How to sketch $f\,'(x)$ from the graph of $f(x)$ and vice versa

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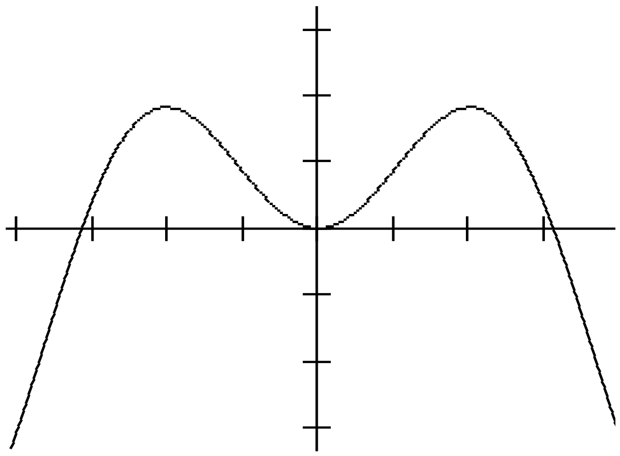
1. Where $f(x)$ has a minimum or a maximum (i.e. its "instantaneous slope" is ***zero***), $f\,'(x)$ equals ***zero***. Put an "*x*" on the x-axis of $f\,'(x)$ wherever $f(x)$ has a minimum or a maximum.

2. If you can guess the apparent functional form of $f(x)$, use $\frac{d(x^n)}{dx} = nx^{n\text{-}1}$.

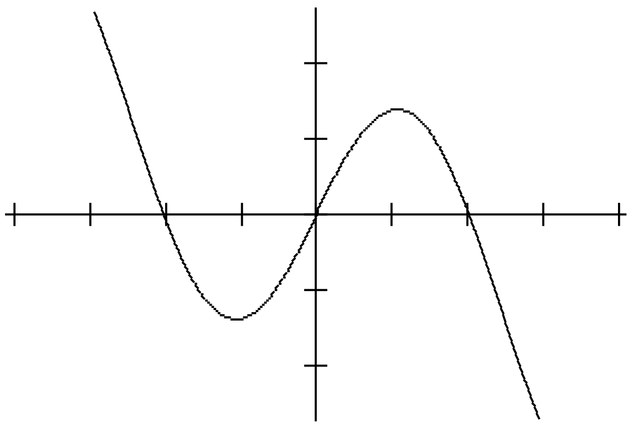
> **Example** if $f(x)$ looks like a cubic, $f\,'(x)$ will look like a parabola.
> (Actually $f(x)$ below is $x \sin x$, but this rule still works.)

3. The derivative is the "instantaneous slope". So if in interval (a, b) the **slope of *f*(x)** is negative, then in interval (a, b) the **value (<u>NOT</u> the slope) of *f* '(x)** will be negative.

> **Example**: $f(x)$ looks like:



> Since the slope of $f(x)$ above is positive in intervals $(\infty, -2)$ and $(0, 2)$, $f\,'(x)$ will be positive in those intervals (and negative elsewhere). So $f\,'(x)$ should look something like:



> Note that rule 2 helps here too. $f(x)$ looks like a quartic, so $f\,'(x)$ should look like a cubic.
> (Actually $f(x)$ is $x \sin x$, but this rule still works.)

> **Example**: See the graphs above at $x = \pm 2$.

4. To sketch $f(x)$ from a graph of $f\,'(x)$ you run the above advice backwards.