Work the following problems on the attached blank paper – showing all work. Label and circle your final answer(s). It is fine if you need to scratch out and start over, or if you need to skip a problem and put it at the end. Just make sure each problem is clearly numbered.

1. Identify the **coordinates** of the absolute extremum of the function \( f(x) = -2x^2 + 8x + 2 \) on the closed interval \([-4, 4]\).

2. Use the Mean Value Theorem to **determine a value for** \( c \) in the function \( f(x) = x^3 \) on the open interval \((0, 10)\) such that \( f'(c) = \frac{f(10) - f(0)}{10 - 0} \).

3. Given that \( t \leq 16 \), find any **critical numbers** of the function \( g(t) = t\sqrt{16 - t} \).

4. Identify the **open intervals** where the function \( g(t) = t\sqrt{16 - t} \) is increasing or decreasing.

Problems 5 through 9. Using the function \( f(x) = 4x^3 - 30x^2 + 1 \)

(5) Find the **critical numbers** of \( f \) (if any);
(6) Find the open **intervals** where the function is increasing or decreasing; and
(7) Give the **coordinates** of all **relative** extrema.
(8) Give the **coordinates** of any points of inflection.
(9) Identify the **intervals** on which the function is concave up and/or concave down.

10. Find the **coordinates** of the points of inflection and discuss the concavity of the function \( f(x) = -\sin x + \cos x \) on the interval \((0, 2\pi)\).

11. Find the **length and width** of a rectangle that has perimeter 48 meters and a maximum area.
12. Determine the **dimensions** of a rectangular solid (with a square base) with maximum volume if its surface area is 294 meters.

13. The radius, \( r \), of a circle is decreasing at a rate of 2 centimeters per minute. Find the rate of change of area, \( A \), when the radius is 4

14. A point is moving along the graph of the function \( y = 4x^2 + 4 \) such that \( dx/dt = 4 \) centimeters per second. Find \( dy/dt \) when \( x = 3 \)

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\begin{align*}
0) & \quad \text{Max} \ (2, 10) \quad \text{Min} \ (4, -62) \\
3) & \quad {\frac{10\sqrt{3}}{3}} \\
4) & \quad \text{inc} \ (-\infty, \frac{32}{3}) \quad \text{dec} \ (\frac{32}{3}, 16) \\
5) & \quad 0 \in (5) \\
6) & \quad (-\infty, 0) \quad \text{inc} \ (0, 5) \quad \text{dec} \ (5, \infty) \\
7) & \quad \text{Max} \ (0, 1) \quad \text{Min} \ (5, -249) \\
8) & \quad \text{POI} \ (\frac{5}{2}, -124) \\
9) & \quad (-\infty, \frac{5}{3}) \quad \text{down} \\
& \quad \text{up} \ (\frac{5}{3}, \infty) \\
10) & \quad \text{POI} \ (\frac{\pi}{4}, 0) \ (\frac{3\pi}{4}, 0) \\
& \quad \text{down} \ (0, \frac{\pi}{4}) \cup \ (\frac{3\pi}{4}, \frac{5\pi}{4}) \\
& \quad \text{up} \ (\frac{\pi}{4}, \frac{5\pi}{4}) \\
\end{align*}
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