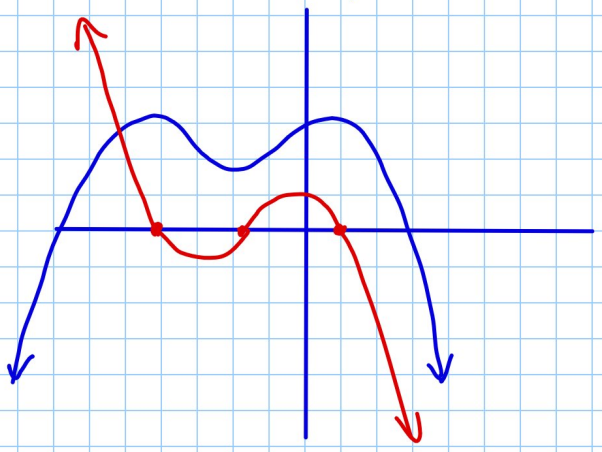
WARMUP

Sketch the graph of the derivative:



Section 2.6 The Second Derivative

The derivative of the derivative is the **second derivative**.

It is notated by $f''(x) = \frac{d^2y}{dx^2} \Rightarrow \frac{d}{dx}\left(\frac{dy}{dx}\right)$

"f double prime of x"

$$\frac{d}{dx}\left[kx^n\right] = kn\,x^{n-1}$$

$$\frac{d}{dx}\left[kx\right] = k$$

$$\frac{d}{dx}\left[k\right] = 0$$

$$\frac{d}{dx}\left(6x^2-5x\right) = 12x-5$$

ex: $f(x) = x^4$

$f'(x) = 4x^3$

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

ex: $f(x) = \frac{5}{x} = 5x^{-1}$

$f'(x) = -5x^{-2} = -\frac{5}{x^2}$

$f''(x) = 10x^{-3} = \frac{10}{x^3}$

When $f'(x) > 0$, $f(x)$ is increasing

so when $f''(x) > 0$, $f'(x)$ is increasing

The graph of f is

<u>concave up</u> when

$f''(x) > 0$

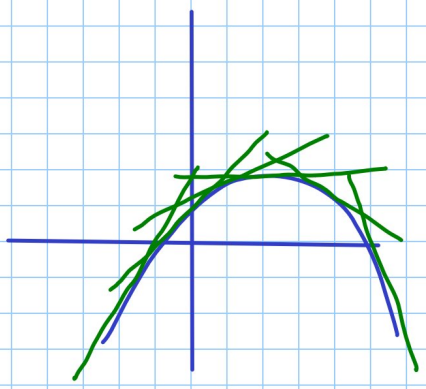
When $f'(x) < 0$, $f(x)$ is decreasing

so when $f''(x) < 0$, $f'(x)$ is decreasing

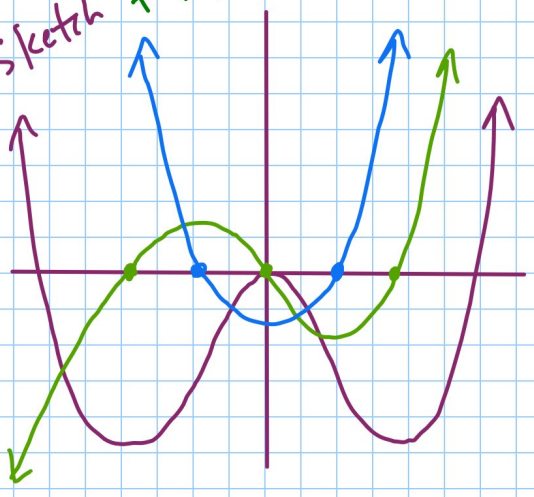
The graph of f is

<u>concave down</u> is

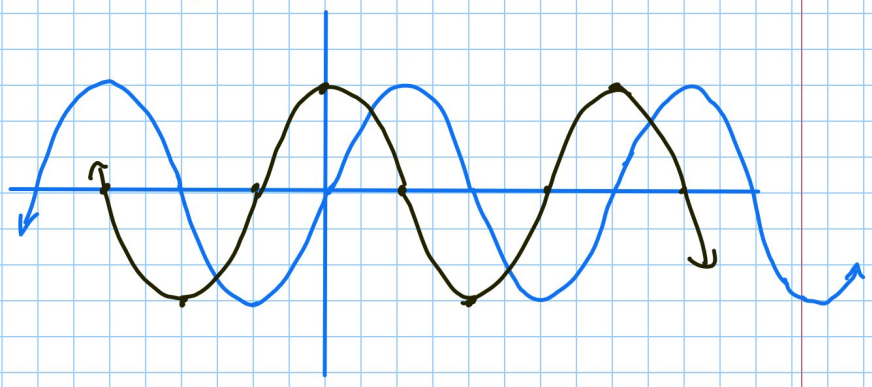
$f''(x) < 0$



ex: Sketch $f'(x)$ and $f''(x)$ for given $f(x)$:

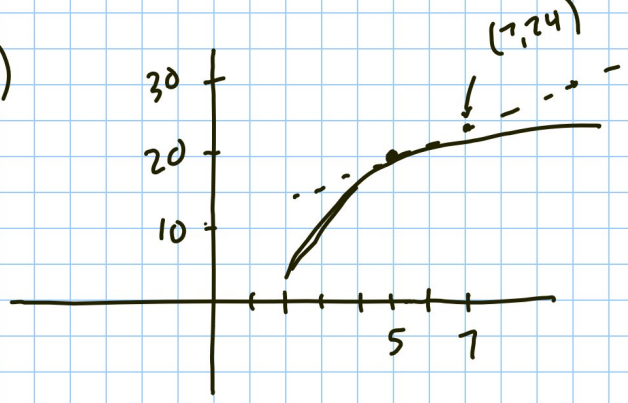


ex: $f(x) = \sin x$ $f'(x) = \cos x$



p93-94 1-3, 5, 6, 12, 16, 20, 22

16)



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