ALGEBRA
Homework List 1.
Analytic geometry on the plane

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1. Straight line ℓ and a point M on the plane are given. Write the parametric and the normal forms of equation for a line which contains M and is

(1) parallel to ℓ;   (2) orthogonal to ℓ

in the following cases:

a) $M(2,-3)$, $\ell: 2x-3y+5=0$;

b) $M(1,-2)$, $\ell: 5x-y+3=0$;

c) $M(4,-1)$, $\ell: -3x+y+2=0$.

2. Straight line ℓ and a point P on the plane are given. Find the point Q, which is the projection of P on ℓ, and the point R, which is symmetric to P w.r.t. ℓ

a) $P(-6,4)$, $\ell: 4x-5y+3=0$;

b) $P(-5,13)$, $\ell: 2x-3y-3=0$;

c) $P(-8,12)$, ℓ contains $M_1(2,-3), M_2(-5,1)$;

d) $P(8,-9)$, ℓ contains $M_1(3,-4), M_2(-1,-2)$.

3. For the triangle ABC with $A(-2,3)$, $B(4,1)$, $C(6,-5)$, write the the parametric and the normal forms of equation for a line which contains

a) the median;

b) the bisector;

c) the altitude

containing the vertex A.

4. The middle points of the sides of a triangle are $M_1(2,3)$, $M_2(-1,2)$ i $M_3(4,5)$. Find equations of the sides of the triangle.

5. Write an equation of the line such that the point $P(2,3)$ is the projection of the origin on this line.

6. The lengths of vectors $\vec{v}$ and $\vec{w}$ are equal to 2 and 3, respectively. Knowing that $\vec{v}\circ\vec{w}=-1$

a) $(\vec{v}+2\vec{w})\circ(2\vec{v}-\vec{w})$;

b) cosine of the angle between $\vec{v}+\vec{w}$ and $\vec{v}-\vec{w}$.

7. Check if the lines ℓ_1 and ℓ_2 are parallel. For parallel lines find the distance between them. For non-parallel lines find the acute angle between them.

a) $\ell_1: x+y+3=0, \ell_2: \begin{cases} x=1-t, \\ y=2+t, \end{cases}$;

b) $\ell_1: 2x-y+1=0, \ell_2: \begin{cases} x=1+t, \\ y=2-t, \end{cases}$.