Calculus   Lesson #2a
The Derivative of the Reciprocal Function

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The four-step method

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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The Derivative of the Reciprocal Function

Consider the function $y = f(x) = \dfrac{1}{x}$.

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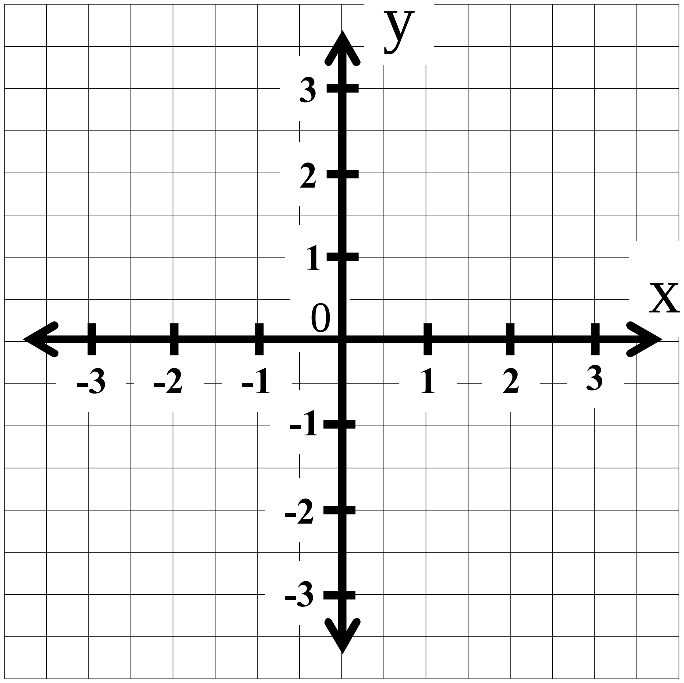
x	f(x)



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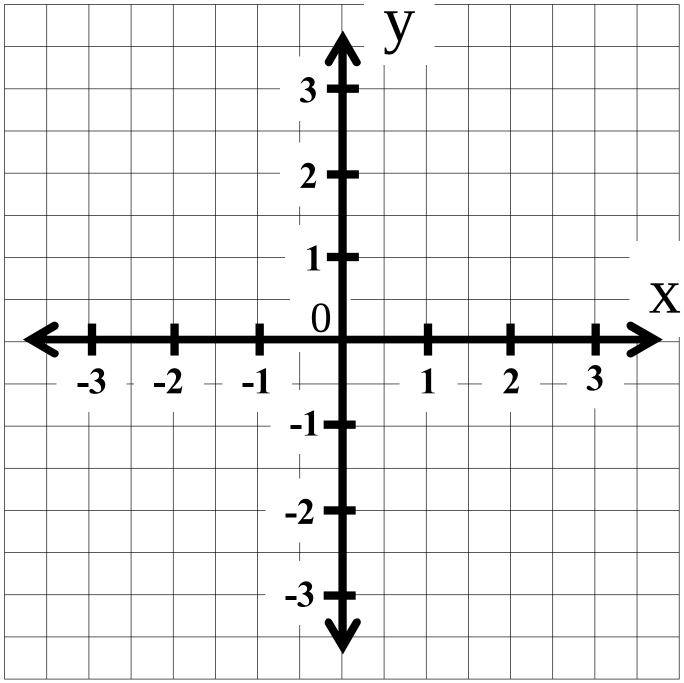
x	f(x)
1	



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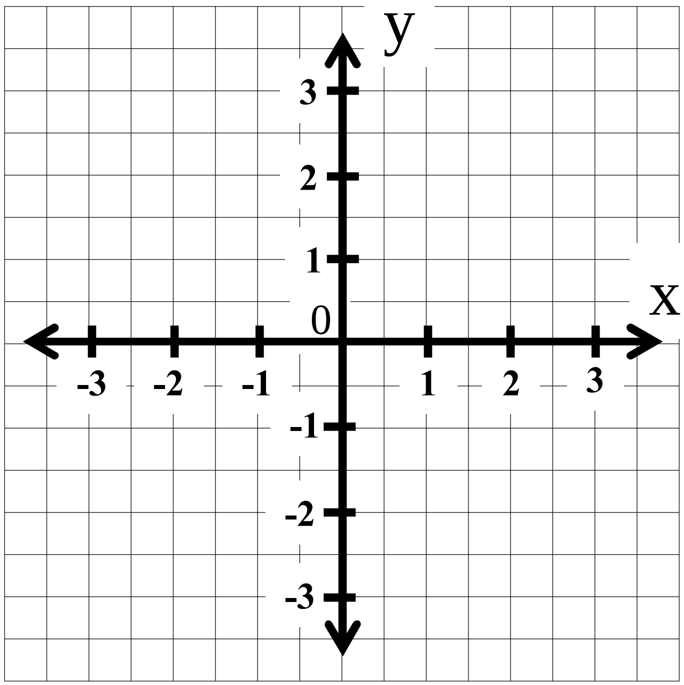

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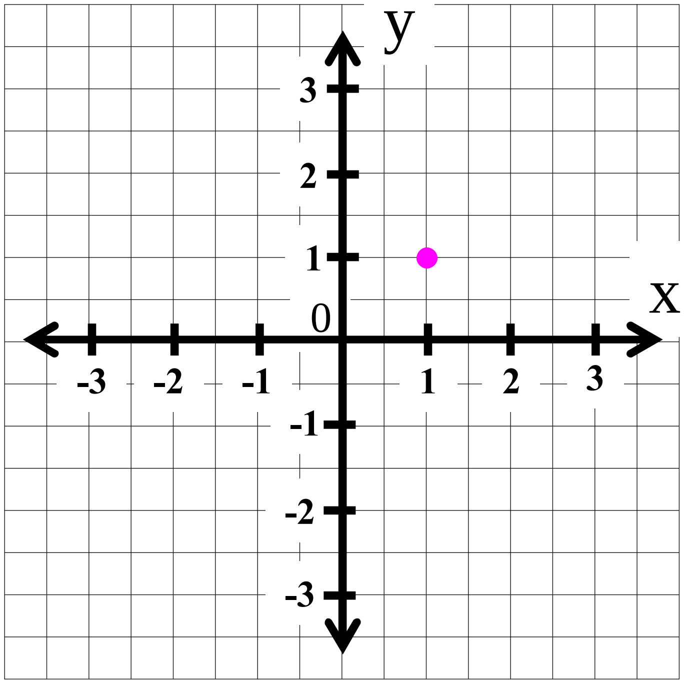

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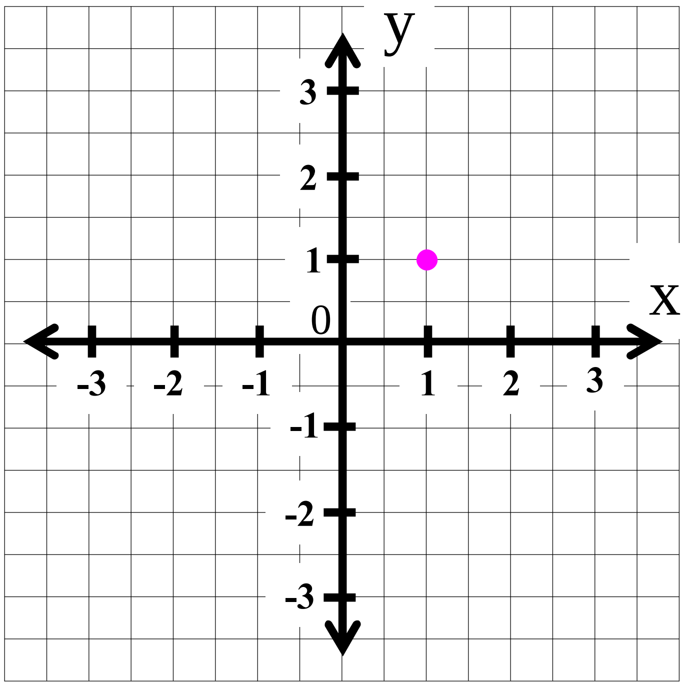
x	f(x)
1	1
2	



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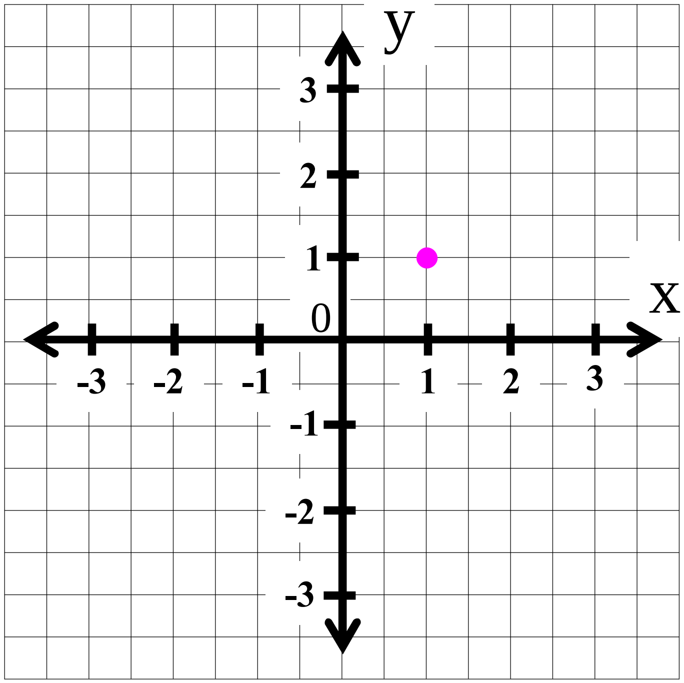

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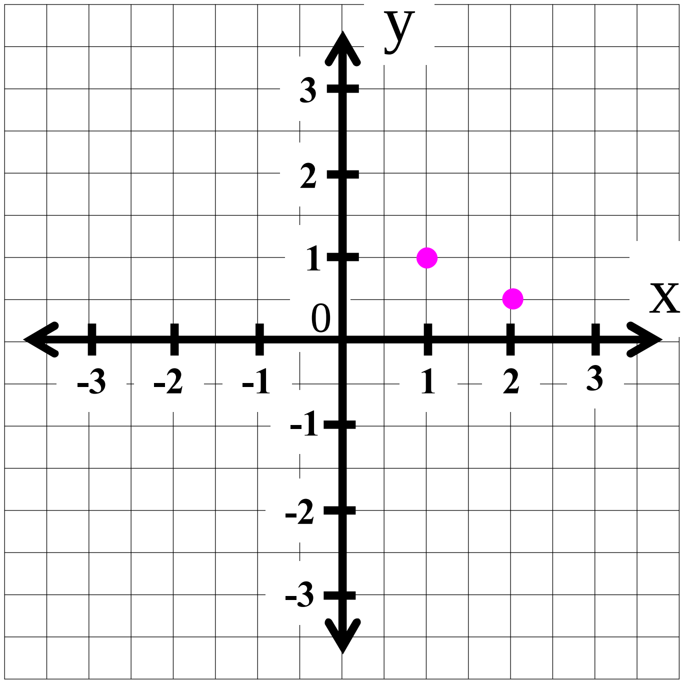

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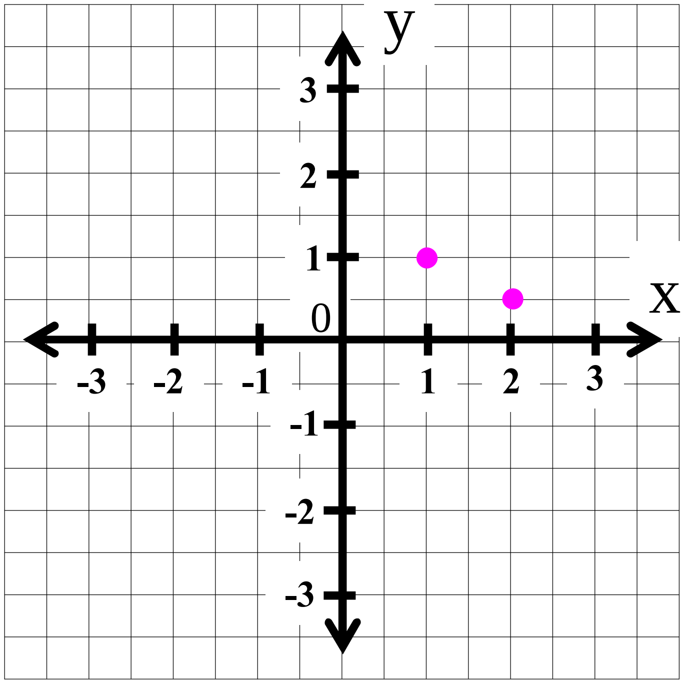

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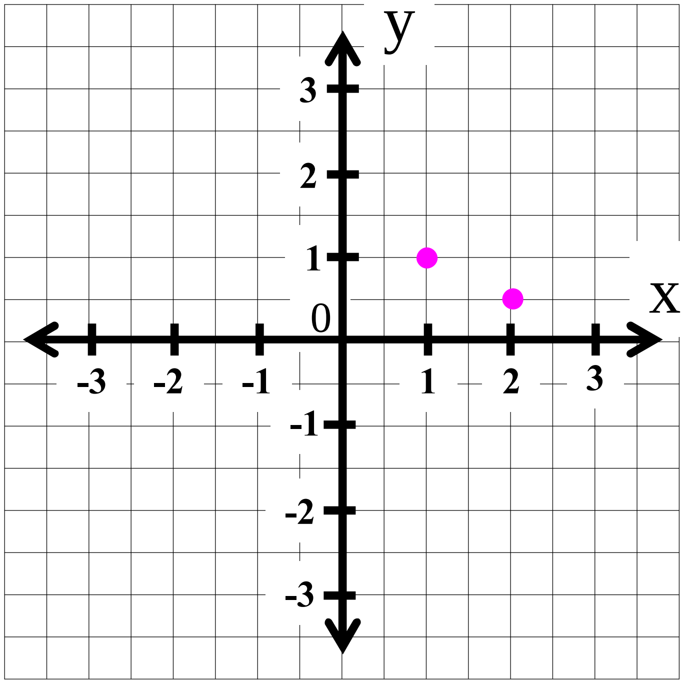

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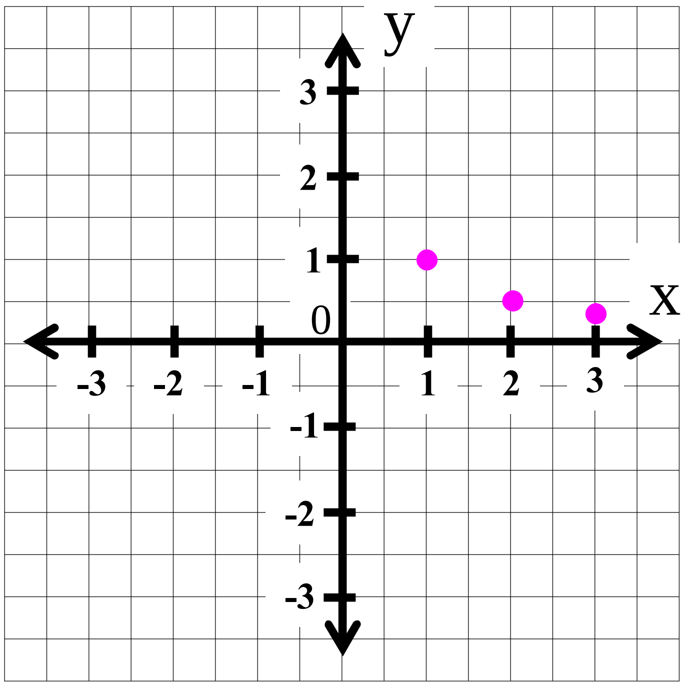

