Calculus Lesson #2b
The Derivative of the Square Root Function

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The four-step method

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Step 1: Find $f(x + \Delta x)$.

Step 2: Subtract $f(x)$.

Step 3: Divide by Δx.

Step 4: Evaluate the limit as Δx approaches 0.

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Now, $(A - B)(A + B) = A^2 - B^2$!!!

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$$= \frac{(\sqrt{x+\Delta x})^{2}}{}$$

Now, $(A \text{ ï } B)(A + B) = A^2 \text{ ï } B^2$!!!

Clearly, we can not divide now. The technique that is needed is called órationalizing the numeratorô. It looks like this.

The Derivative of the Square Root Function

Consider the function $y = f(x) = \sqrt{x}$.

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$$\mathbf{f'(x)} = \lim_{\Delta x \to 0}\left[\frac{\mathbf{f(x + \Delta x) - f(x)}}{\mathbf{\Delta x}}\right]$$

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$$= (\sqrt{x + \Delta x})^2 - (\sqrt{x})^2$$

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Step 1: Find $f(x + \Delta x)$. $\quad f(x + \Delta x) = \sqrt{x + \Delta x}$

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Step 4: Evaluate the limit as Δx approaches 0.

The Derivative of the Square Root Function

Consider the function $y = f(x) = \sqrt{x}$.

According to the definition of derivative,

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$\mathbf{f'(x)} =$

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($\Delta x \to$ 0)

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0

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($\Delta x \to 0$)

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0

The Derivative of the Square Root Function

Consider the function $y = f(x) = \sqrt{x}$.

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The Derivative of the Square Root Function

$$y = f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

The Derivative of the Square Root Function

$$y = f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

Consider the graph of the square root function.

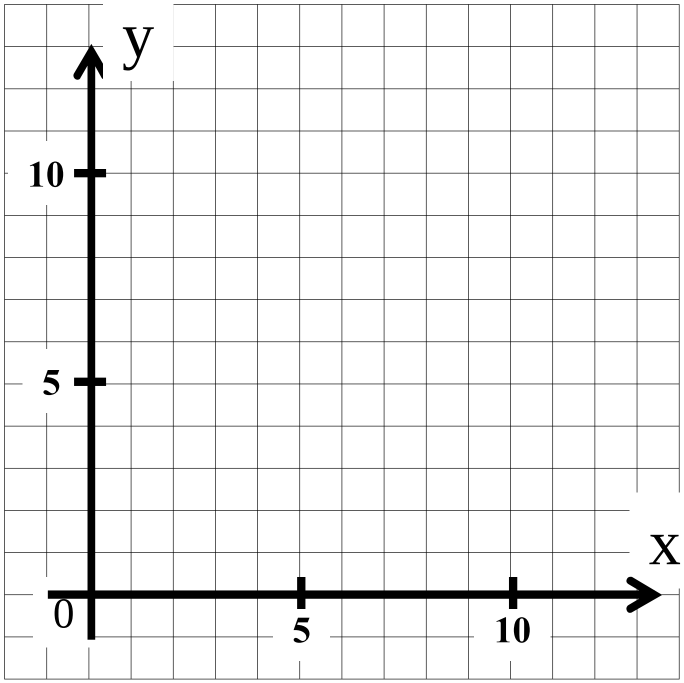
The Derivative of the Square Root Function

$$y = f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

Consider the graph of the square root function.

x	f(x)



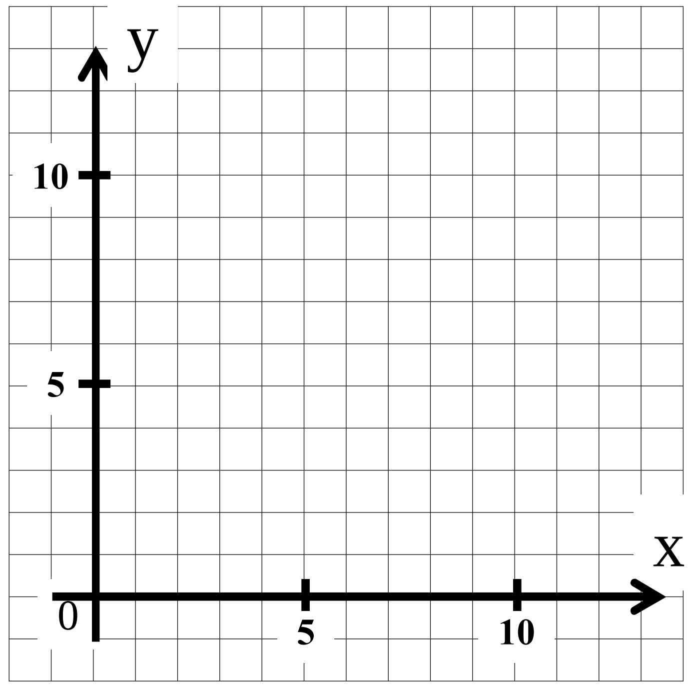
The Derivative of the Square Root Function

$$y = f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

Consider the graph of the square root function.

x	f(x)
0	



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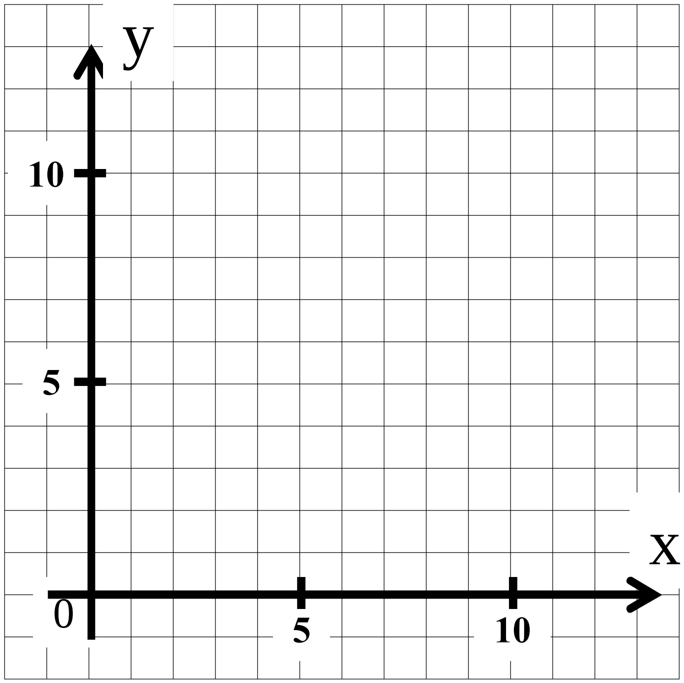
0	0



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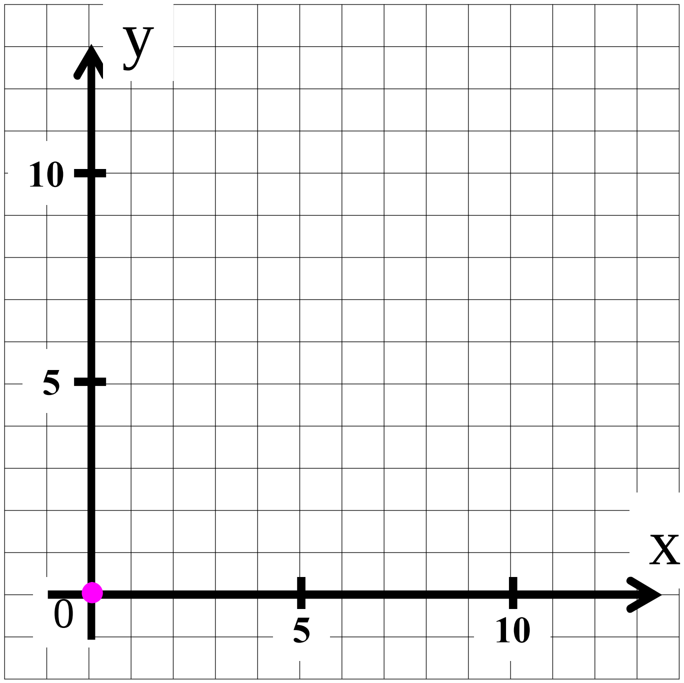
0	0



