

Practice Questions

1. Which x^* gives the minimum of $y(x) = x^2 + 2x$? Solve $\frac{dy}{dx} = 0$.
2. Find $\frac{d^2y}{dx^2}$ for $y(x) = x^2 + 2x$.
This is > 0 so parabola bends up.
3. Find the maximum height of $y(x) = 2 + 6x - x^2$. Solve $\frac{dy}{dx} = 0$.
4. Find $\frac{d^2y}{dx^2}$ to show that this parabola bends down.
5. For $y(x) = x^4 - 2x^2$ show that $\frac{dy}{dx} = 0$ at $x = -1, 0, 1$.
Find $y(-1), y(0), y(1)$.
6. Now $\frac{dy}{dx} = 4x^3 - 4x$. What is the second derivative $\frac{d^2y}{dx^2}$?

7. At a minimum point explain why $\frac{dy}{dx} = 0$ and $\frac{d^2y}{dx^2} > 0$.
8. Bending down $\left(\frac{d^2y}{dx^2} < 0\right)$ changes to bending up $\left(\frac{d^2y}{dx^2} > 0\right)$ at a point of _____ : At this point $\frac{d^2y}{dx^2} = 0$
Does $y = x^2$ have such a point? Does $y = \sin x$ have such a point?
9. Suppose $x + X = 12$. What is the maximum of x times X ?
This question asks for the maximum of $y = x(12 - x) = 12x - x^2$.
Find where the slope $\frac{dy}{dx} = 12 - 2x$ is zero. What is x times X ?

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Resource: Highlights of Calculus
Gilbert Strang

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