Thu May 30, 2013 **MATH 250, Quiz 1** Prof. V. Panferov

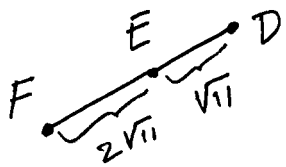
Name (print): Solutions.

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

1. Determine whether the points lie on straight line:

$$D(0,-5,5), \quad E(1,-2,4), \quad F(3,4,2).$$

One way:



$$|DE| = \sqrt{1^2+3^2+1^2} = \sqrt{11}$$

$$|DF| = \sqrt{3^2+9^2+3^2} = \sqrt{99} = 3\sqrt{11}$$

$$|EF| = \sqrt{2^2+6^2+2^2} = \sqrt{44} = 2\sqrt{11}$$

$\Rightarrow |DF| = |EF| + |DE| \Rightarrow$ the three points are on the same line.

Another way: $\vec{DE} = (1,3,-1)$; $\vec{DF} = (3,9,-3)$

$\vec{DF} = 3\,\vec{DE} \Rightarrow$ vectors are parallel $\Rightarrow$ points are on the same line.

2. Find an equation of the sphere that passes through the point $P(4,3,-1)$ and has center $Q(3,8,1)$.

$$|PQ| = \sqrt{1^2+5^2+2^2} = \sqrt{30}$$ – radius of the sphere.

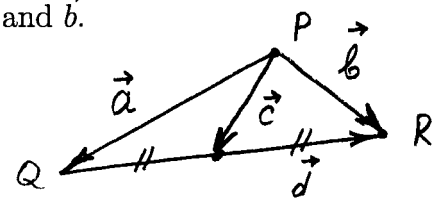
Sphere has center at Q $\Rightarrow$

$$(x-3)^2+(y-8)^2+(z-1)^2 = 30$$

(or $x^2+y^2+z^2-6x-16y-2z+44=0$)

Please turn over...

3. In the figure, the tip of $\vec{c}$ and the tail of $\vec{d}$ are both the midpoint of QR. Express the $\vec{c}$ and $\vec{d}$ in terms of $\vec{a}$ and $\vec{b}$.



$\vec{c} = \frac{\vec{a}+\vec{b}}{2}$ — parallelogram rule

$\vec{d} = \frac{\vec{b}-\vec{a}}{2}$, since $\overrightarrow{QR} = \vec{b}-\vec{a}$.

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

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

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

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