1. Sketch the curve \( x = \cos^2 t, \ y = 1 - \sin t, \ 0 \leq t \leq \pi/2 \).

2. Sketch the curve \( x = 1 - t^2, \ y = t - 2, \ -2 \leq t \leq 2 \).

Eliminate the parameter to find a Cartesian equation for the curve. Use \( t = y + 2 \) and substitute \( x = 1 - (y + 2)^2 \), and \(-4 \leq y \leq 0\).

3. Describe the motion of a particle with position \((x, y)\) as \(t\) varies in the given interval. \( x = 3 + 2 \cos t, \ y = 1 + 2 \sin t, \ \pi/2 \leq t \leq 3\pi/2 \).

From the parametric equation, we can see that it is a circle centered around \((3,1)\) with radius 2, which has equation \((x - 3)^2 + (y - 1)^2 = 4\). Also, notice that we are moving counterclockwise. At \(t = \pi/2\), we are at \((3,3)\), and at \(t = 3\pi/2\), we are at \((3,-1)\). Also, note that since the interval of \(t\) has width \(\pi\), so we make less than one revolution.

Therefore, the particle moves counterclockwise along the circle \((x - 3)^2 + (y - 1)^2 = 4\), moving from \((3, 3)\) to \((3, -1)\).

4. Find an equation of the tangent to the curve \( x = 1 + 4t - t^2, \ y = 2 - t^3 \) at \( t = 1 \).

At \(t = 1\), \( x = 1 + 4 - 1 = 4 \) and \( y = 2 - 1 = 1 \). Also, \( \frac{dx}{dt} = 4 - 2t \), and \( \frac{dy}{dt} = -3t^2 \).

Thus, at \(t = 1\),
\[
\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{-3(1)^2}{4 - 2(1)} = -\frac{3}{2}
\]
thus the tangent line is $y = -\frac{3}{2}(x - 4) + 1$.

5. Find the equation of the tangent(s) to the curve $x = 6\sin t$, $y = t^2 + t$ at the point $(0, 0)$.

Notice $0 = x = 6\sin t \implies t = k\pi$ for some $k \in \mathbb{Z}$. Also $0 = y = t^2 + t = (t + 1)t$ so $t = -1, 0$.

Therefore, the only possible $t$ is $t = 0$.

Then since $\frac{dx}{dt} = 6\cos t$ and $\frac{dy}{dt} = 2t + 1$, so

$$\frac{dy}{dx} = \frac{2(0) + 1}{6\cos 0} = \frac{1}{6}$$

so the tangent line is $y = \frac{1}{6}(x - 0) + 0$ so $y = \frac{1}{6}x$.

6. At what points on the curve $x = 2t^3$ and $y = 1 + 4t - t^2$ does the tangent line have slope 1?

First $\frac{dx}{dt} = 6t^2$ and $\frac{dy}{dt} = 4 - 2t$ so when $\frac{dx}{dt} = \frac{dy}{dt} = \frac{dy/dt}{dx/dt} = 1$, we know that

$$6t^2 = 4 - 2t$$
$$6t^2 + 2t - 4 = 0$$
$$(2t + 2)(3t - 2) = 0$$

so $t = -1, \frac{2}{3}$.

At $t = -1$, $x = 2(-1)^3 = -2$ and $y = 1 + 4(-1) - (-1)^2 = -4$.

At $t = \frac{2}{3}$, $x = 2\left(\frac{2}{3}\right)^3 = \frac{16}{27}$ and $y = 1 + 4\left(\frac{2}{3}\right) - \left(\frac{2}{3}\right)^2 = 1 + \frac{8}{3} - \frac{4}{9} = \frac{9}{3} + \frac{24}{9} - \frac{4}{9} = \frac{29}{9}$.

Thus the points are $(-2, -4)$ and $\left(\frac{16}{27}, \frac{29}{9}\right)$.