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Convex Function

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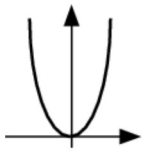

convex function

A convex function is a continuous function whose value at the midpoint of every interval in its domain does not exceed the arithmetic mean of its values at the ends of the interval.

More generally, a function $f(x)$ is convex on an interval $[a, b]$ if for any two points x_1 and x_2 in $[a, b]$ and any λ where $0 < \lambda < 1$,

$$f[\lambda x_1 + (1-\lambda) x_2] \leq \lambda f(x_1) + (1-\lambda) f(x_2)$$

(Rudin 1976, p. 101; cf. Gradshteyn and Ryzhik 2000, p. 1132).

If $f(x)$ has a second derivative in $[a, b]$, then a necessary and sufficient condition for it to be convex on that interval is that the second derivative $f''(x) \geq 0$ for all x in $[a, b]$.

If the inequality above is strict for all x_1 and x_2, then $f(x)$ is called strictly convex.

Examples of convex functions include x^p for $p = 1$ or even $p \geq 2$, $x \ln x$ for $x > 0$, and $|x|$ for all x. If the sign of the inequality is reversed, the function is called concave.

SEE ALSO:
Convex, Concave Function, Interval, Logarithmically Convex Function

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