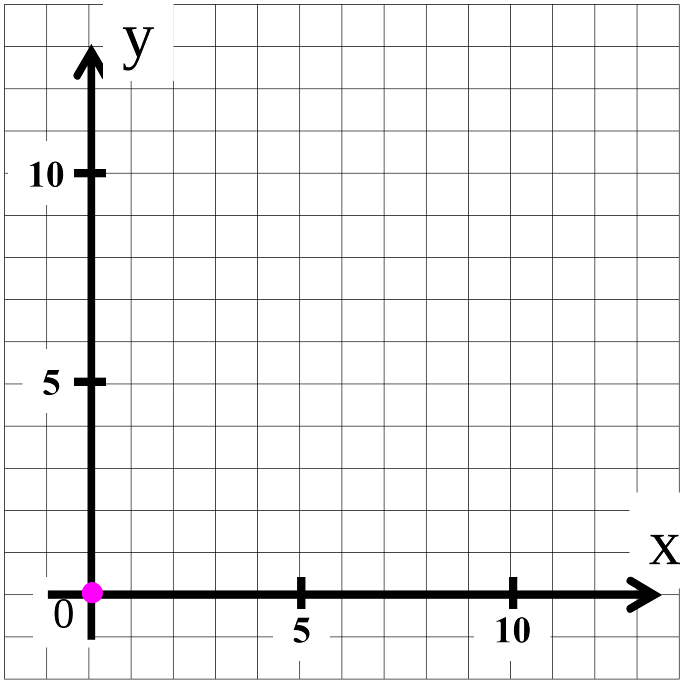
The Derivative of the Square Root Function

$$y = f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

Consider the graph of the square root function.

x	f(x)
0	0
1	



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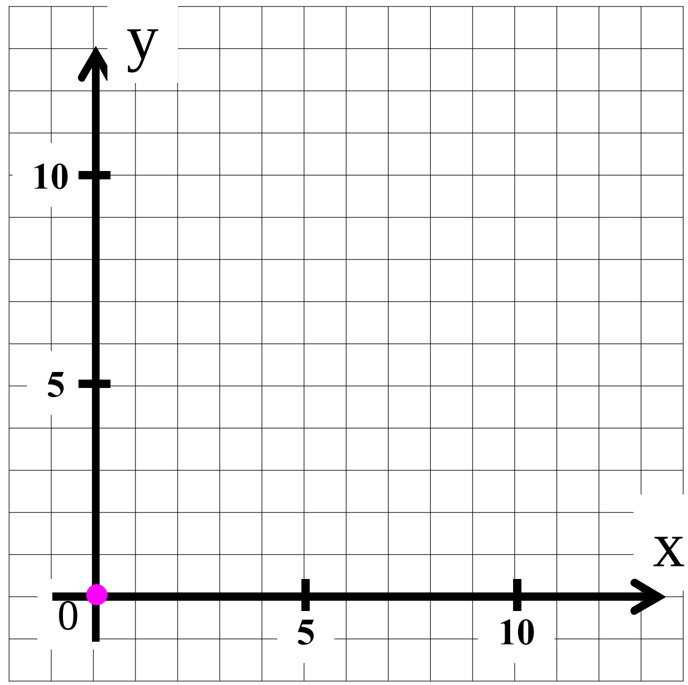
x	f(x)
0	0
1	1



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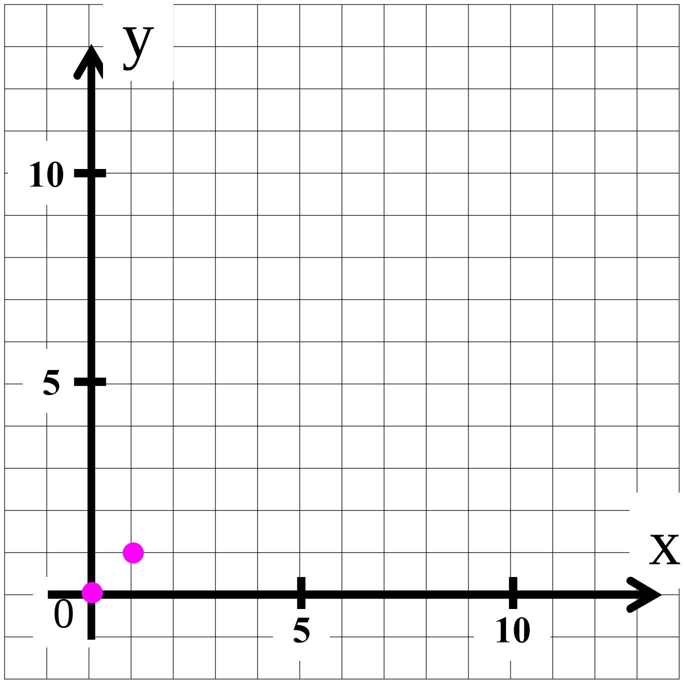
1	1



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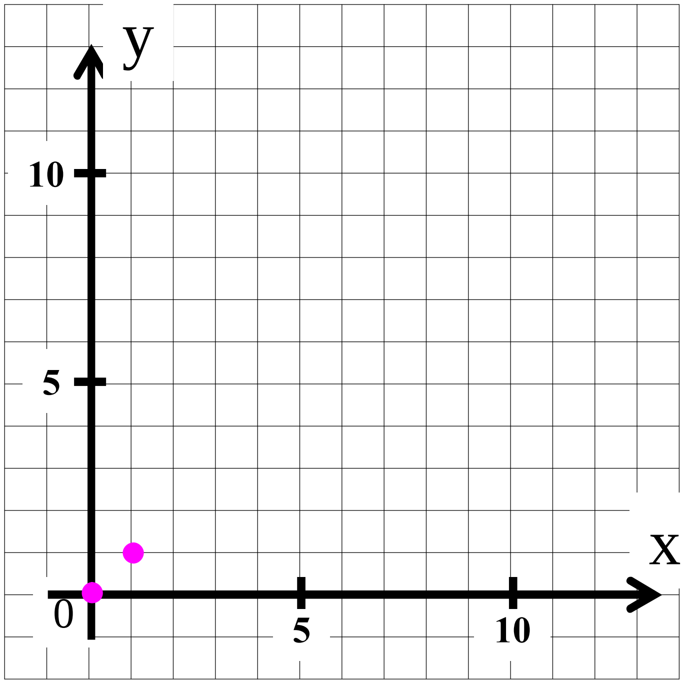
x	f(x)
0	0
1	1
4	



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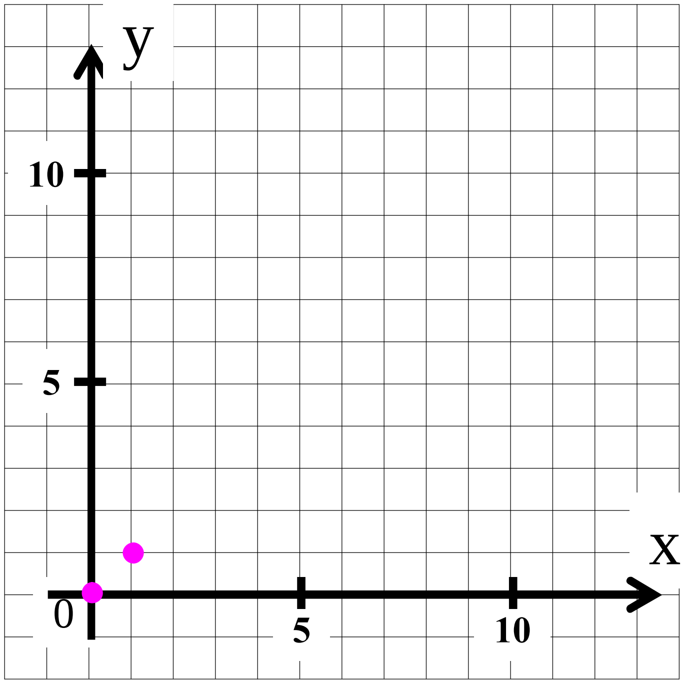
Consider the graph of the square root function.

