Brady Hess

Physics Midterm

1. (C) 11.0 g cm^{-3}

2. (C) 10.00 hours

3. 25 m/s × 3.6 km/h per m/s
= 90 km
(D) 90 km/hr

4. Accel = $\frac{\Delta \text{velo}}{\text{time}}$
$\frac{10 \text{ km/hr}}{60 \text{ seconds}}$
(C) 1/6 km hr/s

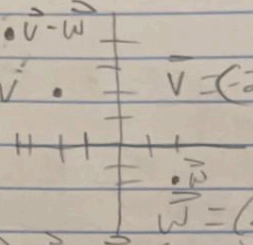
5. (A) 5000 m^2

6. (C) 4×10^3

7. Southwest means both South and West are negative. Therefore:
(D) -7.1 and -7.1 Km/hr

8. Since both are negative:
It is in the third quadrant
180° + 45 = 225
(A) 225 degrees

9a. $\vec{v} - \vec{w}$



B.) $\vec{v} + \vec{w} = (-2\hat{i} + 2\hat{j}) + (2\hat{i} - 2\hat{j})$
$= 0\hat{i} + 0\hat{j} = \vec{0}$

C.) $\vec{v} - \vec{w}$
$(-2\hat{i} + 2\hat{j}) - (2\hat{i} - 2\hat{j})$
$= -4\hat{i} + 4\hat{j}$

D. on graph

E. $(-2)(2) + (2)(-2)$
$-4 - 4$
$= -8$

Unit 1:

1. $V = V_0 + at$
$V = 15 \text{ m/s} + (3 \text{ m/s}^2)(4 \text{ s}) = 15 \text{ m/s} + 2 \text{ m/s}$
$= 27 \text{ m/s}$

B. $S = V_0 t + \frac{1}{2} a t^2$
$S = 15 \text{ m/s}(4 \text{ s}) + \frac{1}{2}(3 \text{ m/s}^2)(4 \text{ s})^2$
$S = 60 \text{ m} + \frac{1}{2}(3)(16) = 84$
84 m

