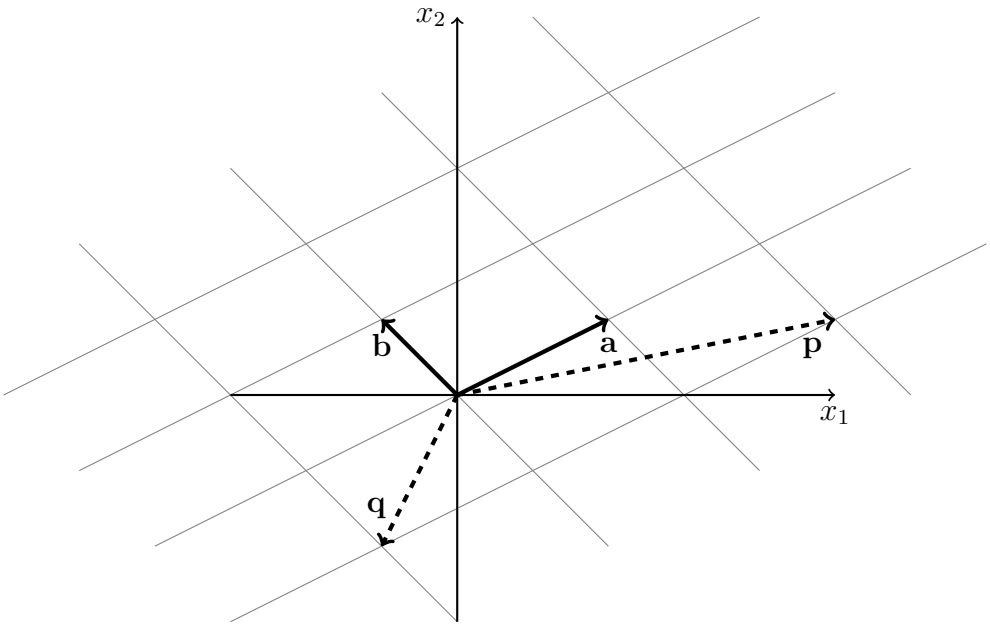
Math 2210-002/010 Quiz 3 **Name:** _____ 9/18/19

This quiz will be graded with partial credit.

1. (4 points) The vectors **a**, **b**, **p** and **q** from $\mathbb{R}^2$ are graphed below. Note that **p** and **q** are in Span$\{\mathbf{a}, \mathbf{b}\}$.



   (i) (2 points) Based on the figure above, express **p** as a linear combination of **a** and **b**.

   (ii) (2 points) Based on the figure above, express **q** as a linear combination of **a** and **b**.

2. (6 points) Consider the matrix

$$A = \begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 3 \\ -1 & -2 & 7 \end{bmatrix}$$

Let $\mathbf{a}_1 = \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix}$, $\mathbf{a}_2 = \begin{bmatrix} 2 \\ -4 \\ -2 \end{bmatrix}$ and $\mathbf{a}_3 = \begin{bmatrix} -1 \\ 3 \\ 7 \end{bmatrix}$ be the columns of A.

(i) (4 points) Is $\mathbf{b}_1 = \begin{bmatrix} 1 \\ -1 \\ 5 \end{bmatrix}$ a linear combination of the columns of A? If so, give weights x_1, x_2 and x_3 that witness this. If not, justify why.

(ii) (2 points) Let $\mathbf{b}$ be any vector in $\mathbb{R}^3$. Does the equation $A\mathbf{x} = \mathbf{b}$ necessarily have a solution? Justify your answer.