

1. Let $f(x) = 3x^4 - 4x^3 + 1$. Determine the intervals where f is concave up and concave down.

$$f'(x) = 12x^3 - 12x^2$$

$$f''(x) = 3 \cdot 12x^2 - 2 \cdot 12x$$

$$= 12x(3x - 2) \stackrel{\text{set}}{=} 0$$

$$\Rightarrow 12x = 0, \quad 3x - 2 = 0$$

$$x = 0, \quad x = \frac{2}{3}$$



$$f''(-1) = (-)(-) = +$$

$$f''(\frac{1}{3}) = (-)(+) = -$$

$$f''(1) = (+)(+) = +$$

So f is concave up on $(-\infty, 0) \cup (\frac{2}{3}, \infty)$

So f is concave down on $(0, \frac{2}{3})$

