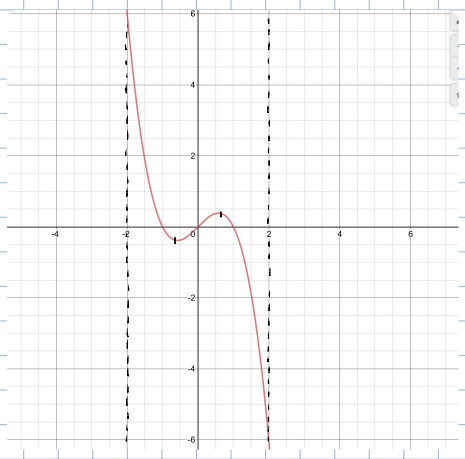
MATH 1A - PROBLEM SET (8)

* PROBLEM 8.1

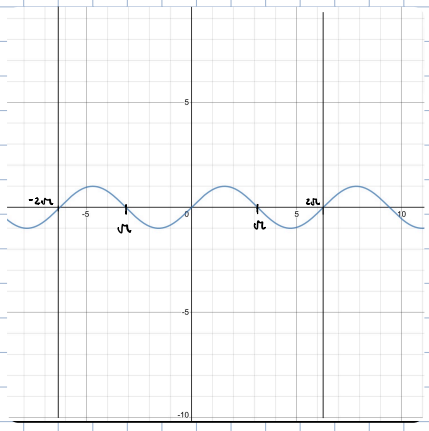
A) $f(x) = -x^3 + x \qquad [-2, 2]$



- INTERVALS IN WHICH THE FUNCTION $f(x) = -x^3 + x$ IS MONOTONICALLY INCREASING ARE:
  $x \in [-1.1, 1.1]$ (APROXIMATELY)

- INTERVALS IN WHICH THE FUNCTION $f(x) = -x^3 + x$ IS MONOTONICALLY DECREASING ARE: (APPROXIMATELY)
  $x \in [-2, -1.1]$
  $x \in [1.1, 2]$

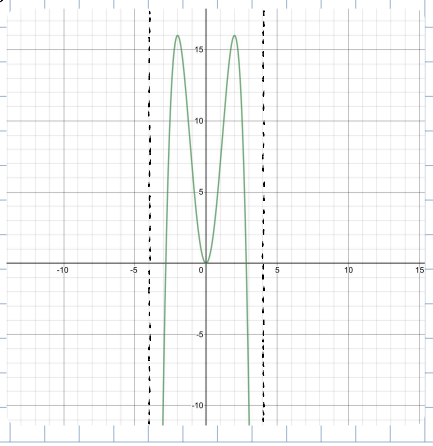
B) $f(x) = \sin(x) \qquad [-2\pi, 2\pi)$



- INTERVALS IN WHICH THE FUNCTION $f(x) = \sin(x)$ IS MONOTONICALLY INCREASING ARE:
  $x \in (-\pi/2, \pi/2)$
  $x \in (-2\pi, -3\pi/4)$
  $x \in (3\pi/4, 2\pi)$

- INTERVALS IN WHICH THE FUNCTION $f(x) = \sin x$ IS MONOTONICALLY DECREASING ARE
  $x \in (-3\pi/4, -\pi/2)$
  $x \in (\pi/2, 3\pi/4)$

