

Books, watches, notes or cell phones are **not** allowed. The **only** calculators allowed are the Sharp EL-531\*\*\*. You **must** show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

**Question 1.** (1 mark each) Complete each of the following sentences with MUST, MIGHT, or CANNOT.

- Two equivalent vectors \_\_\_\_\_ have the same initial point.
- If  $\mathbf{u} \cdot \mathbf{v} = \mathbf{u} \cdot \mathbf{w}$ , then  $\mathbf{v}$  \_\_\_\_\_ be equal to  $\mathbf{w}$ .
- Let  $\mathbf{w}$  be orthogonal to both  $\mathbf{u}$  and  $\mathbf{v}$ . Then  $\mathbf{w}$  \_\_\_\_\_ be orthogonal to  $\mathbf{u} + \mathbf{v}$ .
- Let  $\mathbf{u}$  be parallel to  $\mathbf{x}$ , and let  $\mathbf{v}$  be parallel to  $\mathbf{y}$ . Then  $\mathbf{u} + \mathbf{v}$  \_\_\_\_\_ be parallel to  $\mathbf{x} + \mathbf{y}$ .

**Question 2.** (4 marks) A parallelogram has sides  $AB$ ,  $BC$ ,  $CD$ , and  $DA$ . Given  $A(1, -1, 2)$ ,  $C(2, 1, 0)$ , and the midpoint  $M(1, 0, -3)$  of  $AB$ , find  $\vec{BD}$ .

**Question 3.** (4 marks) Let  $\mathbf{u}$  be a unit vector, and let  $\mathbf{v}$  be a vector such that  $\|\mathbf{v}\| = 3$ , and  $\|2\mathbf{u} - \mathbf{v}\| = \sqrt{19}$ . Find the angle between  $\mathbf{u}$  and  $\mathbf{v}$ .