Simplify your final answer. Show all relevant work for each problem. Little to no work, even with a correct answer, will receive little to no credit.

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1. Consider the function $f(x) = 4x^3 + 4x^2 + 1$.
   a. Find the intervals on which f is concave up and the intervals on which it is concave down.
   b. Find any inflection points for f (only give the x-coordinate of inflection points; you don't have to find the y-coordinate).
   c. Find the absolute maximum and absolute minimum values of f on the interval $\left[\frac{-1}{2}, 1\right]$.

$f'(x) = 12x^2 + 8x$

$12x^2 + 8x = 0$

$4x(3x+2) = 0$

$x = 0, \; x = -2/3$ ← not in interval

x	$f(x)$	
$\frac{-1}{2}$	$\frac{3}{2}$	
0	1	Abs. Min
1	9	Abs. Max

(c)

$f''(x) = 24x + 8$

$24x + 8 = 0 \Rightarrow x = \frac{-1}{3}$

$f''(x)$ — — — 0 + + +

$\frac{-1}{3}$

(a)

Concave up: $(-1/3, \infty)$

Concave Down: $(-\infty, -1/3)$

(b)

Inflection Point: $x = \frac{-1}{3}$