Test 1 **Dr. Weppner**
PH 241 **Oct. 2007**

NAME _____ SCORE____

Remember to get full credit label answers with correct units, show all work, draw diagrams (pictures!), give axis directions.

A child throws a ball at an angle of 20 degrees.

Questions 1-3 are based on the motion of this ball.

1. **[5 pts]** What is the vertical velocity of the ball at its peak height?
(A) 0 m/s
(B) 9.8 m/s
(C) -9.8 m/s
(D) not enough information

Always

2. **[5 pts]** What is the horizontal velocity of the ball at its peak height?
(A) 0 m/s
(B) 9.8 m/s
(C) -9.8 m/s
(D) not enough information

Need v_0

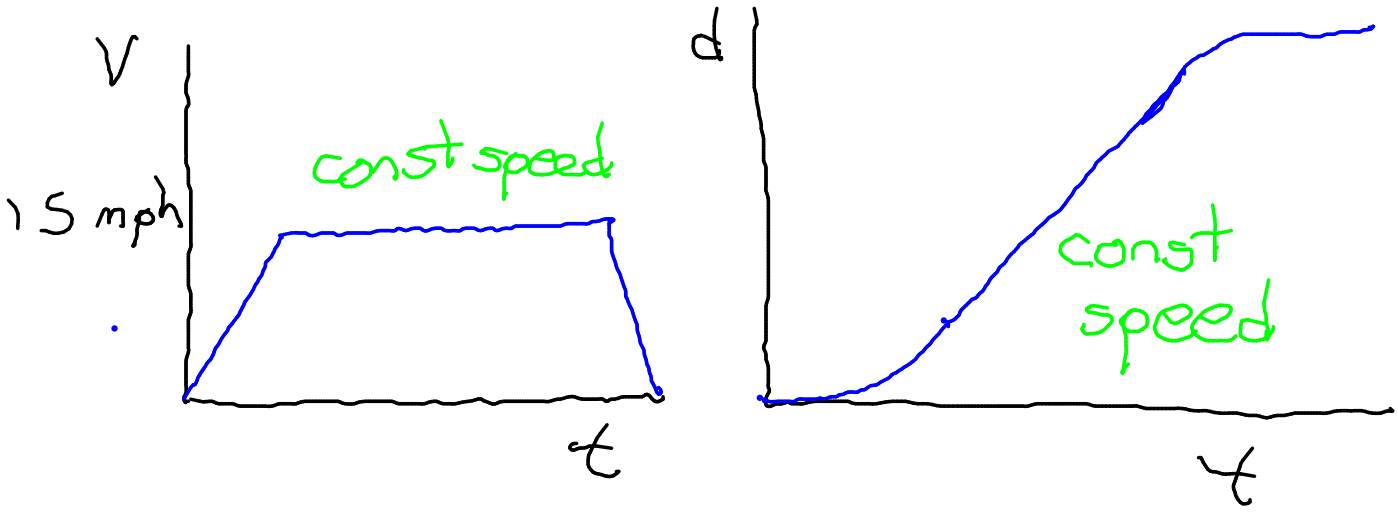
3. **[5 pts]** What is the acceleration of the ball at its peak height?
(A) 0 m/s^2
(B) 9.8 m/s^2
(C) -9.8 m/s^2
(D) not enough information

