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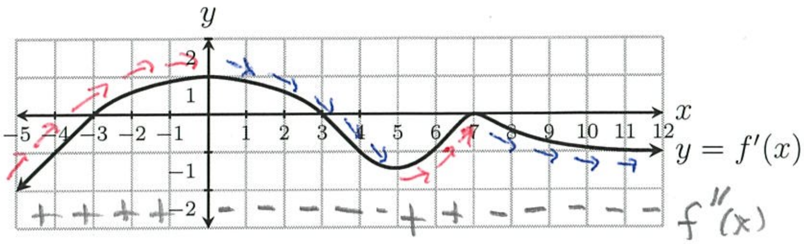
Quiz 16

MATH 200
October 24, 2022

1. The graph $y=f'(x)$ of **the derivative** of a function $f(x)$ is shown. Answer the questions about $f(x)$.



(a) Find the intervals on which $f(x)$ is concave up.

$(-\infty, 0) \cup (5, 7)$ ← because $f'(x)$ increases there, so $f''(x) > 0$

(b) Find the intervals on which $f(x)$ is concave down.

$(0, 5) \cup (7, \infty)$ ← because $f'(x)$ decreases there, so $f''(x) < 0$

(c) State the x values at which any inflection points occur.

$\boxed{x = 0,\ x = 5,\ x = 7}$ because that's where concavity changes

2. Use the second derivative test to find and identify all local extrema of $f(x) = x^3 - 3x$.

$f'(x) = 3x^2 - 3 = 3(x^2 - 1) = 3(x-1)(x+1) = 0$

Critical points: $x = 1$ $\quad x = -1$

$f''(x) = 6x.$

Test CP $x=-1$: $f''(-1) = 6(-1) = -6 < 0$. Therefore

$\boxed{f(x) \text{ has a local max at } x = -1}$

Test CP $x=1$: $f''(1) = 6 \cdot 1 = 6 > 0$. Therefore

$\boxed{f(x) \text{ has a local min at } x = 1}$