Name: _____

	Problem 1
	A golfer tries to hit the ball over a ravine, but the golf ball lands instead at the bottom of the ravine. It lands 90.0 m horizontally from its initial position and 15.0 m below it. The ball's initial velocity was directed 60.0 degrees above the horizontal. The acceleration of gravity is 9.8 m/s^2.
(10 Points)	a) What is the ball's initial velocity in the *y* direction?
(5 Points)	b) What is the maximum height the ball reaches (above its starting point)?
(5 Points)	c) What is the speed and angle with the horizontal (angles below the horizontal count as negative) with which the ball strikes the ground at the bottom of the ravine?
(5 Points)	d) The far edge of the ravine was 92.0 m away from the golfer's position. To just reach the far edge of the ravine, at the same initial speed, what is the angle with the horizontal that the golf ball should be launched?

$-15.0m = 0m + v_i t\sin(60) + \frac{1}{2}(-9.8 m/s^2)t^2$

$-15 = \left(\frac{90}{t\cos 60}\right)\sin 60 \cdot t + \frac{1}{2}(-9.8)t^2$

$-15 = 90\tan 60 - 4.9t^2$

$90.0\,m = v_i t\cos(60) + 0 + 0$

$\frac{90}{t\cos 60} = v_i$

$t = 5.9054\,s$

$v_i = 30.4805\,m/s$

$v_{iy} = \sin 60\, v_i = \sin 60\,(30.4805) = 26.4\,m/s = v_{iy}$ +10

$0 = v_{iy} + at$

$0 = \sin 60 \cdot v_{iy} + -9.8t \qquad t = 2.6955\,s$

$y_{max} = y_i + \sin 60 v_{iy} t - 4.9t^2$ +5

$y_{max} = 35.5\,m$

$t = 5.904\,s$

$v_{fy} = v_i \sin 60 + at$

$= -31.46\,m/s$

$v_{fx} = v_{ix} = v_i \cos 60 = 15.24\,m/s$ +5

$\tan\theta = \frac{v_{fy}}{v_{fx}} =$

$|v_f| = (v_{fy}^2 + v_{fx}^2)^{1/2} = 34.1\,m/s$

$\theta = 64°$ below horizontal

d) $92.0_m = 0_m + V_i \cos(\theta) t + 0$

$V_i = 39.48$

$\frac{92}{V_i \cos\theta} = t$

$0_m = 0_m + V_i \sin(\theta) t - 4.9t^2$

$0 = V_i \sin\theta \cdot \frac{92}{V_i \cos\theta} - 4.9\left(\frac{92}{V_i \cos\theta}\right)^2$

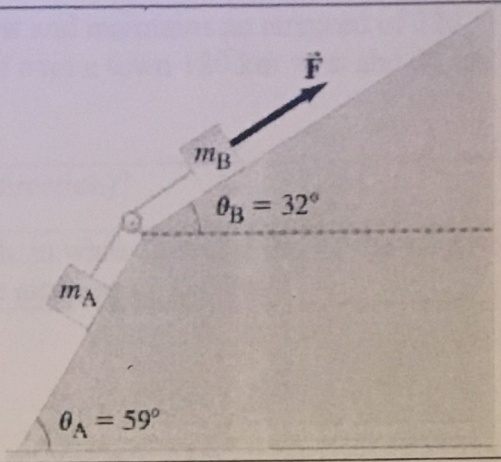
$\frac{\sin\theta 92}{\cos\theta} = 4.9\left(\frac{92}{V_i \cos\theta}\right)^2$

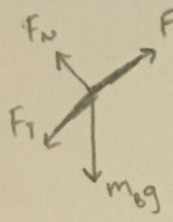
$\sin\theta 92 = \frac{4.9 \cdot 92^2}{V_i^2 \cos\theta}$

$\sin\theta\cos\theta = \frac{4.9 \cdot 92}{V_i^2}$

/4

Name: _____

	Problem 2	
	Consider the system shown in the figure with $m_A = 9.5$ kg and $m_B = 11.5$ kg. The angles $\theta_A = 59°$ and $\theta_B = 32°$.	
(7 points)	a) In the absence of friction, what magnitude of force $\vec{F}$ would be required to pull the masses at a constant velocity up the fixed inclines?	
(6 points)	b) The force $\vec{F}$ is now removed. What is the magnitude and the direction of the acceleration of the two blocks?	
(6 points)	c) In the absence of force $\vec{F}$, what is the tension in the string?	
(6 points)	d) In the absence of force $\vec{F}$ what is the minimum coefficient of static friction applied to both block such that they remain stationary?	