x	f(x)
0	0
1	1
4	2



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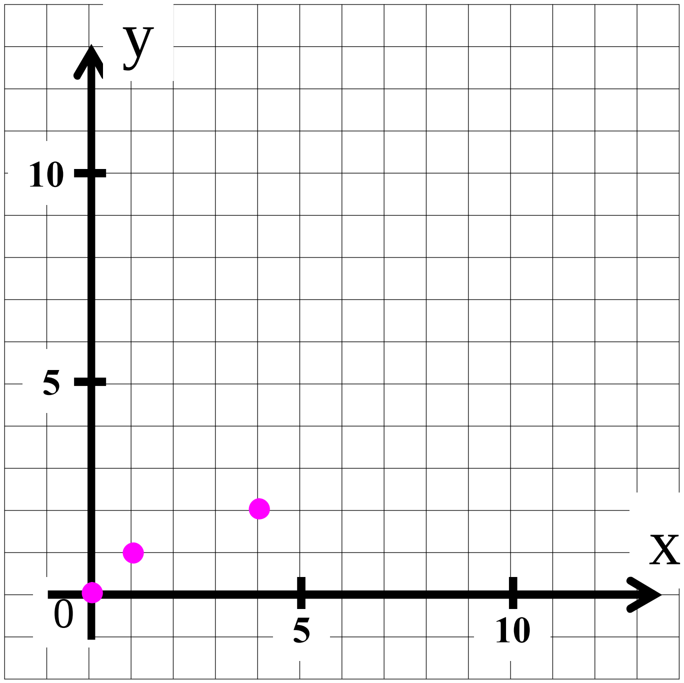
x	f(x)
0	0
1	1
4	2

Consider the graph of the square root function.



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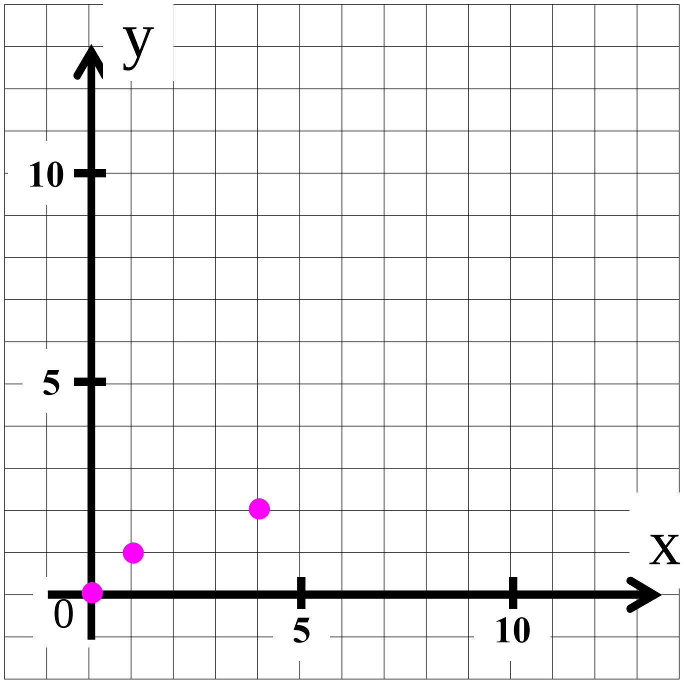
Consider the graph of the square root function.

x	f(x)
0	0
1	1
4	2
9	



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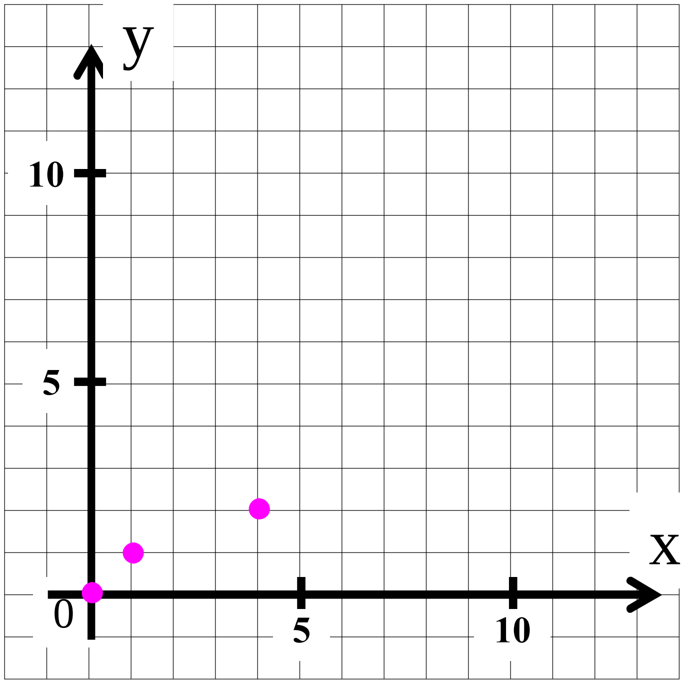
x	f(x)
0	0
1	1
4	2
9	3



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4	2
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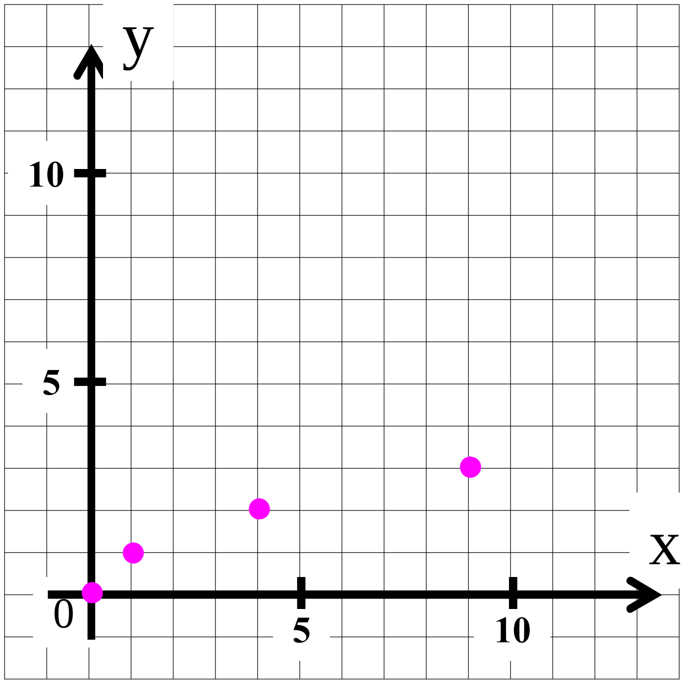

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x	f(x)
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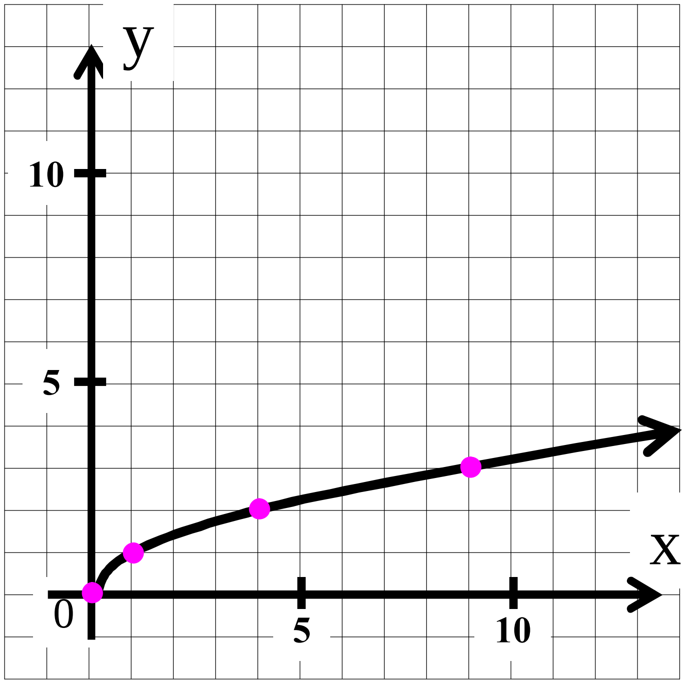
1	1
4	2
9	3



