

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

**MEA 443 WEATHER ANALYSIS AND FORECASTING, Fall 2011**  
**Quiz 9, 27 October 2011**

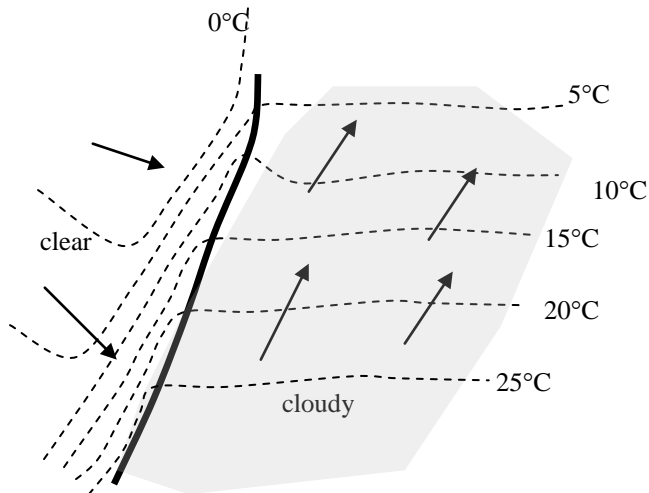
1.) True/False

- \_\_\_ a.) The Rossby number for fronts is defined differently for the along- and across-front directions. The along-front Rossby number is smaller than the cross-front.
- \_\_\_ b.) If the primary flow is frontogenetical, then the Qn component will point towards warmer air.
- \_\_\_ c.) In a *jet exit region*, the primary flow is frontolytical, and a thermally indirect ageostrophic circulation is typically observed.
- \_\_\_ d.) By partitioning the Q-vector into along- and across-isentrope components, one can isolate the 4-cell jet streak vertical motion pattern more easily.

2.) Consider the idealized frontal and isotherm analysis shown below. The y-axis can be rotated such that it is perpendicular to the front, pointing toward cold air. Using the data provided, evaluate each term in the simplified frontogenesis equation shown below, and clearly indicate whether each is frontogenetical (FG), frontolytical (FL), or negligible (N) for the strength of the *surface front*. Assume a *daytime* situation during spring over land. Show your work, and state any additional assumptions that you need to make.

Evaluate each term for the **surface**, and show your work in determining the signs of each term.

$$F = \underbrace{\left[ \frac{\partial \theta}{\partial x} \left( \frac{\partial u}{\partial y} \right) \right]}_{\text{Term A}} + \underbrace{\left[ \frac{\partial \theta}{\partial y} \left( \frac{\partial v}{\partial y} \right) \right]}_{\text{Term B}} + \underbrace{\left[ \frac{\partial \theta}{\partial p} \left( \frac{\partial \omega}{\partial y} \right) \right]}_{\text{Term C}} - \underbrace{\left[ \frac{\partial}{\partial y} \left( \frac{d\theta}{dt} \right) \right]}_{\text{Term D}}$$



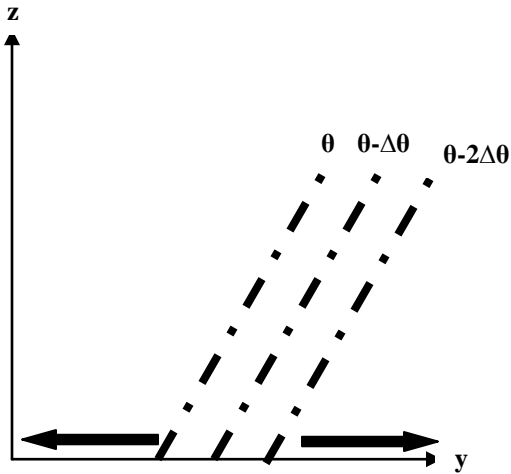
Term A: \_\_\_\_\_

Term B: \_\_\_\_\_

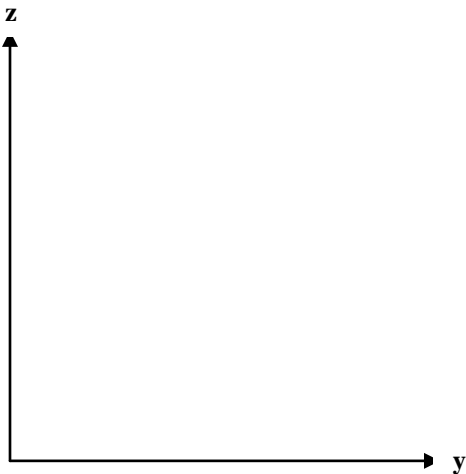
Term C: \_\_\_\_\_

Term D: \_\_\_\_\_

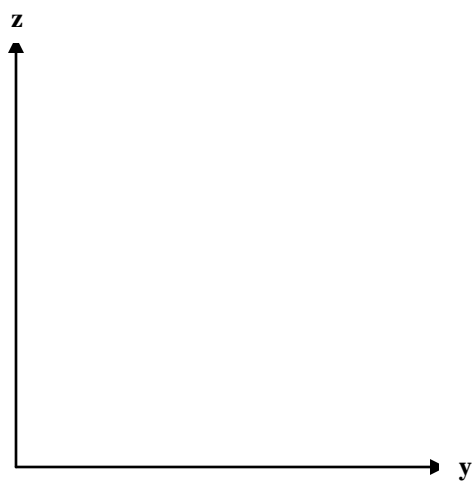
3.) Given below is a plot of isentropes at an initial time. The primary flow is noted by the thick black arrows.



- Is this a case of frontogenesis or frontolysis? Explain your reasoning.
- Sketch a couple of Q-vectors on the plot above.
- Note areas of rising and sinking motion based on your Q-vector analysis.
- Sketch the ageostrophic frontal secondary circulation on the plot above.
- Show the structure of the isentropes at a later time in plot (i) below if using a QG framework. Use dotted lines to represent the isentropes at the later time.
- Show the structure of the isentropes at a later time in plot (ii) below if using a semigeostrophic framework. Use dotted lines to represent the isentropes at the later time.



(i)



(ii)