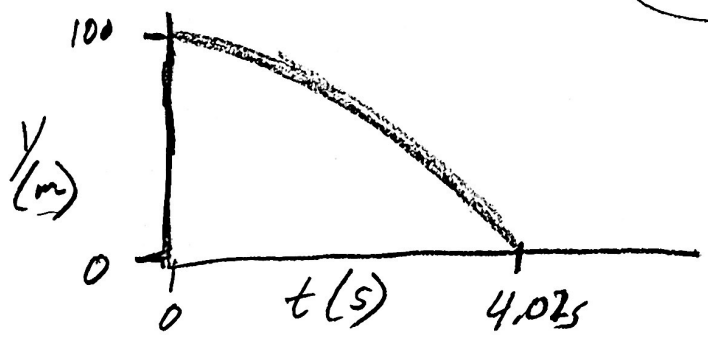
$v_y^2 = (-5.21\ m/s)^2 + 2(-9.8\ m/s^2)(-100\ m)$

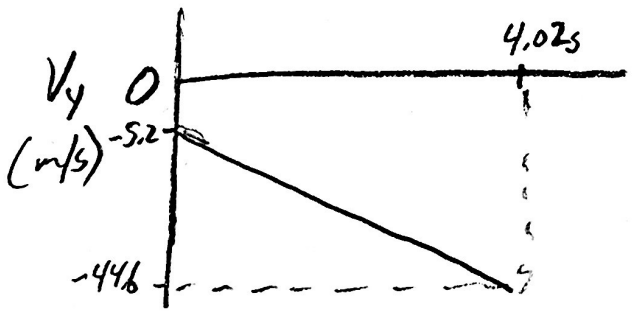
$v_y = -44.6\ m/s$

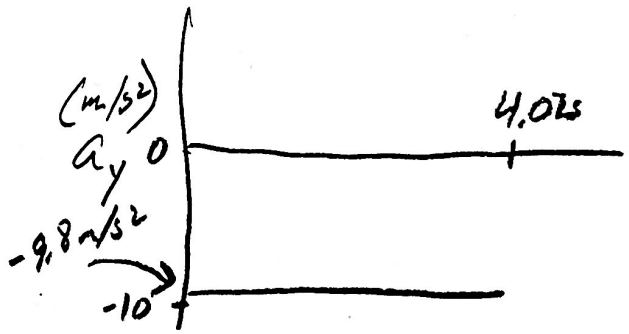
$v_y = v_{0y} + a_y t$

$-44.6\ m/s = -5.21\ m/s + (-9.8\ m/s^2)\, t$

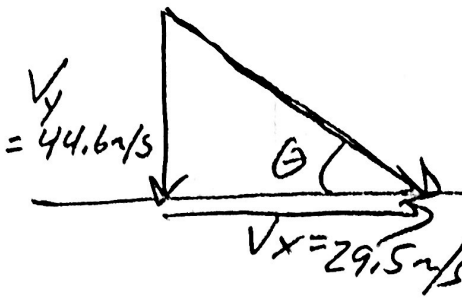
$t = 4.02\ s$







13.



$$\text{Tan}\,\theta = \frac{44.6}{29.5}$$

$$\theta = \text{Tan}^{-1}\left(\frac{44.6}{29.5}\right)$$

$\theta = 56.5°$ = Contact angle

14.