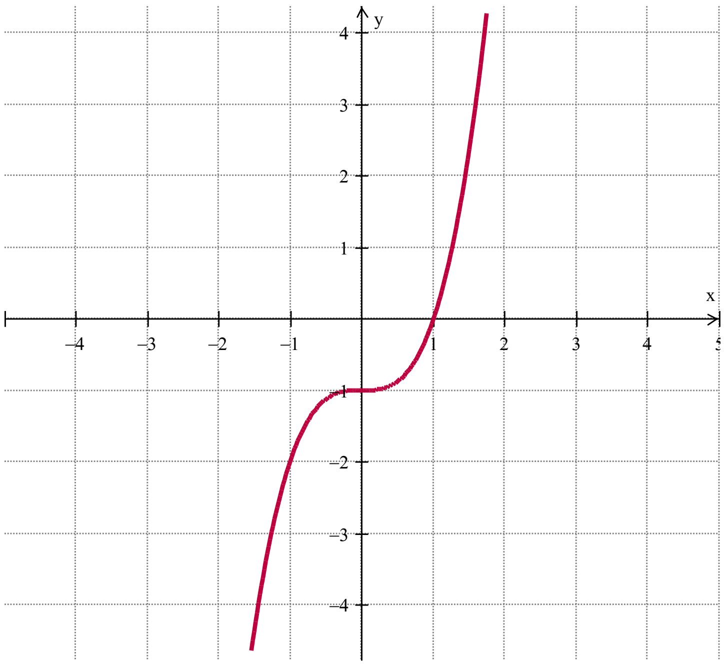


$f(x) = x^3 - 1$

The derivative of this function, which we write $f'(x)$, will be a function which will tell us (graphically) what the ______________________________. This is the same as understanding that we are finding the ***instantaneous rate of change.***

To find the derivative at any x-value, we first must find two points near each other… close to our x value.

These two points are going to be:

(,   ) and (,   ).

Now since we know that the instantaneous rate of change is *approximated* by the ________________________________, we might want to begin there.

The **average rate of change** between the two points is:

However, we know this is just an approximation. To get our approximation more and more exact, what do we need to do?

Thus, we can say the **instantaneous rate of change** at any x value i

Now we have a lot of algebra to do. Flip to the other side and do it.

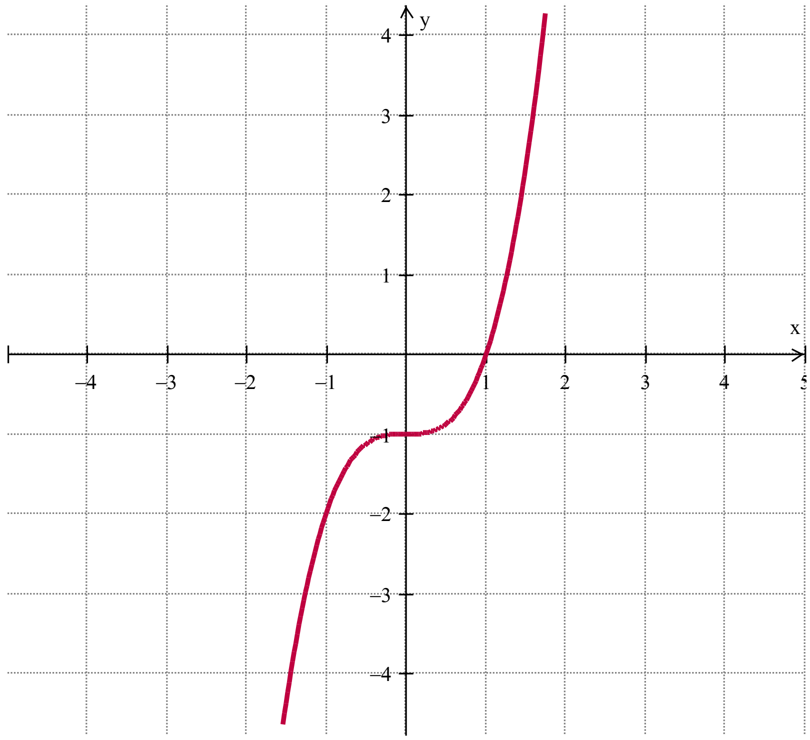
CAUTION: When working these problems out, people *forget* the meaning of what it is they are doing. Make sure your work supports your understanding. *Think* about what you're writing – don't be a robot!

