

Graphing the Derivative of a Function

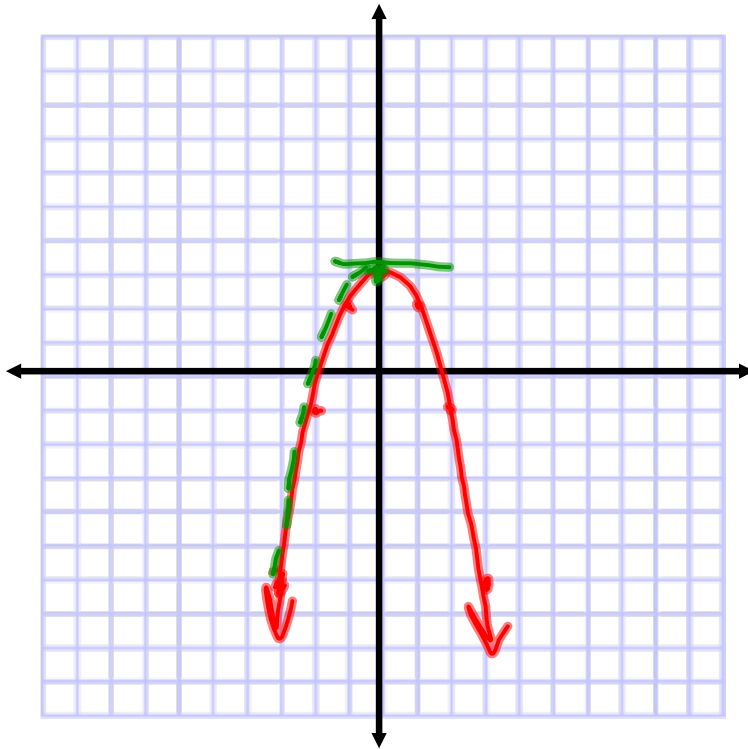
Warm-up: Part 1 - What comes to mind when you think of the word 'derivative'?

*Slope of tangent line @
any given point*

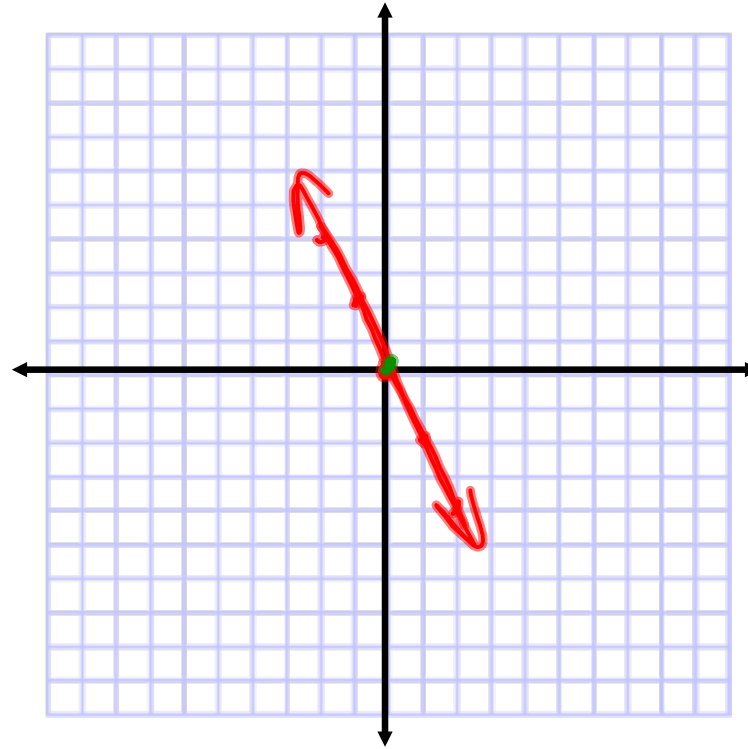
Part 2 - Graph $f(x) = -x^2 + 3$. Then find $f'(x)$ and graph it.

$$f'(x) = -2x$$

Graph of $f(x)$



Graph of $f'(x)$

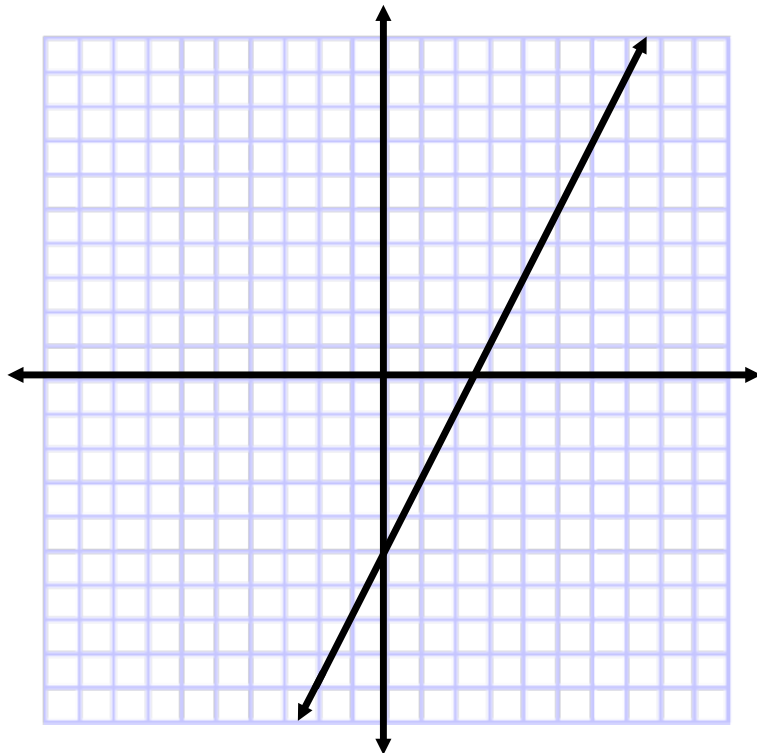


What if you're not given the equation of the original function?

