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QUIZ 9

MATH 200, SECTION 9
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1. Use either the first or second derivative test to find the local extrema of $f(x) = e^x - x$.

$f'(x) = e^x - 1$ ← Defined for all x, so solve $f'(x)=0$ to find all critical points

$e^x - 1 = 0$

$e^x = 1$

$\ln(e^x) = \ln(1)$

$\boxed{x = 0}$ ← critical point

Second derivative: $f''(x) = e^x$

Since $f''(0) = e^0 = 1 > 0$, second derivative test says:

f has a local minimum at $x=0$
f has no local maximum

2. Find the global extrema (i.e. absolute extrema) of $f(x) = x^3 - 3x$ on $[0, 2]$.

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

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

But only $x=1$ is in $[0,2]$.

$f(0) = 0^3 - 3\cdot 0 = 0$

$f(2) = 2^3 - 3\cdot 2 = 2$ ← MAX

$f(1) = 1^3 - 3\cdot 1 = -2$ ← MIN

f has a global maximum of $f(2)=2$ at $x=2$
f has a global minimum of $f(1)=-2$ at $x=1$