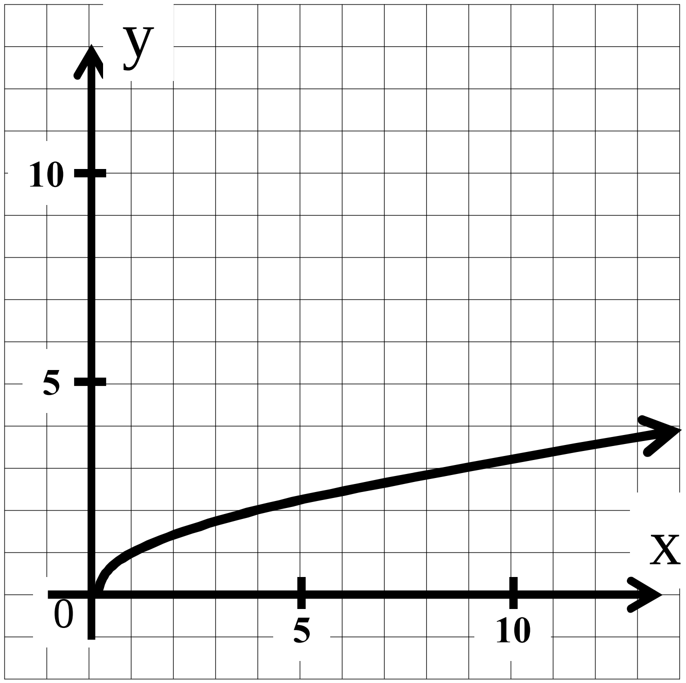
The Derivative of the Square Root Function

$$y = f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

Consider the graph of the square root function.
Now consider derivative function.

x	f(x)
0	0
1	1
4	2
9	3



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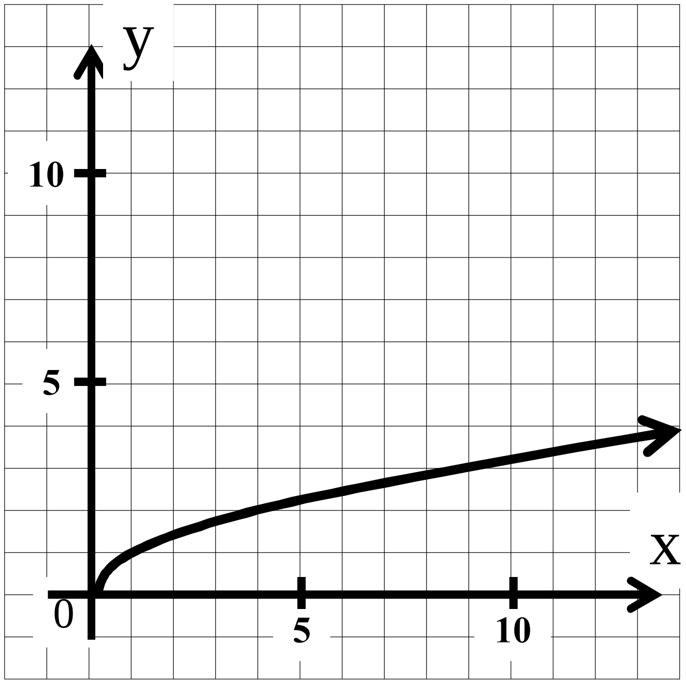
x	f(x)	f ′(x)
0	0	
1	1	
4	2	
9	3	



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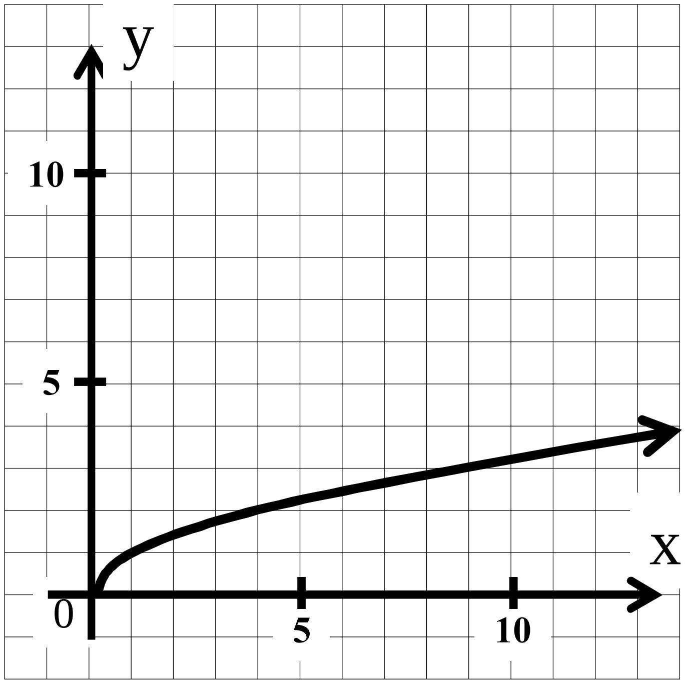
0	0	
1	1	
4	2	
9	3	



Remember, the derivative gives the slope of the tangent line.

The Derivative of the Square Root Function

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$f'(x) = \dfrac{1}{2\sqrt{x}}$

Consider the graph of the square root function.
Now consider derivative function.

x	f(x)	f ′(x)
0	0	
1	1	
4	2	
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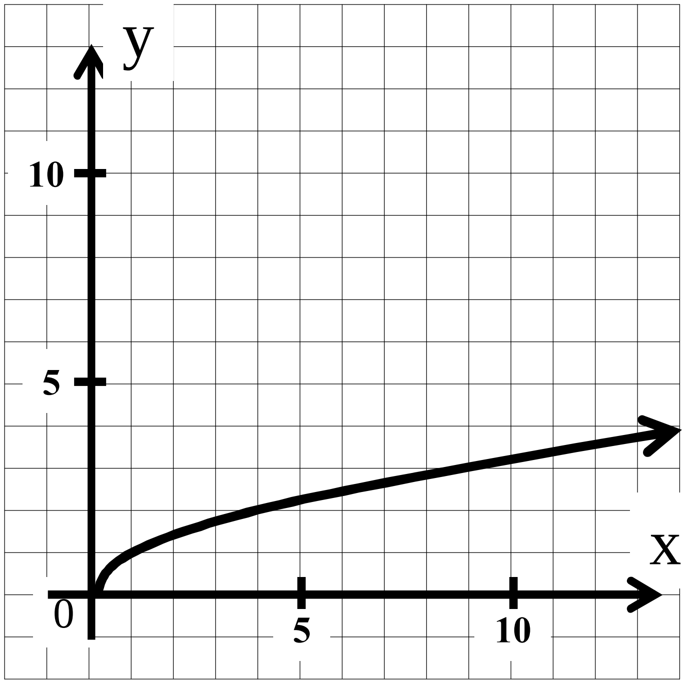

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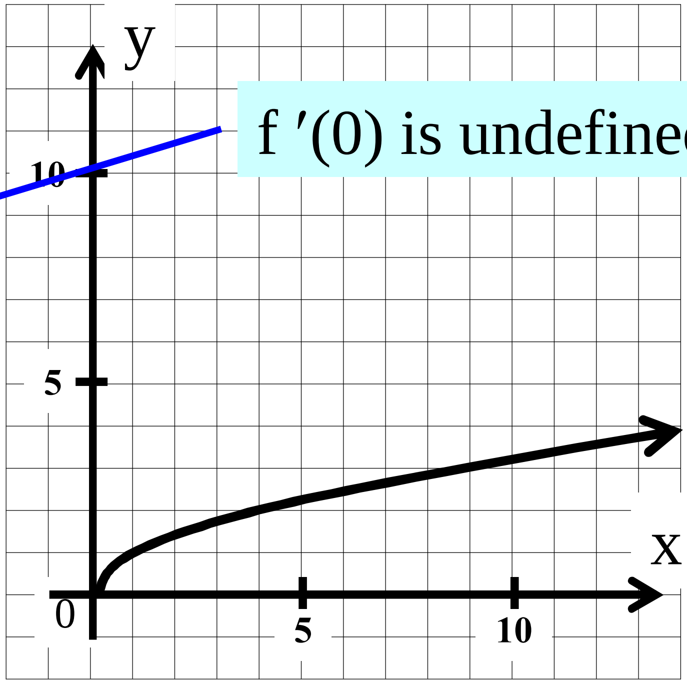
Now consider derivative function.

x	f(x)	f ′(x)
0	0	–
1	1	
4	2	
9	3	



f ′(0) is undefined !!

Remember, the derivative gives the slope of the tangent line.

