

### 5.3-Derivatives and the Shapes of Curves

Mean Value Theorem:

**Recall 5.1:** What  $f'$  and  $f''$  say about  $f$ :

*Second Derivative Test:*

*Examples:*

Determine where the function  $f(x) = x^3 - 3x^2 + 1$  is increasing and decreasing, concave up, and concave down.

Determine where the function  $f(x) = x^2e^{-2x}$  is increasing, decreasing, concave up, and concave down.

Find the inflection points of  $f(x) = -x^2 \cos x + 6 \cos x + 4x \sin x$ ,  $x \in [-\pi, \pi]$ .