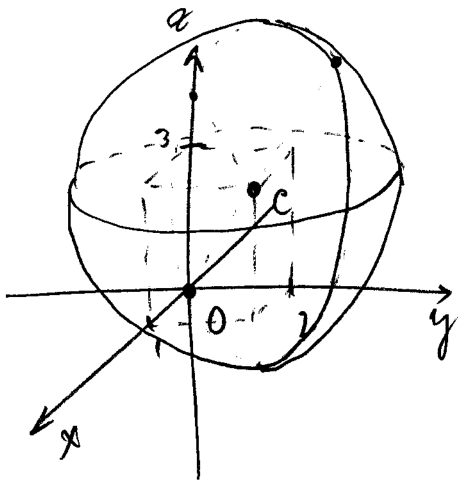
Thu. Sep. 4, 2014 **MATH 250, Quiz 1** Prof. V. Panferov

Name (print): Solutions.

Each problem is worth 2 points. Show all your work.

1. Find an equation of the sphere that passes through the origin and has center at $C(1, 2, 3)$. Draw a figure.



$|OC| = \sqrt{1^2+2^2+3^2} = \sqrt{14}$

– radius of the sphere.

$(x-1)^2 + (y-2)^2 + (z-3)^2 = 14$

or

$x^2 - 2x + y^2 - 4y + z^2 - 6z = 0$

2. Find $\vec{a} - \vec{b}$ and $|\vec{a} - \vec{b}|$:

$$\vec{a} = \vec{i} + 2\vec{j} - 3\vec{k}, \quad \vec{b} = -2\vec{i} - \vec{j} + 5\vec{k}.$$

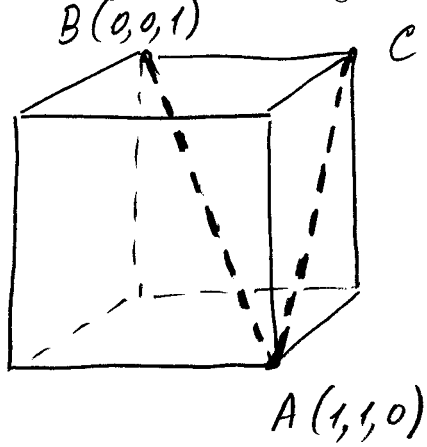
$\vec{a} - \vec{b} = (1-(-2))\vec{i} + (2-(-1))\vec{j} + (-3-5)\vec{k}$

$= 3\vec{i} + 3\vec{j} - 8\vec{k}.$

$|\vec{a} - \vec{b}| = \sqrt{3^2 + 3^2 + 8^2} = \sqrt{82}.$

Please turn over...

3. Find the angle between a diagonal of a cube and a diagonal of one of its faces.



$$\vec{AB} = (-1,-1,1)$$
$$\vec{AC} = (-1,0,1)$$

$$\vec{AB}\cdot\vec{AC} = 2$$
$$|\vec{AB}| = \sqrt{1^2+1^2+1^2} = \sqrt{3}$$
$$|\vec{AC}| = \sqrt{1^2+1^2} = \sqrt{2}$$

$$\cos\vartheta = \frac{\vec{AB}\cdot\vec{AC}}{|\vec{AB}||\vec{AC}|} = \frac{2}{\sqrt{2}\sqrt{3}} = \frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{6}}{3}.$$

$$\vartheta = \arccos\frac{\sqrt{6}}{3} \approx 0.62 \text{ radians}$$
$$\approx 35.26^\circ.$$