The Derivative of the Square Root Function

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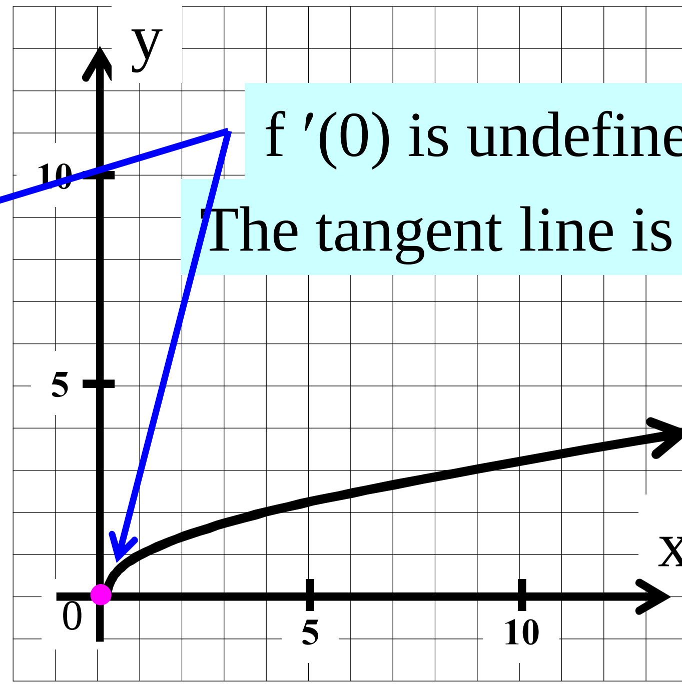
Consider the graph of the square root function.
Now consider derivative function.

x	f(x)	f ′(x)
0	0	–
1	1	
4	2	
9	3	



f ′(0) is undefined !!

The tangent line is vertical !!

Remember, the derivative gives the slope of the tangent line.

The Derivative of the Square Root Function

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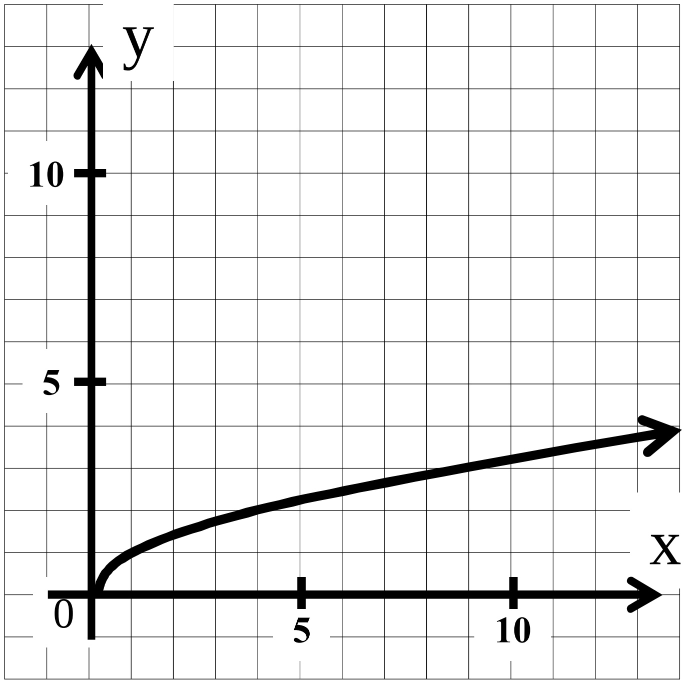
Now consider derivative function.

x	f(x)	f ′(x)
0	0	–
1	1	
4	2	
9	3	



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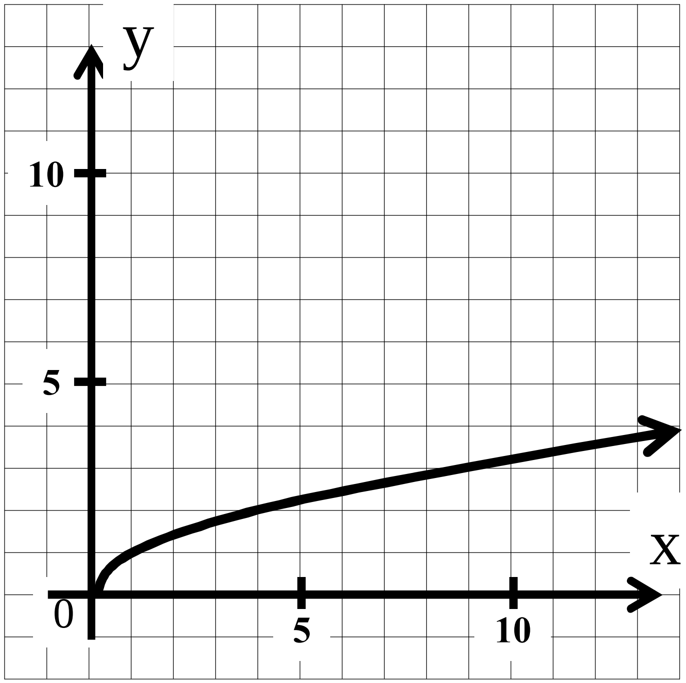

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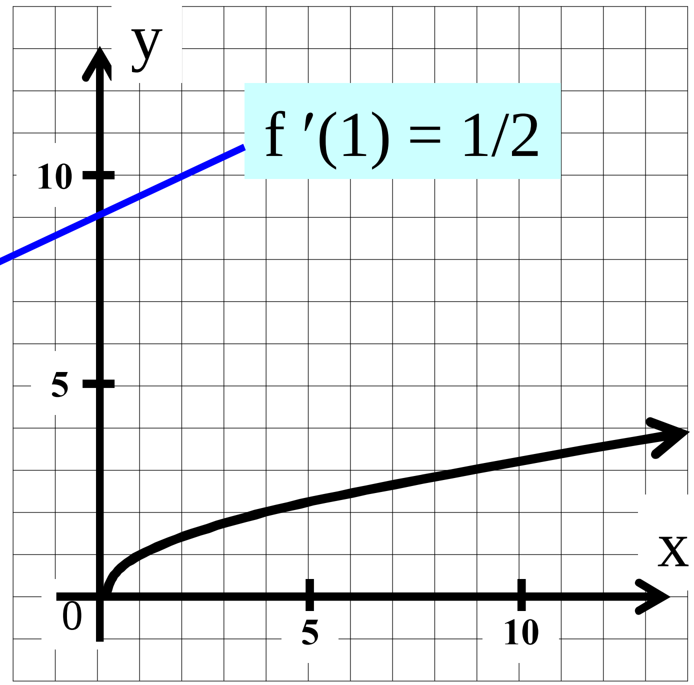

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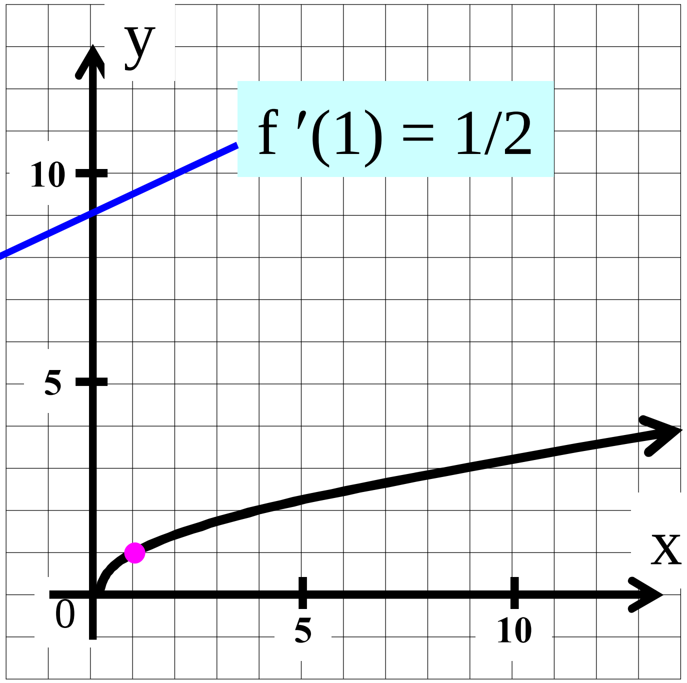