$9.8\ m/s^2$ towards the earth

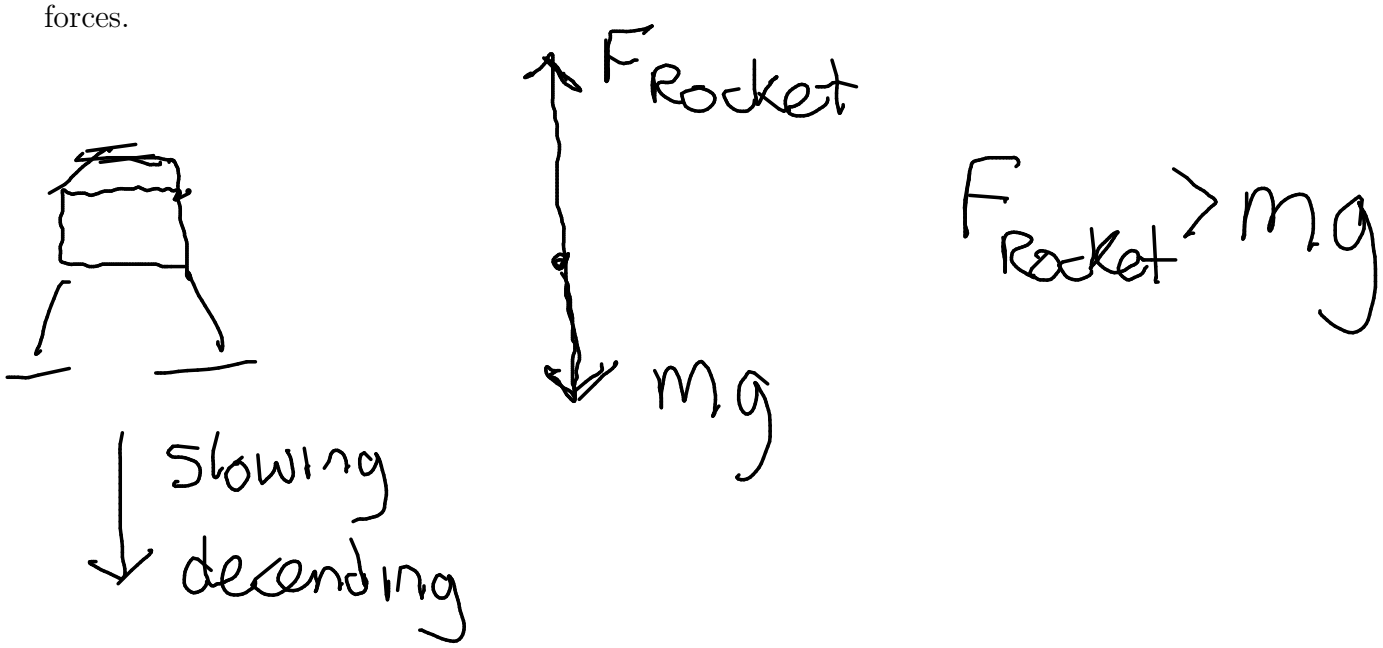
NAME _____

4. **[12 pts]** A child gets on a bicycle, she tries to go as fast as she can. Within 20 seconds she is up to 15 MPH. She stays at this speed for one minute, then she begins to apply the break because she sees a stop sign ahead. She comes to a complete stop after 10 seconds.

Plot the story on a velocity vs. time graph **and** a distance vs. time graph:

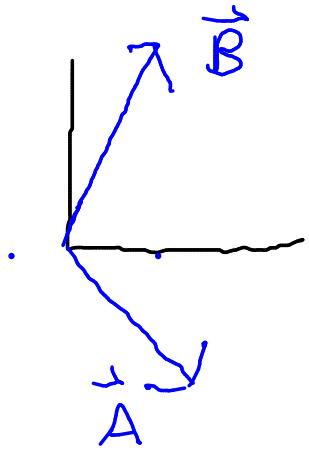


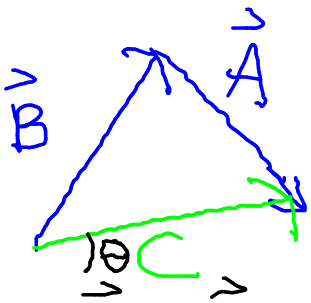
5. **[8 pts]** A Martian Lander is approaching the surface. It is slowinf its decent by firing a rocket motor. What is the correct free body diagram for the lander? Label the forces.



