

## M412 Assignment 5, due Monday October 17

1. [10 pts] Haberman 2.5.1 (a).
2. [10 pts] Haberman 2.5.1 (c).
3. [15 pts] Haberman 2.5.2.
4. [10 pts] Show that in polar coordinates  $(r, \theta)$  the Laplace equation in two space dimensions takes the form

$$r^2 u_{rr} + r u_r + u_{\theta\theta} = 0.$$

Hint: Recall that the relationship between cartesian and polar coordinates is  $x = r \cos \theta$  and  $y = r \sin \theta$ . Set

$$u(r, \theta) := v(x(r, \theta), y(r, \theta)),$$

where  $v(x, y)$  satisfies Laplace's equation in cartesian coordinates,

$$v_{xx} + v_{yy} = 0.$$

5. [10 pts] Haberman 2.5.3 (a).
6. [10 pts] Haberman 2.5.5 (a).