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.