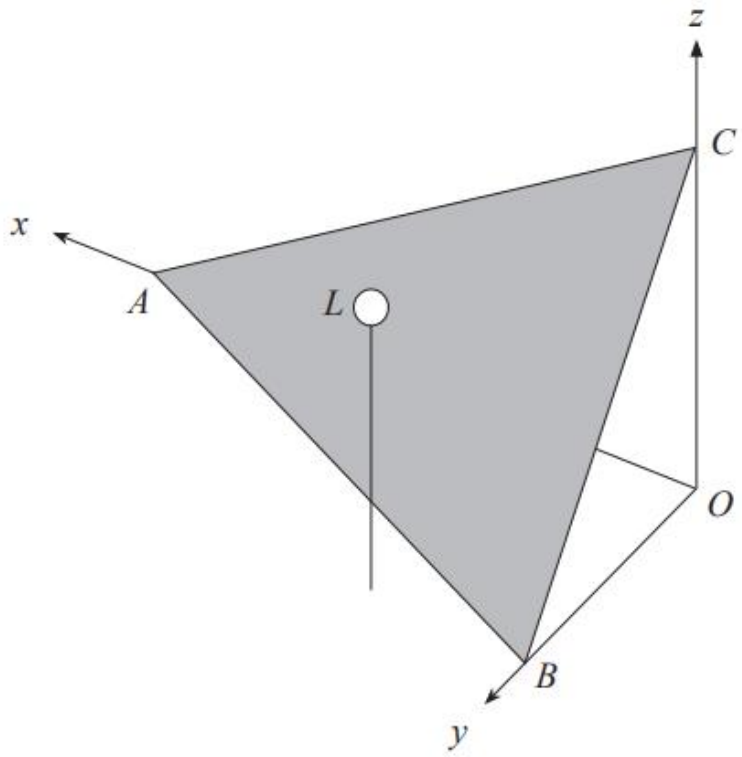
Question 19 **(9 marks)**

A downward-sloping ramp is positioned according to the coordinate system shown.
$A\ (6, 0, 0)$, $B\ (0, 2, 0)$ and $C\ (0, 0, 3)$ are points on the ramp. A lamp L is positioned on top of a post at $\left(2, 2, \frac{5}{2}\right)$. All dimensions are measured in metres.



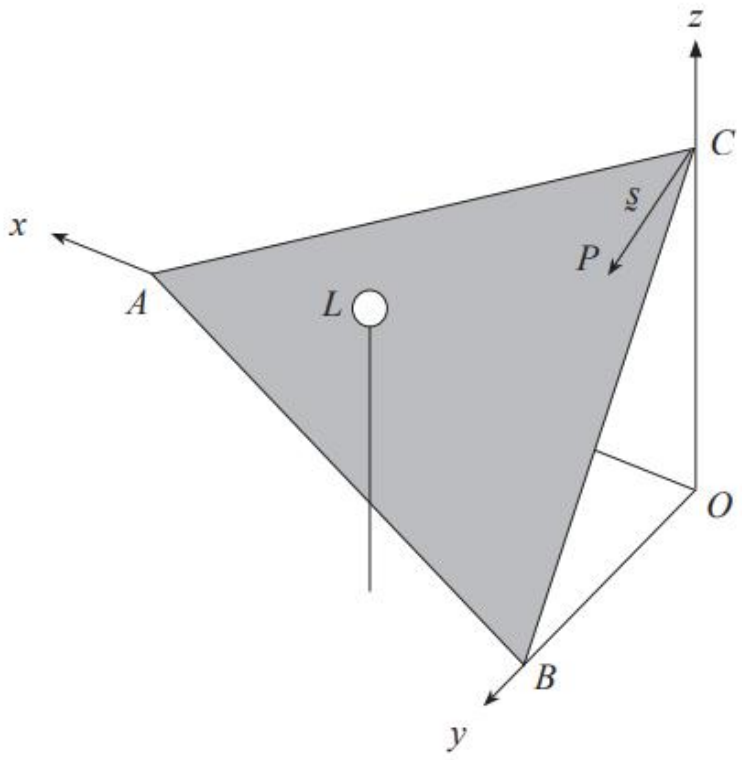
(a) Determine the Cartesian equation for the ramp. (2 marks)

At night, the lamp L emits a bright light and illuminates the ramp. The position that is closest to the lamp will be the most brightly illuminated.

(b) Determine the coordinates for the point on the ramp that is the most brightly illuminated.

(4 marks)

If a ball is released from point C and is allowed to roll down the ramp, gravity will cause it to follow the path of steepest descent. Suppose the ball is allowed to roll exactly 1 metre from point C to point P, where $\underset{\sim}{s} = \overrightarrow{CP}$ is the direction of the steepest descent down the ramp.



(c) Determine vector $\underset{\sim}{s}$, giving components correct to 0.001. (3 marks)