

Finding Local Maxima, Minima and Inflexion Points

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Local Maxima and Minima

Local maxima & minima (turning points) can occur (but might not occur) where $y' = 0$, which is called a stationary point.

Setting $y' = 0$ locates **local** maxima & minima as opposed to **global** maxima & minima. There can be several local maxima or minima, but there can only be one global maxima or minima. Global max/min are often at $\pm\infty$, which setting $y' = 0$ will not find.

To find the local maxima & minima use any of:

Analytically (To “justify”)

2nd Derivative Test

At the x values where $y' = 0$, check whether y'' is positive or negative.

1. If $y'' < 0$ at that point, there is a local maximum there.
2. If $y'' > 0$ at that point, there is a local minimum there.

Graphically

Sketch the graph of y . Locate min/max visually. Use CALC minimum or maximum to find them.

Be aware that this may not give an exact answer if one is required.

“My calculator said so”, does not get the “justify” point.

Inflexion Points

Inflexion points are points on the curve where the concavity changes. The concavity can change (but might not change) where $y'' = 0$.

To find the inflexion points use any of:

Analytically (To “justify”)

Check y'' on each side of the x values where $y'' = 0$.

Construct a sign table for y'' by testing convenient values of x .

If y'' changes sign on opposite sides of the x value where $y'' = 0$:

1. If $f'(x) = 0$ there, it is a horizontal inflexion point.
2. If $f'(x) \neq 0$ there, it is a normal inflexion point.

To visualize this if $y'' > 0$ draw a concave up curve and if $y'' < 0$ draw a concave down curve.

Graphically

Graph y in Y1 in Y=. Turn it off by clicking on the “=” sign.

Graph y' (**not** y) using ALPHA F2 3: nDeriv(and ALPHA F4

Set xRes = 3 (in WINDOW) to speed it up.

Use CALC minimum or maximum to find the local maxima & minima of y' .

Either a local maxima or minima of y' indicates an inflexion point.

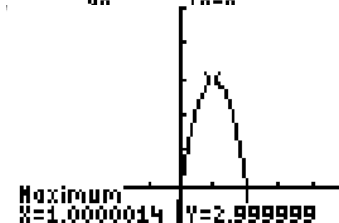
Be aware that this will not give an exact answer if one is required.

Example

Find the inflexion point of $y = -x^3 + 3x + 1$

$$Y_1 = -x^3 + 3x + 1$$

$$Y_2 = \frac{d}{dx}(Y_1) \mid x=x$$



Since y' has a maximum at $x = 1$, y has an inflexion point at $x = 1$

“My calculator said so”, does not get the “justify” point.