C) $f(x) = -x^4 + 8x^2 \qquad [-4, 4]$

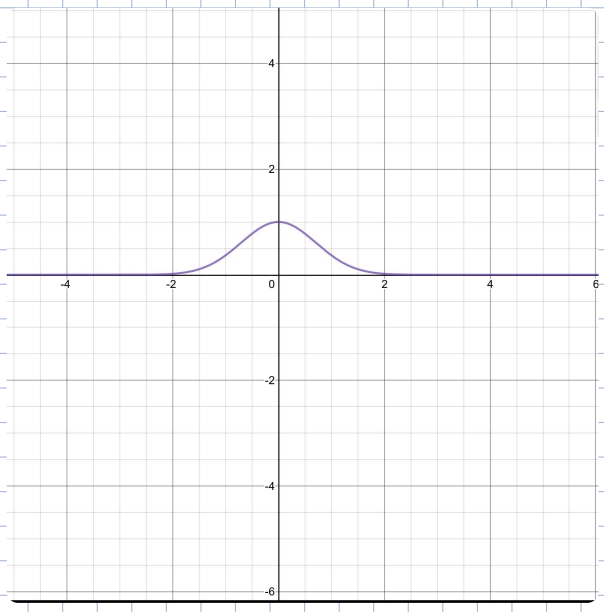


- INTERVALS IN WHICH THE FUNCTION $f(x) = -x^4 + 8x^2$ IS MONOTONICALLY INCREASING ARE
  $x \in (-4, -2)$
  $x \in (0, 2)$

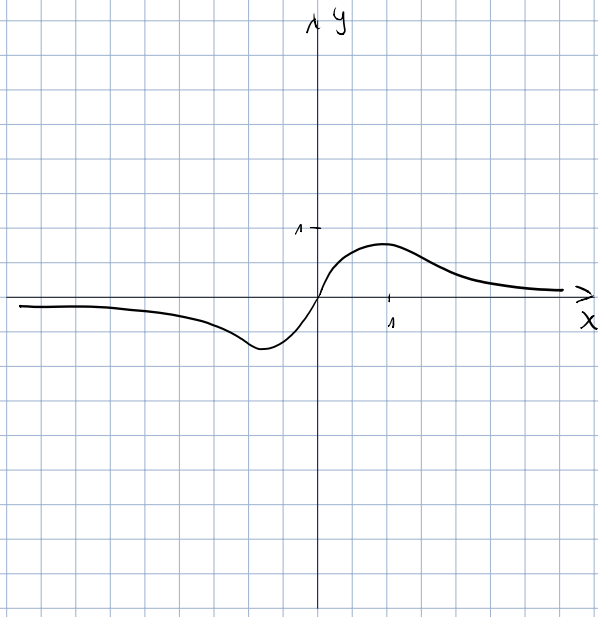
- INTERVALS IN WHICH THE FUNCTION $f(x) = -x^4 + 8x^2$ IS MONOTONICALLY DECREASING ARE:
  $x \in (-2, 0)$
  $x \in (2, 4)$

✈ PROBLEM 8.4

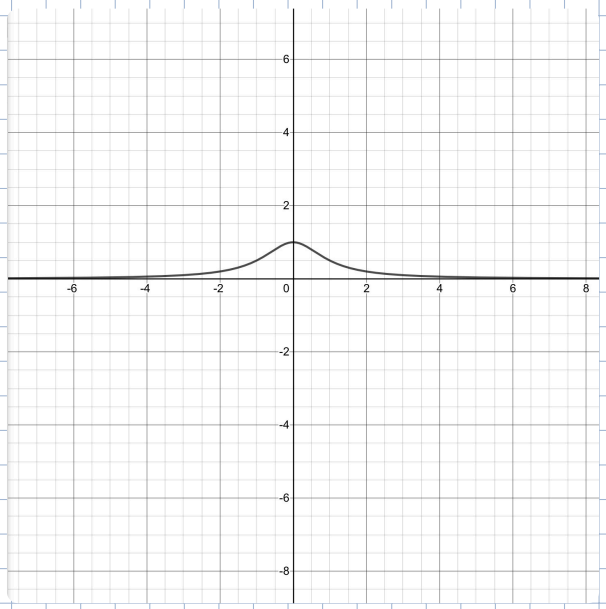
A) $f(x) = e^{-x^2}$ = „TO WHOM THE BELL TOOLS"



