



Calculus

Notes on Graph Interpretation

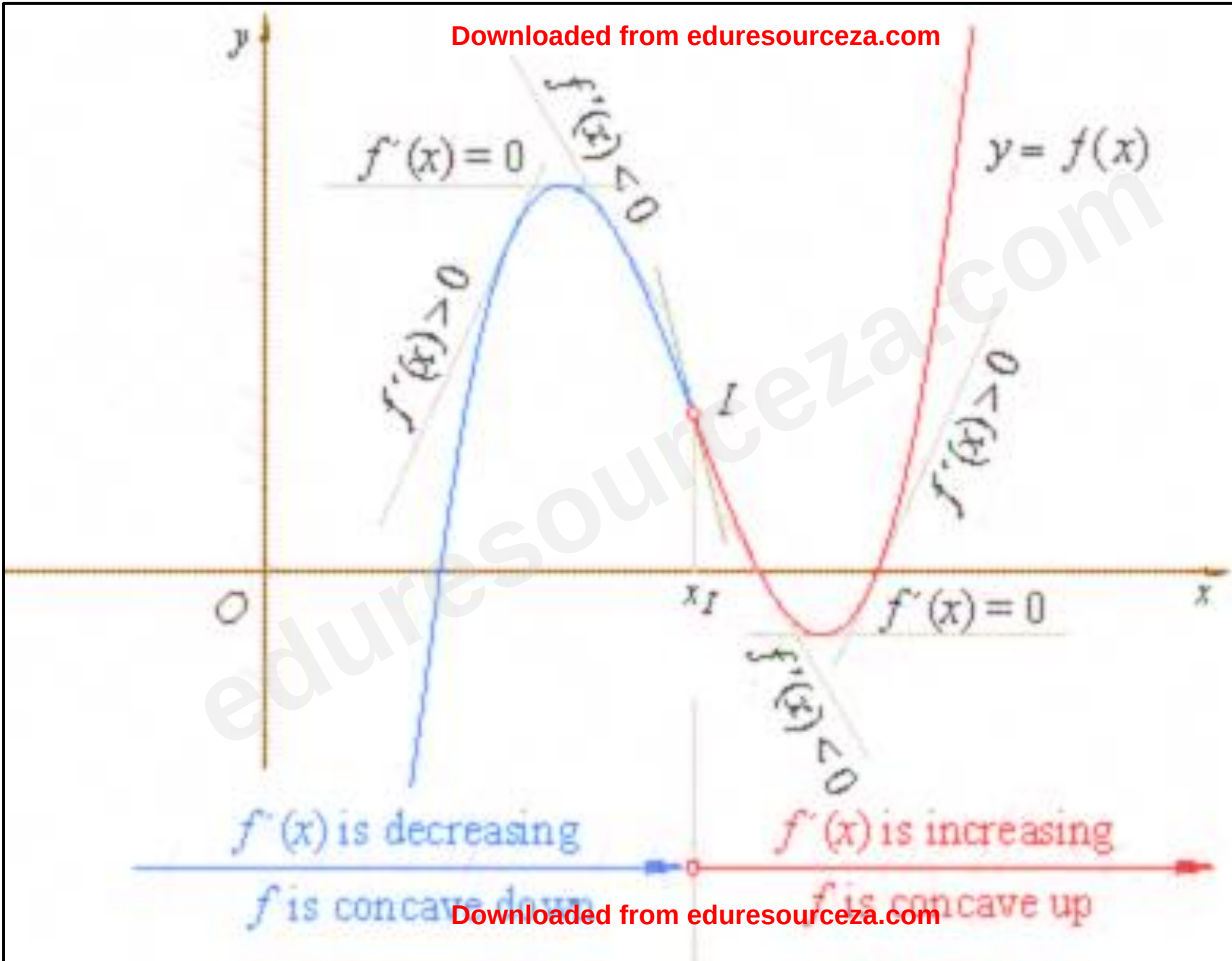
For all Cubic graphs : Domain is $x \in \mathbb{R}$ and Range is $y \in \mathbb{R}$