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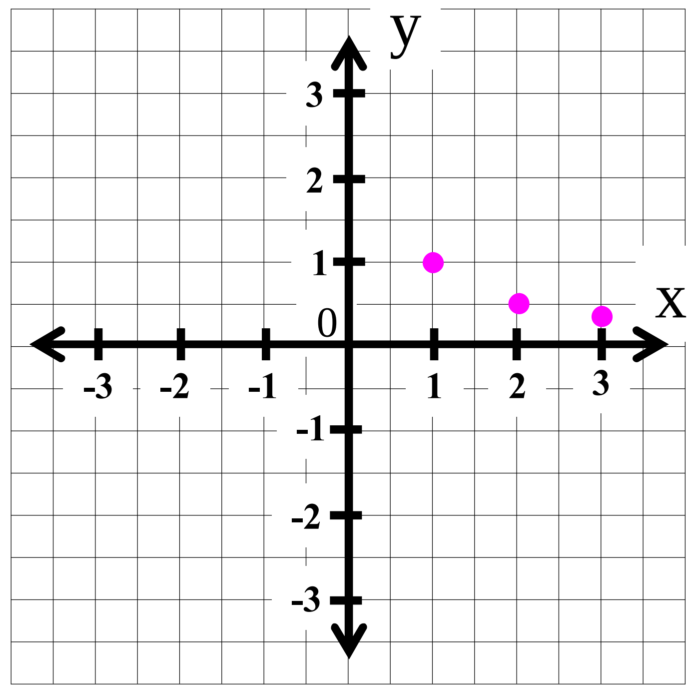

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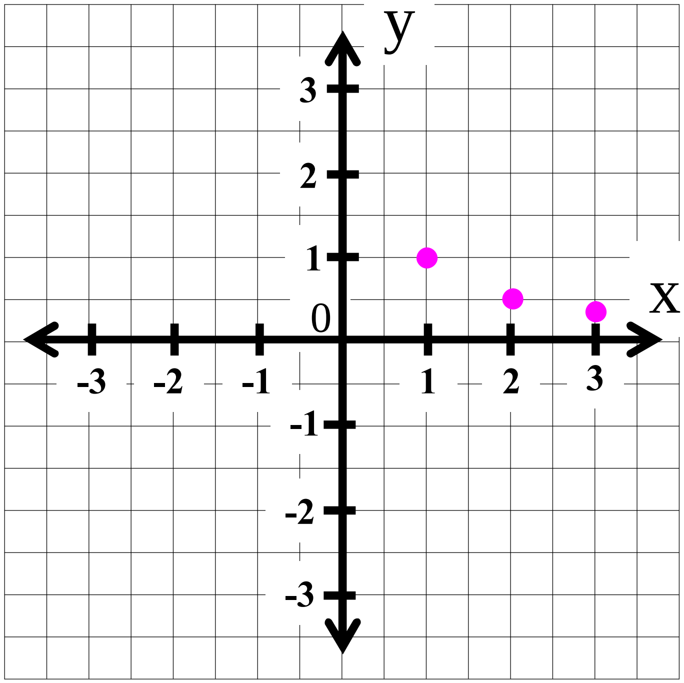

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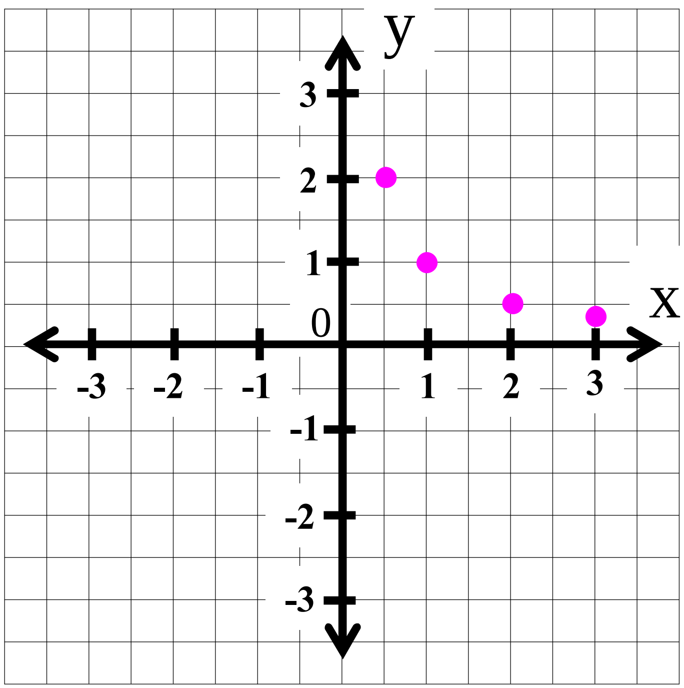

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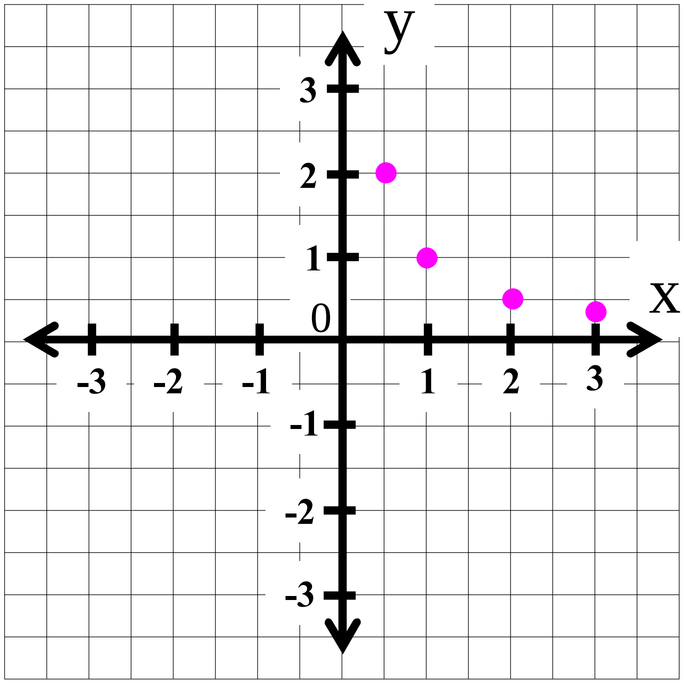

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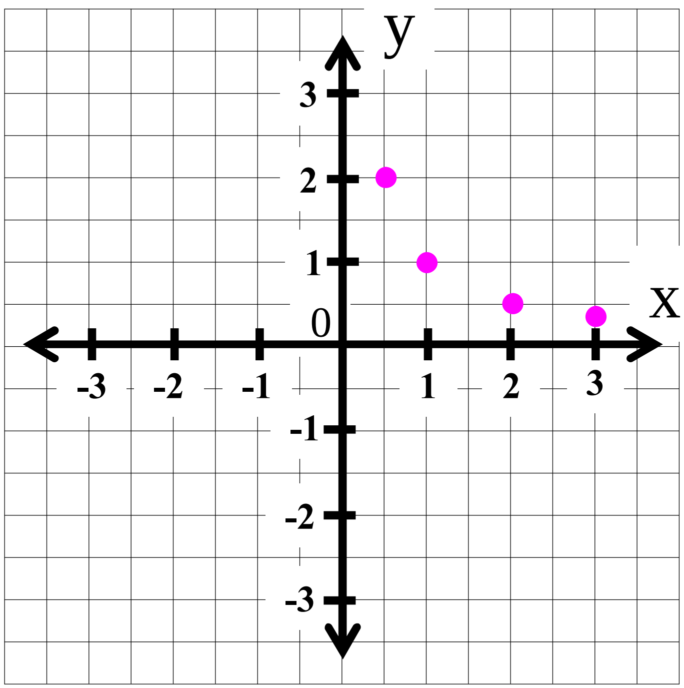

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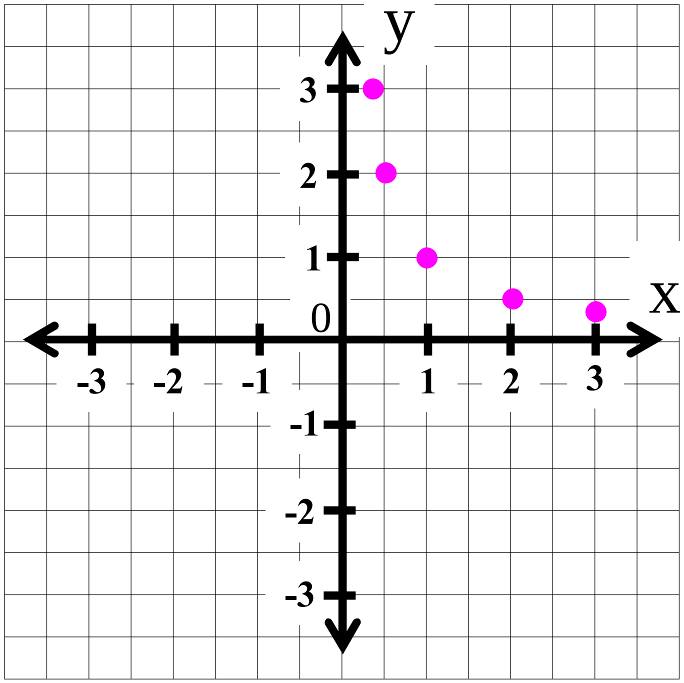

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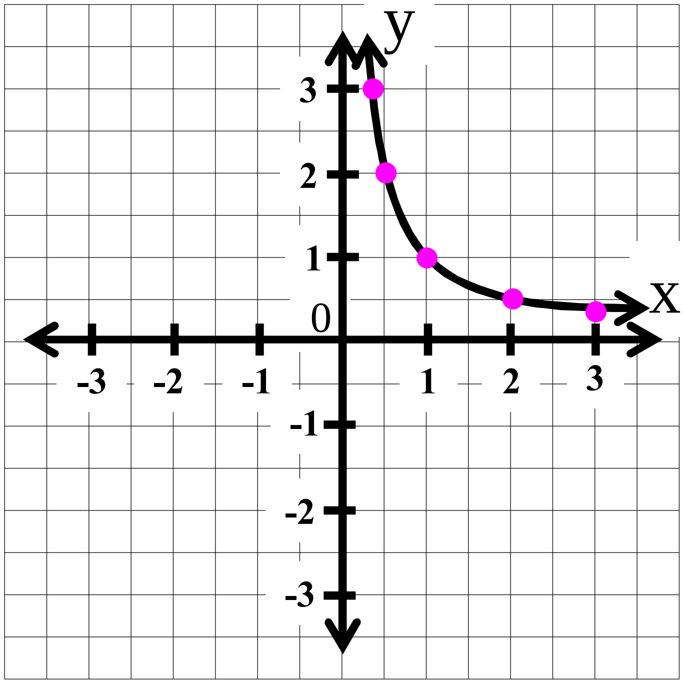


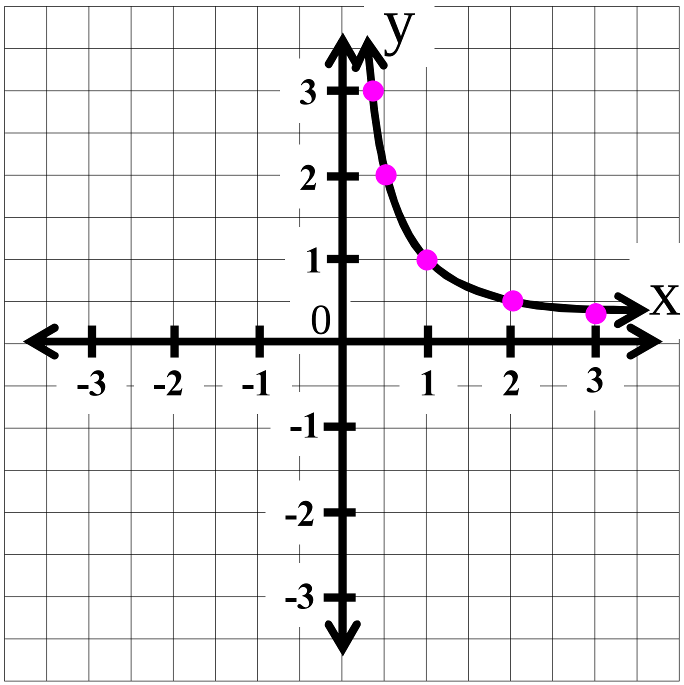
The Derivative of the Reciprocal Function

$$y = f(x) = \frac{1}{x}$$

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

Consider the graph of the reciprocal function.
Now consider derivative function.

x	f(x)
1	1
2	1/2
3	1/3
1/2	2
1/3	3



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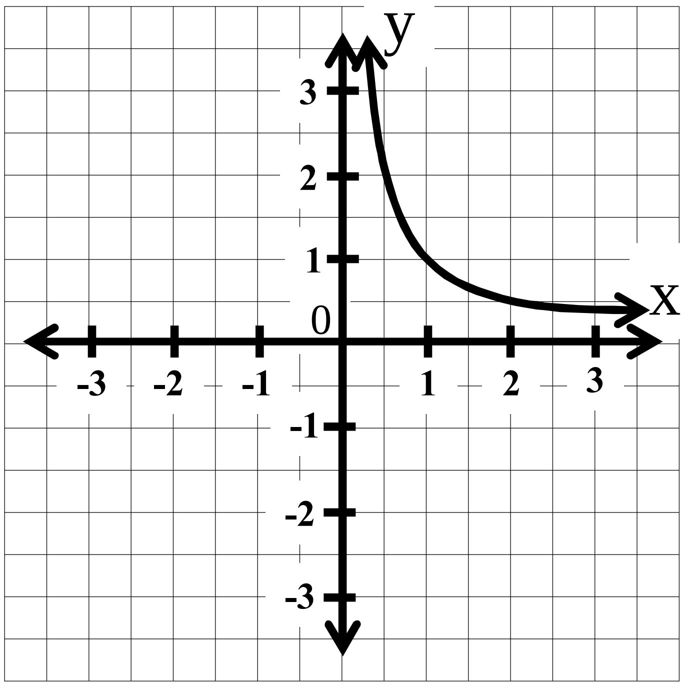

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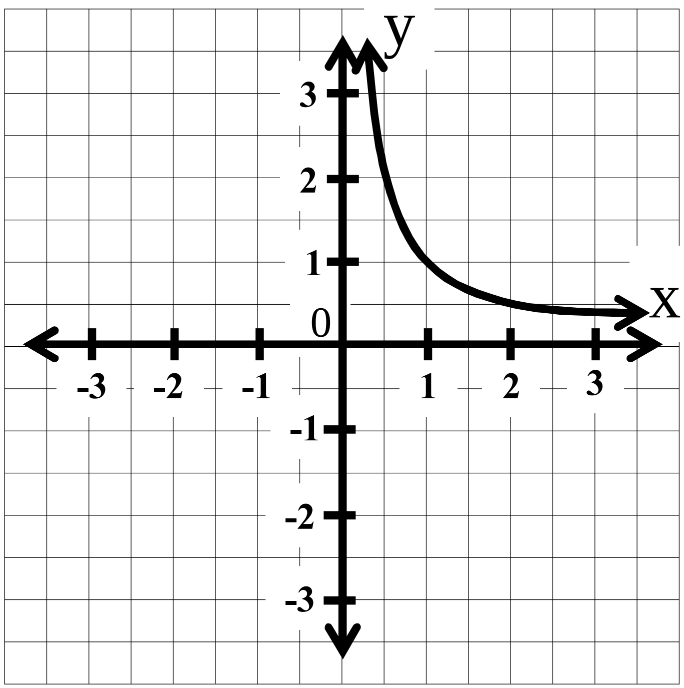

Remember, the derivative gives the slope of the tangent line.