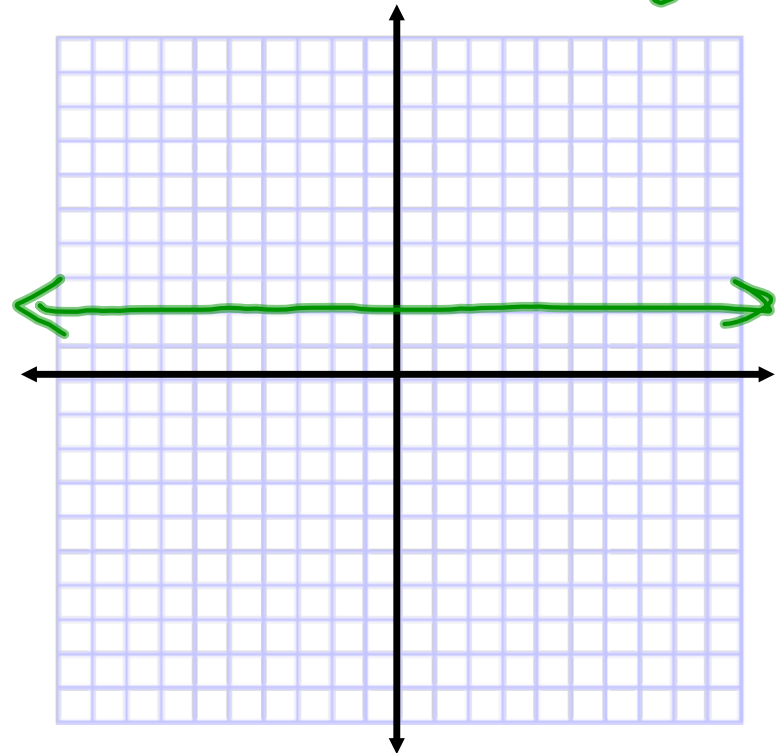
Example 1

Directions: Given the function on the left, graph its derivative on the right.

1) Graph of $f(x) = 2x - 5$

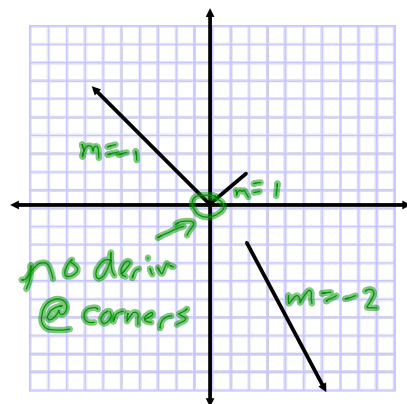


Graph of $f'(x) = 2$



2)

Graph of $f(x)$



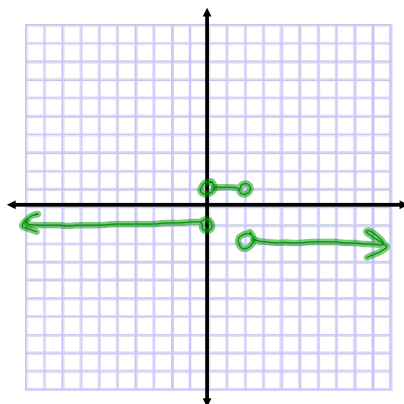
First: Write the piecewise function that represents the graph above.

$$f(x) = \begin{cases} |x|, & x < 2 \\ -2x + 2, & x \geq 2 \end{cases}$$

Second: Find $f'(x)$ and graph it below.

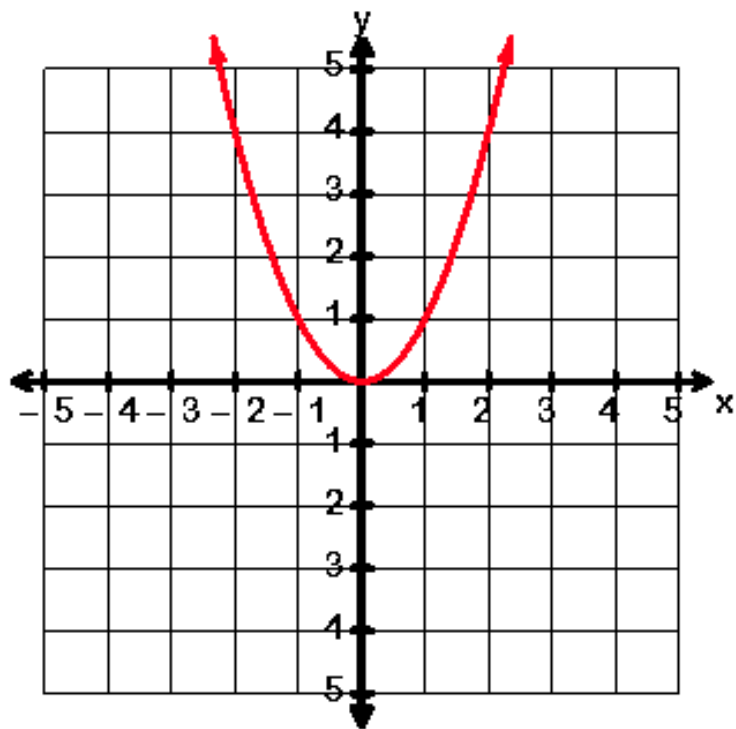
$$f'(x) = \begin{cases} -1, & x < 0 \\ 1, & 0 < x < 2 \\ -2, & x > 2 \end{cases}$$

Graph of $f'(x)$

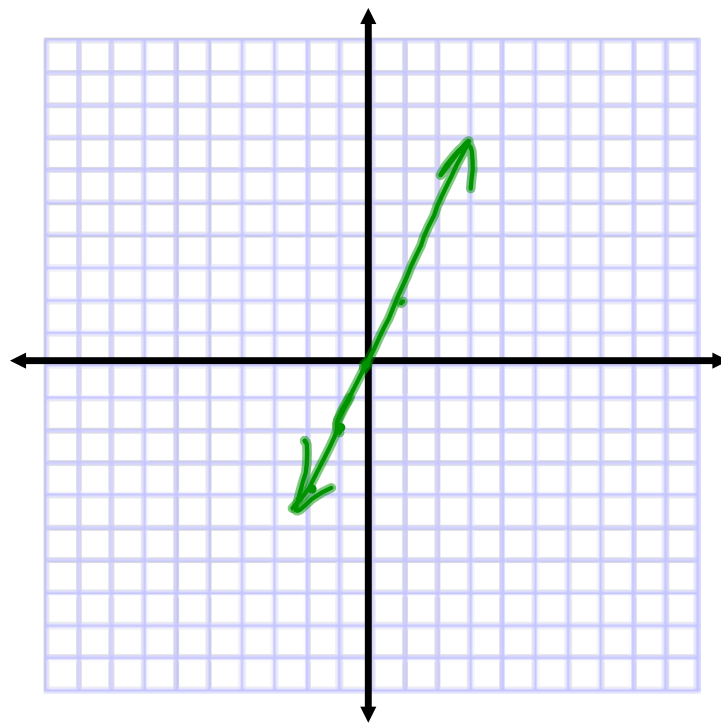


3)

