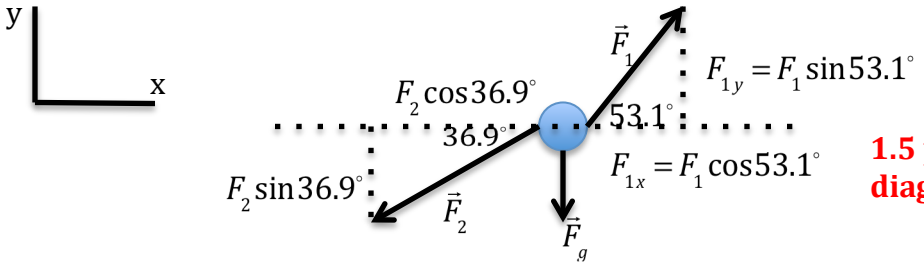
PHYS 1211, QUIZ 4, October 6, 2017

NAME: ID:

A 0.5 kg **ball**, in the **air**, is being pulled by two birds. **Bird number 1** is pulling the **ball rightward** with a force of magnitude, $F_1 = 8N$, at an angle 53.1° **above** the **horizontal**. **Bird number 2** is pulling the ball **leftward** with a force of magnitude, $F_2 = 10N$, at an angle 36.9° **below** the **horizontal**.

A) In the coordinate system below, **right** is defined as **+x**, and **up** is defined as **+y**. Draw a **free body diagram** (FBD) of **all** the **forces** acting on the ball. Express the **three forces** on the **ball** in **unit vector form**.



1.5 points diagram

Force	x-component	y-component	Unit Vector Form

Bird 1, $F_{1x} = 8N\cos 53.1 = 4.8N$, $F_{1y} = 8N\sin 53.1 = 6.4N$, $\vec{F}_1 = F_{1x}\hat{i} + F_{1y}\hat{j} = 4.8N\hat{i} + 6.4N\hat{j}$ **1.5 points**

Bird 2, $F_{2x} = -10N\cos 36.9.1 = -8N$, $F_{2y} = -10N\sin 36.9 = 6N$, $\vec{F}_2 = -8N\hat{i} - 6N\hat{j}$ **1.5 points**

Gravity $F_{gx} = 0$, $F_{gy} = -mg = -0.5kg \times 9.8\frac{m}{s^2} = -4.9N$, $\vec{F}_g = -4.9N\hat{j}$ **1.5 point**

B) Find the **net force**, $\vec{F}^{Net}$ = vector sum of three forces on ball. Use **Newton's second law** to find the **acceleration**, $\vec{a}$. Express $\vec{a}$ in **unit vector form**. **Draw** the **direction** of $\vec{a}$ wrt the ground. If the bird does not stop pulling, will the ball eventually hit the ground? Justify your answer.

Net Force: $\vec{F}^{NET} = \vec{F}_1 + \vec{F}_2 + \vec{F}_g$.

x-component: $F_x^{NET} = F_{1x} + F_{2x} + F_{gx} = 4.8N - 8N + 0 = -3.2N$. **1 point**

y-component: $F_y^{NET} = F_{1y} + F_{2y} + F_{gy} = 6.4N - 6N - 4.9N = -4.5N$. **1 point**

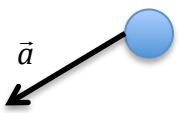
Newton's 2nd Law: $\vec{F}^{NET} = m\vec{a}$

1.5 points

x-comp: $a_x = \frac{F_x^{NET}}{m} = \frac{-3.2N}{0.5kg} = -6.4\frac{m}{s^2}$; **y-comp**: $a_y = \frac{F_y^{NET}}{m} = \frac{-4.5N}{0.5kg} = -9.0\frac{m}{s^2}$

$\vec{a} = \left(-6.4m \cdot s^2\right)\hat{i} + \left(-9.0m \cdot s^2\right)\hat{j}$.

1.5 points



It will eventually hit the ground since $a_y < 0$, eventually $v_y < 0$. **1 point**