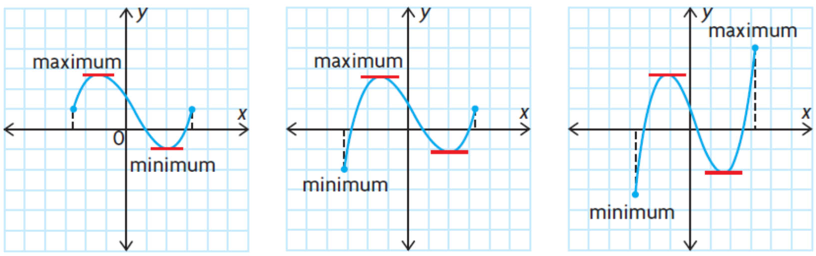
Lesson 2 – Maximum and Minimum over a Given Interval

How to find Extreme Values (Max/Min) over a given interval

Note: the fnct must be continuous over interval

1. Determine the first derivative, $f'(x)$.
2. Determine all the values on the interval $a \le x \le b$ where $f'(x) = 0$.
3. Evaluate $f(x)$ at the end points a and b and at the points you found in step 2 (where $f'(x) = 0$).
4. Compare the values from step 3. The largest value is the maximum value of $f(x)$ and the smallest value is the minimum value of $f(x)$ on the interval $a \le x \le b$.



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Example 1: Determine the extreme values of $f(x) = \frac{1}{100}x^3 - \frac{1}{2}x^2 + 2x + 25$ over the interval $0 \le x \le 50$.

Step 1: Find $f'(x)$

$f'(x) = \frac{3}{100}x^2 - \frac{2}{2}x + 2$

$f'(x) = \frac{3}{100}x^2 - x + 2$

Step 2: Find zeros of $f'(x)$

Q.F. $x_1 = 2.1$

$x_2 = 31.2$

Step 3: Evaluate

$f(0) = \frac{1}{100}(0)^3 - \frac{1}{2}(0)^2 + 2(0) + 25$

$= 25$

$f(50) = \frac{1}{100}(50)^3 - \frac{1}{2}(50)^2 + 2(50) + 25$

$= 125$

$f(2.1) = \frac{1}{100}(2.1)^3 - \frac{1}{2}(2.1)^2 + 2(2.1) + 25$

$= 27$

$f(31.2) = \frac{1}{100}(31.2)^3 - \frac{1}{2}(31.2)^2 + 2(31.2) + 25$

$= -95.6$

end point

∴ The max value occurs at $(50, 125)$ and the minimum value occurs at $(31.2, -95.6)$

turning point

This example illustrates the importance of evaluating the function at the endpoints as well as finding the zeros of the derivative where f'(x)=0 because the max/min values may occur at the end points and NOT the turning points of a given interval.