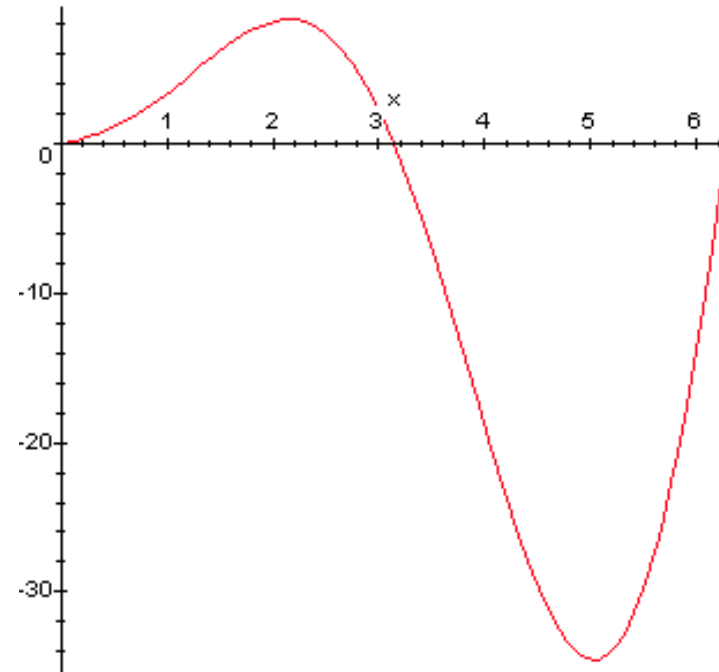
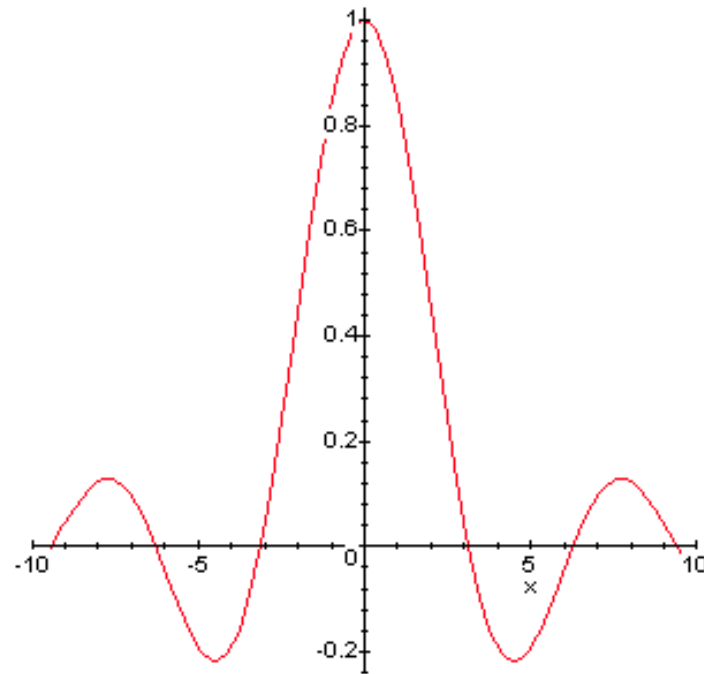
Graph of $f(x) = x^2$



Graph of $f'(x) = 2x$



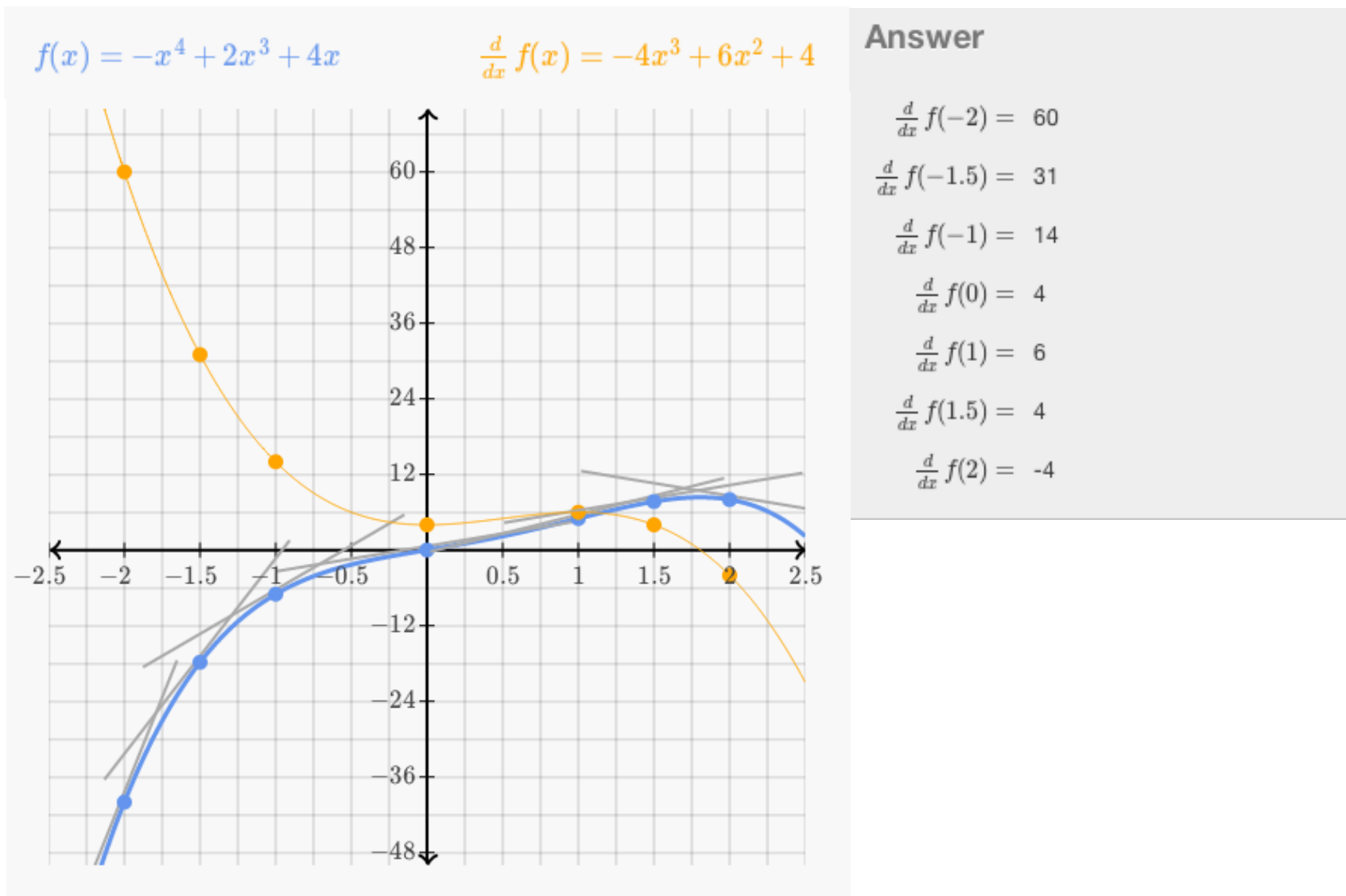
What about these graphs? It would be difficult to come up with the equations. Can you graph their derivatives?



