



Name: \_\_\_\_\_

Mark:         
**25**

## MATH 251 (Winter, 2026)

### Test 1

1. (6 marks) Let  $\mathbf{u} = \begin{bmatrix} 1 \\ -2 \\ -6 \end{bmatrix}$  and  $\mathbf{v} = \begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix}$ .

- (a) Evaluate  $\mathbf{u} \times \mathbf{v}$ .
- (b) Find the area of the parallelogram formed by  $\mathbf{u}$  and  $\mathbf{v}$ .
- (c) Find the equation of the plane that passes through the origin and that contains  $\mathbf{u}$  and  $\mathbf{v}$ .  
Write your answer in both (i) vector form and (ii) general form.

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2. (5 marks) Using projections, find the distance between point  $P = (18, -2, 8)$  and the line that passes through the points  $A = (1, -1, 4)$  and  $B = (2, -3, 6)$ .

3. (5 marks) Use the Gauss-Jordan Elimination method to solve the system of equations.

$$\begin{cases} x_1 - x_2 - 4x_3 = -5 \\ x_2 + 4x_3 = 9 \\ 2x_1 - 2x_2 - 5x_3 = -4 \end{cases}$$

4. (5 marks) Show that the vectors

$$\mathbf{u} = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}, \quad \mathbf{v} = \begin{bmatrix} 2 \\ 5 \\ 4 \end{bmatrix}, \quad \mathbf{w} = \begin{bmatrix} -1 \\ 2 \\ -2 \end{bmatrix}$$

are linearly dependent and find a dependent relationship among them.

5. (4 marks) A Valentine's day package of M&M's contains a mixture of red, pink and white M&M's. There are 50 M&M's altogether, there are six more red M&M's than the combined total number of pink and white M&M's, and the number of pink M&M's is seven more than twice the number of white M&M's. Let  $r$ ,  $p$  and  $w$  represent the number of red, pink and white M&M's, respectively. Set up a system of linear equations to solve for the number of M&M's of each colour and then construct the augmented matrix associated with your system. **Do not solve the system.**

