

## Problems on Chapter 4: Tangent Plane Approximation

**Q 4.1:** Assuming that the Oxy plane is tangential to the Earth's surface at O, how far above the Earth's surface (measured along an Earth radius) is a point in that plane which is 200 km away from O? Repeat for 500 km and 1000 km.

**Q 4.2:** Verify the value of  $\Omega$  given below and calculate the value of  $f$  at  $45^\circ\text{N}$ .

**Q 4.3:** On a certain occasion at  $45^\circ\text{N}$ , the isobars on a surface chart were observed to be straight lines running from southwest to northeast, with isobars drawn at 4 hPa intervals separated by 100 km. Low pressure was to the NW and high to the SE. The wind was observed to be  $30 \text{ ms}^{-1}$  from the southwest. What was the acceleration? Assume the density was  $1.2 \text{ kgm}^{-3}$ .

**Q 4.4:** For the same pressure configuration as in question 3.1, what would the acceleration have been, if the wind had been  $33.3 \text{ ms}^{-1}$  from the south?

**Data:**

Radius of Earth 6371 km

Rate of Earth's rotation,  $\Omega = 7.292 \times 10^{-5} \text{ s}^{-1}$