

# Practice Midterm 1

## Calculus III

February 11, 2009

1. Find the following expressions for complex numbers. Write down your answer in the form  $a + bi$

- a)  $\frac{1+i}{5-3i}$
- b)  $5i(3-2i)$
- c)  $(2i-j+k)(3i-2j+5k)$
- d)  $e^{2-5i}$
- e)  $(1-\sqrt{3}i)^{2007}$

2. a) Find the equation of the plane passing through the three points  $P = (1, 2, 3)$ ,  $Q = (4, 5, 6)$ ,  $R = (3, 0, 1)$ .

b) Find the distance from the origin to this plane.

3. a) For what values of  $x$  are the vectors  $(3x, x, 2)$  and  $(x, 0, 1)$  parallel, perpendicular or have equal length.

b) Change from spherical coordinates to cylindrical coordinates

$$\left(6, \frac{\pi}{6}, \frac{\pi}{4}\right) \quad \left(2, \frac{\pi}{3}, \frac{\pi}{2}\right).$$

4. Find the cosine of the angle between a diagonal of a cube (i.e. a line joining opposite vertices through the center of the cube) and one of its edge.

5. If  $u \times v = \langle 1, 1, 1 \rangle$  and  $u \cdot v = -2$  find the angle between  $u$  and  $v$ .

6. Convert the polar equation  $r = 5 \sin \theta$  from polar coordinates to cartesian coordinates and identify the curve it describes.

7. Find the equation of the plane which passes through the intersection of the planes  $x - y + 2z = 3$  and  $3x + 2y + z = 1$  and is parallel to the line

$$\frac{x-5}{5} = \frac{y-4}{3} = \frac{z+1}{4}.$$