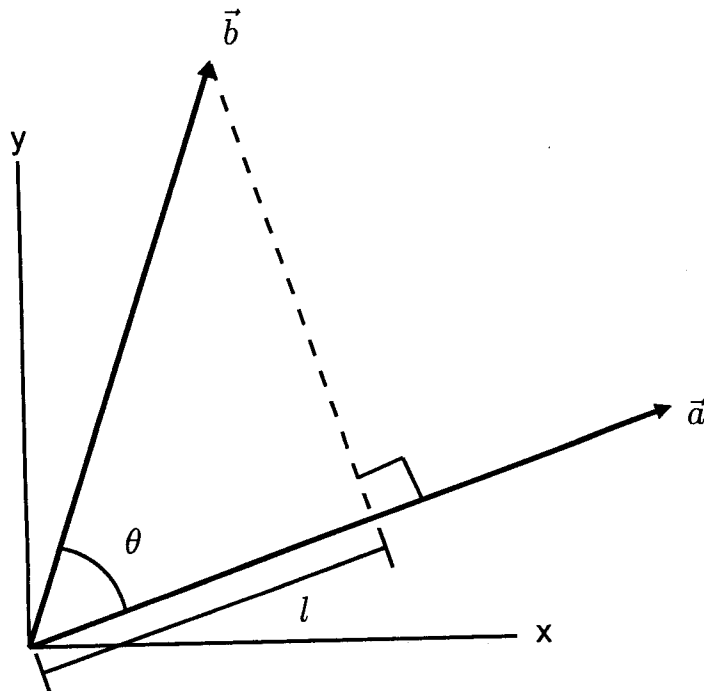


# QP43

## Vectors



Two vectors  $\vec{a} = 3\hat{i} + \hat{j}$  and  $\vec{b} = \hat{i} + 3\hat{j}$  lie in the  $x - y$  plane as shown.

- (a) [1 point] What is the magnitude of the projection of  $\vec{b}$  upon  $\vec{a}$ , indicated as  $l$  in the figure?
- (b) [1 point] What is the angle between  $\vec{a}$  and  $\vec{b}$ , indicated as  $\theta$  in the figure?
- (c) [1 point] What is the magnitude and direction of the cross product  $\vec{a} \times \vec{b}$ ? (**Hint:** You might want to calculate the magnitude without calculating a determinant by using your answer to (b) and the fact that  $\sin^2 \theta + \cos^2 \theta = 1$  for any angle  $\theta$ .)
- (d) [1 point] Draw a vector  $\vec{c}$  connecting the endpoints of  $\vec{a}$  and  $\vec{b}$ . What is the area of the triangle enclosed by the vectors  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$ ?