$\sum F_A = F_T - \sin\theta_A m_A g = 0$

$\sum F_B = F - F_T - \sin\theta_B m_B g = 0$

$F = F_T + \sin\theta_B m_B g$

$= \sin\theta_A m_A g + \sin\theta_B m_B g$

$F = 139\,N$ ✓

$\sum F_A = \sin\theta_A m_A g - F_T = m_A a$ $\quad \sum F_B = F_T + \sin\theta_B m_B g = m_B a$

$a = \dfrac{\sin\theta_A m_A g - F_T}{m_A} = \dfrac{F_T + \sin\theta_B m_B g}{m_B}$

$\sin\theta_A g - \dfrac{F_T}{m_A} = \dfrac{F_T}{m_B} + \sin\theta g$

$\sin\theta_A g - \sin\theta_B g = \dfrac{F_T}{m_B} + \dfrac{F_T}{m_A}$

$= F_T(m_A + m_B)$

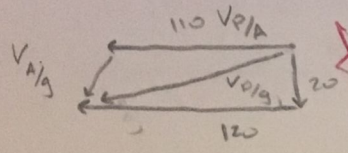
$F_T = \dfrac{\sin\theta_A g - \sin\theta_B g}{m_A + m_B}$

(2)

N
W E
S

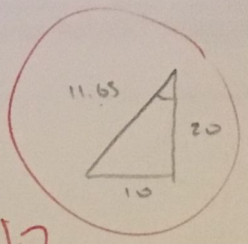
Name: _____

	Problem 3
	An airplane pilot sets a compass course due west and maintains an airspeed of 220 km/hr. After flying for 0.500 h, she finds herself over a town 120 km west and 20 km south of her starting point.
(10 points)	a) What is the wind velocity (magnitude and direction)?
(15 points)	b) If the wind velocity were 40 km/h due south, in what direction should the pilot set her course to travel due west? Use the same airspeed of 220 km/h



+2

$V_{P/A} + V_{A/g} = V_{P/g}$



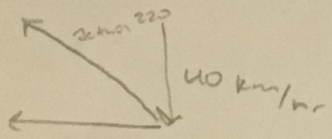
$110 + V_{A/g} = (120^2 + 20^2)^{1/2}$

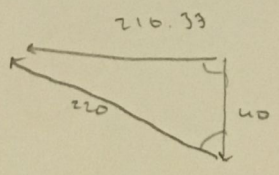
+2

$|V_{A/g}| = 11.65$ km/hr +1

$\frac{\sin 90}{11.65} = \frac{\sin A}{10}$

59.1° west of south





$210.33^2 = 220^2 + 40^2 - 2(220)(40)\cos($

+15

C = 79.52° west of north

Name: _____

	Problem 4
	In 100 m race, it took both Maggie and Judy 10.4 s to cross the finish line. Each one accelerated at a uniform rate until she reached her final speed. Maggie took 2.00 s and Judy 3.00 s to attain their maximum speeds which they maintained for the rest of the race.
(10 points)	a) What was the acceleration of each sprinter?
(6 points)	b) What were their maximum speeds?
(9 points)	c) What is the maximum distance by which Judie was behind Maggie, and at what time did that occur?

14/25

a) M: $v_f = a(t)$ $\quad x_M = 0_m + \frac{1}{2}at^2$

$x_{M2} = v_f(10-t) = at(10-t)$

$100 = x_{M1} + x_{M2} = \frac{1}{2}at^2 + at(10-t)$

$= \frac{1}{2}a(4) + a(2)(8) = 2a + 16a = 18a$

$a_M = 5.\overset{22}{5}\ m/s^2$

$a_J = 3.\overset{75}{9}\ m/s^2$

(+8)

b) $v_{fM} = a_M(2s) = \overset{10.8}{11}\ m/s$

$v_{fJ} = a_J(3s) = 11.\overset{2}{7}\ m/s$

(+5)

c) $t = 2.00s$ (+1)

$x_M = 11.1$

$x_J = 7.8$

3.3 m