

Name \_\_\_\_\_

Let  $\mathbf{u} = \langle 2, 2\sqrt{3} \rangle$  and  $\mathbf{v} = \langle 3, 0 \rangle$ .

1. Calculate the angle between  $\mathbf{u}$  and  $\mathbf{v}$ .

**Solution**

$\mathbf{u} \cdot \mathbf{v} = 2 \cdot 3 + 2\sqrt{3} \cdot 0 = 6$ . But,

$$\mathbf{u} \cdot \mathbf{v} = |\mathbf{u}||\mathbf{v}| \cos(\theta) = 12 \cos(\theta).$$

So

$$\cos(\theta) = \frac{6}{12} = \frac{1}{2}.$$

Then,

$$\theta = \cos^{-1}\left(\frac{1}{2}\right) = 60^\circ \text{ or } \frac{\pi}{3}.$$

2. Calculate  $\text{proj}_{\mathbf{v}}\mathbf{u}$ .

**Solution**

$$\text{proj}_{\mathbf{v}}\mathbf{u} = \left(\frac{\mathbf{u} \cdot \mathbf{v}}{\mathbf{v} \cdot \mathbf{v}}\right) \mathbf{v} = \frac{6}{12} \langle 3, 0 \rangle = \langle 2, 0 \rangle$$