## What does $f^{\prime}$ say about $f$ ?

## Quick Check

Indicate the intervals on which the graphed function is:

- Increasing
- Decreasing
- Constant

O. Observe the derivative to test for increasing and decresing functions.


Choose one in each scenario
$f$ increasing on interval $\qquad$
$\Longrightarrow f^{\prime}$ is + or - or 0
$f$ decreasing on interval $\qquad$
$\Longrightarrow f^{\prime}$ is + or $\quad-\quad$ or 0
$f$ constant on interval $\qquad$
$\Longrightarrow f^{\prime}$ is $+o r \quad-\quad o r \quad 0$

## Test for Increasing and Decreasing Functions

Find where the function $f(x)=3 x^{4}-4 x^{3}-12 x^{2}+5$ is increasing and where it is decreasing algebraically.

* Observe the derivative at the $x$-values where the function goes from increasing to decreasing and vice versa. Use this to set up test intervals.


## The First Derivative Test

Tell whether $x=c$ is a local maximum point, a local minimum point, or neither.

$1 f$ is continuous around $x=c$
$\Longrightarrow f(c)$ is defined
$2 f^{\prime}(c)=0$ or undefined
$\Longrightarrow x=c$ is a critical number
$3 f^{\prime}(x)<0$ for $x<c$ and $f^{\prime}(x)>0$ for $x>c$
$4 f$ has a relative minimum at $x=c$.
The min value is $f(c)$



## Graphical Application of 1st Derivative Test

The graph of the derivative $f^{\prime}$ of a function $f$ is shown.

1. On what intervals is $f$ increasing or decreasing.
2. At what values of $x$ does $f$ have a local extrema.


## Applying the First Derivative Test

1. Find the relative extrems of $f(x)=\left(x^{2}-4\right)^{2 / 3}$.
2. Find the relative extrema of $f(x)=\frac{x^{2}}{x^{2}-9}$.
3. Find the relative extrema of $f(x)=x^{4}-2 x^{2}$.