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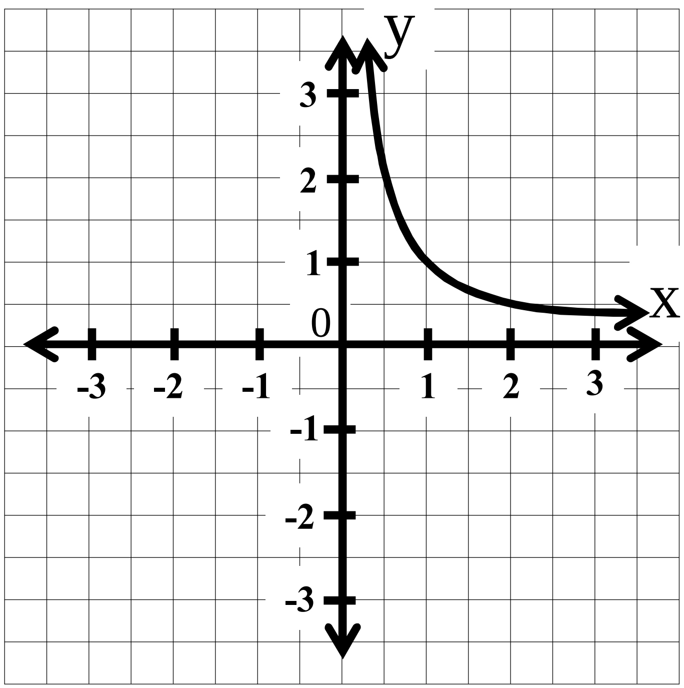

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$f'(1) = -1$

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3	1/3	
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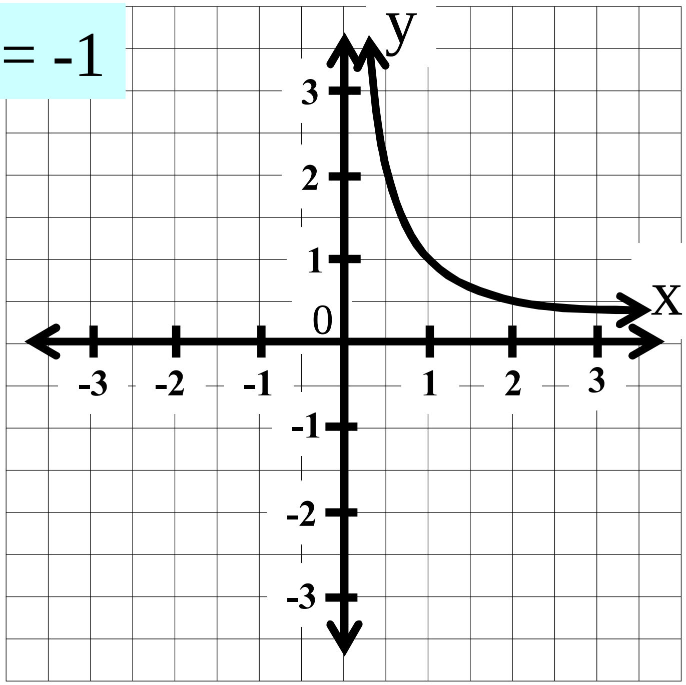

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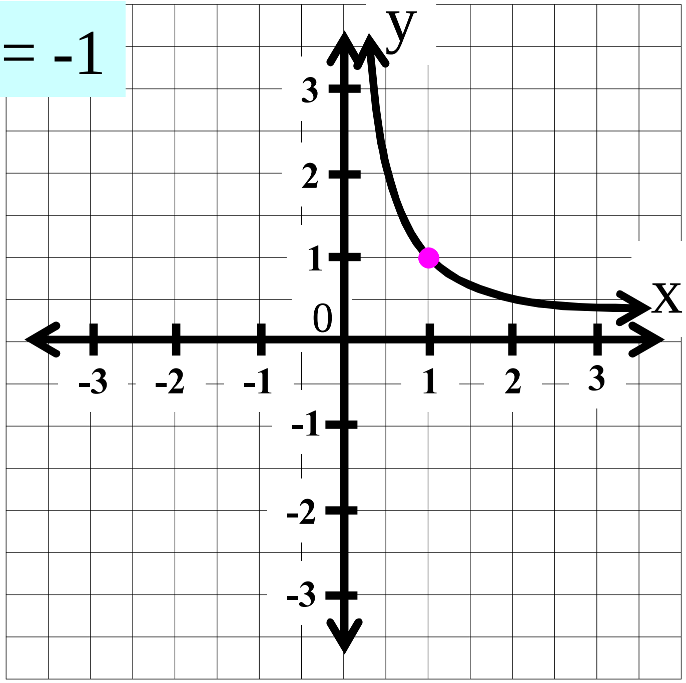

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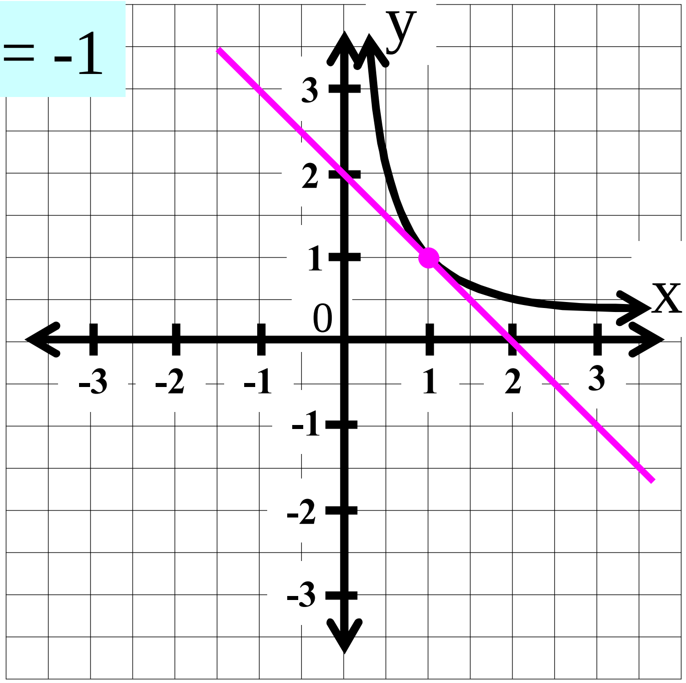

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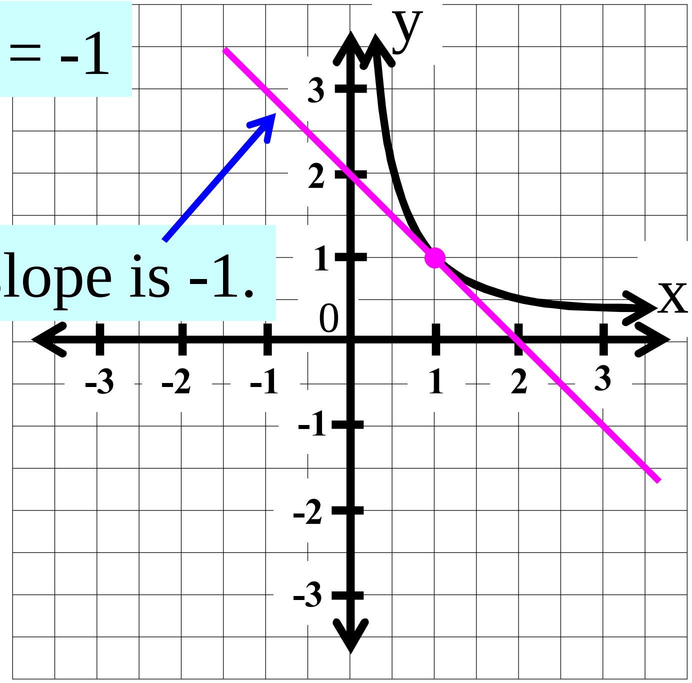

The slope is -1.

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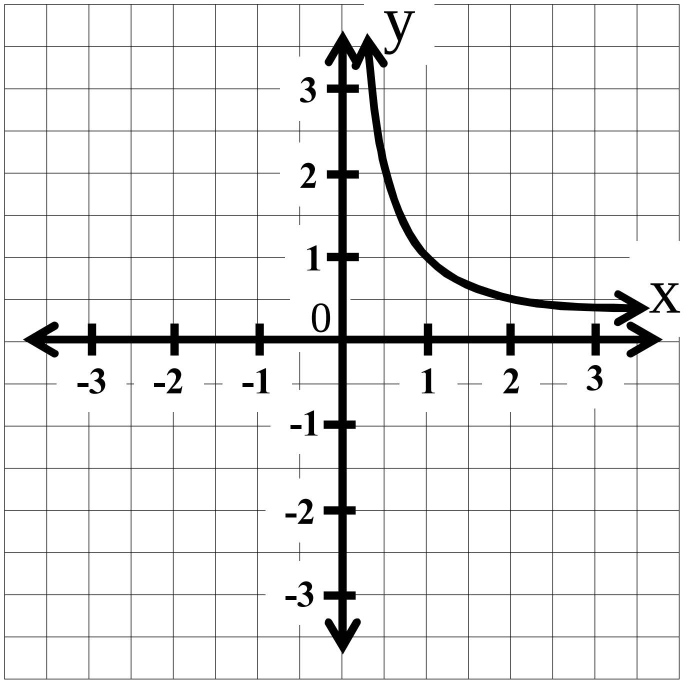

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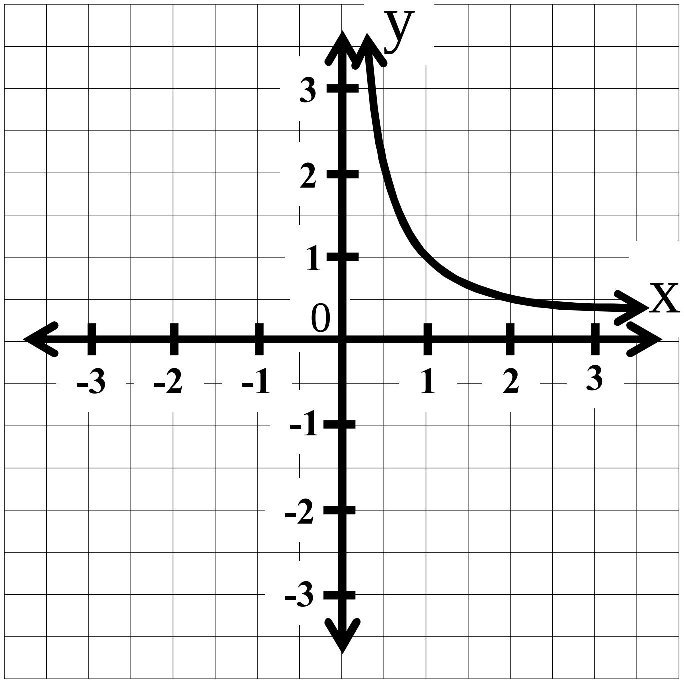

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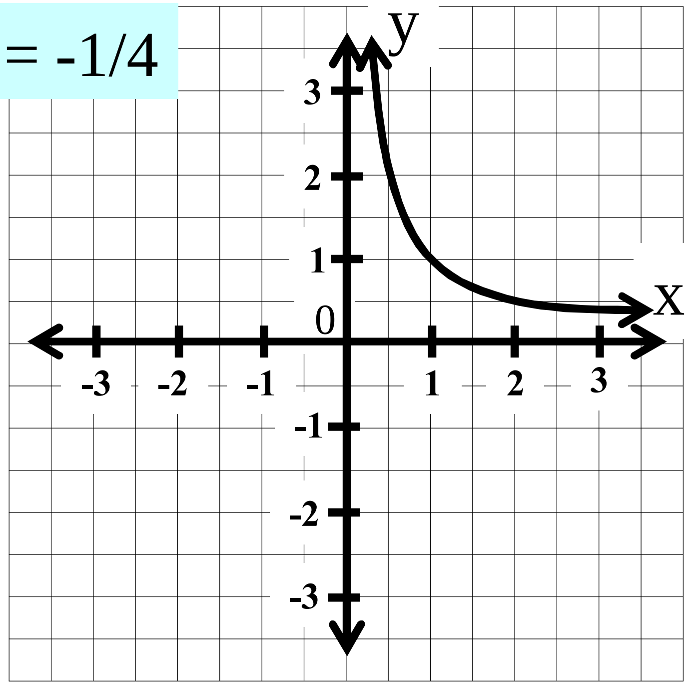
Consider the graph of the reciprocal function.
Now consider derivative function.

