Work through the following problems and have your tutor sign your solutions and record your name before the end of your Week 3 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. Use matrices to solve the following problem.
The materials to make 25kg of an alloy of copper and zinc cost $62. If copper costs $3.20/kg and zinc costs $1.40/kg, determine the composition of the alloy.

2. a) Write down the matrix form of the vectors \( \mathbf{a} \) and \( \mathbf{b} \) illustrated below.

\[
\begin{bmatrix}
  \mathbf{a} \\
  \mathbf{b}
\end{bmatrix}
\]

b) Draw the vectors \( \mathbf{u} = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \) and \( \mathbf{v} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} \) on the axes below.

Please turn over.
3.a) Let \( \mathbf{a} = \begin{pmatrix} 3 \\ -2 \\ 5 \end{pmatrix} \) and \( \mathbf{b} = \begin{pmatrix} -2 \\ 4 \\ 8 \end{pmatrix} \).

Determine the vectors \( \mathbf{c} \) and \( \mathbf{d} \) in matrix form, where

\[
\mathbf{c} = 3\mathbf{a} + \frac{1}{2}\mathbf{b} \quad \text{and} \quad \mathbf{d} = -2\mathbf{b} - \mathbf{a}.
\]

b) Let \( \mathbf{u} \) and \( \mathbf{v} \) be the vectors illustrated below.

Use geometric vector addition and scalar multiplication to illustrate the vectors

\[
\mathbf{c} = 2\mathbf{u} + \mathbf{v} \quad \text{and} \quad \mathbf{d} = \mathbf{v} - \mathbf{u}.
\]

4. Let \( \mathbf{a} = \begin{pmatrix} 3 \\ -2 \\ 5 \end{pmatrix} \).

a) Determine the norm of \( \mathbf{a} \).

b) Determine the matrix form of the unit vector \( \hat{\mathbf{a}} \).