Curve Sketching

1. Locate the absolute extrema on the given intervals (if any exist) for $f(x) = x^2 - 2x$.

a) $[-1, 2]$
b) $(1, 3)$
c) $(0, 2)$
d) $[1, 4]$

2. Find the critical numbers for $f(x) = x\sqrt{4-x}, x < 3$.

3. Find the critical numbers for $f(x) = 2\sin x - \cos 2x$ on the interval $[0, 2\pi]$.

4. $f(x) = x^4 - \frac{16}{3}x^3 - 10x^2 + 2$

5. $f(x) = \sin x + \frac{x}{\sqrt{2}}$ $[0, 2\pi]$

6. 6. $g(x) = (x^2 - 1)^{\frac{2}{3}}$

7. 7. If $f(x) = e^x \sin x$ on $[-2\pi. 2\pi]$ Find where the graph of $f(x) = \frac{\ln x}{x}, x > 0$ is increasing. Justify your answer.

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a) State the intervals on which $f(x)$ increases.

b) State the intervals on which $f(x)$ decreases.

c) List all critical points of $f(x)$.

d) At which of its critical points does $f(x)$ have a local maximum?

e) At which of its critical points does $f(x)$ have a local minimum?

f) Based on this information, sketch a possible graph of $f(x)$.

9. Find the intervals where $f(x) = \frac{1}{3}x^4 - 8x^2 + 8$ is concave up and concave down. Find all inflection points.

10. Find the intervals where $f(x) = \frac{x}{x-1}$ is concave up and concave down. Find all inflection points. Justify your answers.

11. Let f be a function defined for all $x \neq 0$ such that $f(4) = -3$ and the derivative of f is given by $f'(x) = \frac{x^2-2}{x}$.

a) Find all values of x for which the graph of f has a horizontal tangent, and determine whether f has a relative maximum, a relative minimum, or neither at each of these values. Justify your answers.

b) On what intervals, if any, is the graph of f concave up? Justify your answer.

c) Write the equation of the tangent line of f at $x = 4$.

d) Does the line tangent to the graph of f at $x = 4$ lie above of below the graph for $x > 4$. Why?

14. See the graphs of $f'(x)$ and $f''(x)$ below

(a) Determine the critical numbers of f.

(b) Where is f increasing?

(c) Where is f decreasing?

(d) At what values of x does f have a local max?

(e) At what values of x does f have a local min?

(f) Where is f concave up?

(g) Where is f concave down?

(h) At what values of x does f has points of inflection?