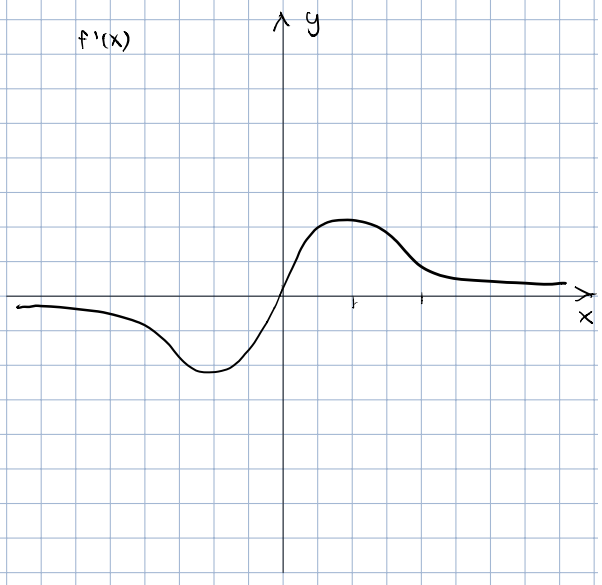
$f'(x) =$



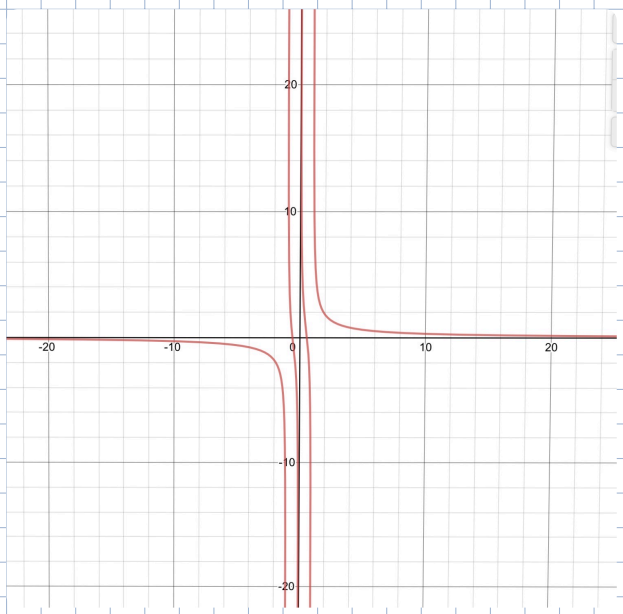
B) $f(x) = \frac{1}{1+x^2}$ = „MARIA AGNESI"

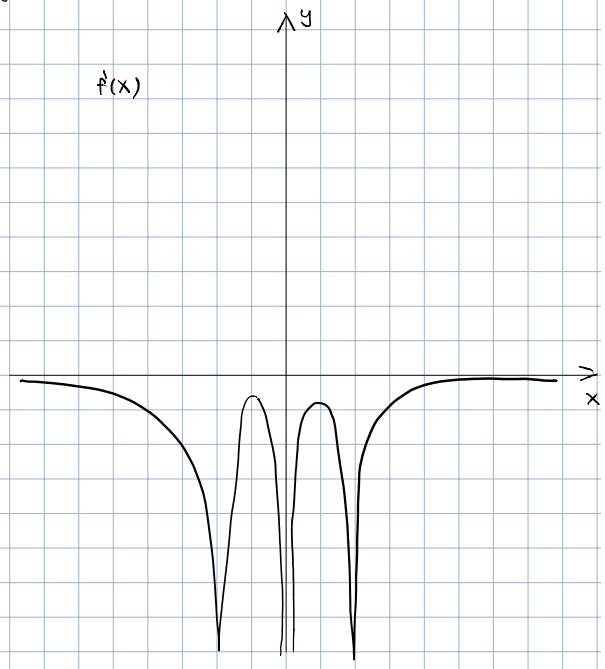


$f'(x)$



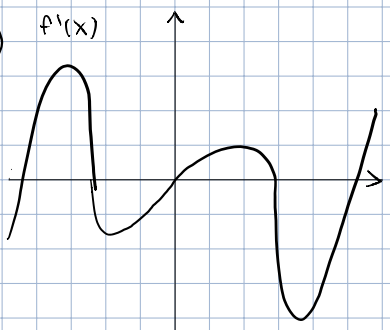
c) $f(x) = \frac{1}{x} + \frac{1}{x-1} + \frac{1}{x+1}$ = THREE GORGES FUNCTION