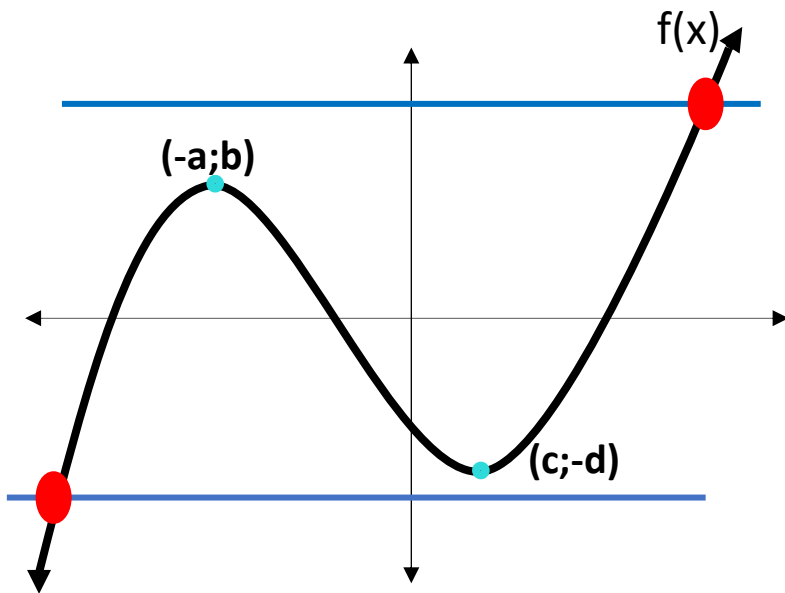
The first derivative will be used for :

- To find stationary points
- To determine where a graph is increasing $f'(x) > 0$ or decreasing $f'(x) < 0$
- To determine the gradient of a tangent at a point
- To find the equation of a graph where the stationary points are given $f'(x) = 0$

The second derivative will be used:

- ❖ To find the point of inflection
- ❖ To determine concave up $f''(x) > 0$ or concave down $f''(x) < 0$
- ❖ To determine stationary point(s) given the derivative graph

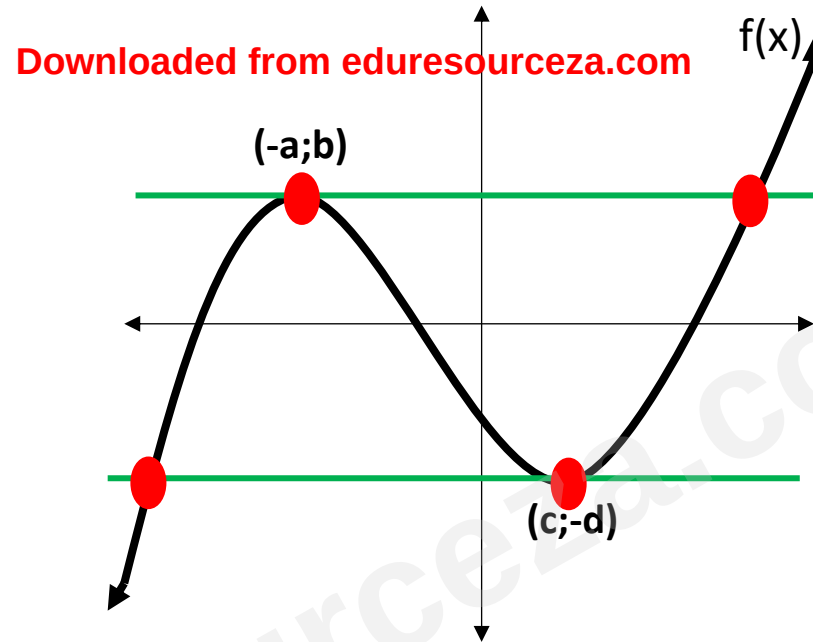




ONE ROOT

The horizontal line $y = k$ cuts the graph $f(x)$ at only one point (red dot). When the horizontal line is **above the stationary point or below the stationary point**