$f'(2) = -1/4$

x	f(x)	f ′(x)
1	1	-1
2	1/2	-1/4
3	1/3	
1/2	2	
1/3	3	



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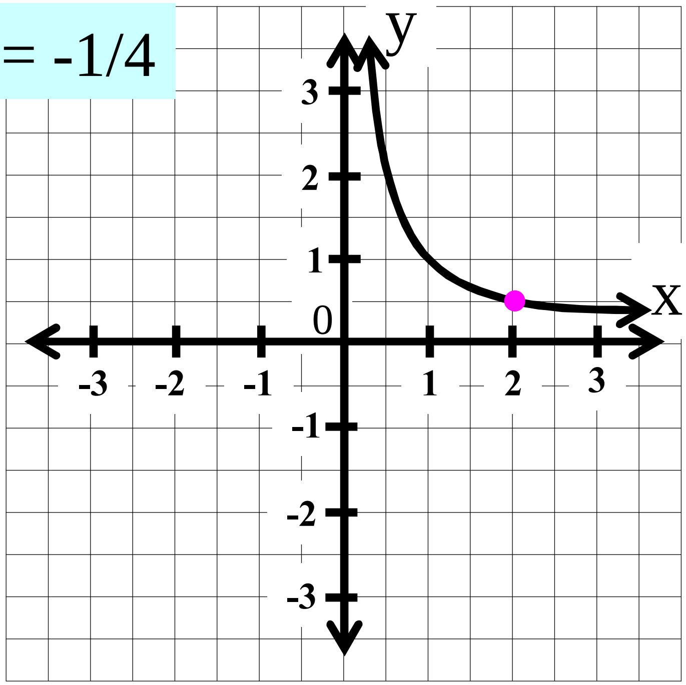

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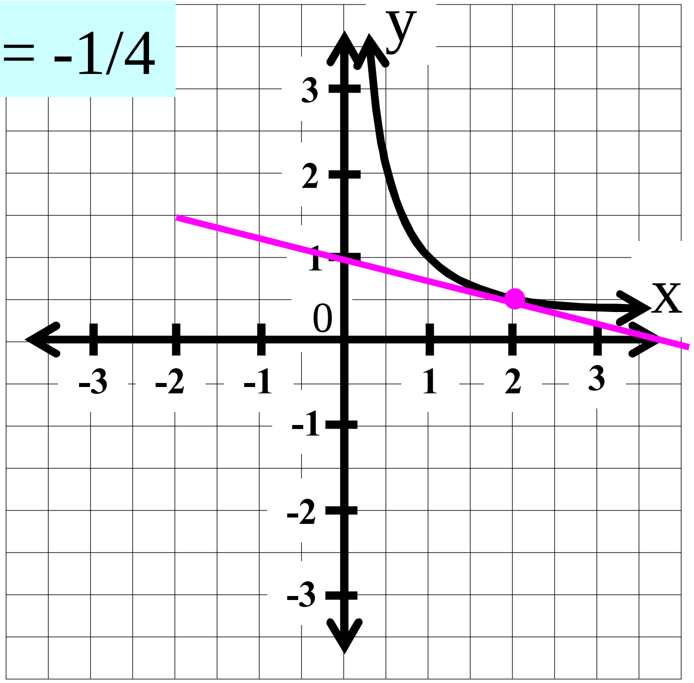

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1/3	3	

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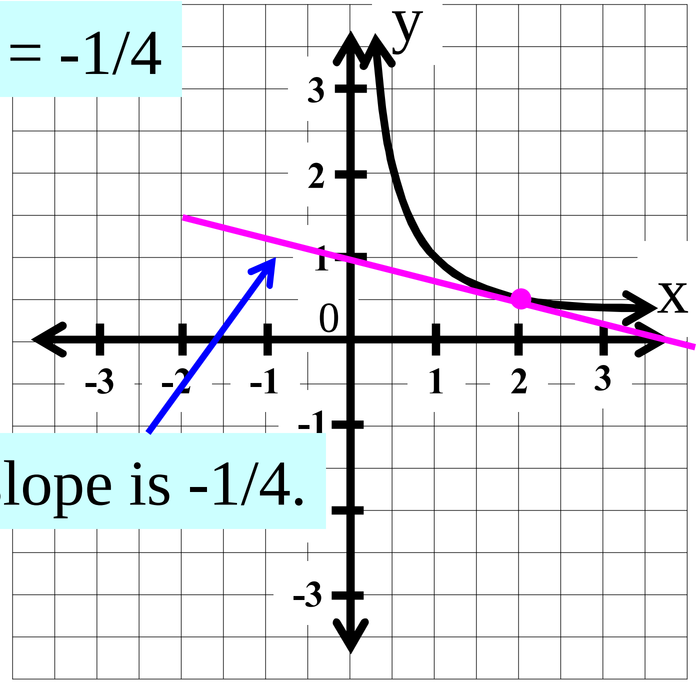

The slope is -1/4.

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

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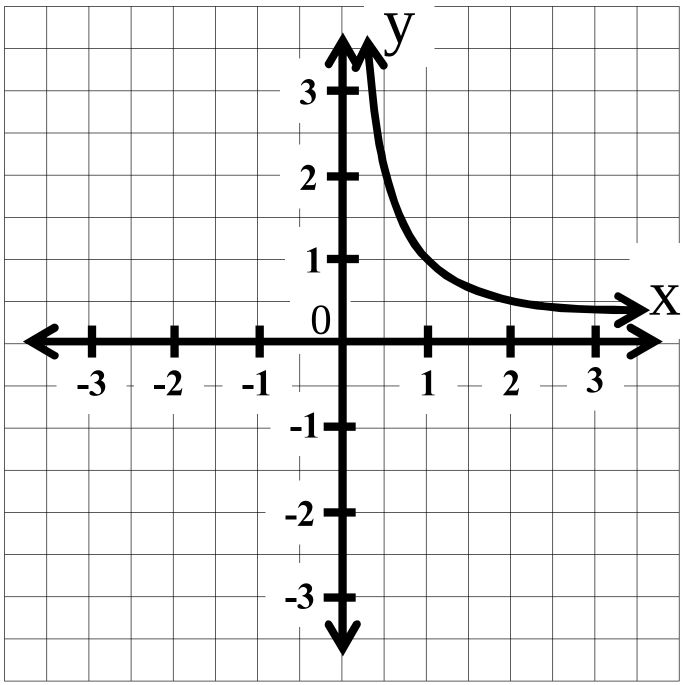

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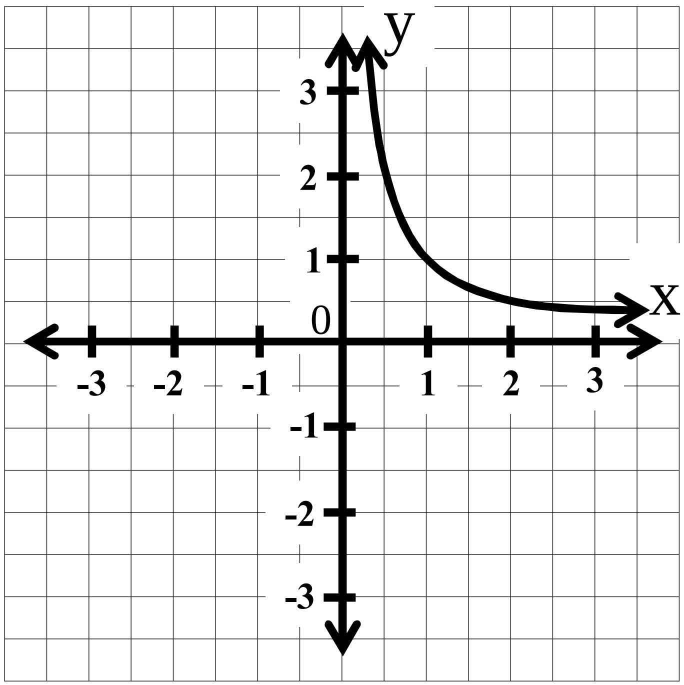

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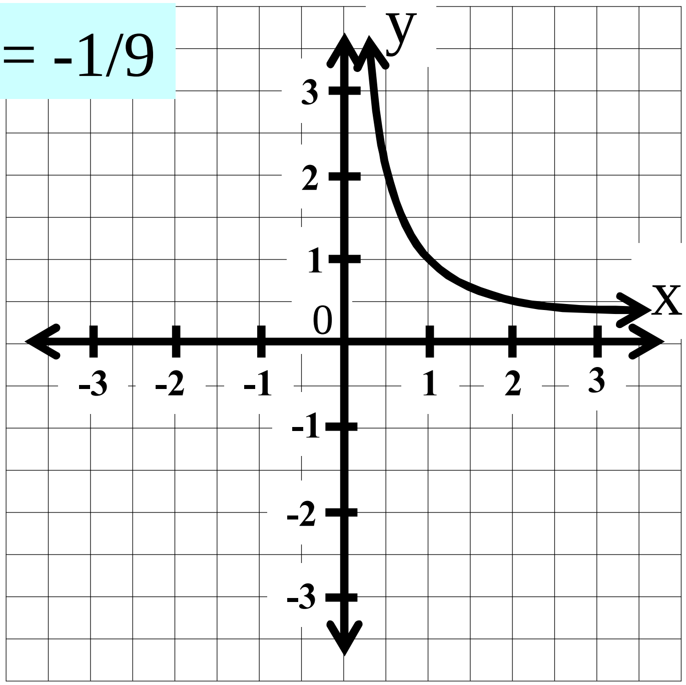
Now consider derivative function.

x	f(x)	f ′(x)
1	1	-1
2	1/2	-1/4
3	1/3	-1/9
1/2	2	
1/3	3	

$f'(3) = -1/9$



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

The Derivative of the Reciprocal Function

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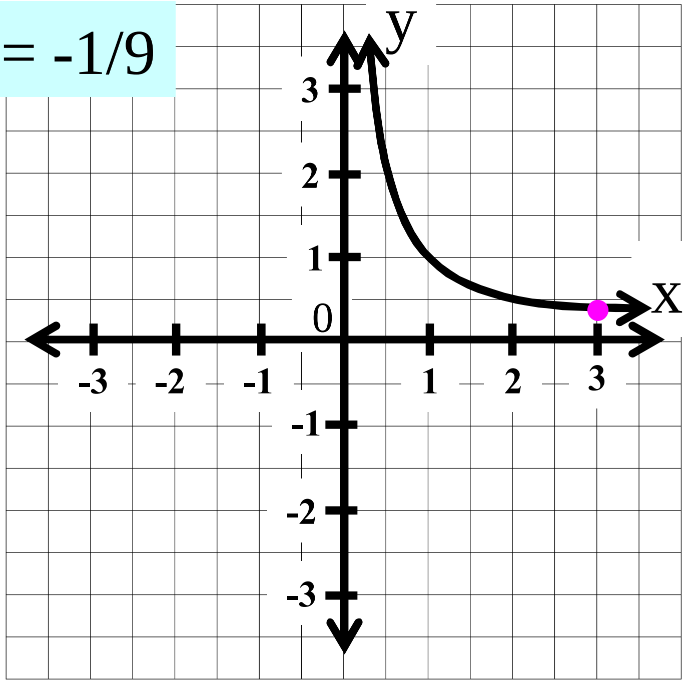
$$f'(x) = \frac{-1}{x^2}$$

Consider the graph of the reciprocal function.
Now consider derivative function.

$f'(3) = -1/9$

x	f(x)	f ′(x)
1	1	-1
2	1/2	-1/4
3	1/3	-1/9
1/2	2	
1/3	3	



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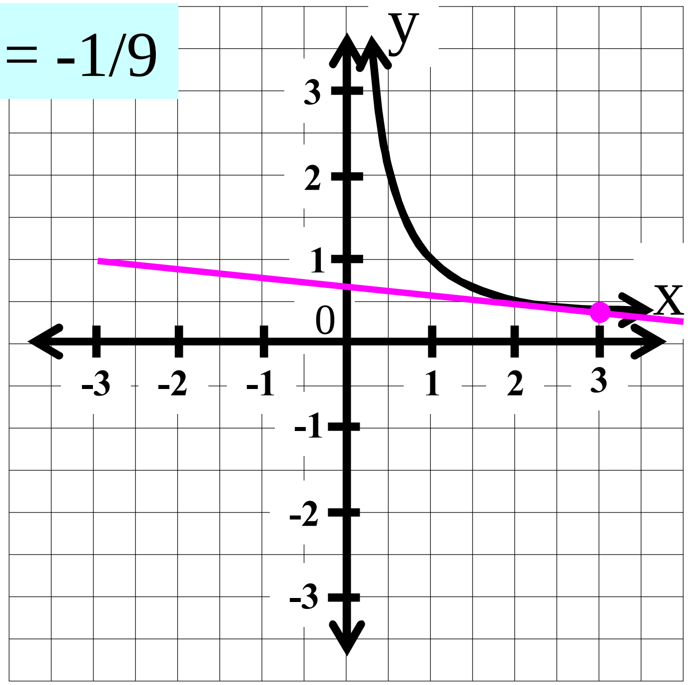
$f'(3) = -1/9$



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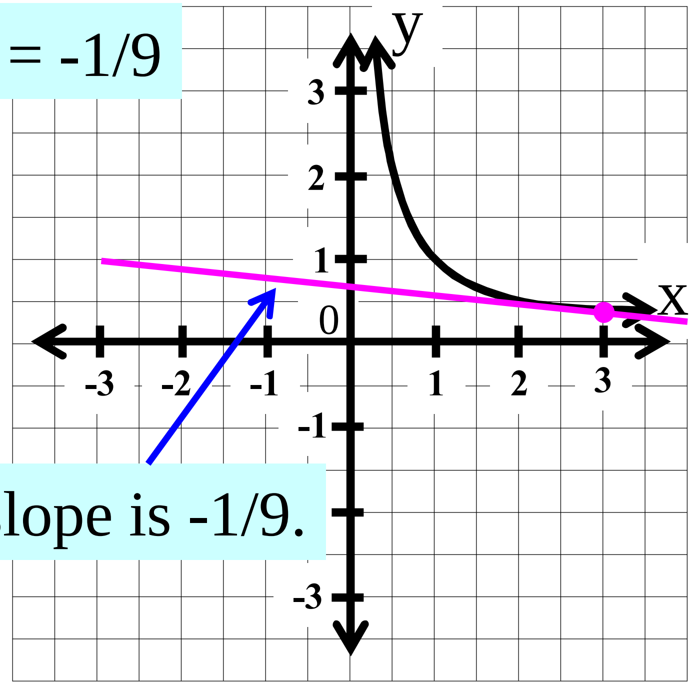
1	1	-1
2	1/2	-1/4
3	1/3	-1/9
1/2	2	
1/3	3	

f ′(3) = -1/9



The slope is -1/9.

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

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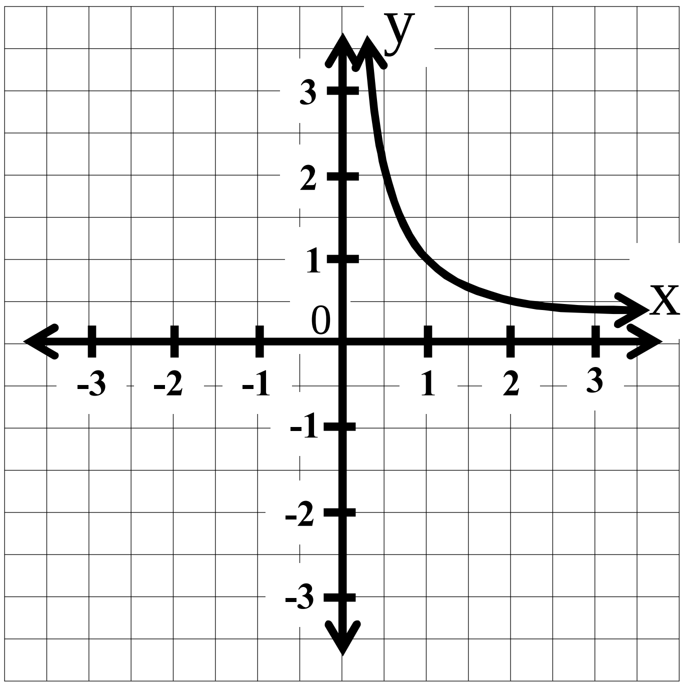

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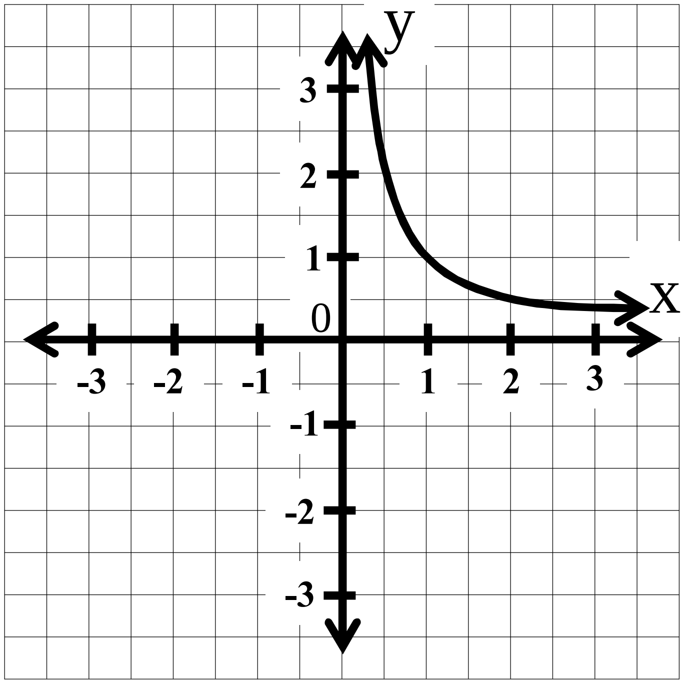

