



Exam duration: 75 minutes

## The First Formative Assessment Exam

### Exercise 1: (2pts)

Consider the vectors :

$$u_1 = (1,0,0), u_2 = (1,1,1), u_3 = (0,1,1), v = (1,2, a).$$

1. Determine  $a$  such that  $v \in \text{span}\{u_1, u_2, u_3\}$ .
2. Does  $\{u_1, u_2, u_3\}$  span  $\mathbb{R}^3$  ?

### Exercise 2: (3.5pts)

Let  $W = \{(x, y, z) \in \mathbb{R}^3 \mid 3x - 2y - z = 0\}$  and  $v = (1, b, 2)$ .

1. Determine  $b$  such that  $v \in W$  and  $2v \in W$
2. Is  $W$  a subspace of  $\mathbb{R}^3$  ?
3. Determine  $\dim(W)$ .

### Exercise 3: (4.5pts)

Let  $T$  be a transformation defined by:

$$T: \mathbb{R}^3 \rightarrow \mathbb{R}^3 \\ (x, y, z) \rightarrow (x + 2y, 8x - z, 4x + 3z)$$

1. Prove that  $T$  is a linear transformation.
2. Determine  $\ker(T)$  and  $\text{Im}(T)$ .
3. Is  $T$  bijective? If yes, determine  $T^{-1}$ .

Good luck