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17. Summary

Second derivative

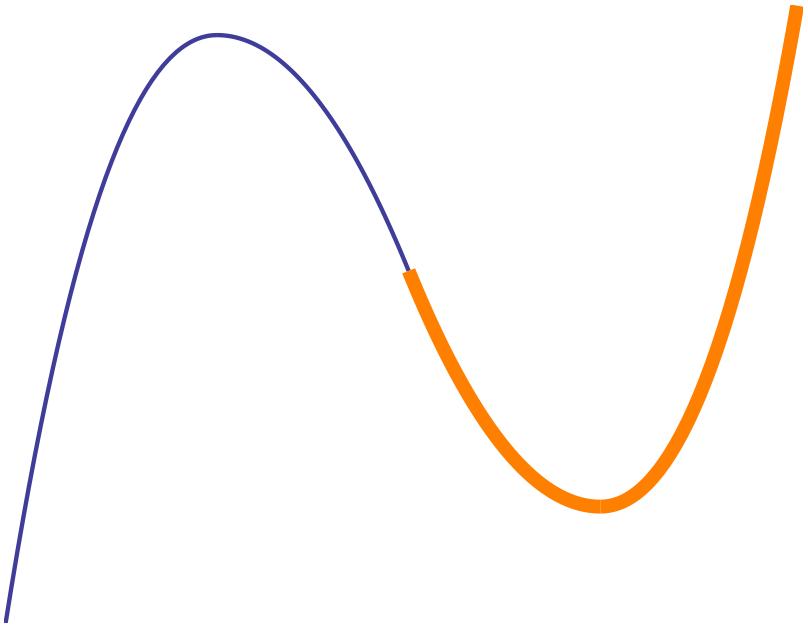
The second derivative of a function $f(x)$ is the first derivative of $f'(x)$, and is denoted by $f''(x)$ or $\frac{d^2f}{dx^2}$.

Higher derivatives

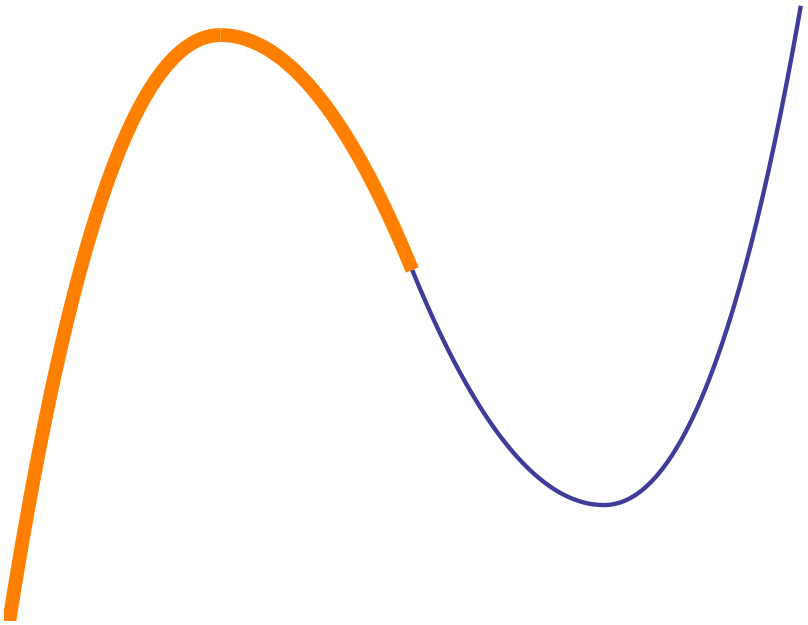
The nth derivative of a function $f(x)$ is the first derivative of $f^{(n-1)}(x)$, and is denoted by $f^{(n)}(x)$ or $\frac{d^nf}{dx^n}$.

Second derivative and concavity summary

On intervals where $f'' > 0$, the function f is concave up.



On intervals where $f'' < 0$, the function f is concave down.



Points where the graph of a function changes from concave up to concave down, or vice versa, are called **inflection points**.

Position, velocity, acceleration

If $x(t)$ is a function that describes position as a function of time, then:

- $x'(t)$ is the velocity, and
- $x''(t)$ is the acceleration.