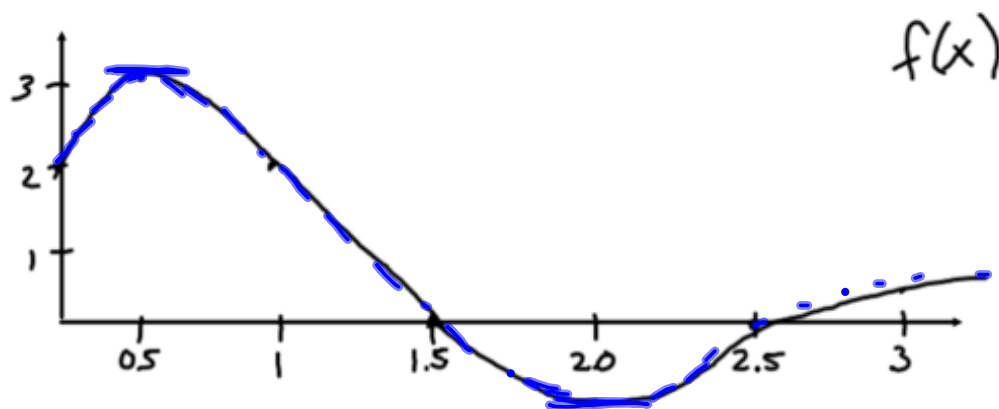
At this time, go to this website on your iPads:

http://www.khanacademy.org/math/calculus/e/derivative_intuition

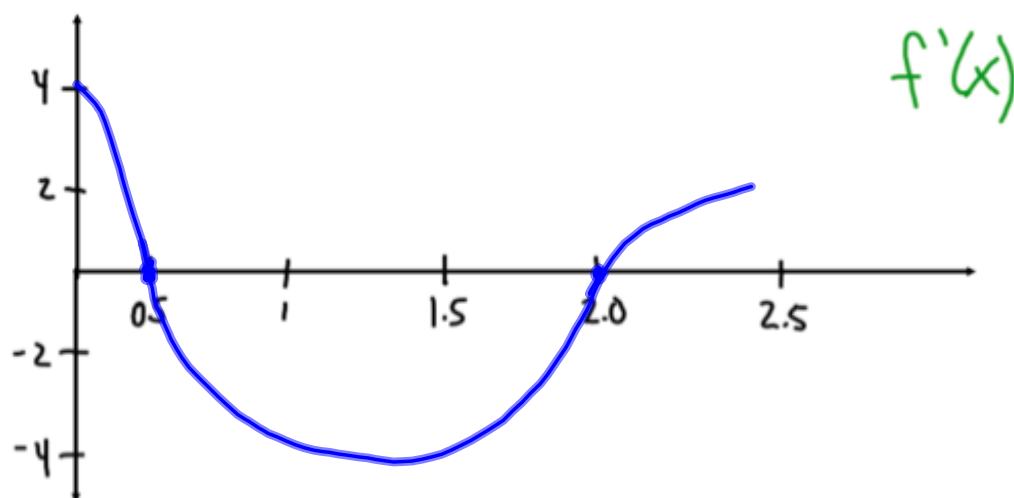
What do you notice about the answer column on the right and the graph?



Example 2: Estimate the slope of the tangent line at various x -values.



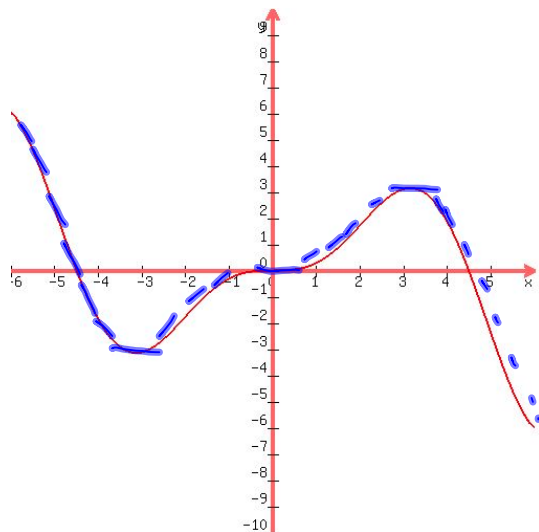
Now graph $f'(x)$ below.



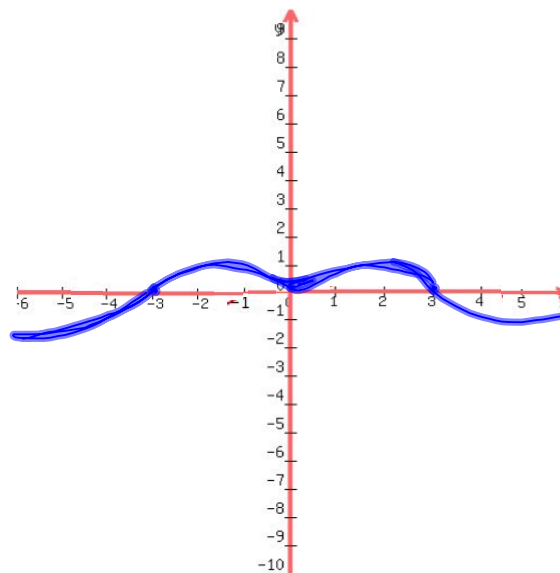
Example 3

Directions: Given the function on the left, graph its derivative on the right.

Graph of $f(x)$



Graph of $f'(x)$



What do you notice about the graph of $f(x)$ when $f'(x)$ is negative?

decreasing

What do you notice about the graph of $f(x)$ when $f'(x)$ is positive?

increasing

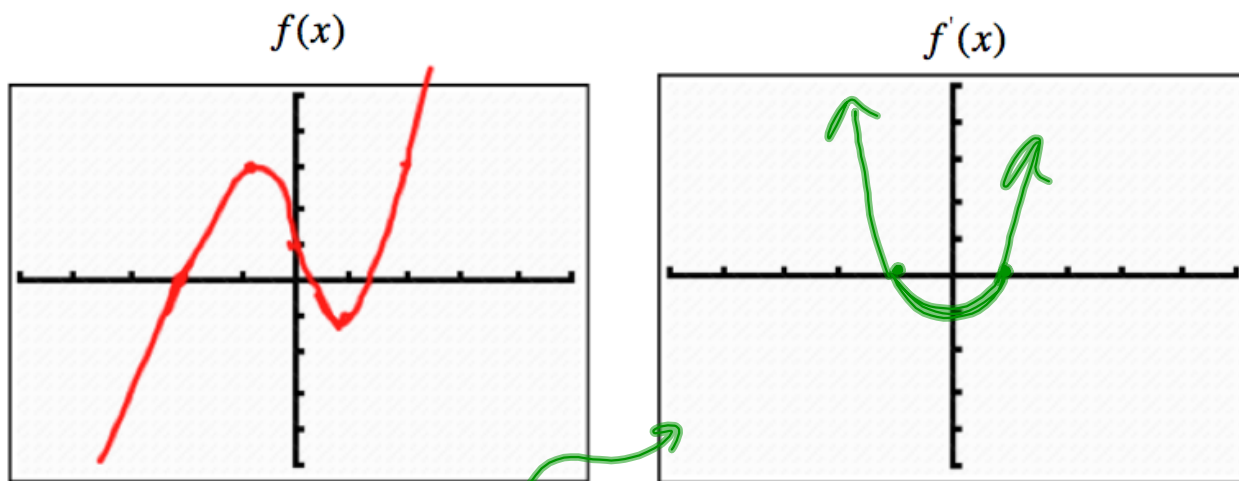
What do you notice about the graph of $f(x)$ when $f'(x)$ is zero?