What is the slope of the tangent line of $f(x) = x^3 - 1$ at $x = 0$?

What is $f'(-1)$?

Draw the tangent line at $x = 0$ and **estimate** the slope. Does it match your "theoretical" prediction

Draw the tangent line at $x = 1$. Does it match your "theoretical" prediction

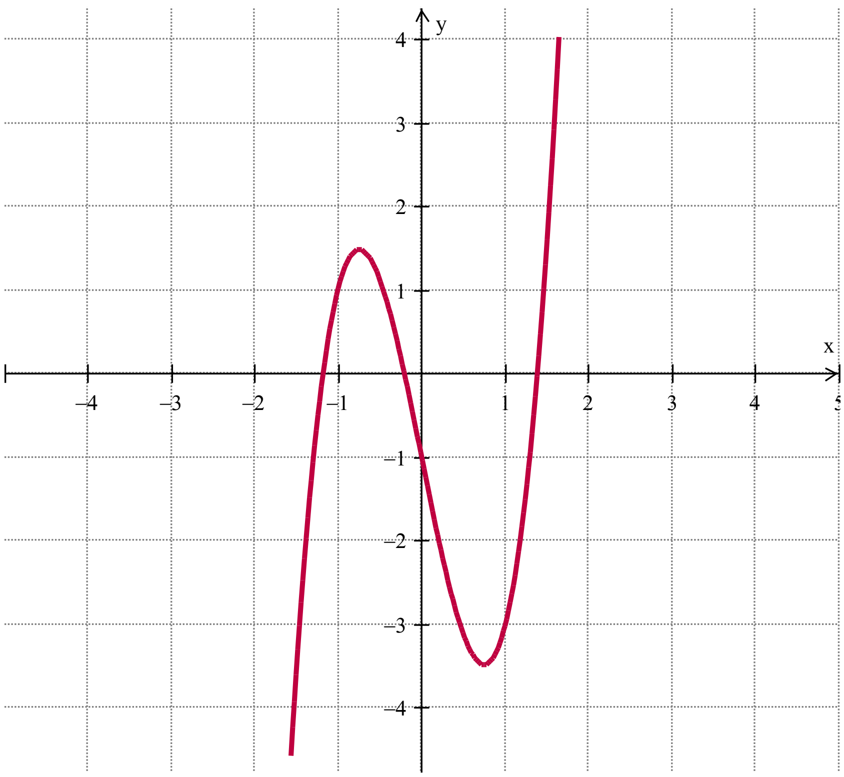


Imagine if we used the function $f(x) = x^3 + 10$ instead. How would that change your answer to the slope of the tangent line at $x = -1$?

Home Enjoyment

0. In your work above, **why** are you allowed to "cancel" out the *h*?

1. Find the **derivative** of $f(x) = 3x^3 - 5x - 1$. Be sure to write out the two points, the average rate of change, and **then** the instantaneous rate of change.



Draw a tangent line at $x = 0$, $x = 1$, and $x = -0.8$. Use those lines to estimate the derivatives at those points:

Estimate at $x = 0$:

Estimate at $x = 1$:

Estimate at $x = -0.8$:

