# Trinity Western University

## Department of Mathematical Sciences

## MATH250 (Linear Algebra)

### Sample Mid-Term II Examination

1 Let A and B be the end points of a diameter of a circle. If C is any other point on the circle, show that AC and BC are perpendicular.

2. Find the equation of the line passing through $P_0$ (1, 1, 2) intersecting the line $L$: $(x, y, z) = (2, 1, 0) + t(1, 1, 1)$, and perpendicular to that line.

3. For what value(s) of $k$ and $(w_1, w_2, w_3)$ the range of the linear operator defined by the equations

$$w_1 = x_1 + 2x_2 + x_3$$
$$w_2 = -2x_1 + x_2 + 4x_3$$
$$w_3 = 7x_1 + 4x_2 + kx_3$$

is not in $\mathbb{R}^3$?
Also for <u>any</u> value of $k$, find which vectors $(x_1, x_2, x_3)$ map into the line $w_1 = 1+2t$, $w_2 = 1+t$, $w_3 = 1+4t$.

4. If $V$ is a set of ordered pairs $(x, y)$ of real numbers with the following operations.

$$(x, y) + (x', y') = (x + x', y + y'+1) \text{ and } k(x, y) = (kx, ky + k - 1),$$

determine if it is a vector space. If it is not, list all axioms that fail to hold.

5. Is the set $V$ of all 2 x 2 matrices with equal column sums a subspace of $M_{22}$? If not, why not?