Work through the following problems, show your tutor then record your name before the end of your Week 6 tutorial. You are encouraged to discuss these questions and your solutions with your peers and to ask your tutor for assistance. Working through ten sets of tutorial problems is compulsory and each of the ten problem sets will contribute 1% towards your final grade. Note that you earn the 1% for your effort in solving these problems during the tutorial rather than for answering all the problems correctly.

Once you have finished these problems, you can use the remainder of your tutorial time to work on other aspects of the course. Solutions to the tutorial problems will be distributed next week.

1. A hanging flower basket of mass 5 kg is suspended using two ropes as illustrated below. The flower basket remains at rest. Find the magnitude of the tension along each rope. (Give your answers to two decimal place accuracy.)

2. Jane walks 400 metres due South, then 250 metres in the direction S85°W, and finally 180 metres in the direction N20°E. Determine the magnitude and direction of her resulting displacement, relative to her starting point.

3. Find the heading needed and the speed made good for a true course of 175° in a boat capable of 5 knots in a current of 3 knots in the direction 300°. (Bearings are measured clockwise from true north.)

4. Let \( \mathbf{u} = (\sqrt{2}, 2) \) and let \( \mathbf{v} = (-\sqrt{2}, 2) \).
   a) Calculate \( ||\mathbf{u}|| \) and \( ||\mathbf{v}|| \).
   b) Calculate \( \mathbf{u} \cdot \mathbf{v} \).
5. Let \( \mathbf{u} \) be a vector with magnitude 3 and direction \( \frac{\pi}{6} \). Let \( \mathbf{v} \) be a vector with magnitude 4 and direction \( \frac{3\pi}{4} \). Let \( \mathbf{w} \) be a vector with magnitude 7 and direction \( \frac{5\pi}{4} \).

   a) Calculate \( \mathbf{u} \cdot \mathbf{v} \).

   b) Calculate \( \mathbf{v} \cdot \mathbf{w} \). Why do you get the answer you do?

   c) Find a vector which is perpendicular to \( \mathbf{v} \).

6. Find \( a \) if the given pair of vectors below are (a) perpendicular and (b) parallel:
   \[ \mathbf{p} = 2\mathbf{i} + 8\mathbf{j} \text{ and let } \mathbf{q} = \mathbf{i} + a\mathbf{j}. \]

7. If \( \mathbf{u} = 3\mathbf{i} + 2\mathbf{j} - \mathbf{k} \text{ and } \mathbf{v} = -\mathbf{i} - 2\mathbf{j} + 4\mathbf{k}, \) calculate \( \mathbf{u} \times \mathbf{v} \).