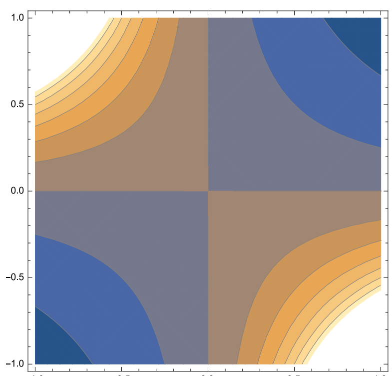
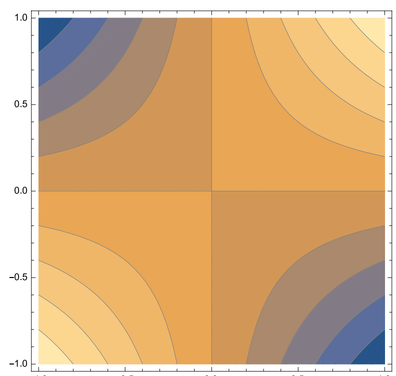
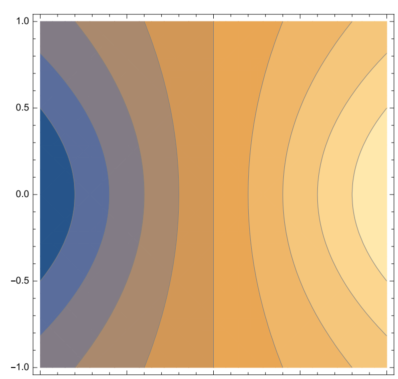
Math 110, Spring 2016
HWK10 due Apr 6

1. Three functions are given, then three graphs then two contour plots.
   (a) Match each function to a contour plot.
   (b) Explain why two of the functions have nearly identical contour plots.
   (c) On each contour plot, indicate with an arrow roughly the directions in which the function is increasing.

$$
\begin{aligned}
f(x, y) &= \frac{x}{1+y^2} \\
g(x, y) &= xy \\
h(x, y) &= \frac{1}{(1+xy)}
\end{aligned}
$$







2. In each case, do these five things:

   (i) Draw the region R.

   (ii) Write the region as $\{(x, y) : \cdots\}$ in a description corresponding to vertical strips.

   (iii) Write $\int_R f(x, y)dA$ as a double integral of f with limits of integration corresponding to vertical strips and the dx and dy in the right order.

   (iv) Write the region as $\{(x, y) : \cdots\}$ in a description corresponding to horizontal strips.

   (v) Write $\int_R f(x, y)dA$ as a double integral of f with limits of integration corresponding to horizontal strips and the dx and dy in the right order.

   (a) The region under the parabola $y = 5 - x^2$ but above the x-axis.

   (b) The region inside the unit circle in which the value of $x + y$ is positive.

3. Compute these iterated integrals.

(a) $\int_0^3 \int_{-2}^5 1 + x + x^2 y + y^3 \, dx \, dy$

(b) $\int_0^1 \int_0^{1/(1+y^2)} y \, dx \, dy$

(c) $\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} 1 \, dy \, dx$
[Hint: draw the picture, then try to avoid any computation.]

4. Compute the double integral

$$\int_0^1 \int_x^1 \frac{2x}{1+y^3}\, dy\, dx$$

by using Fubini's theorem to write it as in integral in the other order. You will need to draw the region R of integration in order to make sure that you write correct limits of integration when you switch the inner and outer variables.