C. Yes, they are different
At $t = 0$
Instant velo = 15 m/s, Avg = 21 m/s

At $t = 4$, Instant velo = 27 m/s
Avg velo = 21 m/s

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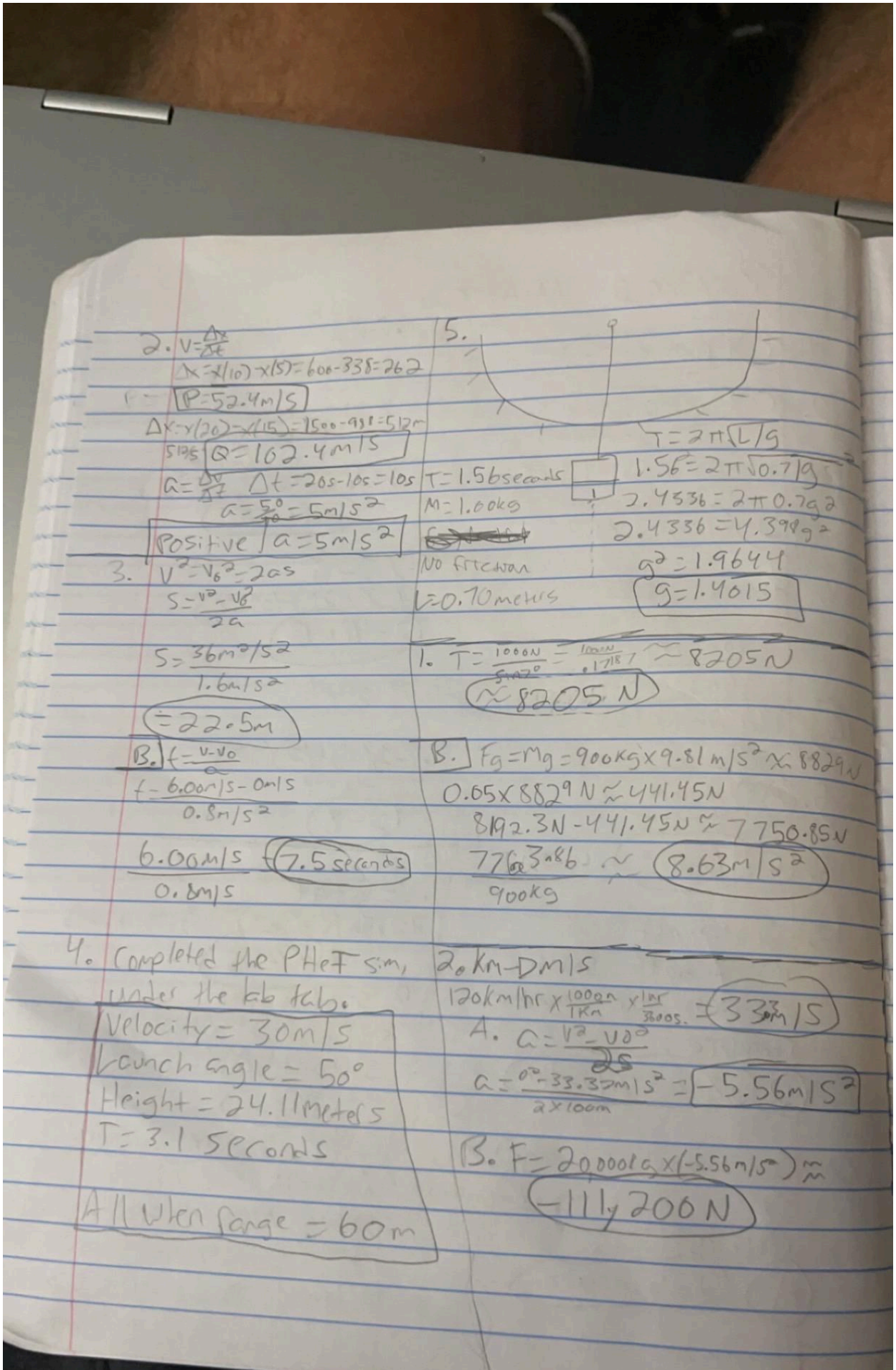

2. $V=\frac{\Delta x}{\Delta t}$

$\Delta x = x(10) - x(5) = 600 - 338 = 262$

$V = 52.4 m/s$

$\Delta x = x(20) - x(15) = 1500 - 938 = 512m$

$\frac{512}{5 s} \quad Q = 102.4 m/s$

$a = \frac{\Delta v}{\Delta t} \quad \Delta t = 20s - 10s = 10s$

$a = \frac{5^0}{10} = 5 m/s^2$

Positive $a = 5 m/s^2$

3. $V^2 = V_0^2 = 2as$

$S = \frac{V^2 - V_0^2}{2a}$

$S = \frac{36 m^2/s^2}{1.6 m/s^2}$

$= 22.5m$

B. $t = \frac{V - V_0}{a}$

$t = \frac{6.00 m/s - 0 m/s}{0.8 m/s^2}$

$\frac{6.00 m/s}{0.8 m/s} \quad 7.5 seconds$

4. Completed the PHeT sim, under the lab tab.

Velocity = 30 m/s
Launch angle = 50°
Height = 24.11 meters
T = 3.1 seconds

All when range = 60m

5.