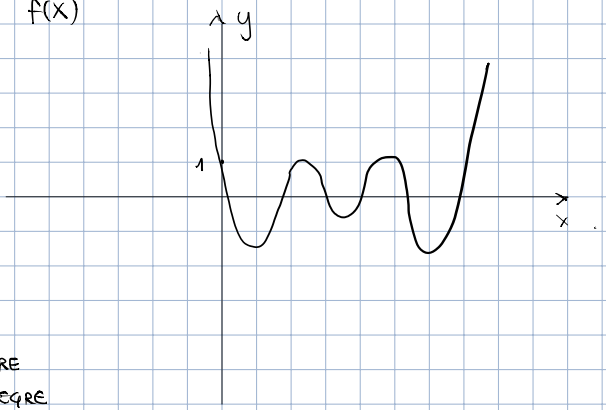
* PROBLEM 8.5

A) f'(x)

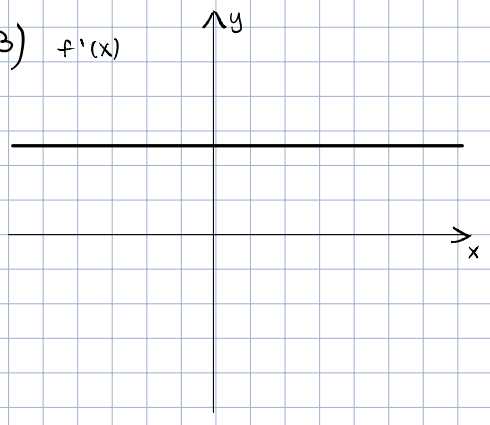


THIS IS A POLYNOMIAL OF 5TH DEGREE
SO THE DERIVATIVE SHOULD BE 6TH DEGREE

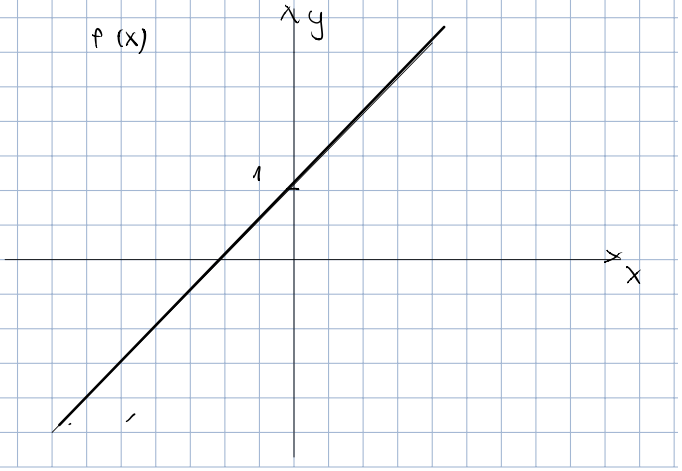
f(x)



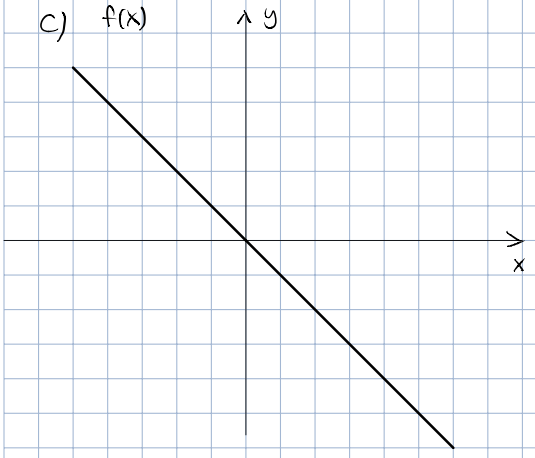
B) f'(x)



