

**Instructions**

- Answer each question completely; justify your answers.
  - This assignment is due at 3:00 pm on Friday April 4, 2003.
  - Please place your completed assignment in Box 35.
1. Consider the point  $P = (6, -3)$  in  $\mathbb{R}^2$ .
    - (a) What is the equation of this point, expressed in line coordinates?
    - (b) What are the coordinates of the line  $PQ$ , where  $Q = (-3, 2)$ ?
    - (c) Are  $P$ ,  $Q$ , and  $R$  collinear, where  $R = (7, -6)$ ?
  2. At what point of  $\mathbb{R}^2$  do the lines  $L_1 = [-4, 5]$  and  $L_2 = [7, 3]$  intersect?
  3. Let  $L_1 = [u_1, u_2]$  and  $L_2 = [v_1, v_2]$  be two lines of  $\mathbb{R}^2$ . Prove that  $L_1$  and  $L_2$  are parallel if and only if  $\begin{vmatrix} u_1 & u_2 \\ v_1 & v_2 \end{vmatrix} = 0$ .
  4. Consider the points  $P = (4, 3, 2)$  and  $Q = (5, 6, 7)$  of  $P_2(\mathbb{R})$ .
    - (a) What is the equation of the line  $PQ$ ?
    - (b) What are the coordinates of the line  $PQ$ ?
  5. Consider the lines  $L_1 = [8, 5, 2]$  and  $L_2 = [-7, 3, 1]$  of  $P_2(\mathbb{R})$ .
    - (a) What is the equation for the point of intersection of  $L_1$  and  $L_2$ ?
    - (b) What are the coordinates for the point of intersection of  $L_1$  and  $L_2$ ?
  6. Are the lines  $L_1 = [4, 0, 1]$ ,  $L_2 = [2, 2, 1]$ , and  $L_3 = [0, 1, -1]$  of  $P_2(\mathbb{R})$  concurrent?
  7. What is the equation for the set of line coordinates for the tangent lines that envelop the curve  $2xy^2 = 1$  in  $\mathbb{R}^2$ ?
  8. What is the equation for the set of line coordinates for the tangent lines that envelop the curve  $x^2 + 2y^2 = 4$  in  $\mathbb{R}^2$ ?