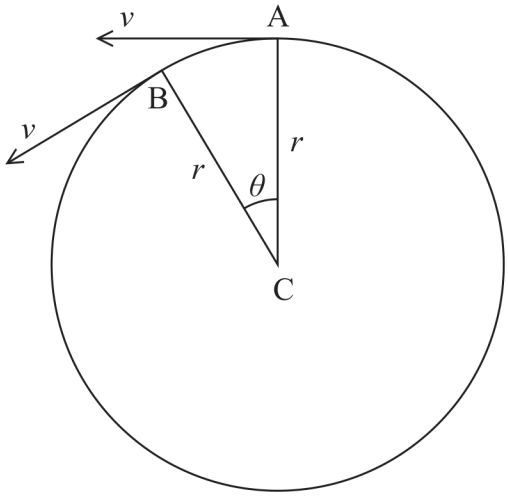
17 An aeroplane flies in a horizontal circular path whilst waiting to land at an airport.

(a) The aeroplane flies at a constant speed v around a horizontal circular path of radius r. The diagram shows two positions A and B of the aeroplane, on its circular path.



The acceleration of the aeroplane is a.

Derive the expression $a = \frac{v^2}{r}$

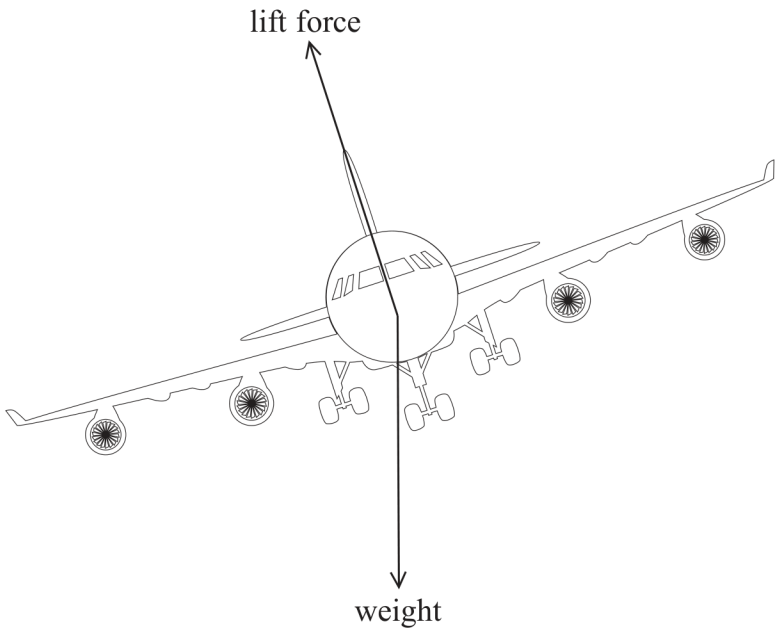
You should include a vector diagram.

(5)

(b) The aeroplane flies in a horizontal circle by tilting to one side in a movement called 'banking'.

The aeroplane creates an upwards lift force, which acts in a direction perpendicular to its wings.

(i) The diagram shows this lift force when the aeroplane is banking.



(Source: © Nadezda0704/Shutterstock)

Explain how banking allows the aeroplane to fly in a horizontal circular path.

(4)

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(ii) During banking, the angle between the wings and the horizontal is 5.2°.

Calculate the radius of the circular path when the aeroplane flies at a constant speed of $530\,m\,s^{-1}$.

mass of aeroplane = 4.1×10^5 kg

(4)

Radius = ...

(Total for Question 17 = 13 marks)

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