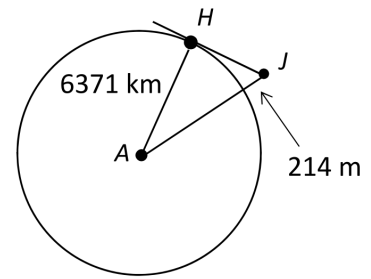**Question 6** (25 marks)

(a) Take the earth as a sphere with radius 6371 km.
Jack is standing on the Cliffs of Moher at the point J which is 214 metres above sea level.
He is looking out to sea at a point H on the horizon.
Taking A as the centre of the earth, find $|JH|$, the distance from Jack to the horizon.
Give your answer correct to the nearest km.

6371 km

214 m

(b) The Cliffs of Moher, at point C, are at latitude 53° north of the equator.
On the diagram, s_1 represents the circle that is at latitude 53°.
s_2 represents the equator (which is at latitude 0°).
A is the centre of the earth.
s_1 and s_2 are on parallel planes.
Find the length of the circle s_1.
Give your answer correct to the nearest km.

6371 km
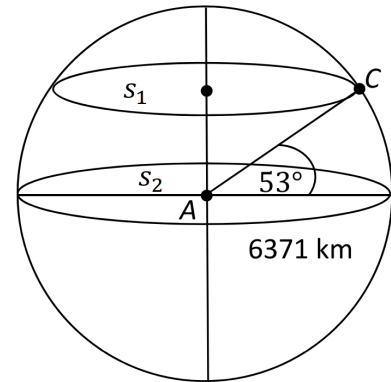
Q6	Model Solution – 25 Marks	Marking Notes
(a)	$$\lvert AJ \rvert = 6371 + 0\!\cdot\!214$$ $$\lvert JH \rvert^2 = \lvert AJ \rvert^2 - \lvert AH \rvert^2$$ $$\lvert JH \rvert = \sqrt{(6371 + 0\!\cdot\!214)^2 - 6371^2}$$ $$= 52\!\cdot\!21 = 52$$	**Scale 15C (0, 6, 9, 15)** *Low Partial Credit:* • $\lvert AJ \rvert$ formulated • indication of Pythagoras *High Partial Credit:* • Pythagoras fully substituted
(b)	$$\cos 53° = \frac{r}{6371} \text{ or } \sin 37^o = \frac{r}{6371}$$ $$r_{S_1} = 6371 \times \cos 53 = 3834\!\cdot\!1635$$ $$l_{S_1} = 2\pi r_{S_1} = 2\pi(3834\!\cdot\!1635) = 24091$$	**Scale 10C (0, 4, 5, 10)** *Low Partial Credit:* • $\cos 53°$ **or** $\sin 47°$ *High Partial Credit:* • radius of s_1 calculated and stops • length of circle formula fully substituted

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