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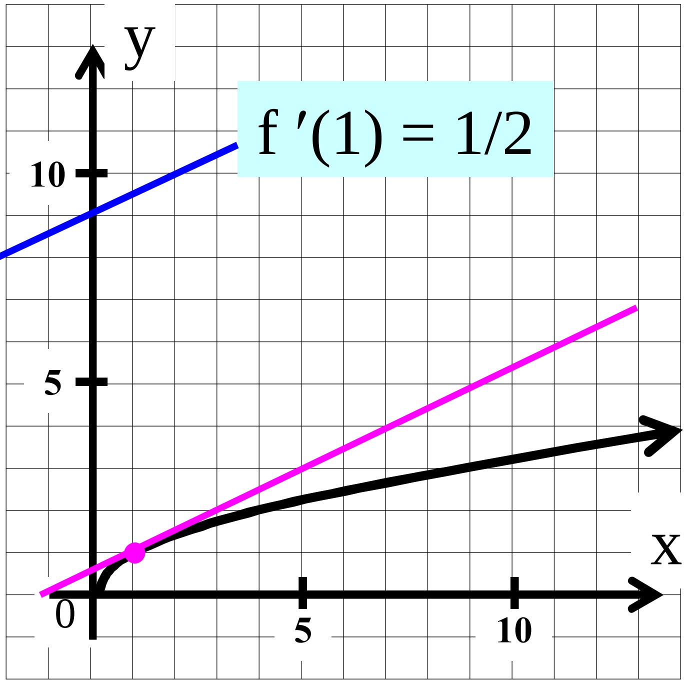

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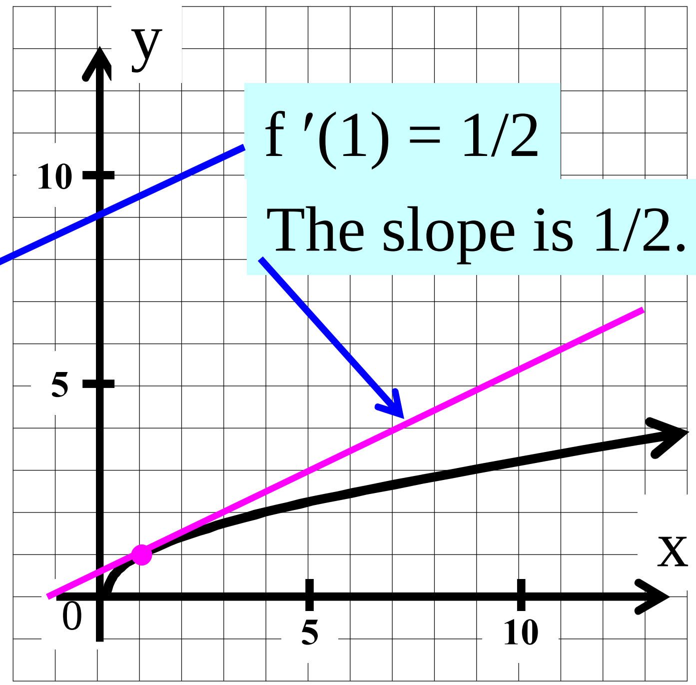

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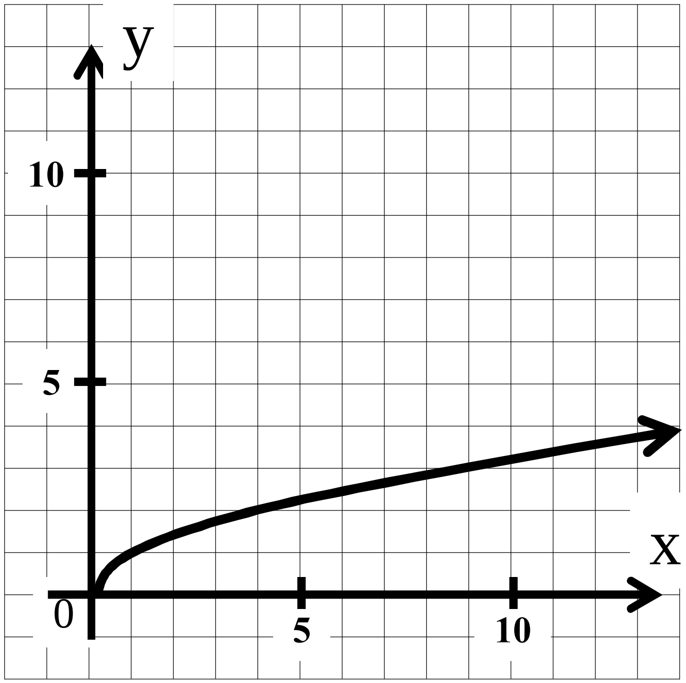

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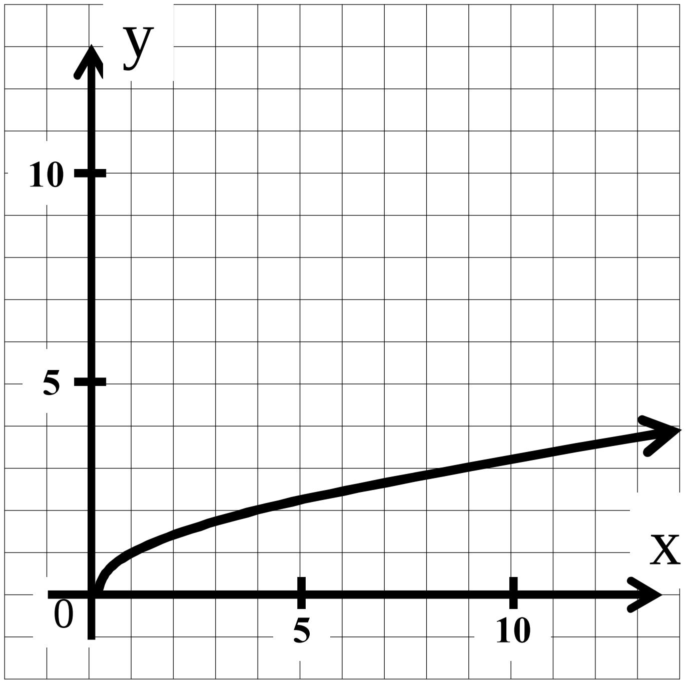

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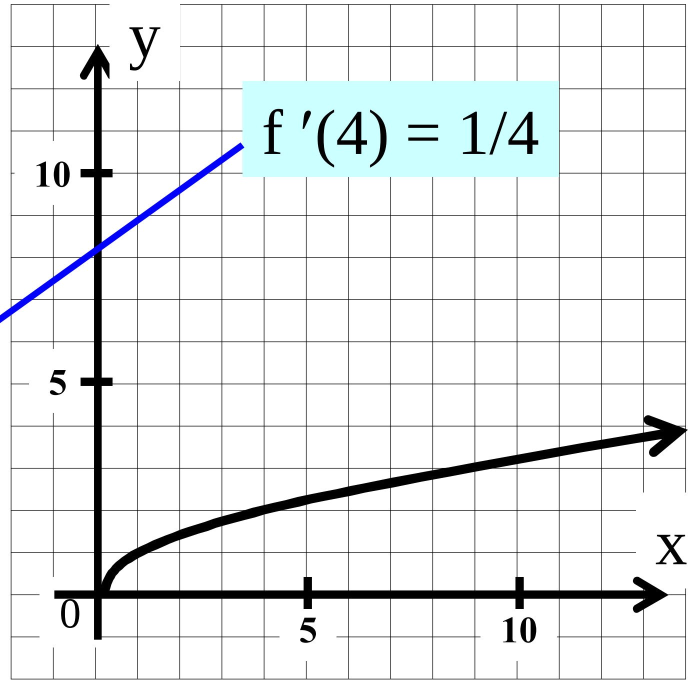

