

Objective: Apply the first derivative test to find relative extrema of a function.

Find all of the relative extrema for the function $f(x) = 3x^5 - 5x^3$.

ANSWER:

$$f(x) = 3x^5 - 5x^3$$

$$f'(x) = 15x^4 - 15x^2$$

$$f'(x) = 15x^2(x+1)(x-1)$$

$$\text{so, } 15x^2 = 0 \quad x+1 = 0 \quad x-1 = 0$$
$$x = 0 \quad x = -1 \quad x = 1$$

The critical points are $x = 0$, $x = -1$, $x = 1$. The function is continuous; therefore, there are no discontinuities.

Interval	$-\infty < x < -1$	$-1 < x < 0$	$0 < x < 1$	$1 < x < \infty$
Test Value	$x = -2$	$x = -\frac{1}{2}$	$x = \frac{1}{2}$	$x = 2$
Sign of $f'(x)$	$f'(-2) > 0$	$f'(-\frac{1}{2}) < 0$	$f'(\frac{1}{2}) < 0$	$f'(2) > 0$
Conclusion	increasing	decreasing	decreasing	increasing

After applying the first derivative test, $x = -1$ is a maximum and $x = 1$ is a minimum.