NAME _____

6. **[12 pts]** Add **A** + **B** displaying the answer in component form, graphical form, and mathematical form (numerical size and direction):
A = 3.0**i** − 3.2**j** **B** = 2.0**i** + 4.7**j**





$\vec{C} = \vec{A} + \vec{B}$

Component form

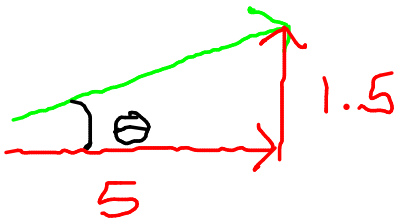
$(3+2)i + (-3.2+4.7)j$

$= 5i + 1.5j$

Math

$|C| = \sqrt{5^2 + 1.5^2} = 5.2$

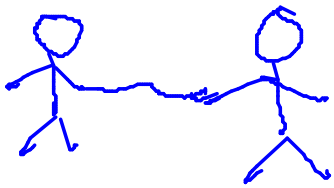
$\theta = \tan^{-1}\frac{1.5}{5} = 17°$



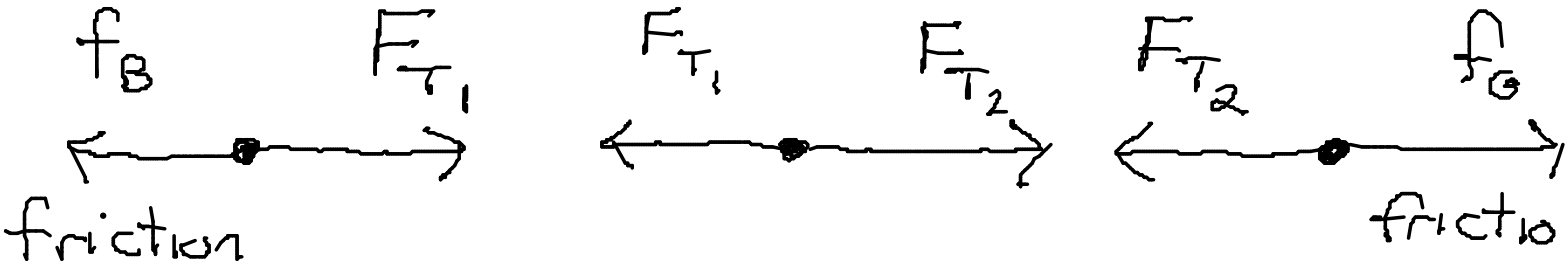
7. **[8 pts]** A boy and a girl are engaged in a tug-of-war. Draw a diagram showing the horizontal forces on

~~(A) the boy~~
(B) the girl
(C) the rope

Boy



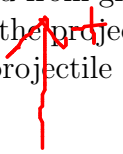
Girl



Boy Rope Girl

NAME _____

8. **[22 pts]** A projectile is launched from ground level to the top of a cliff which is 195 meters away and 155 meters high. If the projectile lands on top of the cliff 7.6 s after it is fired, find the initial velocity of the projectile (magnitude and direction). Show all work.



