Name:		

## Test 3

This test is graded out of 42 marks. No books, notes, graphing calculators or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

**Question 1.** Given  $\vec{u} = (-1, \lambda, -3)$ , A(1,0,1), B(0,1,2) and C(3,-2,1).

a. (2 marks) For which value(s) of  $\lambda$ , if any,  $\vec{u}$  is parallel to  $\vec{AB}$ .

b. (2 marks) For which value(s) of  $\lambda$ , if any,  $\vec{u}$  is orthogonal to  $\vec{AC}$ .

c. (2 marks) Compute  $\operatorname{proj}_{\vec{AB} \times \vec{AC}}(2,3,-4)$ .

- d. (1 mark) Compute the area of the triangle defined by A, B, C.
- e. (1 mark) Compute the volume of the parallelepiped defined by  $\vec{AC}$ ,  $\vec{AB}$  and  $\vec{v} = (1,0,0)$ .

Question 2. (5 marks) Write the parametric equation of the line that passes through the point of intersection and orthogonal to both lines, where

 $\vec{x} = \begin{cases} x = t \\ y = -2 + 2t \quad t \in \mathbb{R} \\ z = 1 + t \end{cases} \text{ and } \vec{x} = \begin{cases} x = 2 + s \\ y = 2 - s \\ z = 3 + 2s \end{cases} s \in \mathbb{R}.$ 

**Question 3.** (5 marks) Find the angle between  $\vec{u} = (1,2,3)$  and  $\vec{v} = (1,0,1)$ .

2x - y - z = 5 and -4x + 2y + 2z = 12

**Question 6.** (5 marks) Maximize Z = 2x + y + 3z subject to the constraints

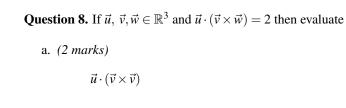
$$2x - y + z \le 100$$

$$x + y + 2z \le 70.$$

**Question 7.** (5 marks) Minimize Z = x + y subject to the constraints

$$x + y \ge 2$$

$$3x + y \ge 4.$$



$$(3\vec{v})\cdot((5\vec{u})\times\vec{w})$$

## **Bonus Question.** (3 marks)

Prove that the line segment joining the midpoints of two sides of a triangle is parallel to the third side and half as long.