1. Consider the parametric equations

$$x = \frac{1}{5}t^2 + t, \quad y = 2t - 1$$

   (a) Sketch the parametric curve for $-2 \leq t \leq 2$

   (b) Eliminate the parameter from the set of equations.

2. Sketch the parametric curve and clearly define the direction of motion

$$x = 5\cos(2t), \quad y = 2\sin(2t), \quad 0 \leq t \leq \pi$$

3. Given the parametric curve

$$x = t^2 - 2t, \quad y = t^3 - 2$$

   (a) Find the equation of the tangent to the curve when $t = -2$.

   (b) Find the point on the parametric curve where the tangent is horizontal.

   (c) Does the parametric curve have a vertical tangent?

4. Consider the curve $\mathcal{C}$ defined by the parametric equations

$$x = t\cos t, \quad y = t\sin t, \quad -\pi \leq t \leq \pi$$

   (a) Find the equation of both tangents to $\mathcal{C}$ at $\left(0, \frac{\pi}{2}\right)$.

5. Find the area under the curve

$$x = 2\cos t, \quad y = 3\sin t, \quad 0 \leq t \leq \frac{\pi}{2}$$

6. Find the arc length of the circle defined by

$$x = \cos 2t, \quad y = \sin 2t, \quad 0 \leq t \leq 2\pi$$

7. Find the arc length of the spiral defined by

$$x = e^t\cos t, \quad y = e^t\sin t, \quad 0 \leq t \leq 2\pi$$

8. Compute $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for the given set of parametric equations

   (a) $x = 7t^2 - 9t, \quad y = t^6 + 2t^2$

   (b) $x = \ln\left(3t^2\right) + 8t, \quad y = \ln\left(t^4\right) - 6\ln\left(t^2\right)$

9. Determine the area of the region below the parametric curve

$$x = 4t^3 - t^2, \quad y = t^4 + 2t^2, \quad 1 \leq t \leq 3$$

10. Set up, **but do not evaluate**, an integral that gives the length of the parametric curve

   (a) $x = 2 + t^2, \quad y = e^t\sin(2t), \quad 0 \leq t \leq 3$

   (b) $x = \cos^3(2t), \quad y = \sin\left(1 - t^2\right), \quad -\frac{3}{2} \leq t \leq 0$

11. Find the length of the parametric curve described by the parametric equations

$$x = \frac{1}{3}t^{3/2}, \quad y = 3 + (4 - t)^{3/2}, \quad 0 \leq t \leq 4$$