*horiz tangent
(max/mins)*

The sign of f' tells us whether f is increasing or decreasing.

If f' is...	...then f is
Positive ($f' > 0$)	Increasing
Negative ($f' < 0$)	Decreasing
Zero ($f' = 0$)	Maximum or Minimum <i>usually</i>

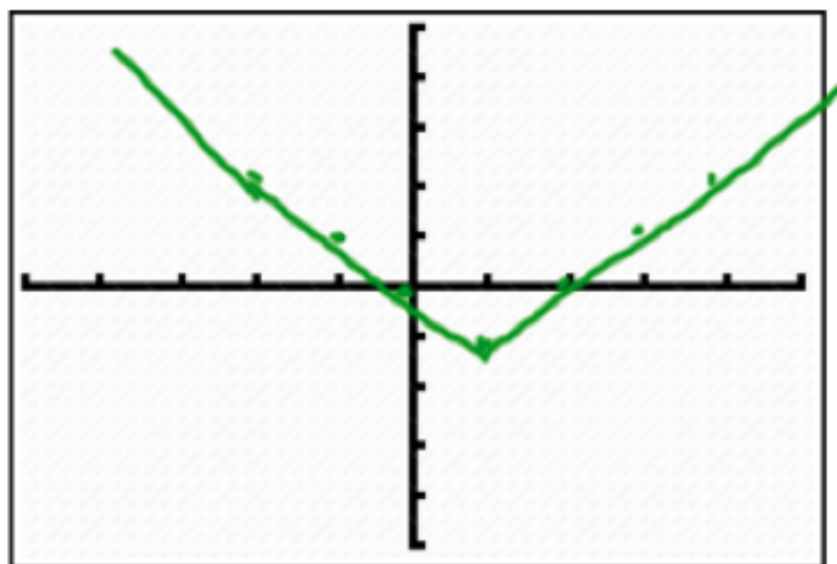
Example 4: Given the graph of $f(x)$, sketch the graph of $f'(x)$.



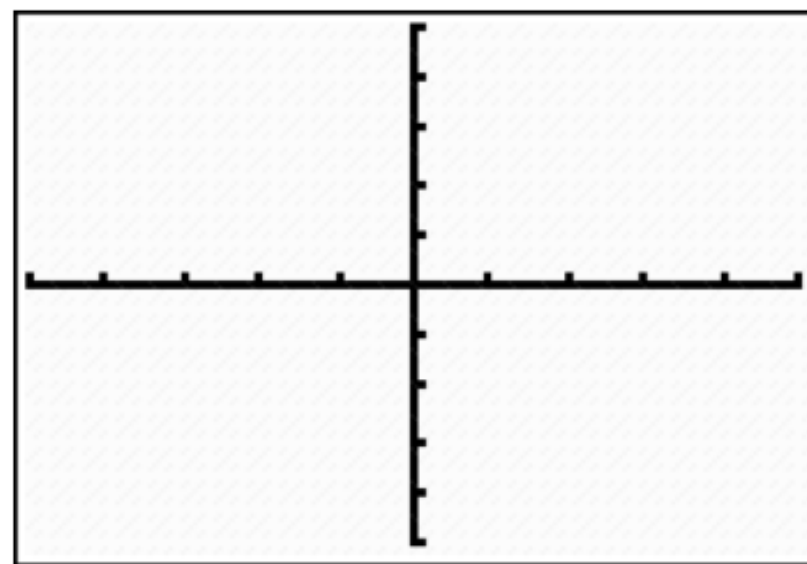
$f(x)$	Interval	$f'(x)$
Inc.	$(-\infty, -1)$	Pos.
max	$x = -1$	0
Dec.	$(-1, 1)$	Neg.
min	$x = 1$	0
Inc.	$(1, \infty)$	Pos.

Example 5: Given the graph of $f(x)$, sketch the graph of $f'(x)$.

$f(x)$

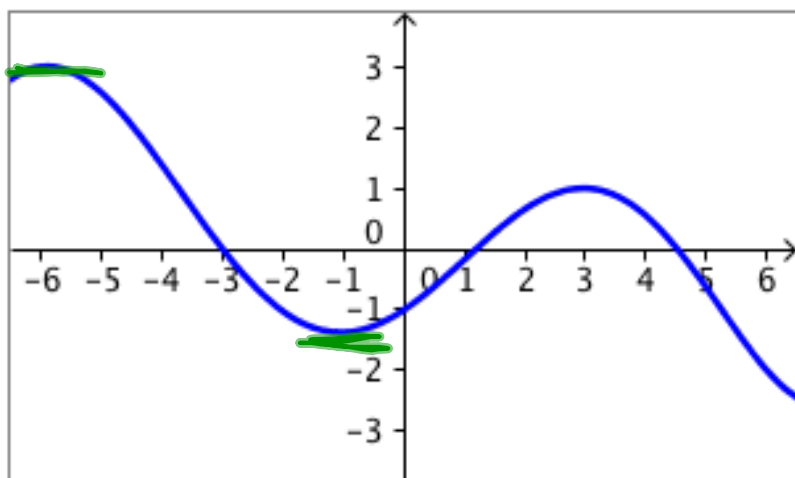


$f'(x)$



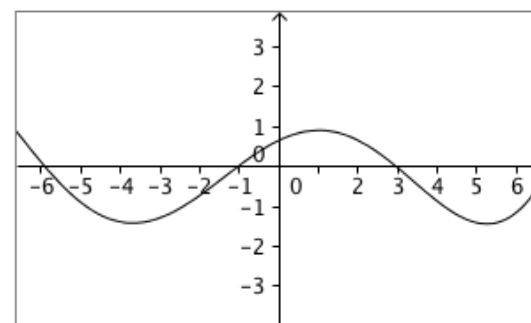
Example 6: Multiple Choice

Which graph on the right is the derivative graph of the function below on the left?

