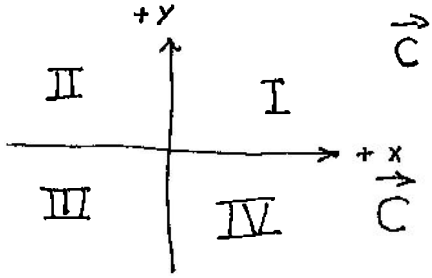
MC(50) ____ Prob11 ____ Prob11 ____ Prob12 ____ ____

Multiple choice, circle the correct answer (5 points each).

1.) The vector $\vec{A}$ is given by $\vec{A} = -3\hat{\imath} + 4\hat{\jmath}$ and the vector $\vec{B}$ is given by $\vec{B} = 4\hat{\imath} + 6\hat{\jmath}$. In what quadrant does $\vec{C}$ defined by $\vec{C} = \vec{A} - \vec{B}$ lie? The quadrants are pictured below.



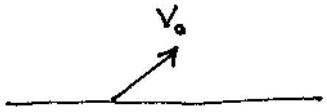
A. I
B. II
(C.) III
E. IV

$\vec{C} = -3\hat{\imath} + 4\hat{\jmath} - (4\hat{\imath} + 6\hat{\jmath})$ (A)

$\vec{C} = -7\hat{\imath} - 2\hat{\jmath}$

both negative $\Rightarrow$ III quadrant

2.) A ball is thrown with an initial velocity $v_{ox} = 3.0$ m/s and $v_{oy} = 5.0$ m/s. After 2.0 s, the ball is located at



A. $x = 6.0m$, $y = 4.9m$
(B.) $x = 6.0m$, $y = -9.6m$
C. $x = 6.0m$, $y = -29.m$
D. $x = 26.m$, $y = 4.9m$
E. $x = 26.m$, $y = -9.6m$

x - direction

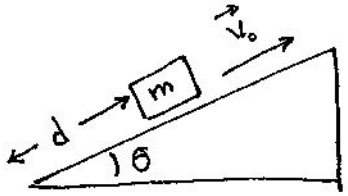
$x = v_{ox} t = 3.0\ m/s \times 2\ s = 6.0\ m$

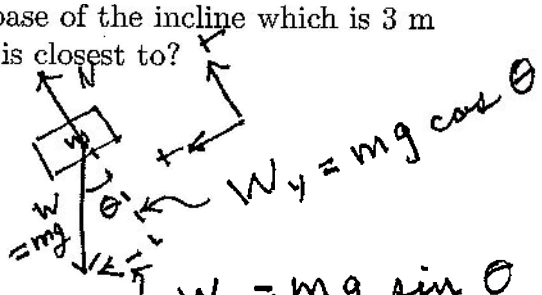
y - direction

$y = v_{oy} t + \frac{1}{2} a_y t^2$, $a_y = -9.8\ m/s^2$

$y = 5.0\ m/s\ 2\ s - 4.9\ m/s^2\ (2\ s)^2 = -9.6$

3.) A block sits on a frictionless incline that makes an angle of $\theta = 30.0$ with respect to horizontal. The block is given a push to start it up the incline with a velocity, measured along the incline, of 4 m/s. After the initial push, nobody touches the block. The velocity of the block when it reaches the base of the incline which is 3 m from its initial position as measured along the incline is closest to?





(A.) 15 m/s
B. 25 m/s
C. 35 m/s
D. 45 m/s
E. 55 m/s

$F_{tot,x} = ma_x$

$mg\sin\theta = ma_x$

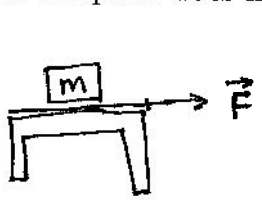
$a_x = 4.9\ m/s^2$

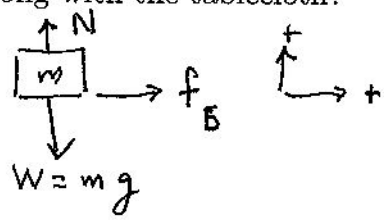
$V_x^2 = V_{ox}^2 + 2 a_x \Delta x$

$V_x^2 = (4\ m/s)^2 + 2(4.9\ m/s^2)(3\ m) =$

$\rightarrow V_x = 6.7$

4.) A block sits on top of a tablecloth covering a horizontal table. You pull the tablecloth with an acceleration a. If the static coefficient of friction is $\mu_s = 0.200$, what is the acceleration necessary such that the plate does not move along with the tablecloth?