$$k > b \text{ or } k < -d$$

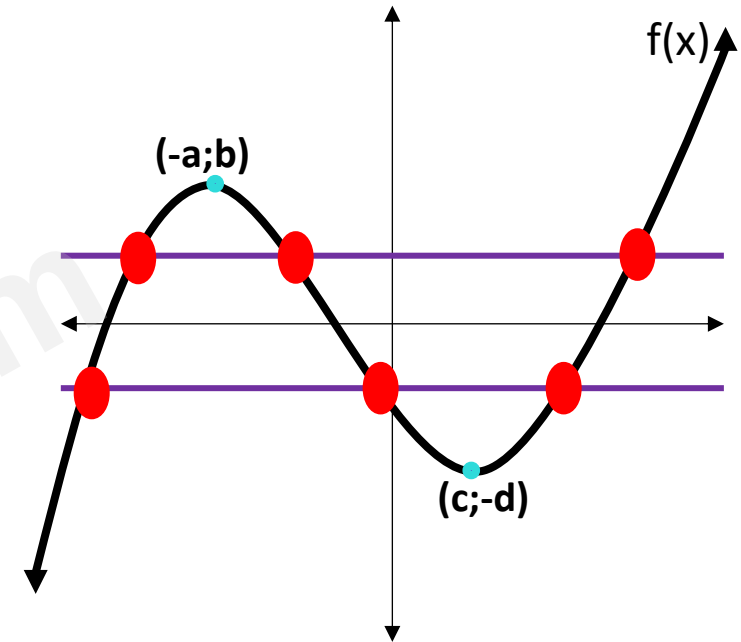


TWO ROOTS

The horizontal line $y = k$ cuts the graph $f(x)$ at two points (red dots). The horizontal line **is at the two stationary points.**

$$k = b \text{ or } k = -d$$

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THREE ROOTS

The horizontal line $y = k$ cuts the graph $f(x)$ at three points (red dots) when the horizontal line is **between the two stationary points.**

$$-d < k < b$$

Translated

$$y = \frac{1}{2} (x - 1)^3 + 2$$

Stretch $\uparrow$ Move $\longleftrightarrow$ Move $\updownarrow$

$x = 1$

THE RELATIONSHIP BETWEEN THE ORIGINAL FUNCTION, THE FIRST DERIVATIVE GRAPH AND THE SECOND DERIVATIVE GRAPH

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$$y = x(x - 3)^2$$

$$= x^3 - 6x^2 + 9x$$

(cubic curve)