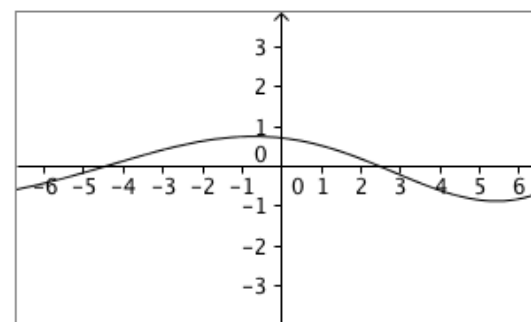


$f(x)$	Interval	$f'(x)$
max	$x = -6$	0
Dec.	$(-6, -1)$	Neg
min	$x = -1$	0

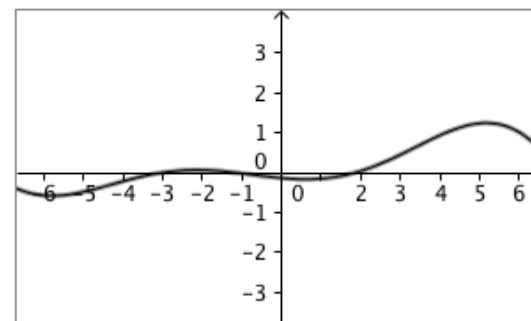
A.



B.

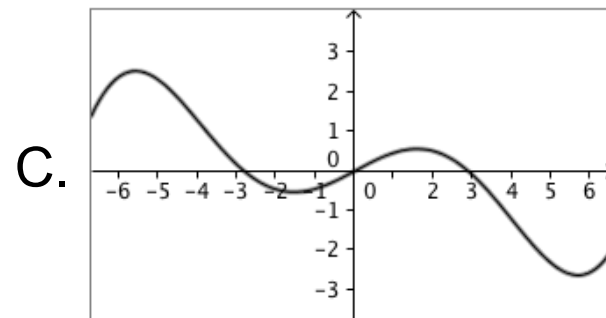
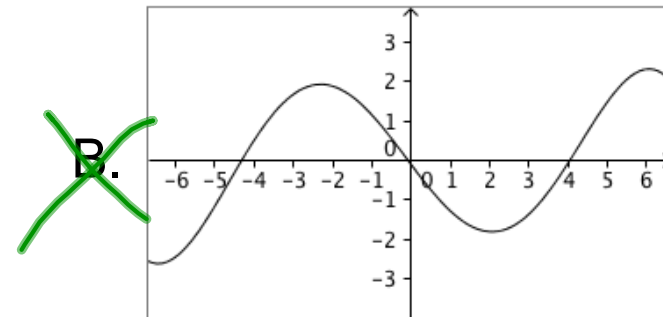
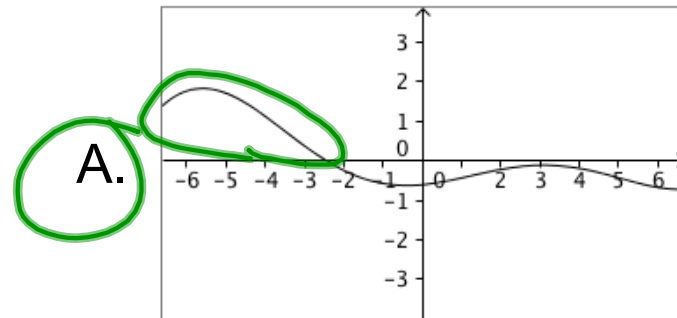
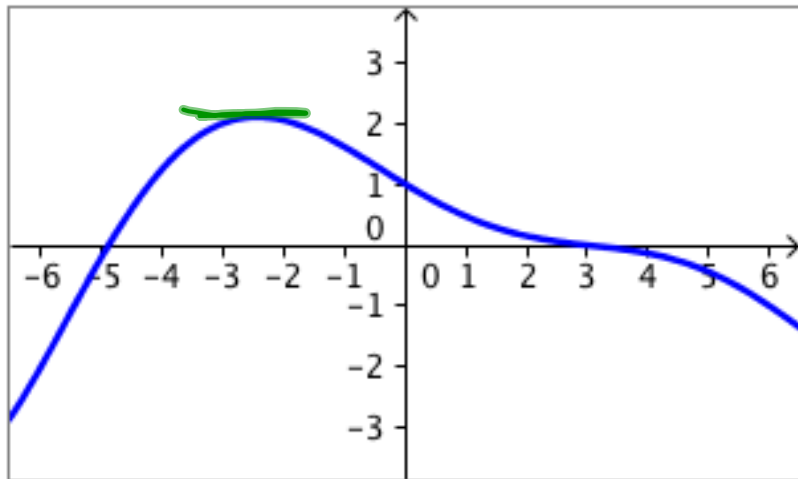


C.



Example 7: Multiple Choice

Which graph on the right is the derivative graph of the function below on the left?