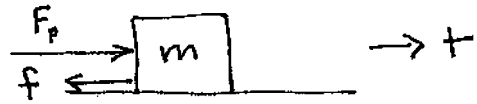




A. 0.98 m/s^2
B. 2.0 m/s^2
C. 3.0 m/s^2
D. 4.9 m/s^2
E. 9.8 m/s^2

y - problem
$N - mg = 0, \quad N = mg$
x - problem
$f = ma$, use $f = \mu_s N$ want when f is max
$\mu_s mg = ma$

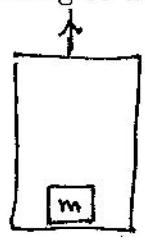
5.) A block sits on a table. You push toward the right with a force of 12. N and the block does not move. The mass of the block is 8.00 kg, the coefficient of static friction is $\mu_s = 0.60$ and the coefficient of kinetic friction is $\mu_k = 0.50$. What is the force of friction on the block?

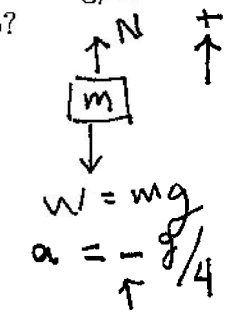


A. 6.0 N
B. 7.2 N
C. 12. N
D. 39. N
E. 47. N

Block is not moving
$F_{tot,x} = F_p - f = 0$
$f = F_p = 12\ N$

6.) A box of mass m sits on a scale on an elevator. The elevator is going upward when somebody hits the emergency switch. The elevator comes to a stop with an acceleration whose magnitude is constant and equal to g/4. What is the normal force on the box while the elevator is coming to a stop?



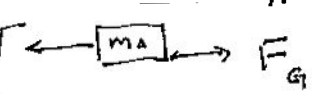


$F_{tot} = N - mg = ma$
$N = +mg + ma$
$N = mg - mg/4$
$= \frac{3}{4} mg$

A. 0.25 mg
B. 0.50 mg
C. 0.75 mg
D. 1.00 mg
E. 1.25 mg

7.) Car A of mass m_A is towing car B of mass m_B on a horizontal surface and they are accelerating toward the right as drawn. The magnitude of the force of the ground on car A, F, is

Look at m_A



$F_G - T = ma$ ↑ is greater

$F_G = T + ma$ ↑ is greater

(A.) Greater than the magnitude of the tension T in the rope.
B. Equal to the magnitude of the tension T in the rope.
C. Less than the magnitude of the tension T in the rope.
D. You need to know which mass is larger to know which force is greater.
E. You need to know in which direction the velocity points to know which force is greater.

8.) You are riding in a train car which is 20. m long. You run from the back of the car to the front of the car. Your velocity with respect to the train is constant and equals 5.0 m/s. The train is moving forward at a velocity of 3.0 m/s. How far as measured by somebody on the ground have you moved when you arrive at the front of the car?

run at 5 m/s (V_{pt})

$d = 20\,m = vt$ person - train

$t = 20\,m / 5\,m/s = 4\,s$

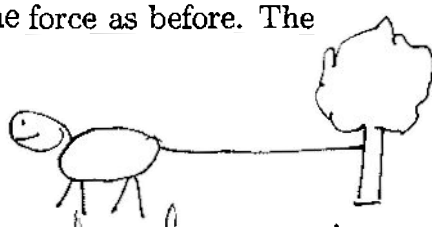
Your velocity wrt ground

$V_{rg} = V_{rt} + V_{tg} = 5\,m/s + 3\,m$

$d = 8\,m/s \times 8\,m/s \; 4\,s =$

A. 8 m
B. 16 m
C. 24 m
D. 32 m
E. 48 m

9.) Two horses are pulling on the ends of a rope as drawn. The rope is not moving. The left horse can pull with a force of 500 N. You now replace the right horse by tying the rope to the tree. The horse continues to pull with the same force as before. The tension in the rope while tied to the tree is

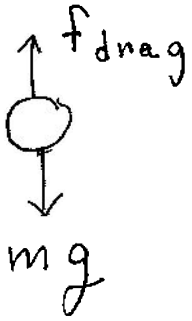


A. 250 N
(B.) 500 N
C. 750 N
D. 1000 N
E. I need to know more about how hard the left horse can pull.

It makes no difference if the horse or tree provides 500 N to right

10.) Using the model of air drag discussed in the text ($f_{drag} = Dv^2$), the drag coefficient of a baseball is 1.06×10^{-3} kg/m. According to the official rules of baseball, the ball's mass is $m = 145$ grams. Suppose Mariano Rivera throws a 95 mph fastball straight down from the Empire State Building. One second after leaving Rivera's hand, the speed of the ball is

A. less than 95 mph.
B. still 95 mph.
C. greater than 95 mph.
D. one cannot say anything for sure.



$W = mg = 0.145\,kg \times 9.8\,m/s^2$

$= 1.42\,N$

$v = 95\,mi/hr \dfrac{.447\,m/s}{1\,mi/hr} = 42.5\,m/s$

$F_{drag} = 1.06 \times 10^{-3}\,\dfrac{kg}{m}\,(42.5\,m/s)^2$

$= 1.91\,N$

Since $F_{drag} > W$, ball is slowing down (net force is up)

Problem, show your work clearly and logically, partial credit will be given (worth 25pt each).