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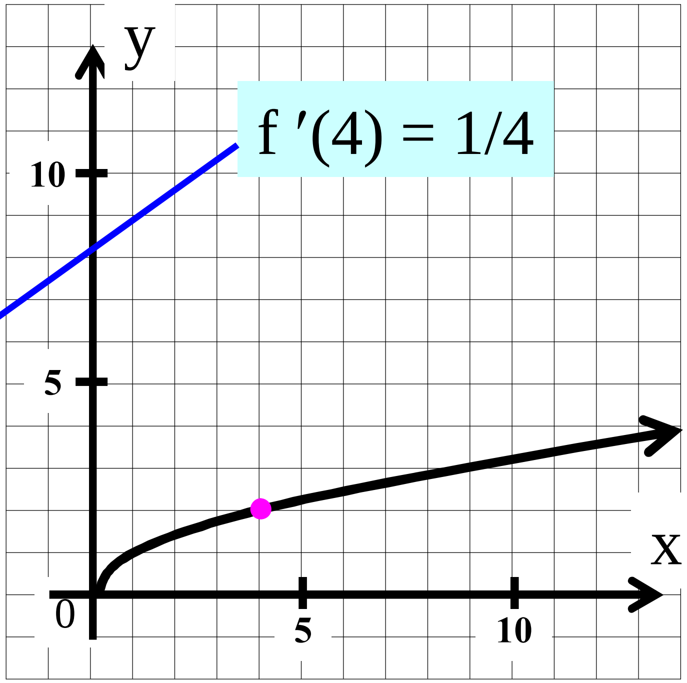

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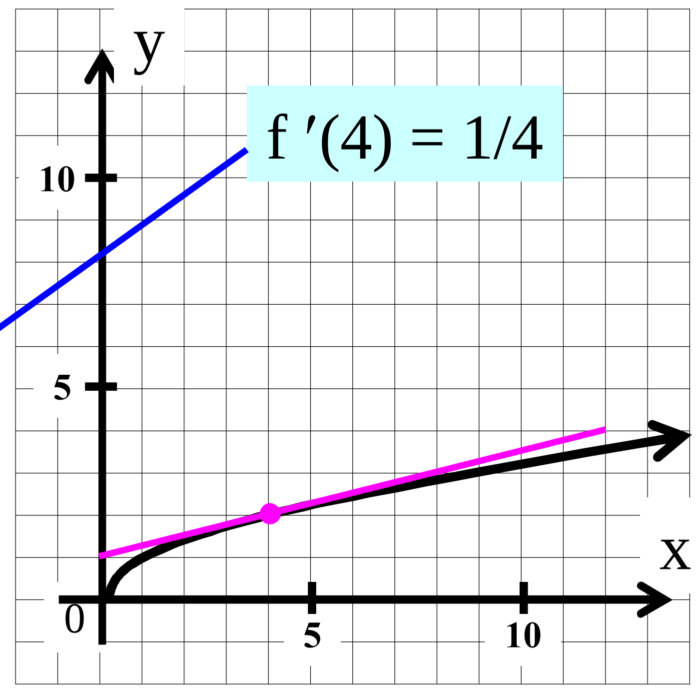

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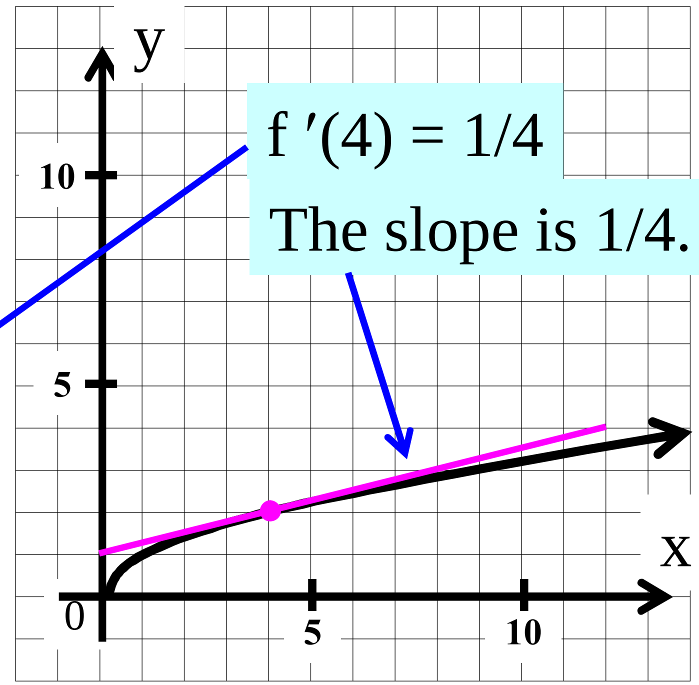

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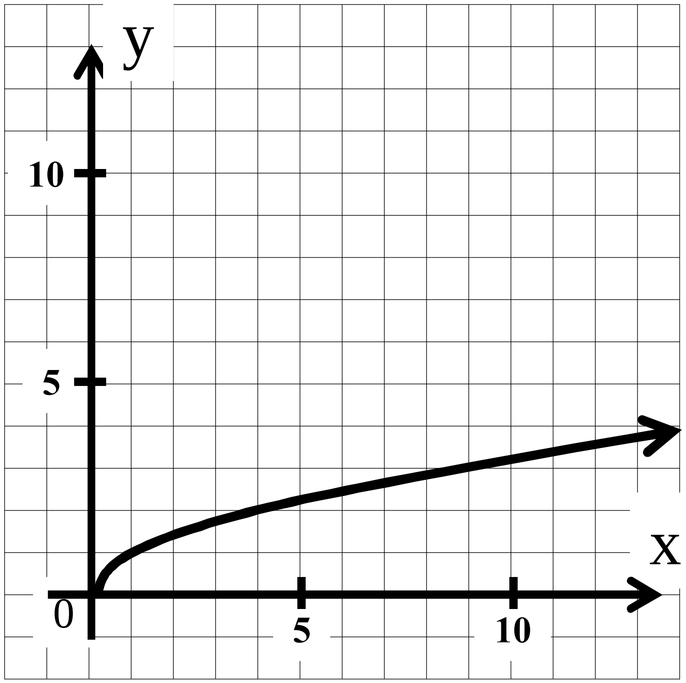

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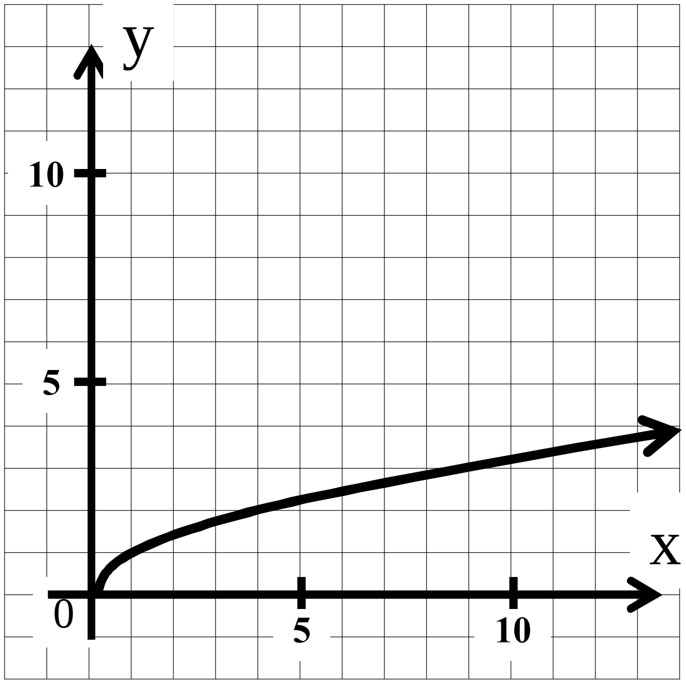

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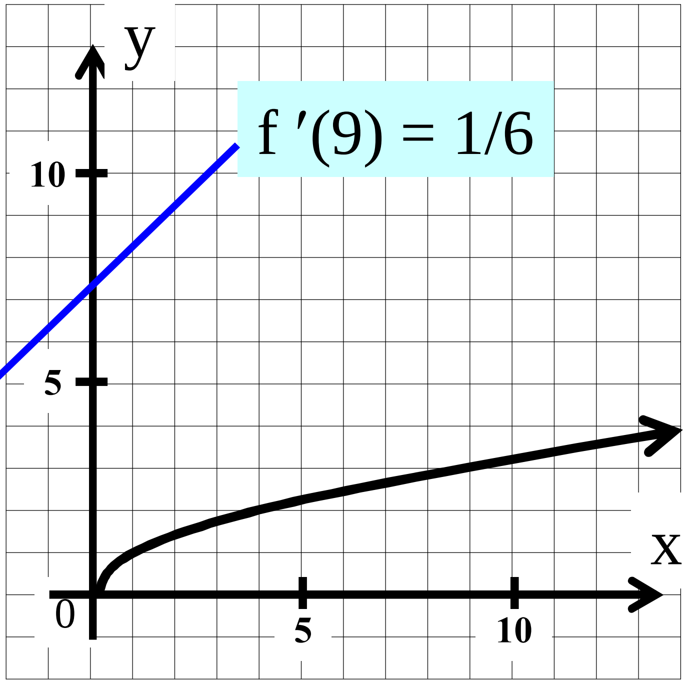