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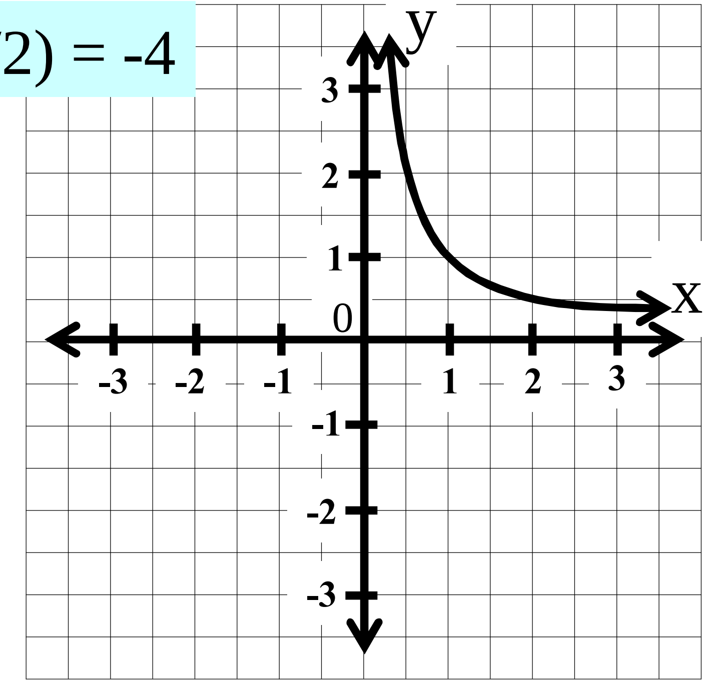
1	1	-1
2	1/2	-1/4
3	1/3	-1/9
1/2	2	-4
1/3	3	

$f'(1/2) = -4$



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$f'(1/2) = -4$

x	f(x)	f ′(x)
1	1	-1
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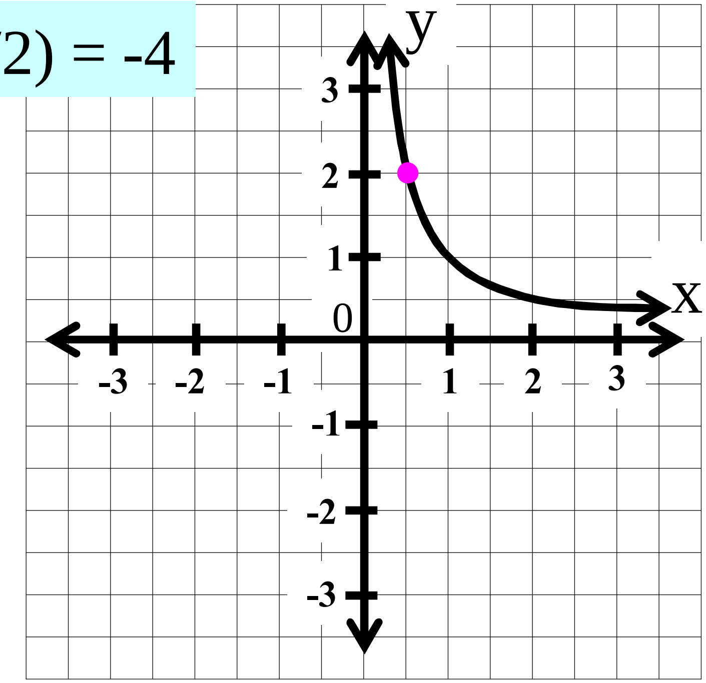

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$f\,'(1/2) = -4$

x	f(x)	f ′(x)
1	1	-1
2	1/2	-1/4
3	1/3	-1/9
1/2	2	-4
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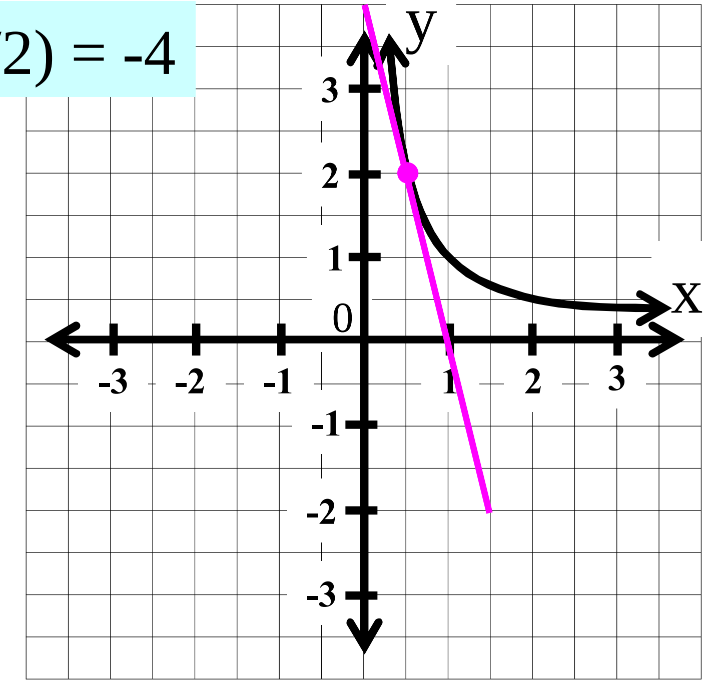

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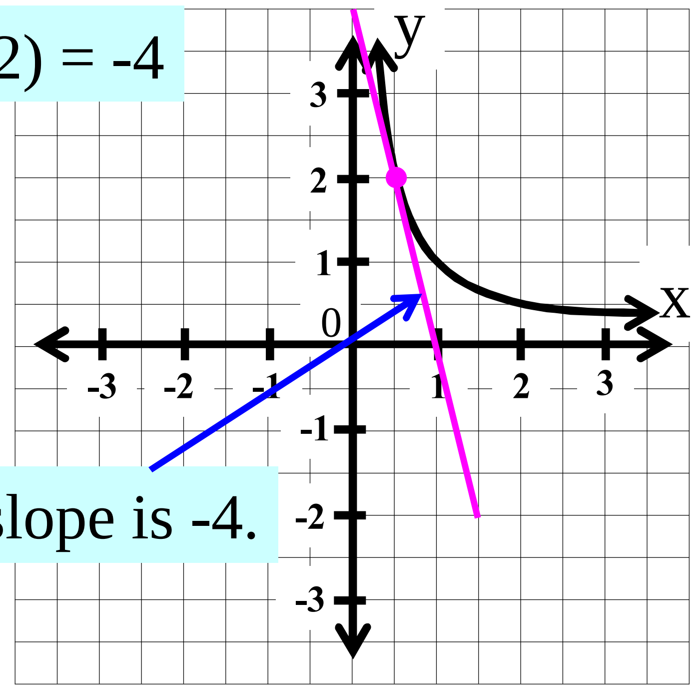

The slope is -4.

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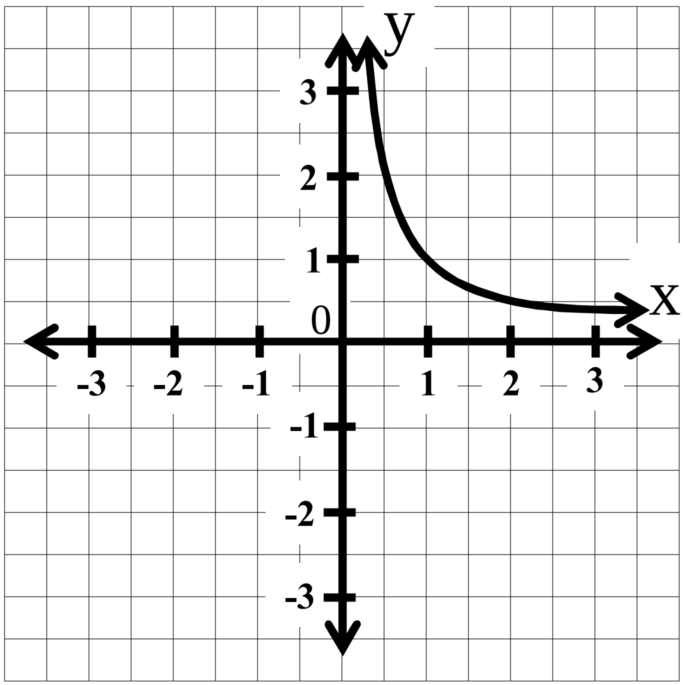

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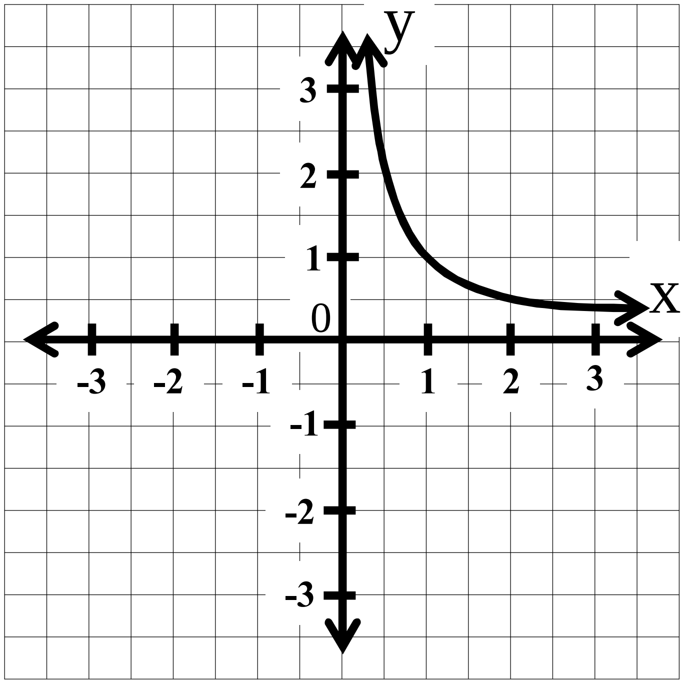

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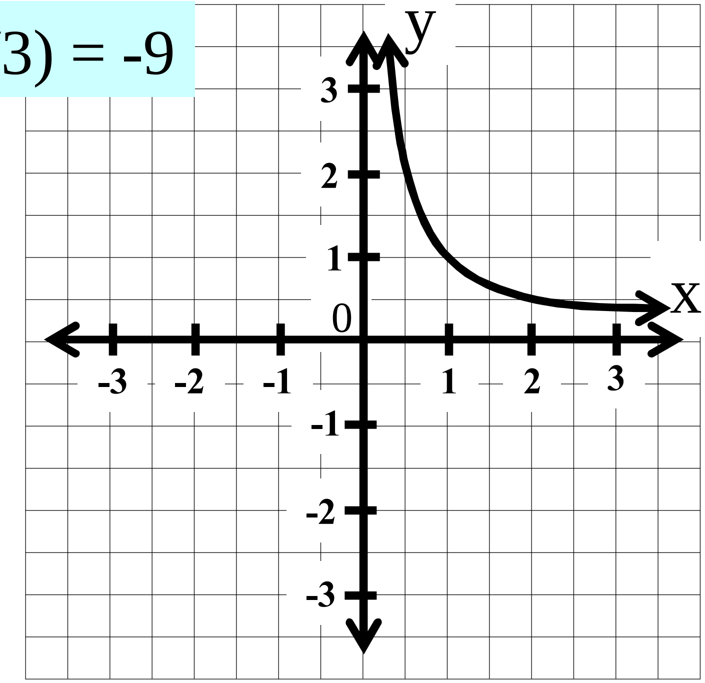
x	f(x)	f ′(x)
1	1	-1
2	1/2	-1/4
3	1/3	-1/9
1/2	2	-4
1/3	3	-9

$f'(1/3) = -9$



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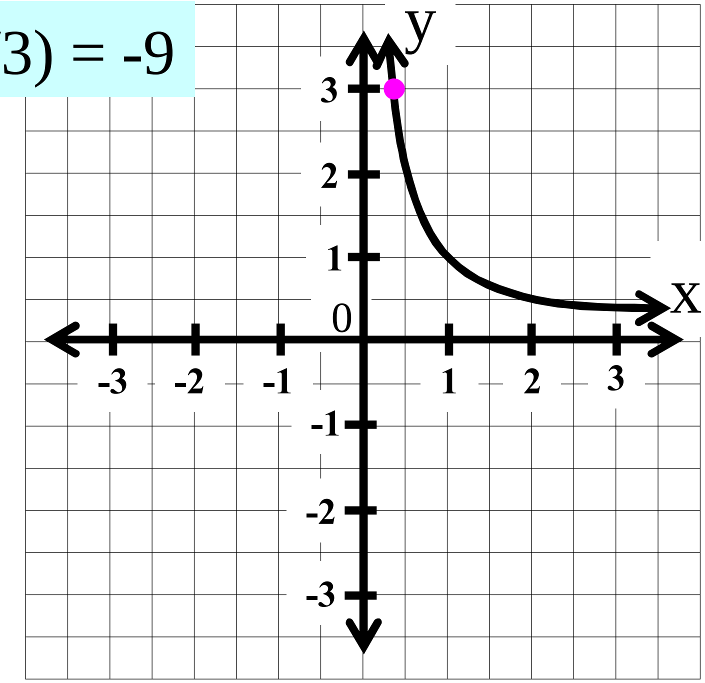

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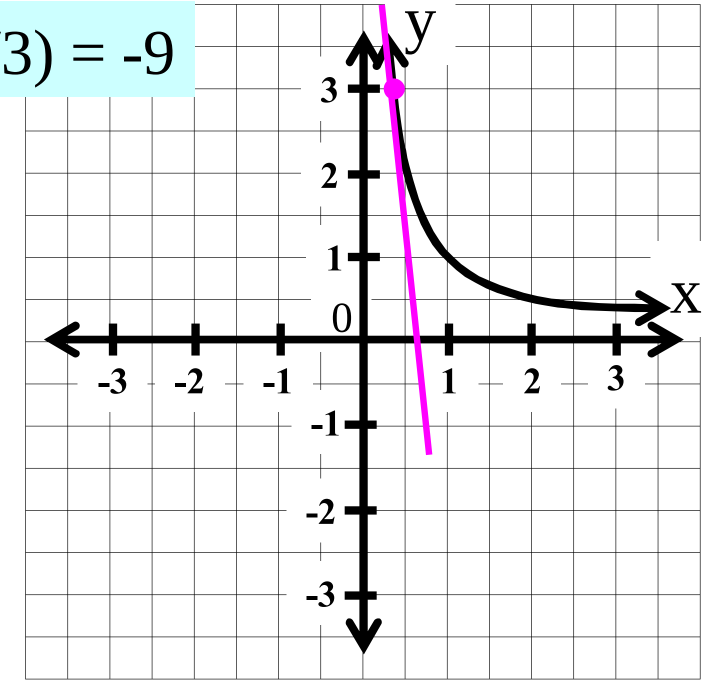

