

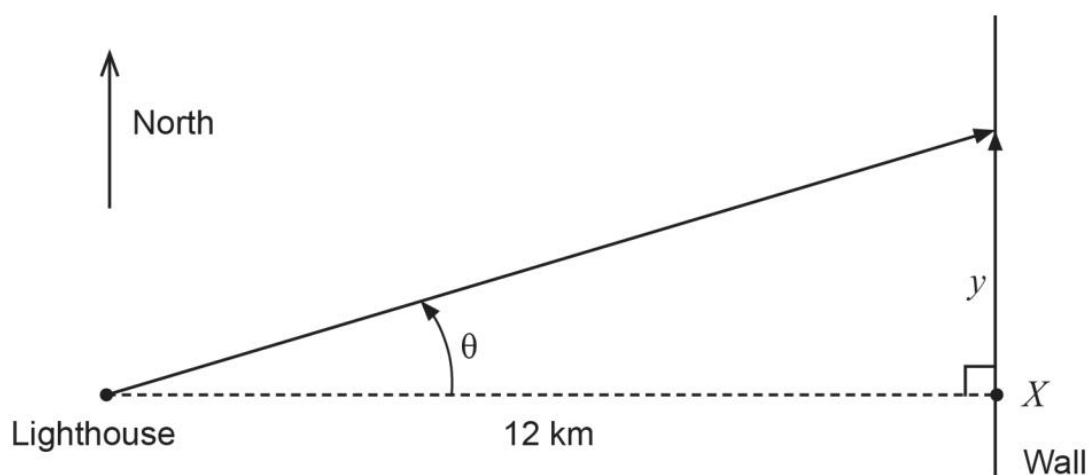
Question 21**(6 marks)**

A lighthouse is situated 12 km away from the shoreline, opposite point X as seen in the diagram below. A long brick wall is placed along the shoreline and at night the light from the lighthouse can be seen moving along this wall.

Let y = displacement of light on the wall from point X and θ = angle of the rotating light from the lighthouse.

The light is revolving anticlockwise at a uniform rate of three revolutions per minute

($\frac{d\theta}{dt} = 6\pi$ radians/minute).



(a) Show that $\frac{dy}{d\theta} = \frac{12}{\cos^2 \theta}$.

(3 marks)

- (b) Determine the velocity, in kilometres per minute, of the light on the wall when the light is 5 km north of point X . (3 marks)

(Hint: $\frac{dy}{dt} = \frac{dy}{d\theta} \times \frac{d\theta}{dt}$)