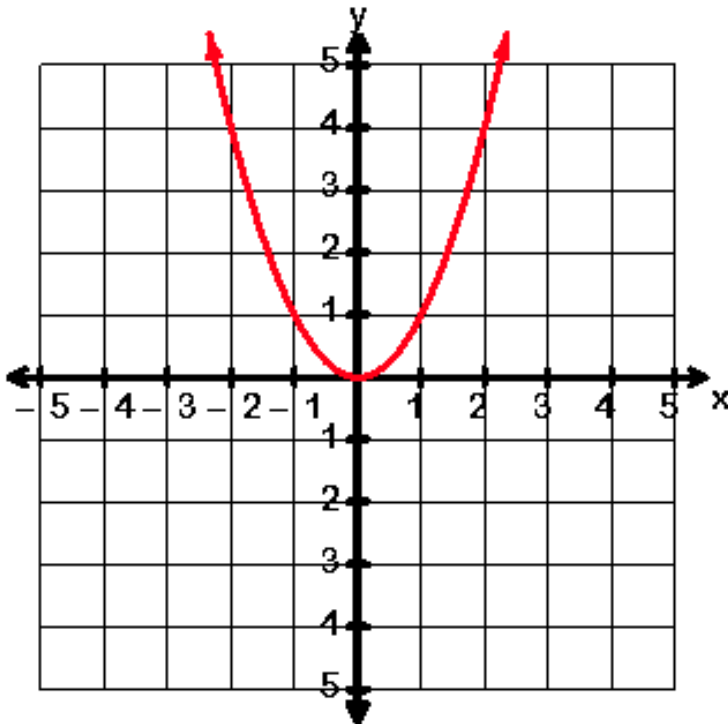


Graphing a Function Given its Derivative Graph

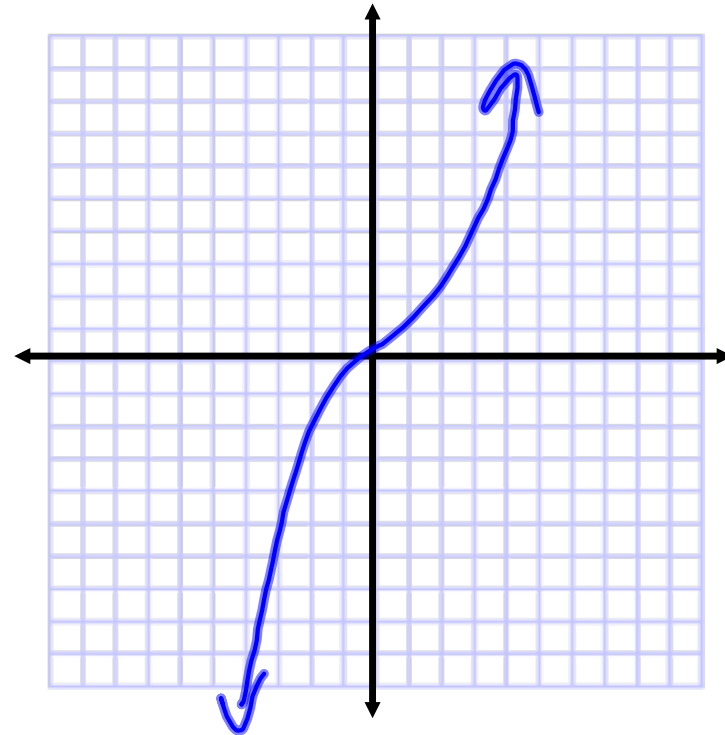
Directions: The function on the left is $f'(x)$. Graph $f(x)$ on the right.

What type of function would $f(x)$ be? *Cubic*

Graph of $f'(x) = x^2$



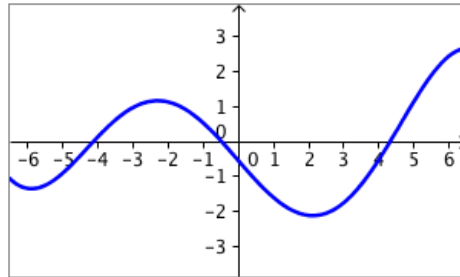
Graph of $f(x) = \frac{1}{3}x^3 + C$



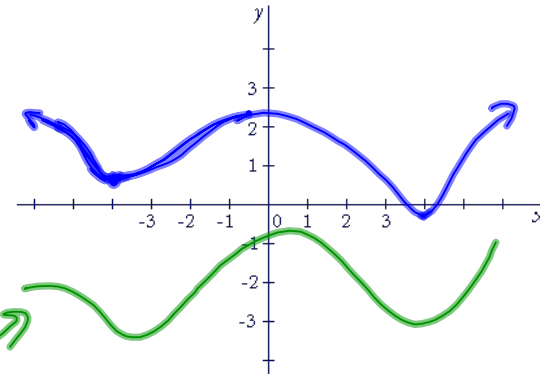
Example 8

Directions: The function on the left is $f'(x)$. Graph $f(x)$ on the right.

Graph of $f'(x)$



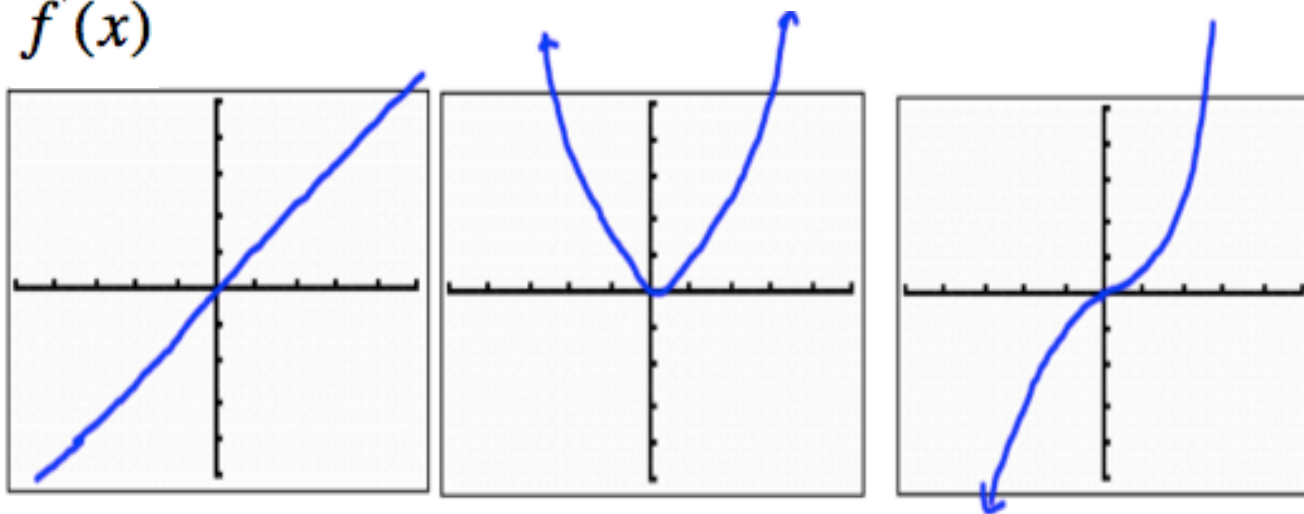
Graph of $f(x)$



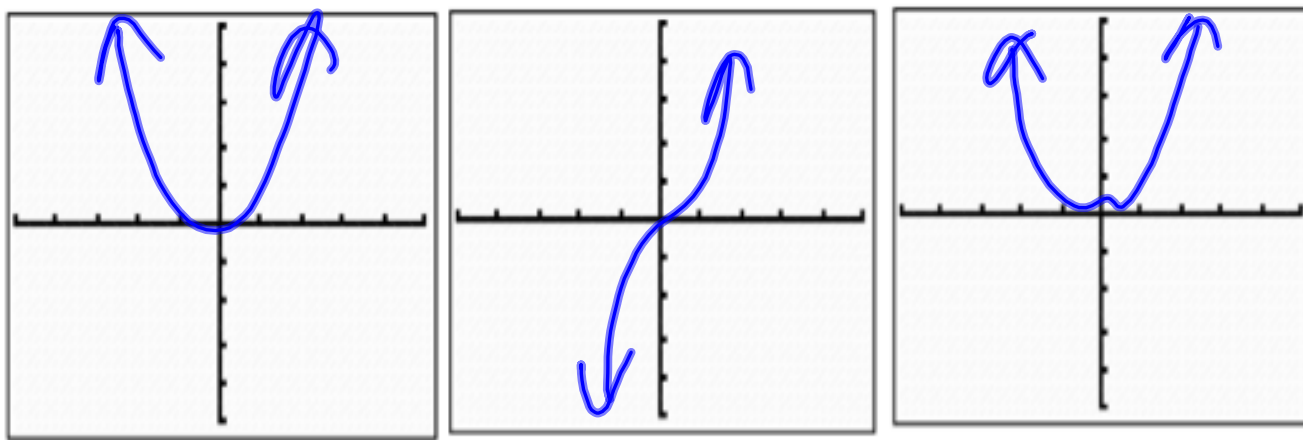
$f'(x)$	Interval	$f(x)$
Neg	$(-\infty, -4)$	Dec.
0	$x = -4$	min.
Pos	$(-4, -\frac{1}{2})$	Inc.
0	$x = -\frac{1}{2}$	max
Neg	$(-\frac{1}{2}, 4)$	Dec.
0	$x = 4$	min.
Pos.	$(4, \infty)$	Inc.