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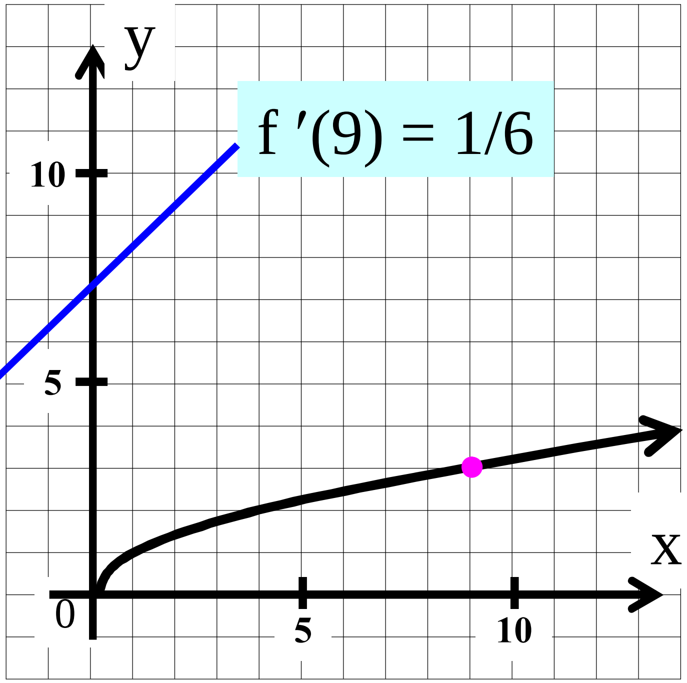

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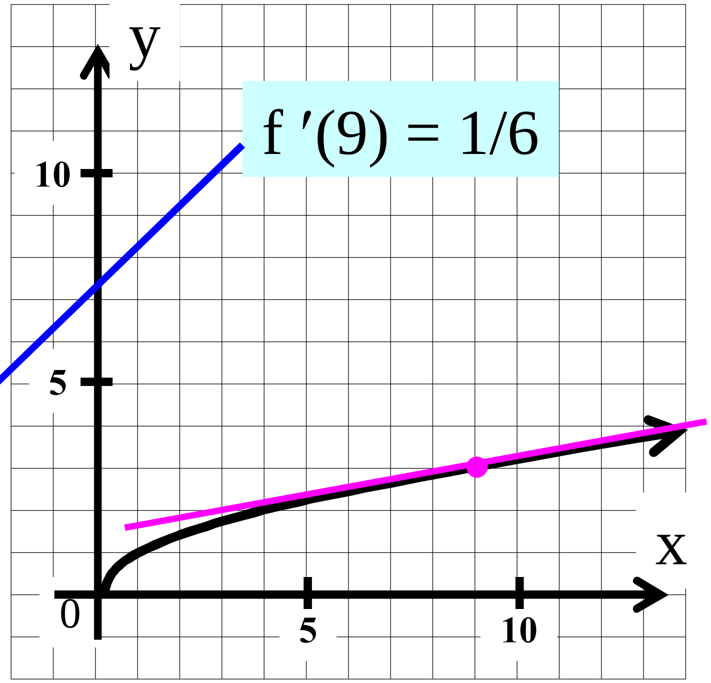

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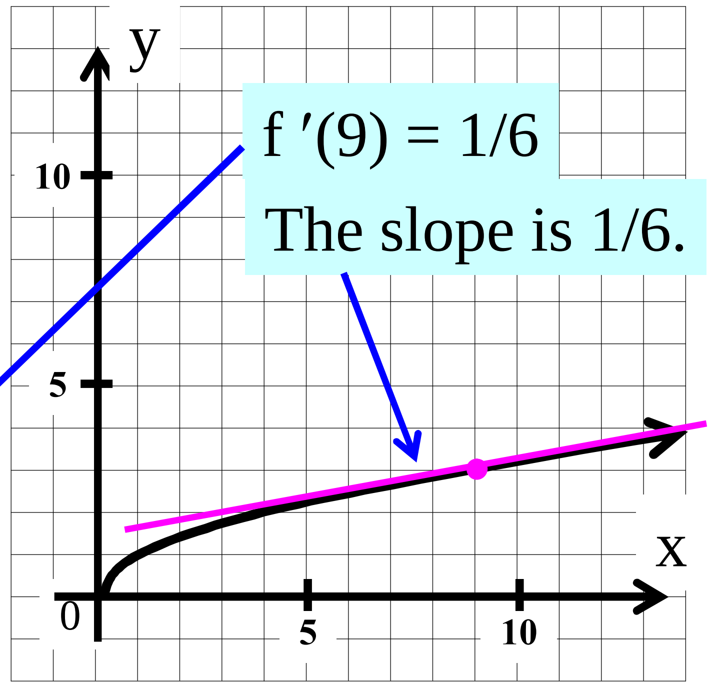

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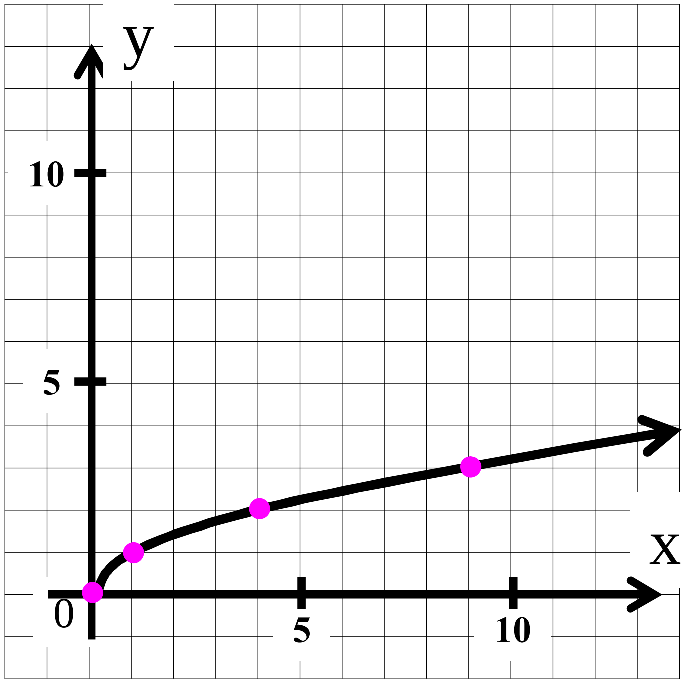

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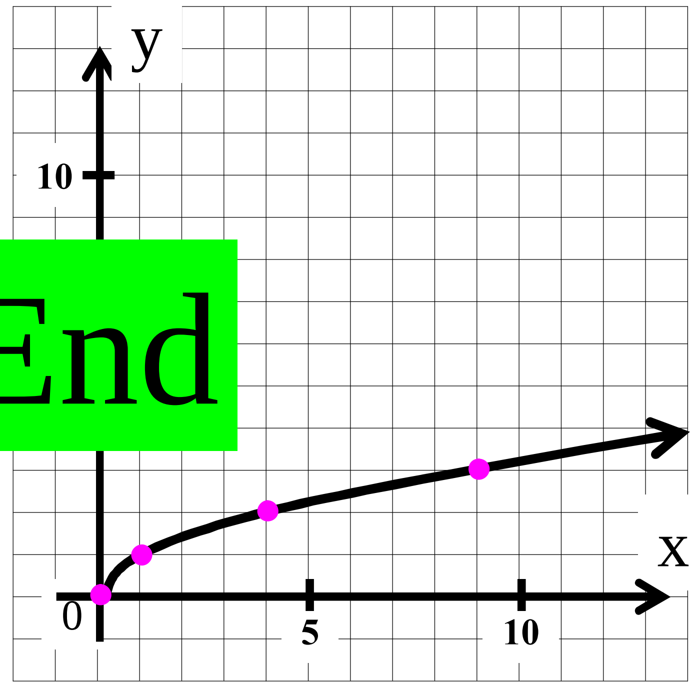
The End



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