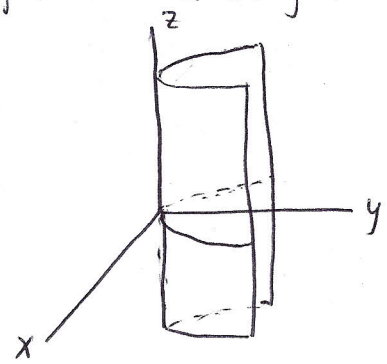
Math 251
Exam 1
Spring 2013

Name Key

Show All Work

1) Describe in words or by graph the region of $\mathbb{R}^3$ represented by the equation $y = x^2$

a parabolic cylinder along the z axis and surrounding the y-axis



2) Find the equation of a sphere if one of its diameters has endpoints (6, 1, 4) and (2, 5, 6)

center is midpoint $\left(\frac{6+2}{2}, \frac{1+5}{2}, \frac{4+6}{2}\right) = (4, 3, 5)$

$r = \sqrt{(6-4)^2 + (1-3)^2 + (4-5)^2} = \sqrt{4 + 4 + 1} = 3$

$$(x-4)^2 + (y-3)^2 + (z-5)^2 = 9$$

3) Find $\overrightarrow{AB}$ if A = (1, 3, -2) and B = (-1, 4, 7).

$$\overrightarrow{AB} = \langle -1-1, 4-3, 7-(-2) \rangle$$
$$= \langle -2, 1, 9 \rangle$$

4) A car is stuck on a sheet of ice on a horizontal road. A tow truck drags the car off the ice using a chain that makes an angle of 20° with the road, and the tension in the chain is 1500N. How much work is done by the truck in pulling the car 25 meters.

$$W = \vec{F} \cdot \vec{D}$$
$$= |\vec{F}| \cdot |\vec{D}| \cdot \cos\theta$$
$$= 1500\,N \cdot 25\,m \cdot \cos 20^\circ$$
$$= 35{,}238.5\ N \cdot m$$