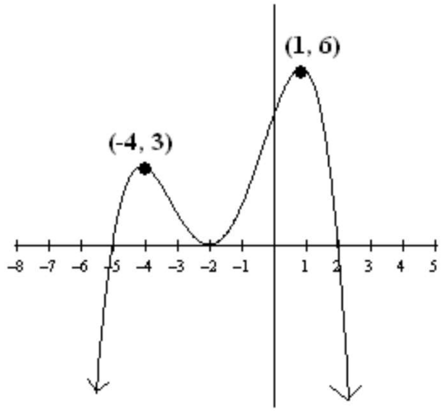
Notes 4.6 – Connecting the Graphs of $f(x)$, $f'(x)$, and $f''(x)$

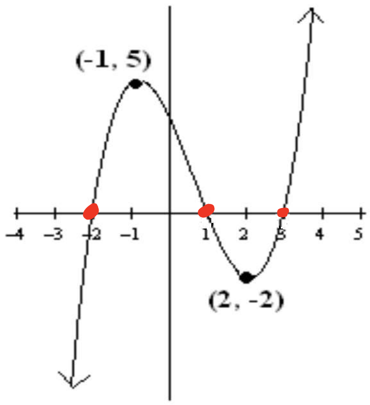
Given below is the graph of a function, $F(x)$. State all of the conclusions that you can state about the graphs of $F'(x)$ and $F''(x)$. Justify each of your conclusions.



Graph of $F(x)$

Conclusions about $F'(x)$	Conclusions about $F''(x)$
• $F' > 0$ on $(-\infty,-4) \cup (-2,1)$ b/c $F(x)$ is increasing on these intervals. • $F'(x) = 0$ at $x = -4, -2$ and 1 b/c $F(x)$ has extrema at these values • $F'(x) < 0$ on $(-4,-2) \cup (1,\infty)$ b/c $F(x)$ is decreasing on these intervals • F' has an odd degree b/c $F(x)$ has even degree.	• $F''(x) < 0$ at $x = -4$ and $x = 1$ b/c $F(x)$ has max at $x = -4, 1$ and concave down. • $F''(x) > 0$ at $x = -2$ b/c $F(x)$ has a min at $x = -2$ and concave up. • $F''(x)$ has even degree b/c $F(x)$ has even degree

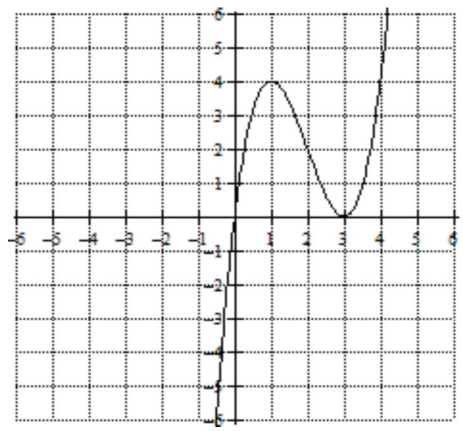
Given below is the graph of a function, $F'(x)$. State all of the conclusions that you can state about the graphs of $F(x)$ and $F''(x)$. Justify each of your conclusions.



Graph of $F'(x)$

Conclusions about $F(x)$	Conclusions about $F''(x)$
• $F(x)$ is decreasing $(-\infty,-2)\cup(1,3)$ b/c $F'<0$ on these intervals. • $F(x)$ is increasing on $(-2,1)\cup(3,\infty)$ b/c $F'>0$ on these intervals. • $F(x)$ has min at $x=-2, 3$ b/c F' changes from neg to pos. at $x=-2$ & 3. • $F(x)$ has max at $x=1$ b/c F' changes fm pos to neg at $x=1$ • $F(x)$ has IP at $x=-1$ & 2 b/c $F'(x)$ has extrema at $x=-1$ & 2 • $F(x)$ has an even degree b/c $F'(x)$ has ODD degree.	• $F''(x)=0$ at $x=-1$ and $x=2$ b/c $F'(x)$ has extrema at $x=-1$ and $x=2$ • $F''>0$ on $(-\infty,-1)\cup(2,\infty)$ b/c F' is increasing on these intervals. • $F''<0$ on $(-1,2)$ b/c F' is decreasing on $(-1,2)$ • F'' will have even degree b/c F' has odd degree

Given below is the graph of a function, $F''(x)$. State all of the conclusions that you can state about the graphs of $F(x)$ and $F'(x)$. Justify each of your conclusions.