$$y' = 3x^2 - 12x + 9$$

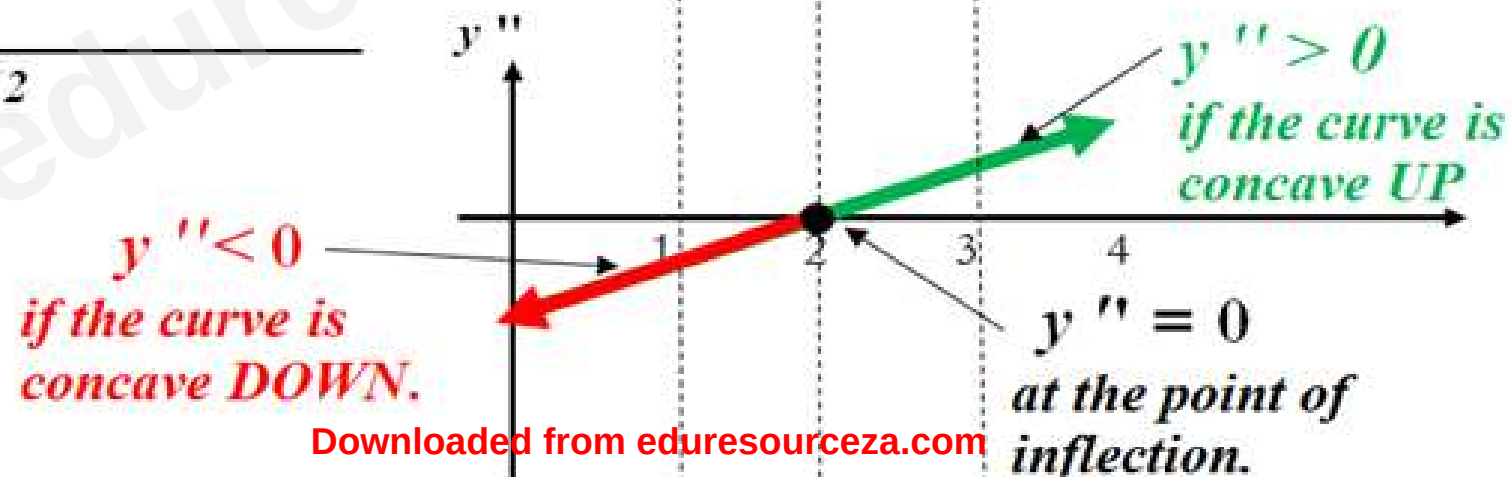
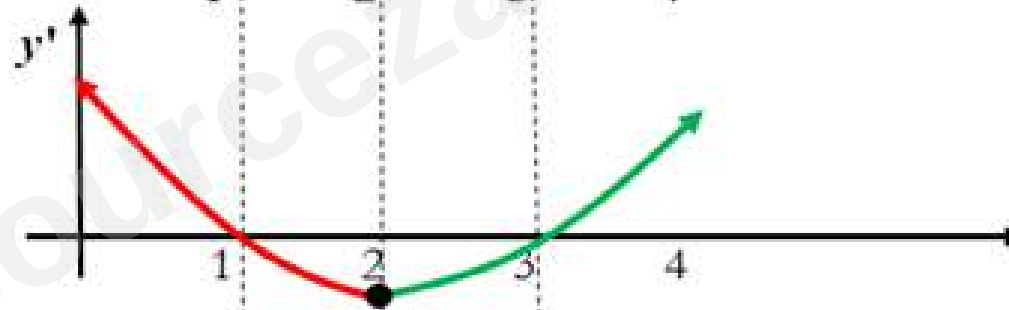
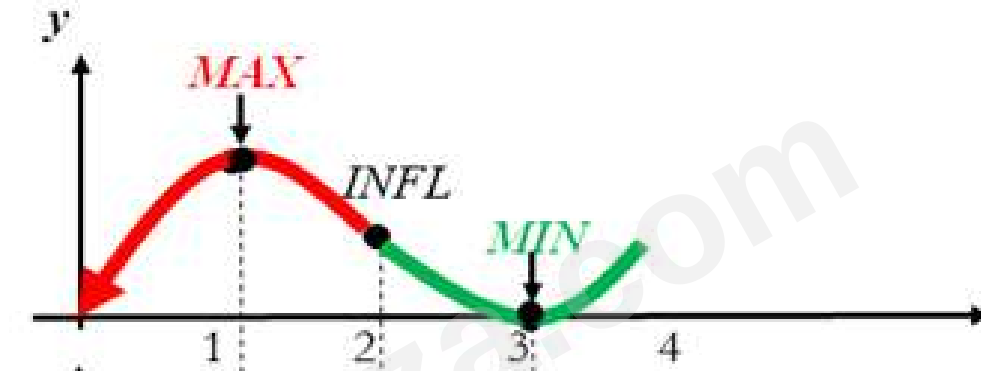
$$= 3(x^2 - 4x + 3)$$

$$= 3(x - 1)(x - 3)$$

(parabola)

$$y'' = 6x - 12$$

(line graph)



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