

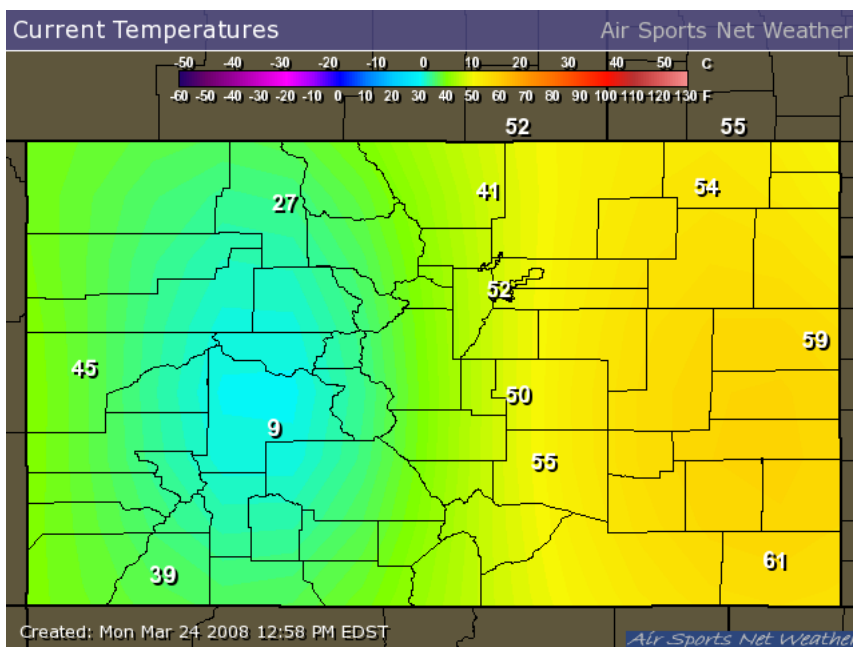
Supplementary Exercises for Sections 14.1

1. (a) What are the parallels between Fubini's Theorem and Clairaut's Theorem?  
 (b) Prove that if  $f(x, y)$  is integrable and if

$$g(x, y) = \int_a^x \int_b^y f(s, t) dt ds$$

then  $g_{xy} = g_{yx} = f(x, y)$ .

2. Find the average value of  $f(x, y) = e^y \sqrt{x + e^y}$  on the rectangle with vertices  $(0, 0)$ ,  $(4, 0)$ ,  $(4, 1)$  and  $(0, 1)$ .
3. Reverse the order of integration on each of the following integrals
  - (a)  $\int_0^3 \int_0^{\sqrt{9-y}} f(x, y) dx dy$
  - (b)  $\int_1^2 \int_0^{\ln x} f(x, y) dy dx$
  - (c)  $\int_0^1 \int_{\arcsin y}^{\frac{\pi}{2}} f(x, y) dx dy$
4. Below is the weather map of Colorado from Monday morning. Use the data to estimate the average temperature in the state using 4, 16 and 25 subdivisions. Give both an upper and lower estimate.



5. Why do we like Colorado for these types of problems? What other state might we like?