1. Determine the equation of the locus of points equidistant from the graphs of \( y = 8 \) and \( y = -4 \).

2. Determine equations for the locus of points equidistant from the graphs of \( y = x + 1 \) and \( y = -x + 1 \).

3. Determine an equation for the locus of points that are 5 units from \((-1, -2)\).

4. Use the locus definition of the parabola to write an equation of the parabola with focus \((-2, 5)\) and directrix \( y = 1 \).

5. Sketch the circle \((x + 7)^2 + (y - 2)^2 = 64\). State the domain and range.

6. Sketch the ellipse \(\frac{(x - 2)^2}{36} + \frac{(y + 3)^2}{9} = 1\). Label the coordinates of the centre, the foci, the vertices, and the co-vertices. State the domain and range.

7. Use the locus definition of the ellipse to write an equation of the ellipse centred at the origin, with foci \((0, -12)\) and \((0, 12)\), and with the sum of the focal radii 26.

8. Sketch the hyperbola \(\frac{(y + 4)^2}{16} - \frac{(x - 2)^2}{9} = 1\). Label the coordinates of the centre, the vertices, the co-vertices, and the foci. State the domain and range.

9. Sketch the parabola \(x - 2 = \frac{1}{2}(y - 3)^2\). Label the coordinates of the vertex and the focus, and the equation of the directrix. Determine the domain and range.

10. Write an equation in standard form for each conic.

   a) the circle with a diameter that has endpoints \((-1, 4)\) and \((3, 6)\)

   b) the hyperbola with foci \((-5, 0)\) and \((5, 0)\), with \(|F_1P - F_2P| = 3\)

   c) the ellipse with centre \((-1, 2)\), major axis parallel to the y-axis, length of the major axis 10, length of the minor axis 8
11. For each of the following equations,
   i) identify the conic
   ii) write the equation in standard form
   iii) determine the key features and sketch the graph
   a) \(9x^2 + y^2 + 36x - 9 = 0\)
   b) \(3x^2 + 12x - 4y - 12 = 0\)
   c) \(x^2 + y^2 - 2x + 4y - 5 = 0\)
   d) \(9x^2 - 4y^2 - 8y + 32 = 0\)

12. Solve each system of equations. Round solutions to the nearest tenth, if necessary.
   a) \(x^2 + y^2 = 20\)
   b) \(x - 2 = (y - 3)^2\)
   c) \(x^2 - y^2 = 1\)
   \(x - 2y = 8\)
   \(y + x = 5\)
   \(y = 2x + 3\)

13. **Solar energy** Solar energy is collected using parabolic mirrors, which concentrate the sun's rays at the focus. The focus of one type of parabolic mirror is located 5 m above the vertex. Assume that the mirror opens up and that its vertex is at the origin.
   a) Write an equation in standard form for the parabolic mirror.
   b) Find the diameter of the mirror 10 m from the vertex. Round the diameter to the nearest tenth of a metre.

14. **Pond** A pond in a botanical garden is built in the shape of an ellipse, with a major axis of length 6 m and a minor axis of length 4 m. Assume that the centre of the pond is at the origin of a coordinate grid on which 1 unit represents 1 m, and that the major axis is along the x-axis.
   a) Write an equation in standard form to represent the ellipse.
   b) A bridge across one end of the pond can be represented by the equation \(y = x + 2\). Find the length of the bridge, to the nearest tenth of a metre.

15. A balloon arch is being built for a celebration. The arch is to span 4 m and have a height of 2.2 m. Find a possible equation for the arch if it is in the shape of
   a) a parabola
   b) a semi-ellipse
   c) a hyperbola