

**METR 2413 - Homework 7**

**Name:** \_\_\_\_\_

**Date assigned: 5 March, 2004**

**Date due: 12 March, 2004**

1. Using the equation for potential temperature  $\theta = T \left( \frac{1000}{p} \right)^\kappa$  with  $\kappa = R/c_p$

derive the following expression for the vertical gradient of potential temperature:

$$\frac{d\theta}{dz} = \frac{\theta}{T} \left( \frac{dT}{dz} + \Gamma_d \right).$$

What does this equation imply about the change of potential temperature with height for dry adiabatic conditions?

What is the sign of the vertical gradient of potential temperature for unstable dry adiabatic motion?

2. If the morning environmental temperature at 850 hPa is 10°C, estimate the afternoon maximum temperature at sea level assuming a mixed layer depth of 150 hPa. Under what environmental conditions is this estimate most valid? Would you expect the maximum temperature to be higher or lower if the mixed layer depth was shallower than 150 hPa?