Graph of $F''(x)$

Conclusions about $F(x)$	Conclusions about $F'(x)$
• $F(x)$ is concave up on $(0,3)\cup(3,\infty)$ b/c $F''>0$ on $(0,3)\cup(3,\infty)$ • $F(x)$ is concave down on $(-\infty,0)$ b/c $F''<0$ on $(-\infty,0)$ • $F(x)$ has potential IP at $x=0,3$ b/c $F''(x)=0$ at $x=0,3$ • $F(x)$ has odd degree b/c F'' has odd degree	• $F'(x)$ has IP at $x=1$ and $x=3$ b/c F'' has extrema at $x=1,3$ • $F'(x)$ has min at $x=0$ b/c F'' changes from negative to pos. • F' degree is even • F' is increasing $(0,3)\cup(3,\infty)$ b/c $F''>0$ on $(0,3)\cup(3,\infty)$ • F' is decreasing $(-\infty,0)$ b/c $F''<0$ on $(-\infty,0)$

Calculator Active Questions

The function $f'(x) = \cos(\ln x)$ is the first derivative of a twice differentiable function, $f(x)$.

a. On the interval $0 < x < 10$, find the x – value(s) where $f(x)$ has a relative maximum. Justify your answer.

At $x = 0.009$ and $x = 4.810$ $f(x)$ has rel max
b/c $f'(x)$ changes from pos to neg at these x-values

b. On the interval $0 < x < 10$, find the x – value(s) where $f(x)$ has a relative minimum. Justify your answer.

At $x = 0.208$ $f(x)$ has rel min
b/c $f'(x)$ changes from neg to pos at this x-value

c. On the interval $0 < x < 10$, find the x – value(s) where $f(x)$ has a point of inflection. Justify your answer.

At $x = 0.043$ and $x = 1$, $f(x)$ has IP
b/c $f'(x)$ has extrema at $x = 0.043$ and $x = 1$

On the interval $0 < x < 10$, how many relative minimums does the graph of $g(x)$ have if $g'(x) = \dfrac{\sin x}{x+2}$?

A. 0

B. 1

C. 2

D. 3

E. 4

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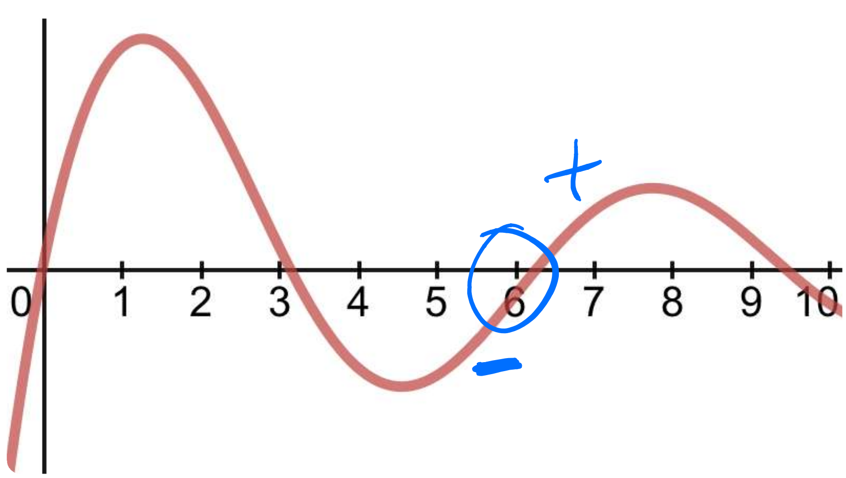

www.desmos.com/calculator/