

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

**Math 2030, Winter 2016, Quiz 9**  
**24 March 2016**  
**R. Bruner**

1. Polar and cylindrical coordinates: Draw the diagram which shows the relation between  $(x, y)$  and  $(r, \theta)$ . Write the formulas for
  - (a)  $x$  and  $y$  in terms of  $r$  and  $\theta$ ,
  - (b) for  $dA = dx dy$  in terms of  $r, \theta, dr$  and  $d\theta$ ,
  - (c) for  $dV = dx dy dz$  in terms of  $r, \theta, z, dr, d\theta$  and  $dz$ .
  
2. Spherical coordinates: Draw the diagram which shows the relation between  $(r, z)$  and  $(\rho, \phi)$ . Write the formulas for
  - (a)  $r$  and  $z$  in terms of  $\rho$  and  $\phi$ ,
  - (b) for  $dA = dr dz$  in terms of  $\rho, \phi, d\rho$  and  $d\phi$ ,
  - (c) for  $dV = dx dy dz$  in terms of  $\rho, \theta, \phi, d\rho, d\theta$  and  $d\phi$ .
  
3. Find the volume of the region described by  $0 \leq r \leq z^2 - z^3$  in cylindrical coordinates.