Example 9: Given the graph of the derivative, sketch a possible graph for the function.

$f'(x)$

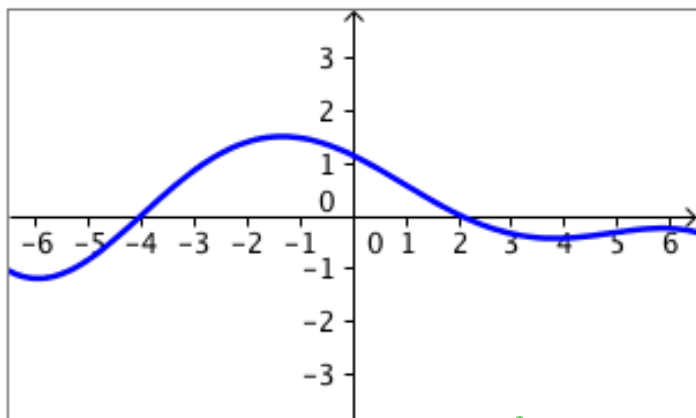


$f(x)$



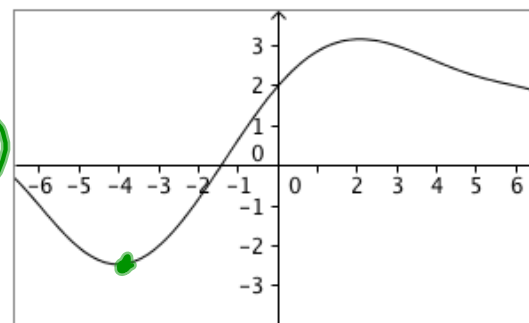
Example 10: Multiple Choice

The function on the left is $f'(x)$. Which graph on the right is $f(x)$?

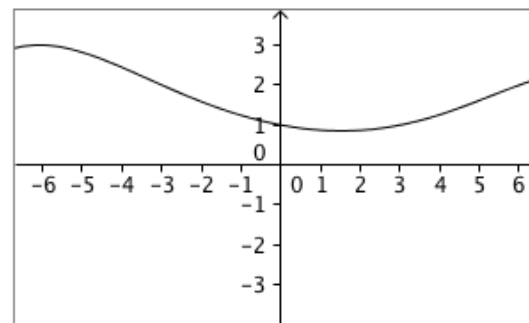


$f'(x)$	Int.	$f(x)$
Neg	$(-\infty, -4)$	Dec.
0	$x = -4$	min.
Pos	$(-4, \infty)$	Inc.

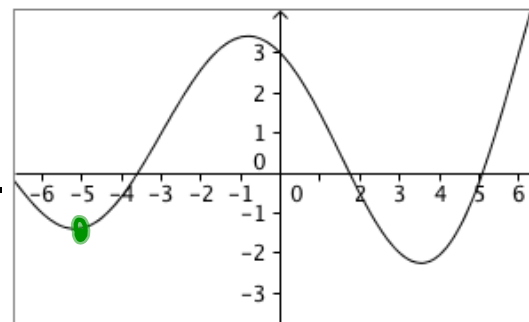
A.



B.

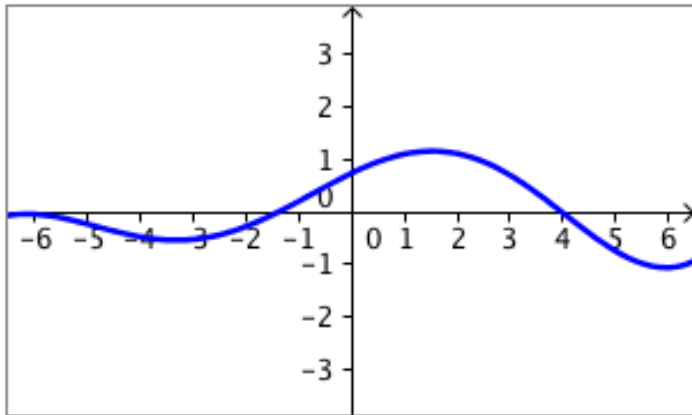


C.

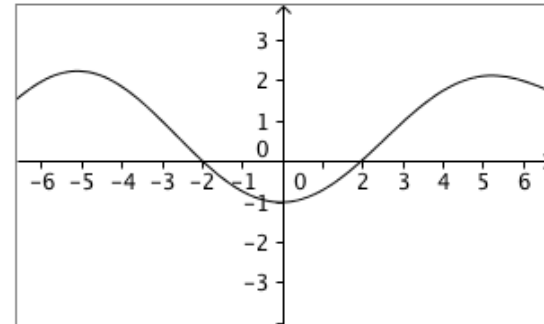


Example 11: Multiple Choice

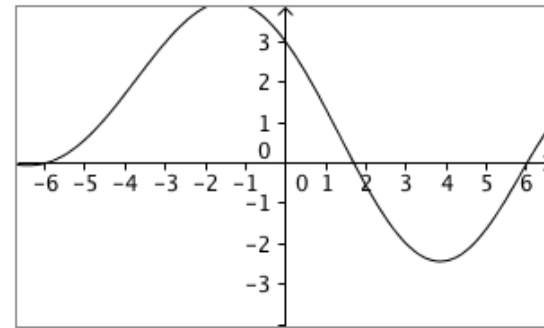
The function on the left is $f'(x)$. Which graph on the right is $f(x)$?



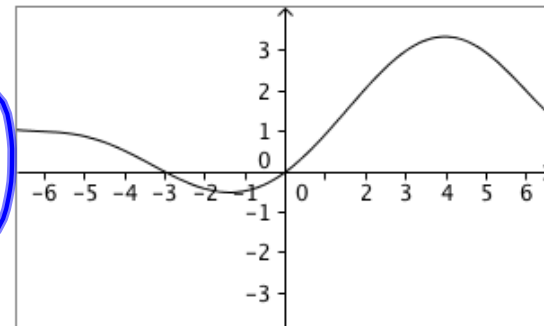
A.



B.



C.



Recalling the Lesson: Fill in the blank.

1. $f'(x)$ is zero when $f(x)$ is max/min.

2. $f(x)$ is increasing when $f'(x)$ is pos.

3. $f'(x)$ is negative when $f(x)$ is decreasing.

Use these websites to practice...

Practice graphing a derivative given the graph of the original function:

http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_try_to_graph.html

Practice graphing an original function given a derivative graph:

http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_app_1_graph_AD.html

Multiple Choice: Graphing a derivative.

http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_matching.html

Multiple Choice: Graphing an original function given a derivative.

http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_matching_antiderivative.html