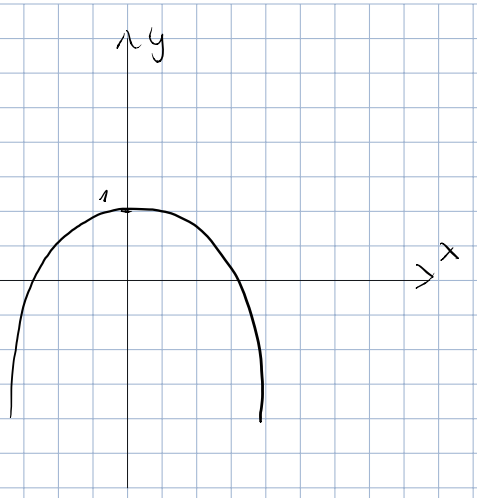
f (x)



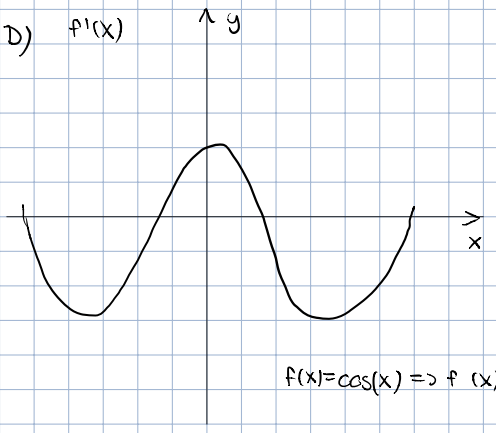
C) f(x)



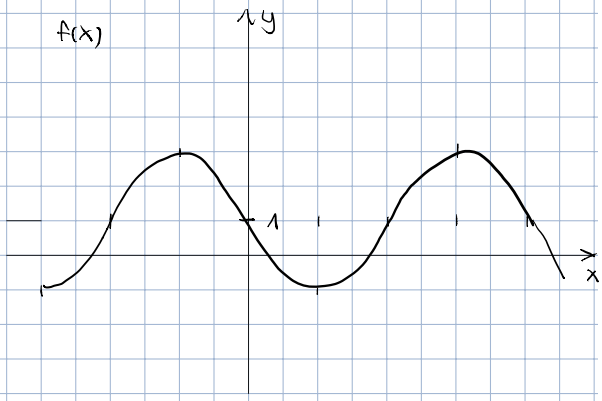
f'(x)



D) f'(x)



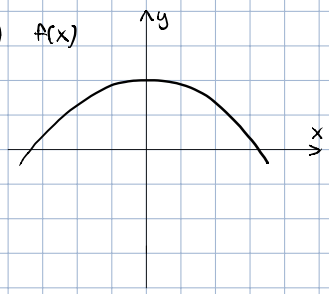
f(x)



$f(x)=\cos(x) \Rightarrow f'(x)=-\sin(x)$

* PROBLEM 8.2

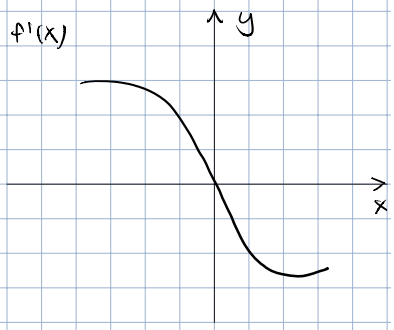
A) f(x)



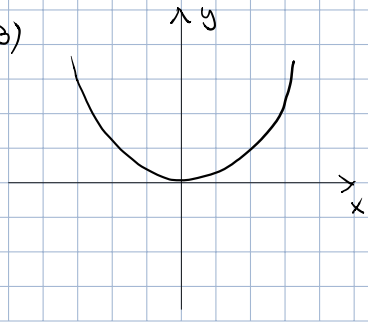
THE FUNCTION IS INCREASING IN THE INTERVAL $[-\infty,0]$ AND DECREASING IN THE INTERVAL $[0,\infty]$, THE DERIVATIVE OF THIS FUNCTION IS POSITIVE ON THE INTERVALS WHERE f(x) IS INCREASING AND NEGATIVE WHERE f(x) IS DECREASING

$\Rightarrow$

2) f'(x)



