Section 4.3 – Derivatives and the Shapes of Graphs

- First of all, please note that the derivative of a function doesn't **affect** the shape of the graph, but **explains it**.

Increasing/Decreasing:

- We have already seen that when a function is increasing, its derivative is _______________.
- And when a function is decreasing, its derivative is _______________.

Local Max and Min:

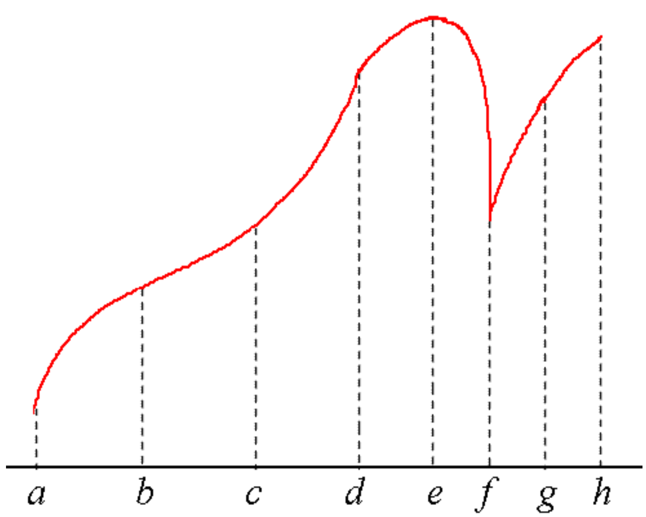
- If the derivative changes from positive to negative at a point *c*, then *c* is a _______________.
- If the derivative changes from negative to positive at a point *c*, then *c* is a _______________.
- If the derivative does not change sign at a point *c*, then it is _______________.

Concavity:

- Recall when the second derivative of a function is positive, it is _______________. When the second derivative of a function is negative, it is _______________.
- Any point where the second derivative is zero is called a _______________, where the function changes from concave up to down (or down to up).

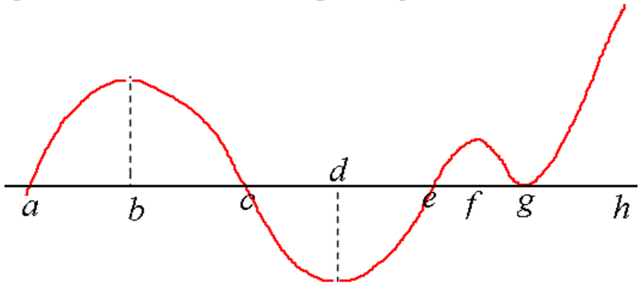
Examples:

- Q: For the graph below identify intervals/points where the function is increasing/decreasing, concave down/up, horizontal tangents, max, min, inflection points and critical points.



A:

- Q: Given the graph of the derivative (below) what can you say about the function itself (same questions as before except for global max/min)?



A:

- *Example. For* $f(x) = x \ln x$, *find when it is increasing/decreasing, max/min, concavity and points of inflection.*