1. Find the slope of the tangent to the curve \( y = 2x^2 + \sec^3 \sqrt{x^3 + 1} \), at \( x = 1 \).
2. Let \( s(t) = 2t^3 - 3t^2 - 12t + 10 \), be a position function of a particle moving along a coordinate line. on the interval \([-3, 3]\), describe where the particle moves to the right or left, and sketch a diagram describing the motion.

3. Let \( f(x) = x^4 - 4x^2 \), find all the critical numbers. Give the intervals where \( f(x) \) is
   a. Increasing
   b. Decreasing
   c. Concave up
   d. Concave down.
4. Let \( f(x) = x^4 + 4x^2 \), sketch a complete graph of \( f \) showing symmetry, increasing - decreasing, concavity, and relative extrema.

5. Find the points on the parabola \( y = 2x^2 \), closest to the point \( P(1, 0) \).
6. Water is running out of an inverted conical tank so that the height of the water is changing at a rate of \( 2 \text{ ft/min} \). At what rate the volume is changing when the height of the water is 6 ft. The height of the tank is 10 ft and the radius of the tank is 5 ft. 

\[
V = \frac{\pi r^2 h}{3}
\]

7. If \( y \) is defined implicitly by \( x^2 y + xy^2 = 2 \), then estimate the change in \( y \) at the point \( P(1, 1) \), if \( x \) changes from 1 to 0.9.
8. Use Newton’s method to approximate where the two graphs \( y = x \), and \( y = \cos x \) intersect.

9. Find \( \frac{d}{dx} \sqrt{x} \) if \( \frac{df(x)}{dx} = 2x^2 \).

10. Find all the critical numbers of \( f(\theta) = \cos 2\theta + 2 \cos x \) \( \theta \in \mathbb{R}, 2\pi \).