Topic 3: Geometry and Trigonometry **3D Plane**

Dan is building a wood container in the shape of a rectangular prism to store his swimming pool equipment. He created the diagram below on his laptop to help with the appropriate dimensions. The finished dimensions will be in feet.

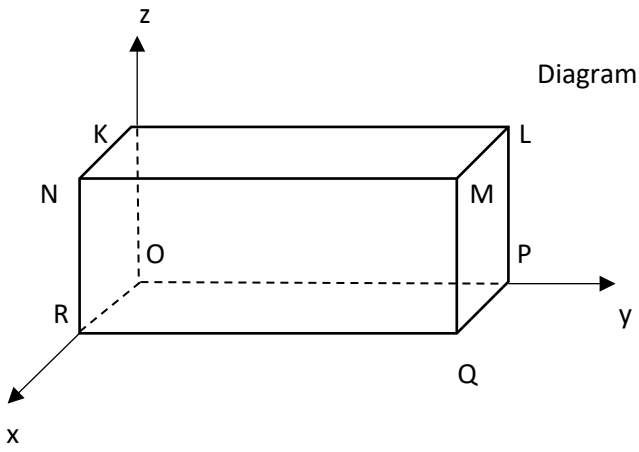

Diagram not to scale.

For the prism above, O is at the origin of the xyz-axes and the following coordinates are known: R(2, 0, 0), P(0, 4, 0), and L(0, 4, 3).

(a) Dan needs to build supports into the lid so that the container will also act as a seat. Find the distance from K to M. [2 marks]

(b) Dan also wants to make sure that the cross supports in the lid meet one another at their midpoint. Find the midpoint of LN. [2 marks]

(c) Dan has a skimmer pole that is 5 ft. long; decide if it will fit into the container. Explain your reasoning. [2 marks]

Mark scheme:

(a) Finding points K(0, 0, 3) and M(2, 4, 3) and using the distance formula (M1)

$d = \sqrt{(2-0)^2 + (4-0)^2 + (3-3)^2}$

$d = \sqrt{20} \approx 4.47\, ft.$ A1

[2 marks]

(b) Finding points L(0, 4, 3) and N(2, 0, 3) and using the midpoint formula (M1)

$midpoint = \left(\frac{0+2}{2}, \frac{4+0}{2}, \frac{3+3}{2}\right)$

$midpoint = (1, 2, 3)$ A1

[2 marks]

(c) One possibility is finding points 0(0, 0, 0) and M(2, 4, 3) and using the distance formula (other diagonals can be used)

$d = \sqrt{(2-0)^2 + (4-0)^2 + (3-0)^2}$

$d = \sqrt{29} \approx 5.39\, ft.$ (M1)

Yes, the pole can fit into the container diagonally as the distance from 0 to M is greater than 5 ft. R1

[2 marks]