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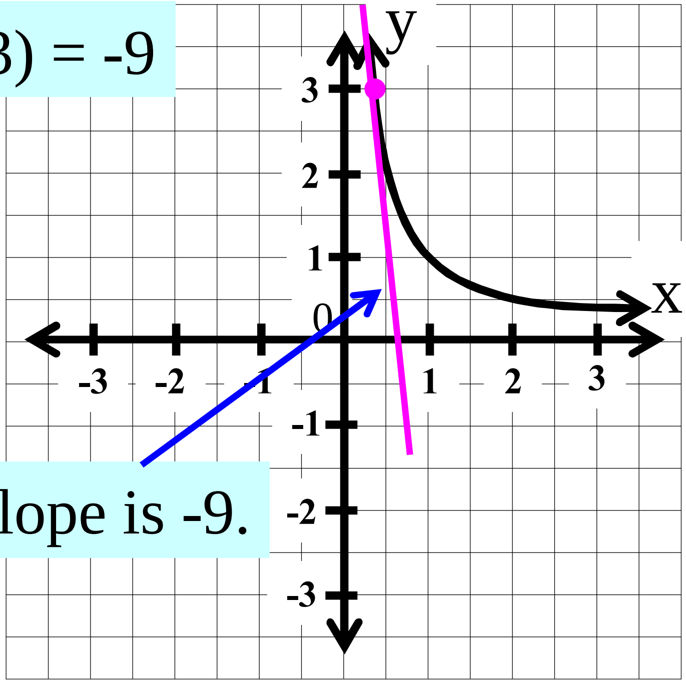

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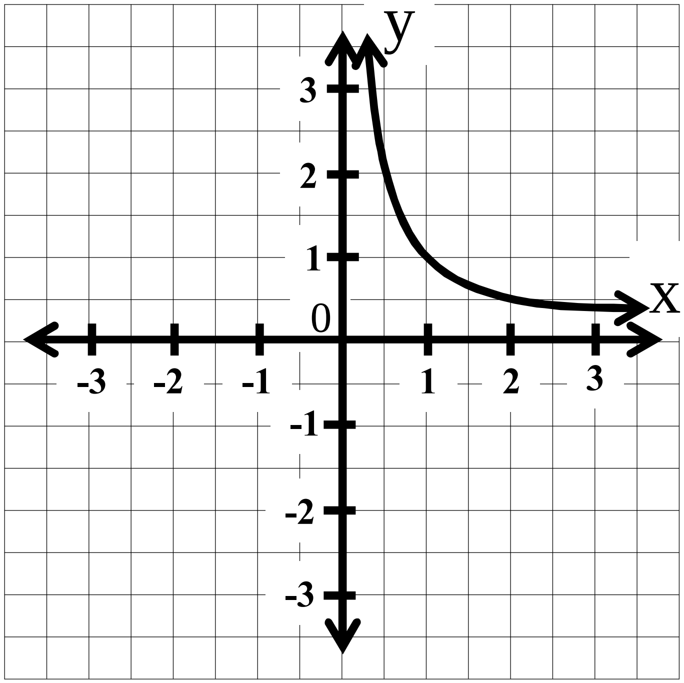
2	1/2	-1/4
3	1/3	-1/9
1/2	2	-4
1/3	3	-9



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

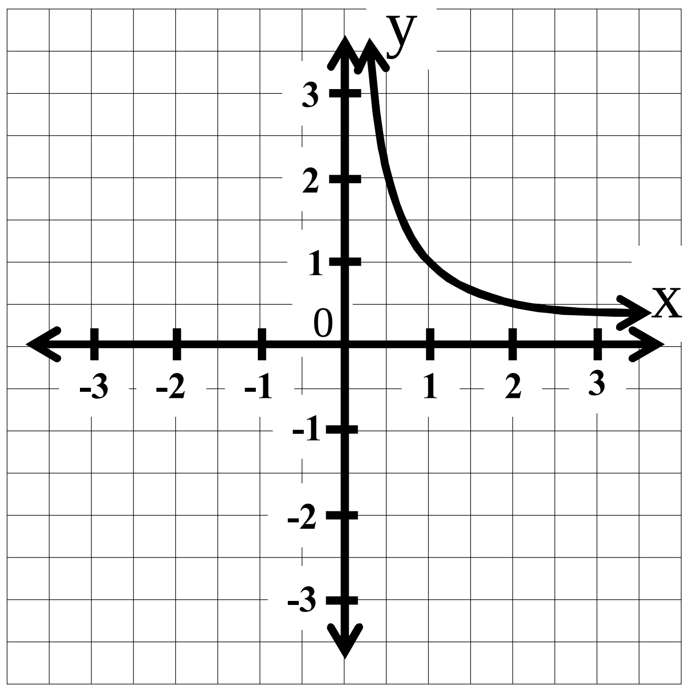
The Derivative of the Reciprocal Function

$$y = f(x) = \frac{1}{x}$$

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

Consider the graph of the reciprocal function.

x	f(x)	f ′(x)



Here are some more points on the graph.

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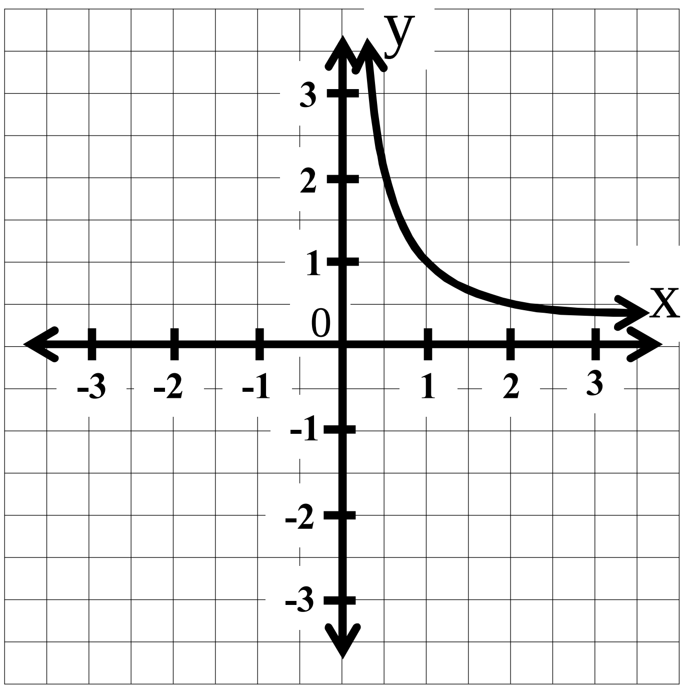
-1		



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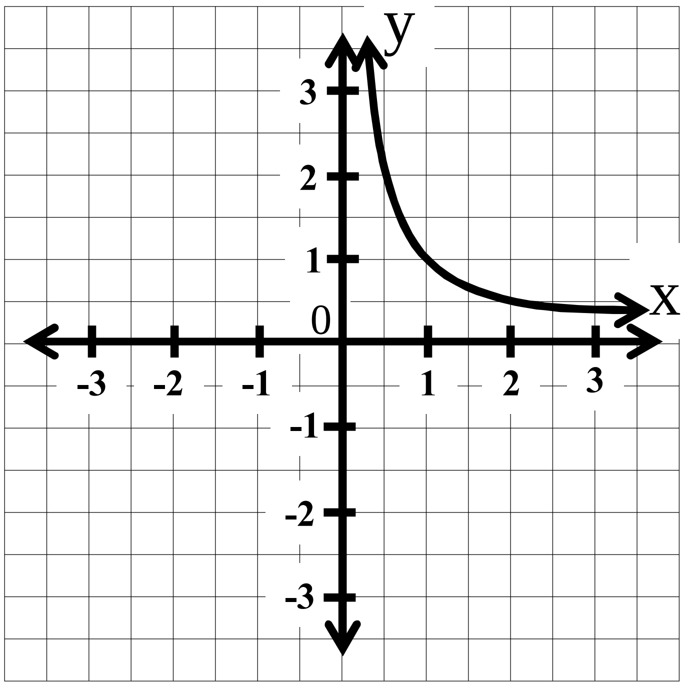

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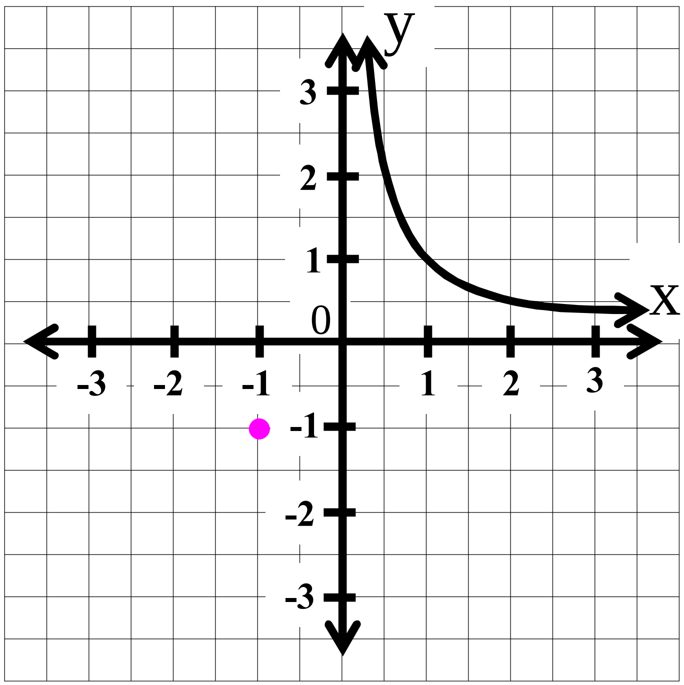

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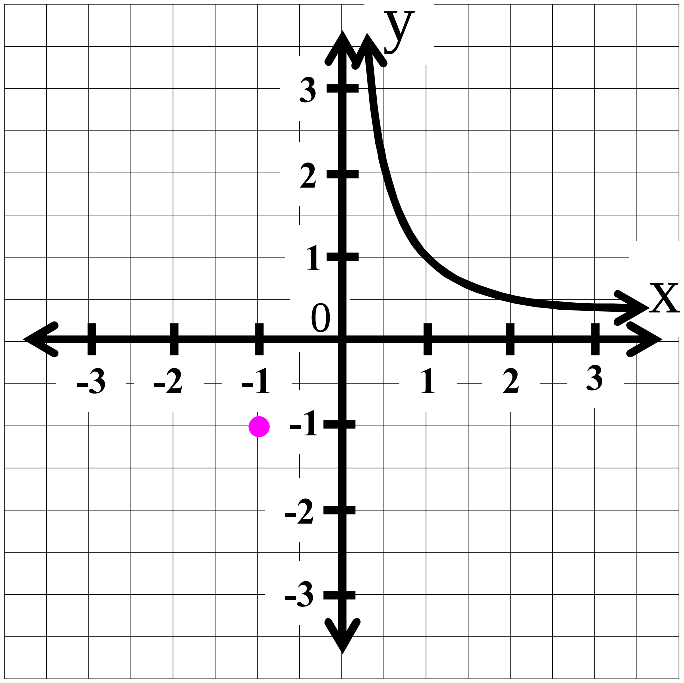
-1	-1	
-2		



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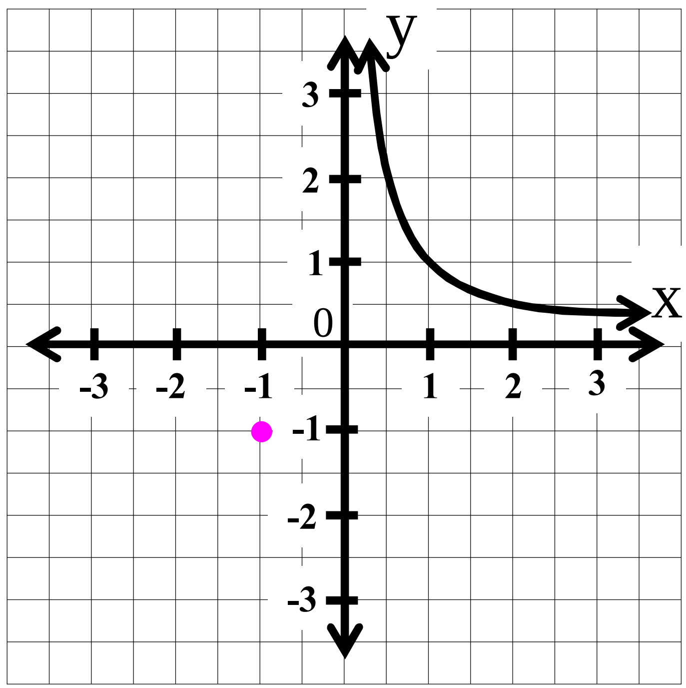
-2	-1/2	



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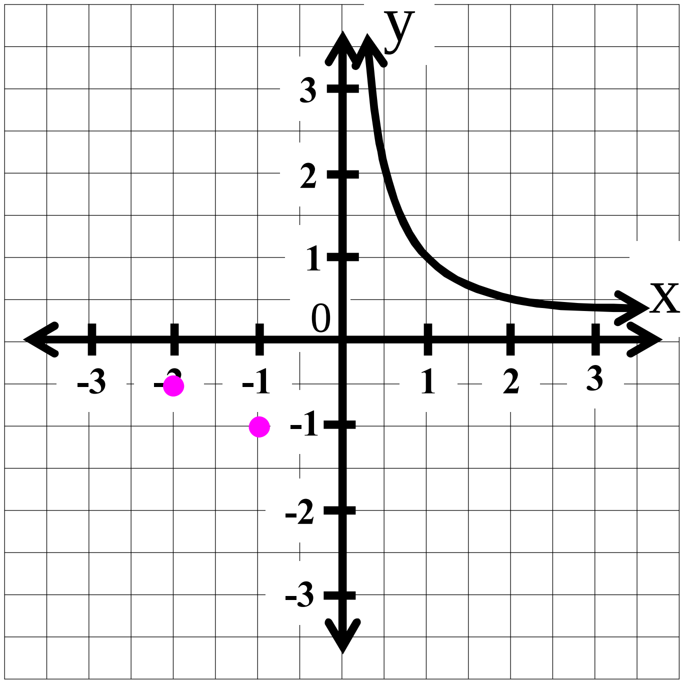

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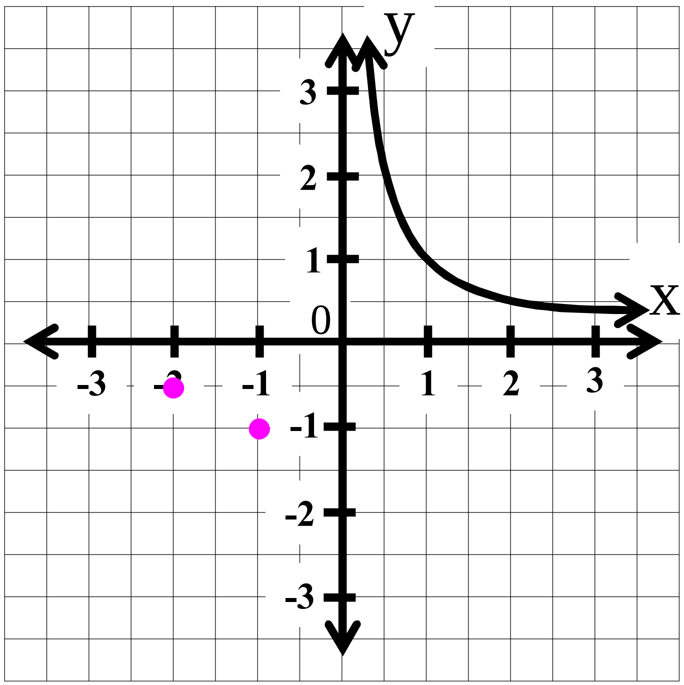
-3		



