Around the neighborhood of $x = x_0$ and $f(x)$ is continuous at x_0, if $f(x)$ changes orientation from decreasing to increasing at x_0, then $x = x_0$ is a local minimum point

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Around the neighborhood of $x = x_0$ and $f(x)$ is continuous at $x = x_0$, and if $f(x)$ does not change orientation at x_0, then $x = x_0$ is neither a local minimum nor a local maximum point.

Inflection Points

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Inflection points may occur when

1) $f''(x) = 0$ or
2) $f''(x)$ does not exist.

If $f''(x) > 0$ on an interval I, this indicates that $f(x)$ is concave up on I.

If $f''(x) < 0$ on an interval I, this indicates that $f(x)$ is concave down on I

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Around the neighborhood of $x = x_0$, and $f(x)$ and $f'(x)$ are continuous at x_0, and if $f(x)$ changes concavity at x_0, then $x = x_0$ is an inflection point.

Around the neighborhood of $x = x_0$, and $f(x)$ and $f'(x)$ are continuous at x_0, and if $f(x)$ does not change concavity at x_0, then $x = x_0$ is not an inflection point.

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(a) If $f'(x_0) = 0$ and $f''(x_0) < 0$, then $f(x)$ has a local maximum at x_0.

(b) If $f'(x_0) = 0$ and $f''(x_0) > 0$, then $f(x)$ has a local minimum at x_0.

(c) If $f(x)$ has an inflection point at $x = x_0$, then $f''(x_0) = 0$ or $f''(x_0)$ does not exist.

(d) However, if $f''(x_0) = 0$ or $f''(x_0)$ does not exist, this test fails and we cannot conclude if $x = x_0$ is a local minimum or a local maximum or an inflection point.

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Guidelines for curve sketching can be found on page 249 of your textbook.

Example :-

Sketch the graph of $f(x) = 3x^4 + 8x^3 + 8x^2$

Preview from Notesale.co.uk
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