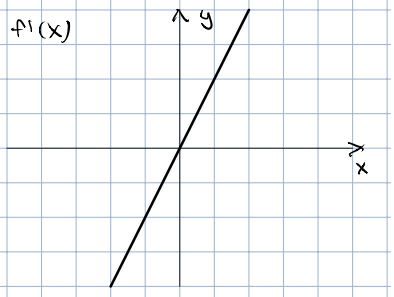
B)



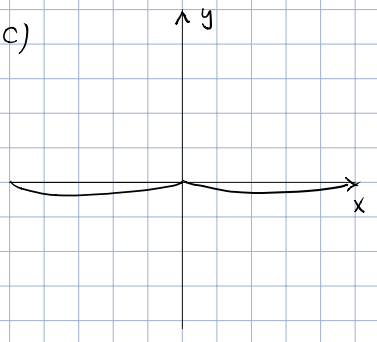
THE FUNCTION IS DECREASING AT THE INTERVAL $[-\infty,0]$ AND INCREASING ON THE INTERVAL $[0,\infty]$. THE DERIVATIVE OF THIS FUNCTION IS POSITIVE ON THE INTERVALS WHERE f(x) IS INCREASING AND NEGATIVE WHERE f(x) IS DECREASING

$\Rightarrow$

3.) f'(x)

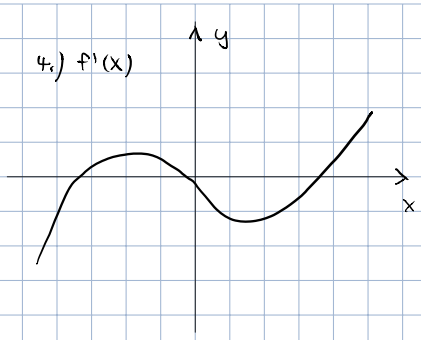


C)

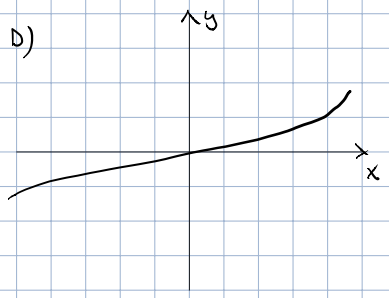


THIS FUNCTION'S DERIVATIVE SHOULD HAVE ROOTS.

4.) $f'(x)$

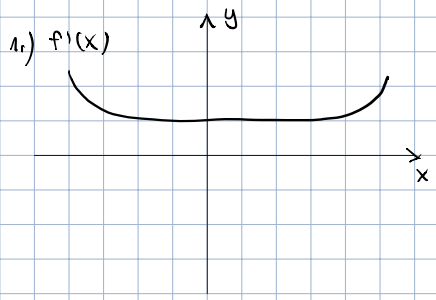


D)



THIS FUNCTION IS ALWAYS MONOTONICALLY INCREASING. THEREFORE, ITS DERIVATIVE IS ALWAYS POSITIVE $\Rightarrow$

1.) $f'(x)$

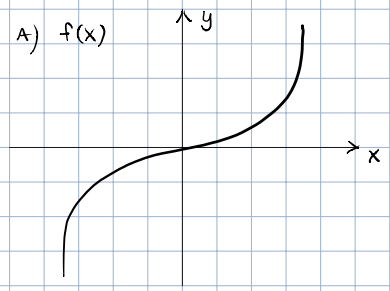


SOLUTION:

