

**DIRECTIONS** To receive full credit, you must provide complete legible solutions to the following problems in the space provided. No Attached papers. Transfer all your answers to the space provided.

1. Find two unit vectors orthogonal to both  $\mathbf{a} = \langle 3, -1, 7 \rangle$ ,  $\mathbf{b} = \langle -2, 4, 3 \rangle$  Ans \_\_\_\_\_

2. Find the volume of the parallelepiped determined by the vectors  $\mathbf{a}$ ,  $\mathbf{b}$ , and  $\mathbf{c}$ .  
 $\mathbf{a} = 4\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$ ,  $\mathbf{b} = 4\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$ ,  $\mathbf{c} = -3\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$  Ans \_\_\_\_\_

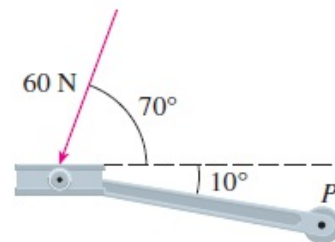
3. Find the volume of the parallelepiped determined by the vectors  $\mathbf{a}$ ,  $\mathbf{b}$ , and  $\mathbf{c}$ .  
 $\mathbf{a} = \langle 1, 3, 3 \rangle$ ,  $\mathbf{b} = \langle -1, 1, 4 \rangle$ ,  $\mathbf{c} = \langle 5, 1, 3 \rangle$  Ans \_\_\_\_\_

4. Use the scalar triple product to determine if the vectors  $\mathbf{u} = \mathbf{i} + 4\mathbf{j} - 3\mathbf{k}$ ,  $\mathbf{v} = 3\mathbf{i} - \mathbf{j}$ , and  $\mathbf{w} = 6\mathbf{i} + 11\mathbf{j} - 9\mathbf{k}$  are coplanar.

Ans \_\_\_\_\_

5. A bicycle pedal is pushed by a foot with a 60-N force as shown. The shaft of the pedal is 18 cm long. Find the magnitude of the torque about P. (Round your answer to one decimal place.)

Ans \_\_\_\_\_



6. A wrench 25 cm long lies along the positive y-axis and grips a bolt at the origin. A force is applied in the direction  $\mathbf{v} = 4\mathbf{j} - 3\mathbf{k}$  at the end of the wrench. Find the magnitude of the force needed to supply 130 N·m of torque to the bolt. (Round your answer to the nearest whole number.)

Ans \_\_\_\_\_