$T = 1.56 seconds$

$M = 1.00 kg$

No friction

$L = 0.70 meters$

$T = 2\pi\sqrt{L/g}$

$1.56 = 2\pi\sqrt{0.7/g}$

$2.4336 = 2\pi 0.7 g^2$

$2.4336 = 4.398 g^2$

$g^2 = 1.9644$

$g = 1.4015$

1. $T = \frac{1000N}{\sin 7^0} = \frac{1000N}{.1218} \approx 8205N$

$\approx 8205 N$

B. $F_g = mg = 900kg \times 9.81 m/s^2 \approx 8829 N$

$0.05 \times 8829 N \approx 441.45N$

$8192.3N - 441.45N \approx 7750.85N$

$\frac{7763.86}{900kg} \approx 8.63 m/s^2$

2. $Km \to D m/s$

$120 km/hr \times \frac{1000m}{1Km} \times \frac{1hr}{3600s} = 33\frac{3}{3} m/s$

A. $a = \frac{V^2 - V_0^2}{2S}$

$a = \frac{0^2 - 33.33 m/s^2}{2 \times 100m} = -5.56 m/s^2$

B. $F = 20000kg \times (-5.56 m/s^2) \approx$

$-111,200 N$

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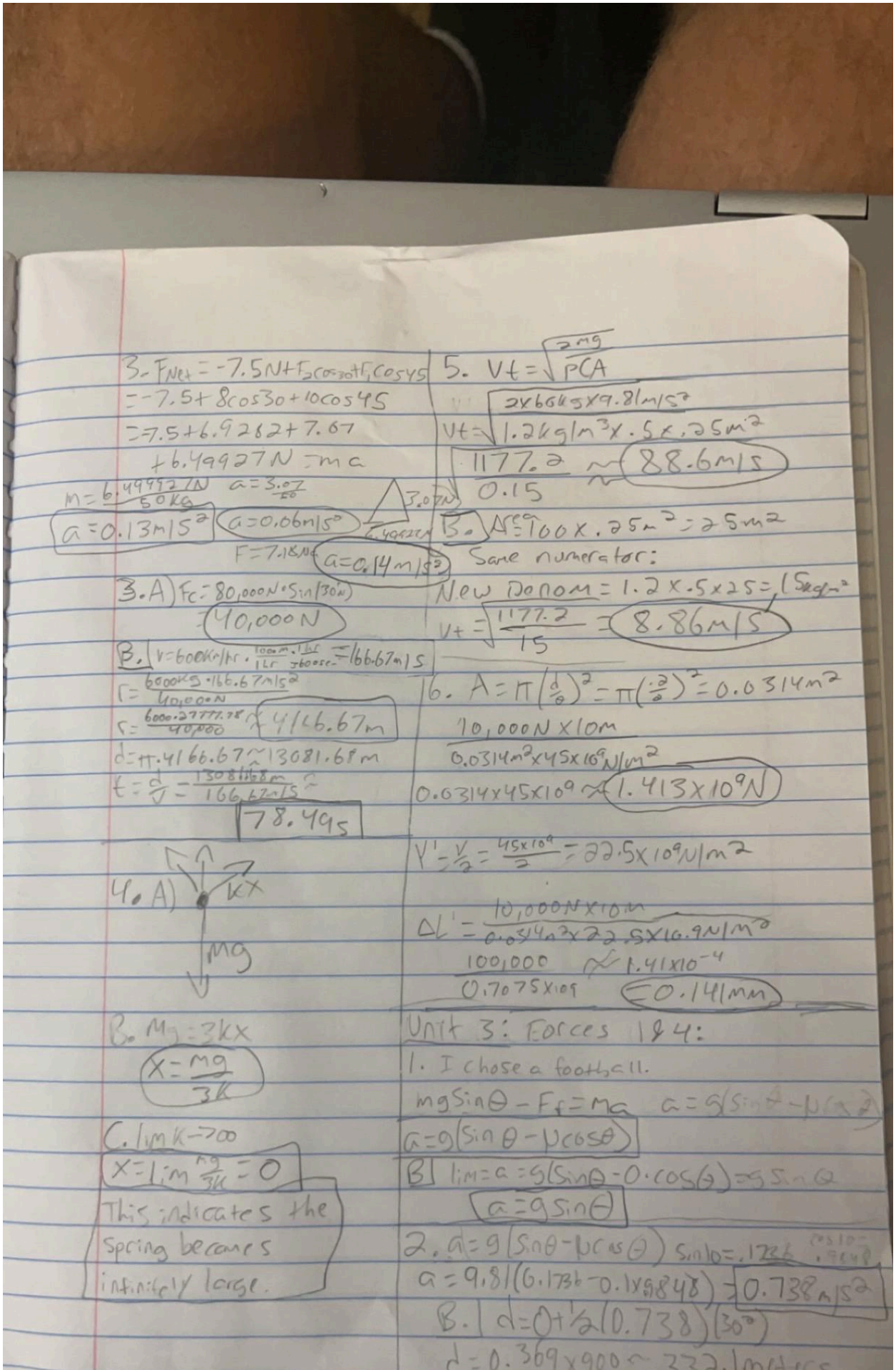