A) $\Rightarrow$ 2
B) $\Rightarrow$ 3
C) $\Rightarrow$ 4
D) $\Rightarrow$ 1

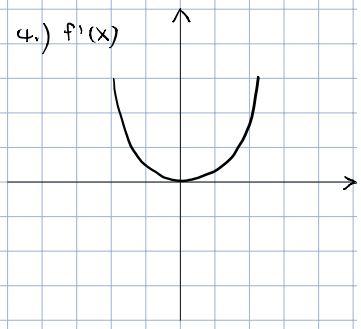
* PROBLEM 8.3

A) $f(x)$

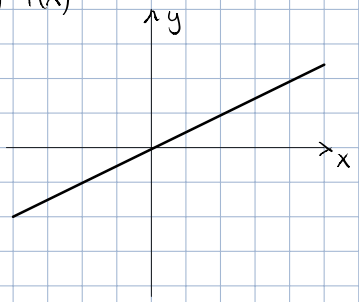


THIS FUNCTION IS MONOTONICUSLY GROWING ALL THE TIME. THEREFORE ITS DERIVATIVE SHOULD ALWAYS BE POSITIVE. THIS FUNCTION LOOKS LIKE A POLYNOMAL OF THIRD DEGRE. $\Rightarrow$ THERFORE, ITS DERIVATIVE SHOULD LOOK LIKE A POLYNOMAL OF SECOND DEGRE.

4.) $f'(x)$

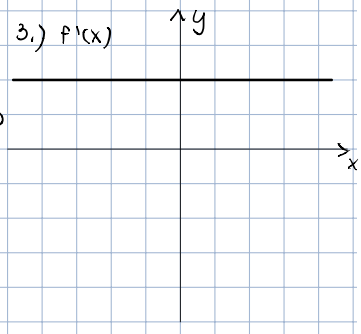


B) $f(x)$

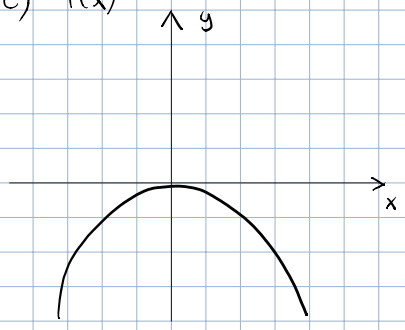


THIS FUNCTION IS A LINEAR FUNCTION THAT IS MONOTONICUSLY GROWING. $\Rightarrow$ THEREFORE ITS DERIVATIVE SHOULD BE A POSITIVE CONSTANT.

3.) $f'(x)$

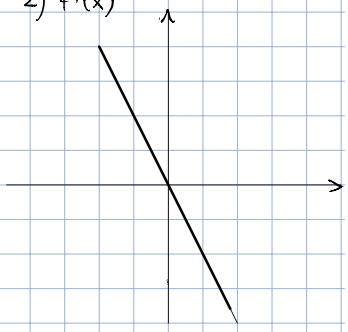


C) f(x)

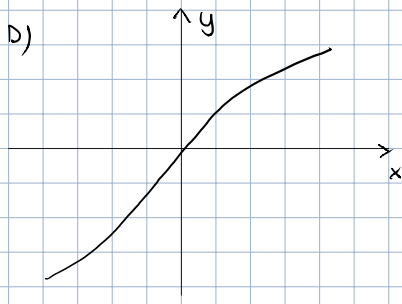


THIS FUNCTION IS A POLYNOMAL OF 2ND DEGRE. IT IS MONOTONICUSLY INCREASING IN THE INTERVAL $[-\infty, 0]$. IT IS MONOTONICUSLY DECREASING IN THE INTERVAL $[0, \infty]$. ITS DERIVATIVE SHOULD BE A LINEAR FUNCTION THAT IS POSITIVE ON THE INTERVALS WHERE f(x) IS INCREASING AND NEGATIVE WHERE IT IS DECREASING. =>

2) f'(x)

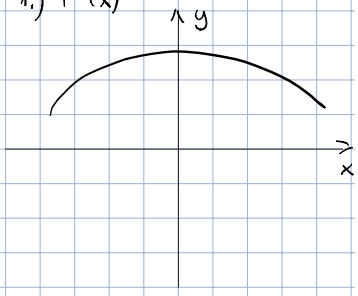


D)



THIS FUNCTION IS MONOTONICUSLY GROWING ALL THE TIME. THEREFORE ITS DERIVATIVE SHOULD ALWAYS BE POSITIVE. THIS FUNCTION LOOKS LIKE A POLYNOMAL OF THIRD DEGRE. => THERFORE, ITS DERIVATIVE SHOULD LOOK LIKE A POLYNOMAL OF SECOND DEGRE.

1.) f'(x)



SOLUTION:

A) => 4.
B) => 3.
C) => 2.
D) => 1.