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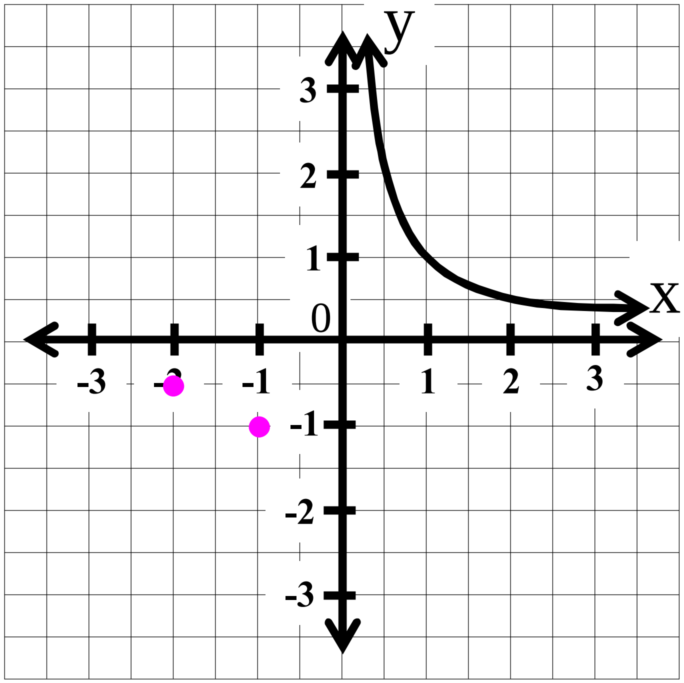

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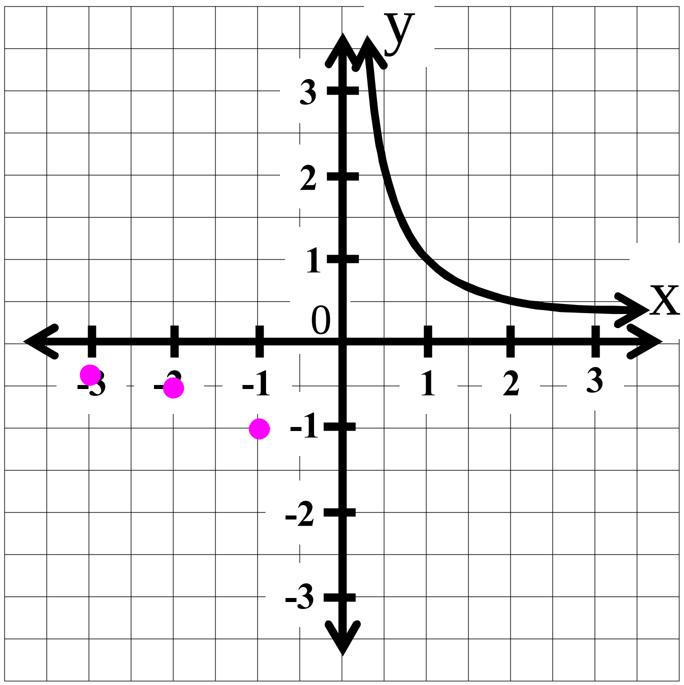

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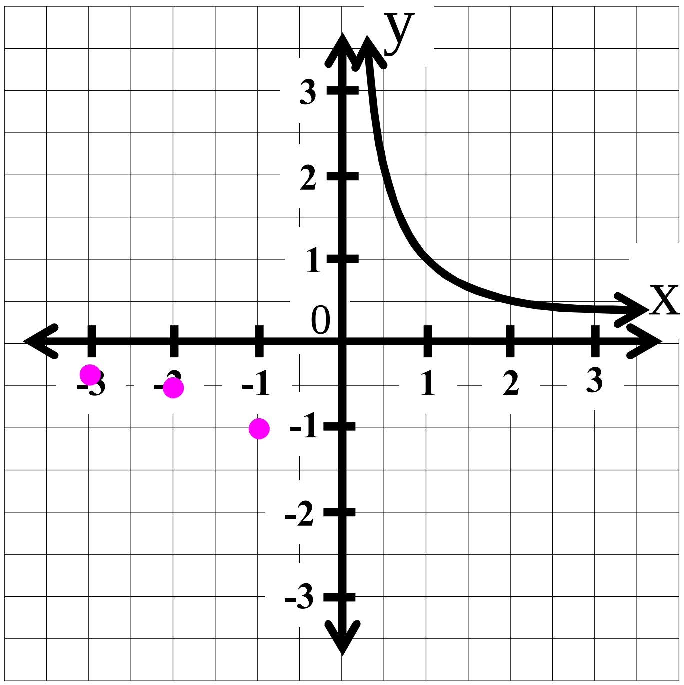
-1/2		



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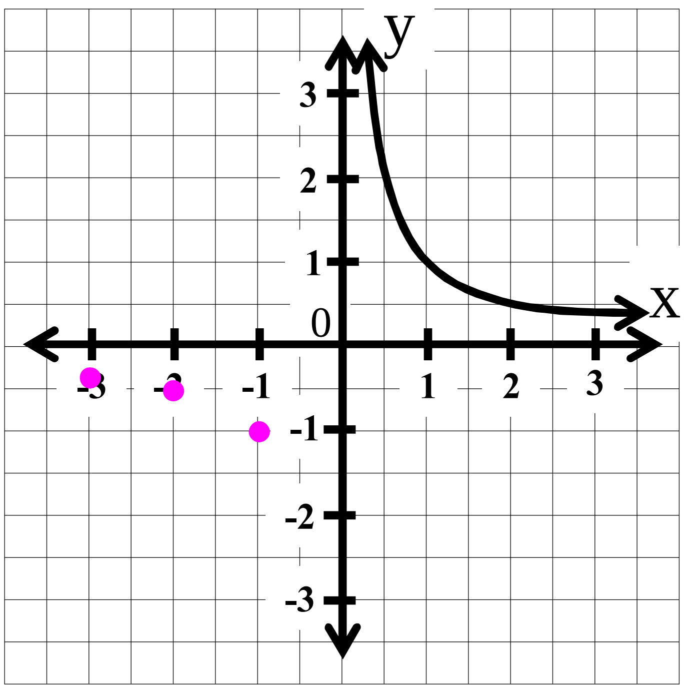

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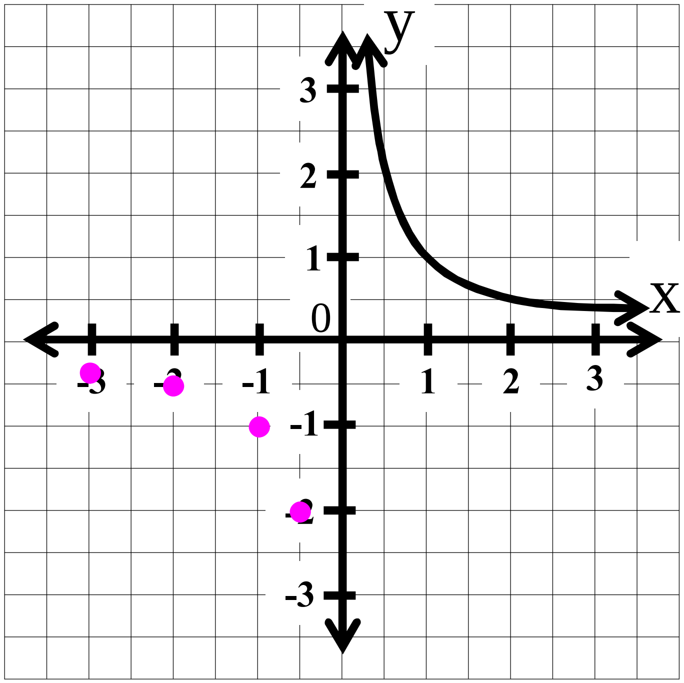

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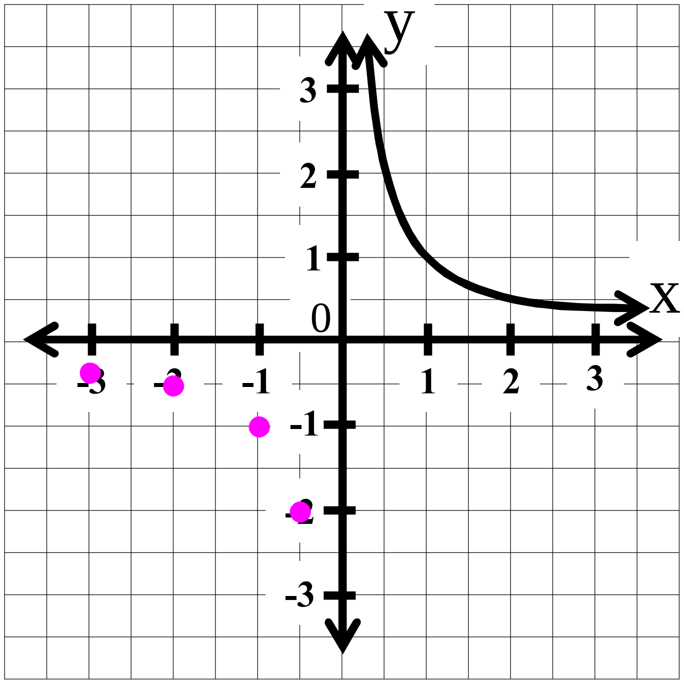

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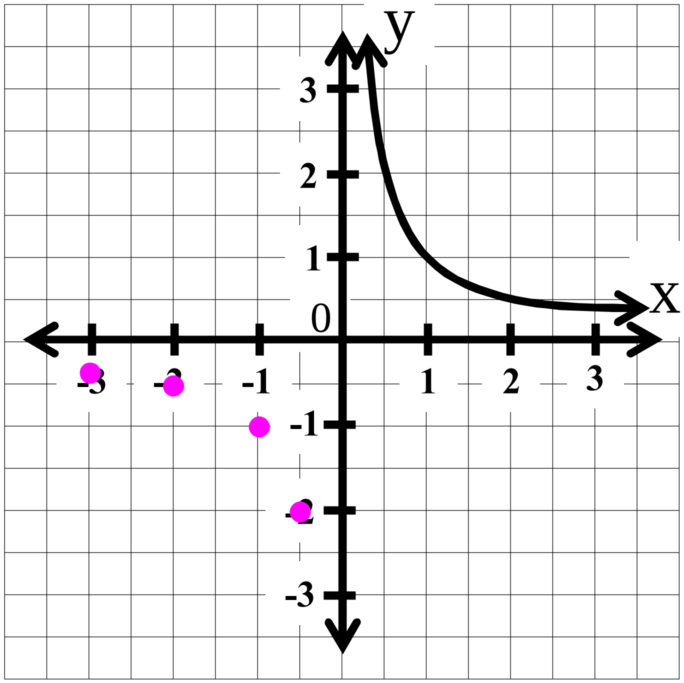

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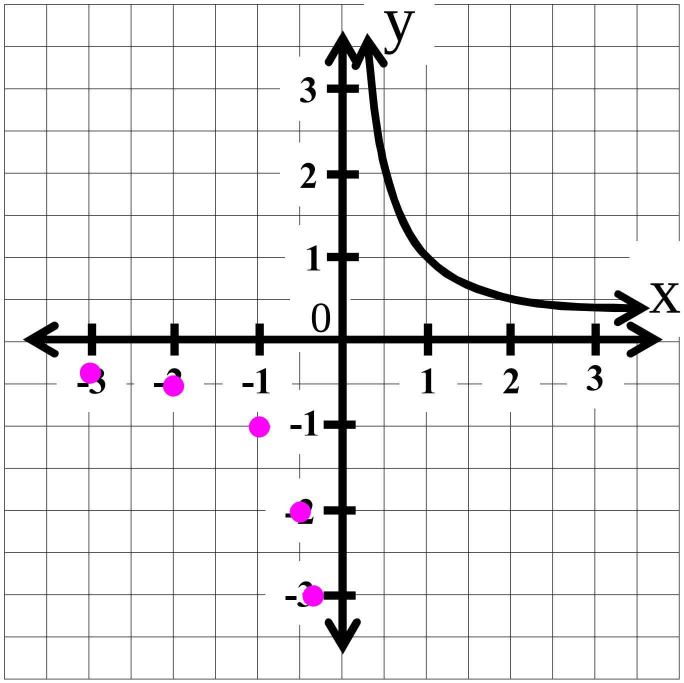

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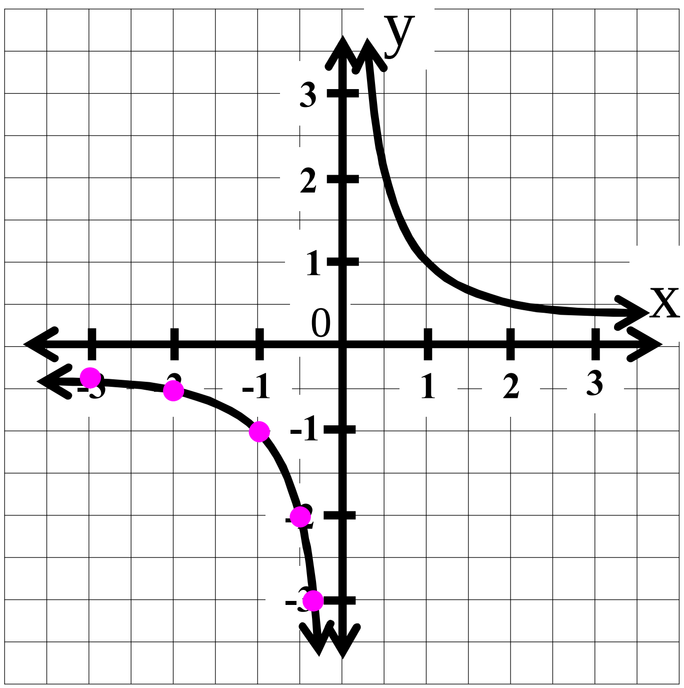

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-3	-1/3	
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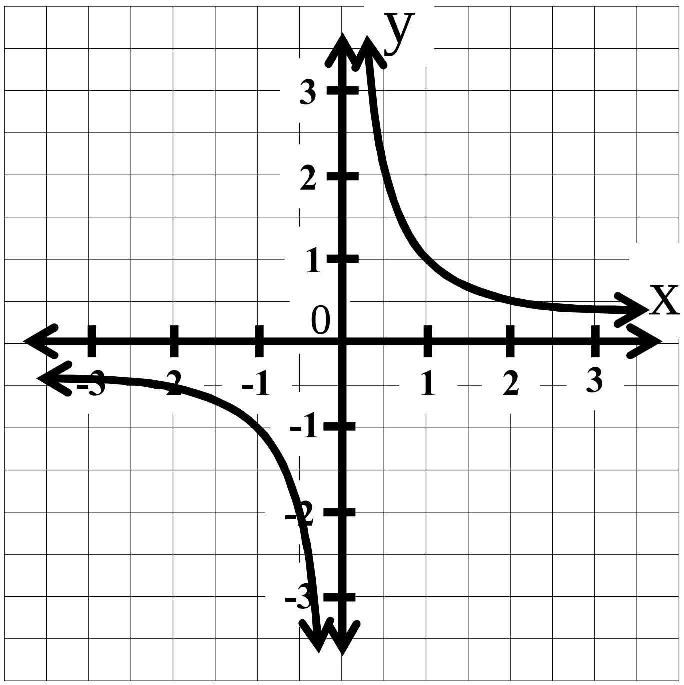

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Now consider derivative function.