3. $F_{Net} = -7.5N + F_2\cos30 + F_1\cos45$

$= -7.5 + 8\cos30 + 10\cos45$

$= -7.5 + 6.9282 + 7.07$

$+6.49927N = ma$

$m = \frac{6.49927N}{50kg}$ $a = \frac{3.07}{50}$

$a = 0.13m/s^2$ $a = 0.06m/s^2$

3.07N, 6.49927N, F = 7.18N, $a = 0.14m/s^2$

3. A) $F_c = 80{,}000N \cdot \sin(30°)$

$= 40{,}000N$

B. $v = 600km/hr \cdot \frac{1000m}{1km} \cdot \frac{1hr}{3600sec} = 166.67m/s$

$r = \frac{6000kg \cdot 166.67m/s^2}{40{,}000N}$

$r = \frac{6000 \cdot 27777.78}{40{,}000} \approx 4166.67m$

$d = \pi \cdot 4166.67 \approx 13081.68m$

$t = \frac{d}{v} = \frac{13081.68m}{166.67m/s} \approx$

78.49s

4. A)

B. $Mg = 3kx$

$x = \frac{mg}{3k}$

C. $\lim_{k \to \infty}$

$x = \lim \frac{mg}{3k} = 0$

This indicates the spring becomes infinitely large.

5. $V_t = \sqrt{\frac{2mg}{\rho CA}}$

$V_t = \sqrt{\frac{2 \times 66.5 \times 9.81m/s^2}{1.2kg/m^3 \times .5 \times .25m^2}}$

$\frac{1177.2}{0.15} \approx 88.6m/s$

B. $A = 100 \times .25m^2 = 25m^2$

Same numerator:

New Denom $= 1.2 \times .5 \times 25 = 15kg/m$

$V_t = \sqrt{\frac{1177.2}{15}} = 8.86m/s$

6. $A = \pi\left(\frac{d}{2}\right)^2 = \pi\left(\frac{.2}{2}\right)^2 = 0.0314m^2$

$\frac{70{,}000N \times 10m}{0.0314m^2 \times 45 \times 10^9 N/m^2}$

$0.0314 \times 45 \times 10^9 \approx 1.413 \times 10^9 N$

$V' = \frac{V}{2} = \frac{45 \times 10^9}{2} = 22.5 \times 10^9 N/m^2$

$\Delta L' = \frac{10{,}000N \times 10m}{0.0314m^2 \times 22.5 \times 10^9 N/m^2}$

$\frac{100{,}000}{0.7075 \times 10^9} \approx 1.41 \times 10^{-4}$

$= 0.141mm$

Unit 3: Forces 1 & 4:

1. I chose a football.

$mg\sin\theta - F_f = ma$ $a = g(\sin\theta - \mu\cos\theta)$

$a = g(\sin\theta - \mu\cos\theta)$

B. $\lim a = g(\sin\theta - 0 \cdot \cos\theta) = g\sin\theta$

$a = g\sin\theta$

2. $a = g(\sin\theta - \mu\cos\theta)$ $\sin10 = .1736$ $\cos10 = .9848$

$a = 9.81(0.1736 - 0.1 \times 0.9848) = 0.738m/s^2$

B. $d = 0 + \frac{1}{2}(0.738)(30^2)$

$d = 0.369 \times 900 \approx 332.1m$