(1) $\Delta X = V_{ox} t$

(2) $\Delta y = V_{oy} t - \frac{1}{2} g t^2$

$V_y = V_{oy} - gt$

$-g\Delta y = \frac{V_y^2 - V_{oy}^2}{2}$

Note that this is a general solution most Let $\Delta X = 195m$ which is OK

$\Downarrow$

must travel $\Delta y = 155m$

(2) $155m = V_{oy}(7.6s) - \frac{1}{2}(9.8 m/s^2)(7.6s)^2$

$V_{oy} = 57.6 m/s$

(1) $V_{ox} = \frac{\Delta X}{7.6s}$

$\theta = \tan^{-1}\left(\frac{57.6 m/s}{\frac{\Delta X}{7.6s}}\right)$

So $V_o = \sqrt{\left(\frac{\Delta X}{7.6s}\right)^2 + (57.6 m/s)^2}$

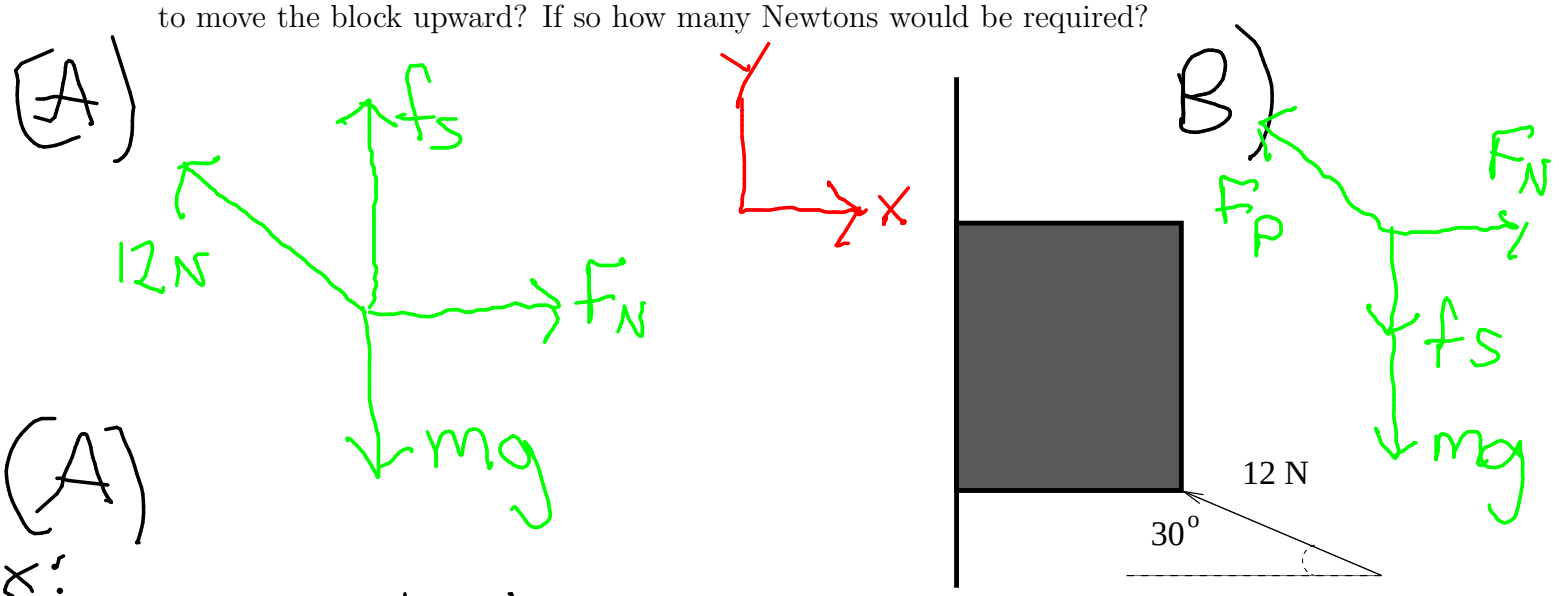
NAME _____

9. **[22 pts]** A box of mass 1.0 kg is pressed against a wall with the force shown in the diagram. The box is moving unless there is a good amount of static friction on the wall.

show all work including force diagrams, coordinate systems, etc

(A) What would be the minimum coefficient of static friction (μ_s) needed to keep the box from moving?

(B) If the person pushed harder, but kept the push at the same angle, would it be possible to move the block upward? If so how many Newtons would be required?



(A)

x: $0 = F_N - 12N\cos 30^\circ \Rightarrow F_N = 10.4N$

y: $0 = f_s - mg + 12N\sin 30^\circ$

$\mu_s(10.4N) = mg - 12N(\sin 30^\circ)$

$\mu_s = .37$

(B) $0 = F_N - F_p\cos 30^\circ$ ② x:

$0 = F_p\sin 30^\circ - .37F_N - mg$ y:

$mg = F_p(\sin 30^\circ - .37\cos 30^\circ)$

$F_p = 54.6N$