

MEMORIAL UNIVERSITY OF NEWFOUNDLAND  
DEPARTMENT OF MATHEMATICS AND STATISTICS

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SECTION 1.3

Math 2050 Worksheet

WINTER 2026

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**For practice only. Not to be submitted.**

1. Given  $\mathbf{u} = \begin{bmatrix} 4 \\ -1 \\ 1 \end{bmatrix}$  and  $\mathbf{v} = \begin{bmatrix} 1 \\ 0 \\ -3 \end{bmatrix}$ , find all values of the scalar  $k$  such that  $2\mathbf{u} - k\mathbf{v}$  is orthogonal to

(a)  $\mathbf{u}$

(b)  $\mathbf{v}$

(c)  $\mathbf{u} \times \mathbf{v}$

2. Let  $\mathbf{u}$  and  $\mathbf{v}$  be non-orthogonal vectors. Find an expression for the scalar  $k$  such that  $k\mathbf{u} + \mathbf{v}$  is orthogonal to  $\mathbf{v}$ .

3. Find an equation of the plane spanned by the vectors  $\mathbf{u} = \begin{bmatrix} 2 \\ 4 \\ 5 \end{bmatrix}$  and  $\mathbf{v} = \begin{bmatrix} -1 \\ 3 \\ 0 \end{bmatrix}$ . Note that we assume by convention that the origin  $(0, 0, 0)$  is in a plane unless this is specifically contradicted by the given information.

4. Find an equation of the plane containing the points  $A(0, 4, -1)$ ,  $B(6, 2, 2)$  and  $C(1, -1, -3)$ .

5. Find vector and parametric equations of the line through the points  $P(1, 6, 0)$  and  $Q(5, -3, 0)$ .

6. Show that the lines with vector equations

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 4 \\ 9 \end{bmatrix} + t \begin{bmatrix} -3 \\ 3 \\ 2 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 16 \\ -11 \\ -1 \end{bmatrix} + t \begin{bmatrix} 6 \\ -6 \\ -4 \end{bmatrix}$$

are the same.

7. Determine whether the lines with vector equations

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 2 \\ 1 \\ -4 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \\ 4 \end{bmatrix} + t \begin{bmatrix} 6 \\ 3 \\ -12 \end{bmatrix}$$

intersect. If so, find their point of intersection.

8. Determine whether the plane with equation  $x - 6y + 5z = 10$  and the line with vector equation

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 3 \\ -1 \end{bmatrix} + t \begin{bmatrix} -8 \\ 3 \\ 3 \end{bmatrix}$$

intersect. If so, find their point of intersection.