

Session 1

1. A ship is streaming northward at a rate of 10km/h. The surface pressure increases toward the northwest at the rate 5Pa/km. What is the pressure tendency recorded at a nearby island station if the pressure aboard the ship decreases at a rate 100Pa/3h.

2. Show that a homogeneous atmosphere (density independent of height) has a finite height that depends only on the temperature at the lower boundary. Compute this height and temperature profile for surface temperature $T_0 = 273\text{K}$ and surface pressure 1000hPa.

3. Show that:

$$\text{a) } \underline{\nabla} * (\underline{a} \times \underline{b}) = \underline{b}(\underline{\nabla} \times \underline{a}) - \underline{a}(\underline{\nabla} \times \underline{b})$$

$$\text{b) } \underline{\nabla} \times (f \underline{a}) = f(\underline{\nabla} \times \underline{a}) + [(\underline{\nabla} f) \times \underline{a}]$$

$$\text{c) } \underline{a} \times (\underline{b} \times \underline{c}) = \underline{b}(\underline{a} * \underline{c}) - \underline{c}(\underline{a} * \underline{b})$$

$$\text{d) } \underline{\nabla} \times (\underline{\nabla} \times \underline{a}) = \underline{\nabla}(\underline{\nabla} * \underline{a}) - \Delta \underline{a}$$