CS 355 Homework #2:
More With Points, Vectors, and Lines

1. A line passes through the points $\mathbf{p}_1 = (10, 20)$ and $\mathbf{p}_2 = (30, 40)$.

   (a) Express this line in parametric form as described in Section 9.2.1 of your book.

   (b) Express the line in implicit form as described in Section 9.2.2 of your book.

   (c) How close is the point $\mathbf{q} = (22, 29)$ from the line? (You may use either the implicit or parametric form of the line to do this.)

   (d) Does the closest point on the line to the point $\mathbf{q} = (22, 29)$ fall within the endpoints of this line segment?

2. A circle has center at $\mathbf{c} = (10, 12)$ and radius $r = 3$.

   (a) Show mathematically whether the point $\mathbf{q} = (12, 13)$ is within the circle.

   (b) What point on the circle is closest to the point $\mathbf{q} = (20, 15)$?

3. An ellipse has center at $\mathbf{c} = (10, 12)$ with width 20 and height 10.

   (a) Show mathematically whether the point $\mathbf{q} = (19, 13)$ is within the ellipse.

   (b) What are the corners of the bounding box for this shape?

4. A square with length 10 on each side is centered at position $\mathbf{c} = (60, 80)$. Show mathematically the steps you would do to determine whether the point $\mathbf{q} = (64, 74)$ is within the square.

5. A triangle has corners at $p_1 = (10, 20)$, $p_2 = (30, 40)$, $p_3 = (20, 50)$. Show mathematically whether the point $q = (20, 40)$ is within the triangle.