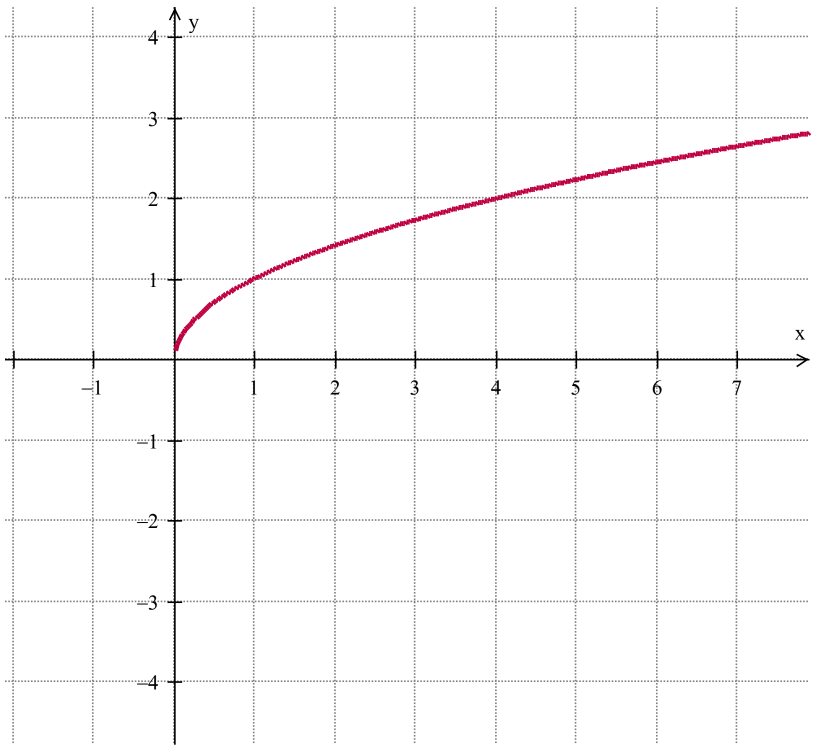
Use the derivative function you calculated above to say what the derivative is **exactly** at these points:

$f'(0) =$

$f'(1) =$

$f'(-0.8) =$

2. Find the **derivative** of $f(x)=\sqrt{x}$. Be sure to write out the two points, the average rate of change, and **then** the instantaneous rate of change.



Draw a tangent line at $x=0$, $x=1$, and $x=4$. Use those lines to estimate the derivatives at those points:

Estimate at $x=0$:

Estimate at $x=1$:

Estimate at $x=4$:

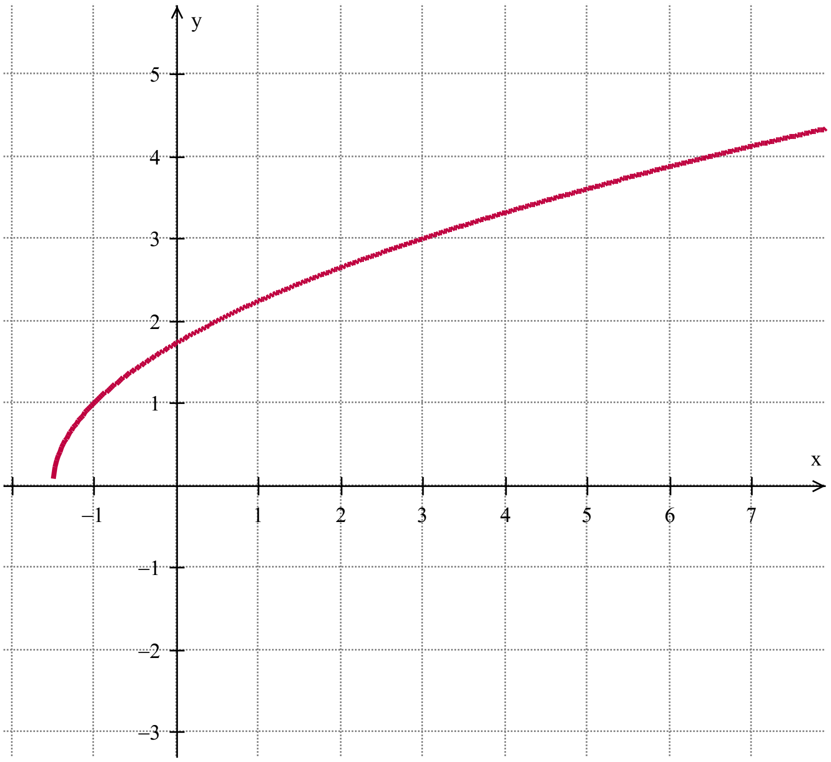
Use the derivative function you calculated above to say what the derivative is **exactly** at these points:

$f'(0)=$

$f'(1)=$

$f'(4)=$

3. Find the **derivative** of $f(x)=\sqrt{2x+3}$. Be sure to write out the two points, the average rate of change, and **then** the instantaneous rate of change.



Draw a tangent line at $x=-1$, $x=2$, and $x=6$. Use those lines to estimate the derivatives at those points:

Estimate at $x=-1$:

Estimate at $x=2$:

Estimate at $x=6$:

Use the derivative function you calculated above to say what the derivative is **exactly** at these points:

$f'(-1)=$

$f'(2)=$

$f'(6)=$