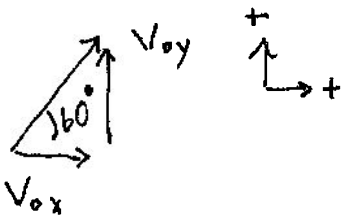
11.) A baseball is hit upward at an angle of 60 degrees above the horizontal with an initial speed of 80 m/s.

8 pt A.) How high does the ball go?

8 pt B.) What is the velocity of the ball at its highest point?

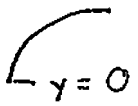
9 pt C.) The ball lands in the stands at a height of 4m above the point where it was hit. How far horizontally did the ball travel?

A.)



components $V_{oy} = V_o \sin 60^\circ = 69.3\ m/s$

$V_{ox} = V_o \cos 60^\circ = 40.0\ m/s$



$V_y^2 = V_{oy}^2 + 2ay$

0

$V_{oy}^2 = -2ay$

$y = -\frac{V_{oy}^2}{2a} = -\frac{(69.3\ m/s)^2}{2(-9.8\ m/s^2)} = 245\ m$

B.) $V_y = 0$, V_x = constant $= 40.0\ m/s$

C.)

$y = V_{oy} t + \frac{1}{2} a_y t^2$ or

$0 = -4m + 69.3\ m/s\ t - 4.9\ \frac{m}{s^2} t^2$, $at^2 + bt + c = 0$

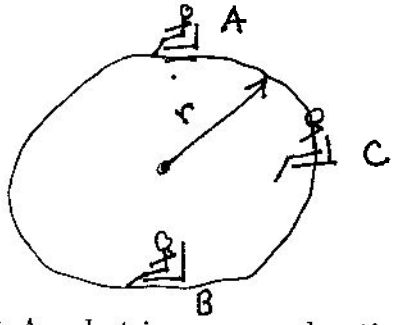
$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-69.3 \pm [69.3^2 - 4(-4.9)(-4)]^{1/2}}{2(-4.9)}$

$= 14.1\ s$ { want larger answer → ball on way down

$x = V_{ox} t = 564\ ft$

Problem, show your work clearly and logically, partial credit will be given.

12.) You are riding on a Ferris Wheel. The magnitude of your velocity is 0.500 m/s. Your mass is 75 kg.



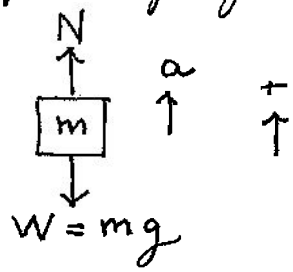
$r = 10\,m$

A.) at the top, point A, what is your acceleration?
B.) at the bottom, point B, what is the normal force on you?
C.) at point C, horizontal with the axle, what is the magnitude and direction of the total force the seat is exerting on you?

A. You are going in a circle, $a_c = v^2/r = \frac{(0.5\ m/s)^2}{10\,m}$

$a_c = 0.025\ m/s^2$

B.



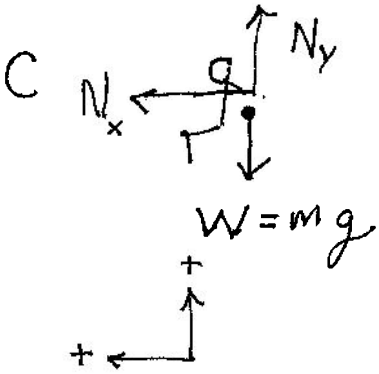
$F_{tot} = ma$

$N - W = mv^2/r$

$N = mg + mv^2/r = 75kg\ 9.8\ m/s + 75kg\ (.025\ \frac{m}{s^2})$

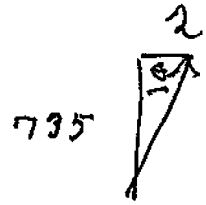
$= 737\ N$ { slightly more than your weight

C



$N_y = mg = 735\ N$

$N_x = ma_c = 75kg\ (0.025\ \frac{m}{s}) = 2\ N$



$N = \sqrt{N_y^2 + N_x^2} = 735\ N$

$\tan\theta = \frac{2}{735} =$

$\theta = .15°$