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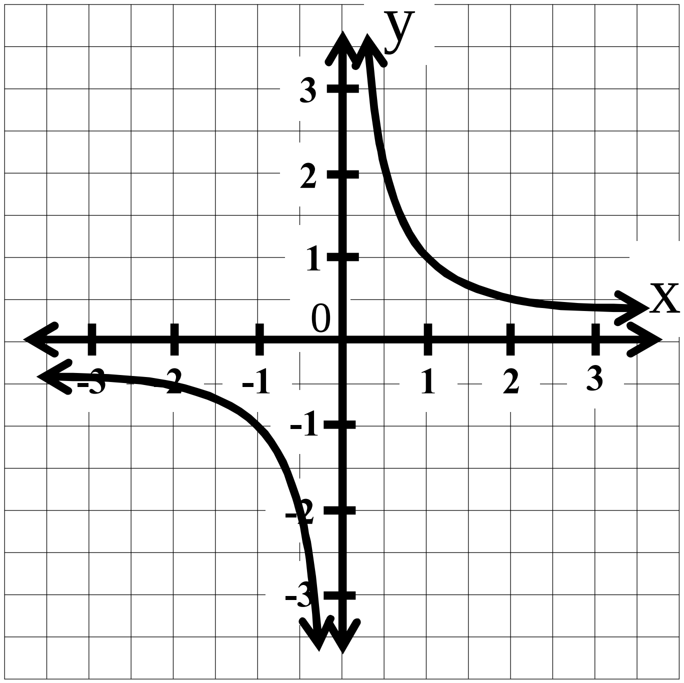

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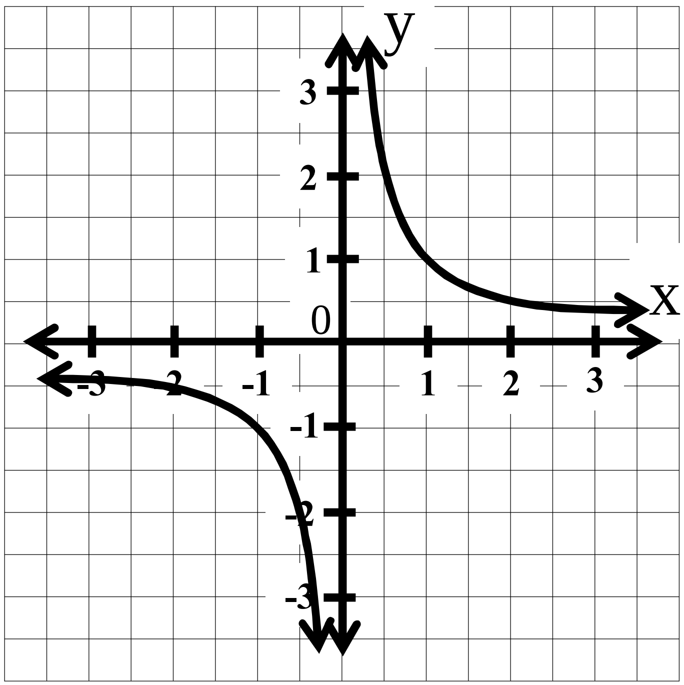

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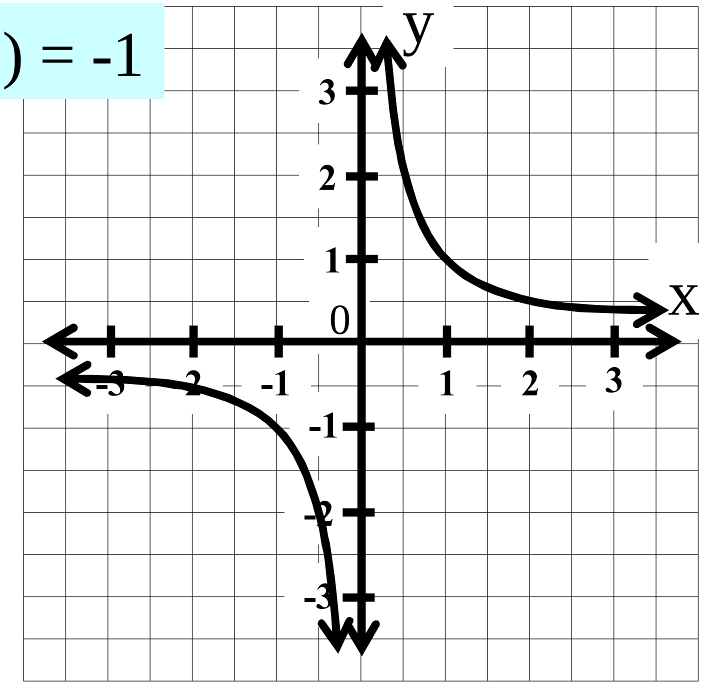
Consider the graph of the reciprocal function.
Now consider derivative function.

$f'(-1) = -1$

x	f(x)	f ′(x)
-1	-1	-1
-2	-1/2	
-3	-1/3	
-1/2	-2	
-1/3	-3	



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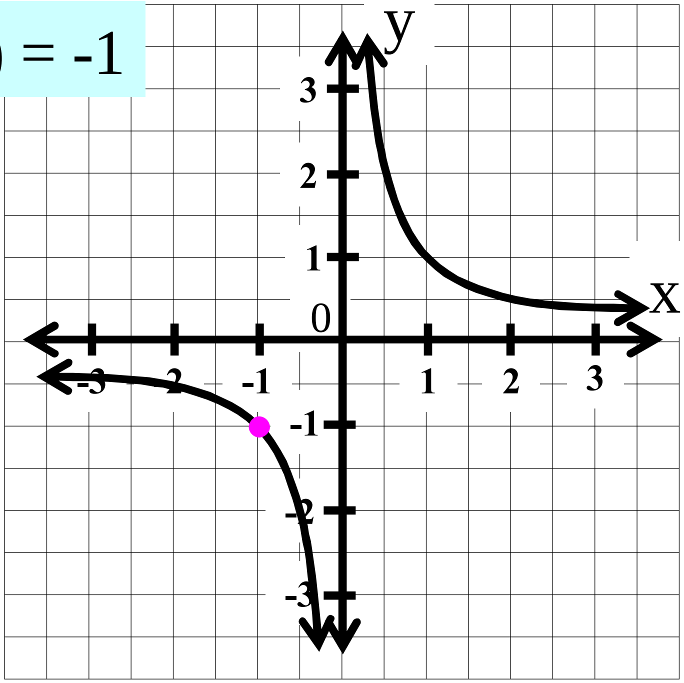

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-3	-1/3	
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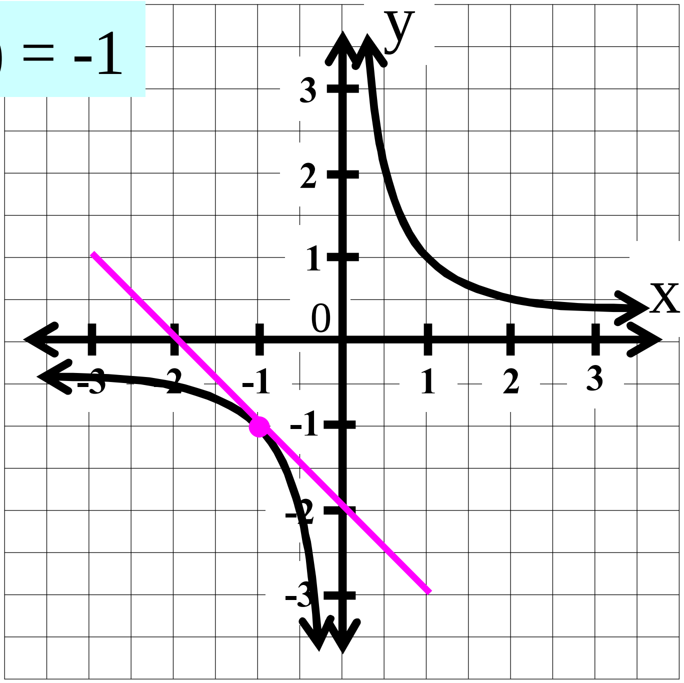

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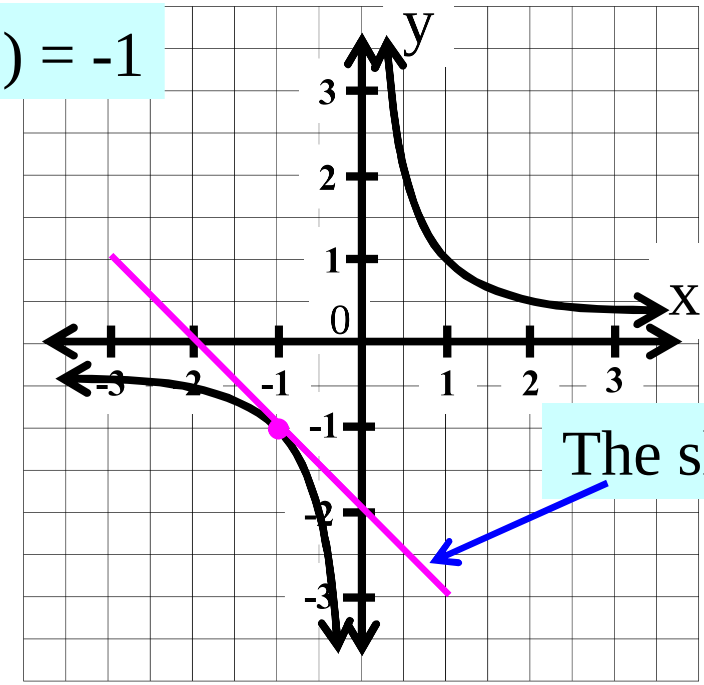
Now consider derivative function.

f ′(-1) = -1

x	f(x)	f ′(x)
-1	-1	-1
-2	-1/2	
-3	-1/3	
-1/2	-2	
-1/3	-3	



The slope is -1.

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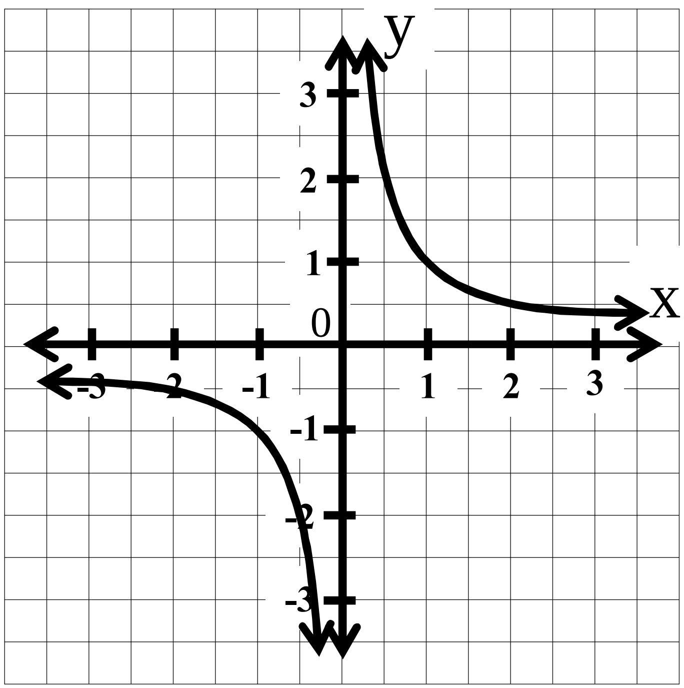

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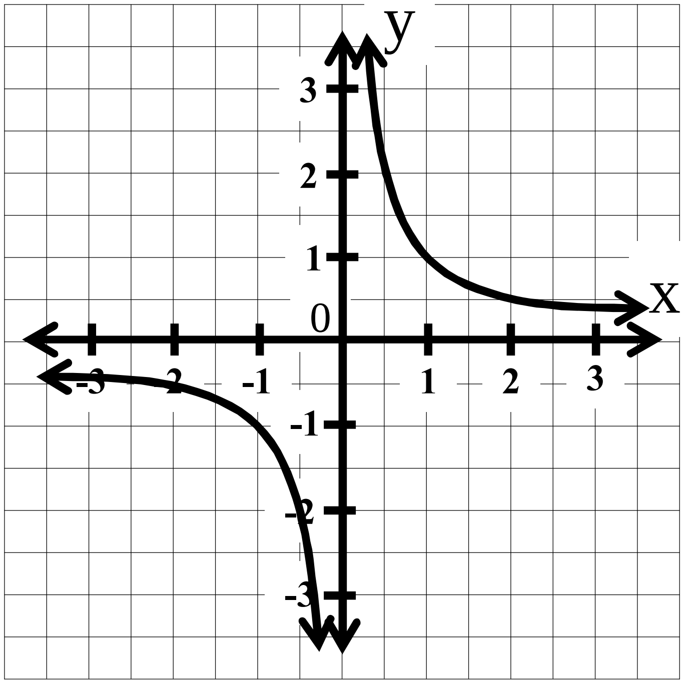

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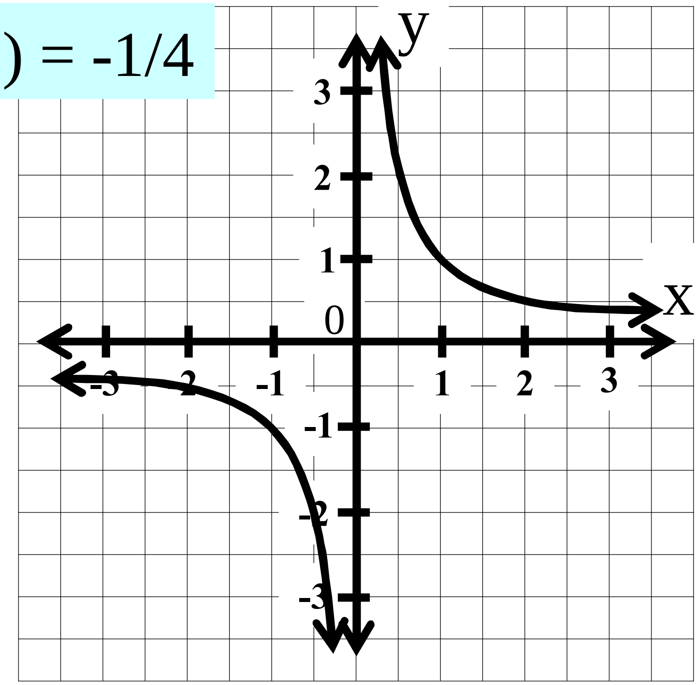
$$y = f(x) = \frac{1}{x}$$

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

Consider the graph of the reciprocal function.
Now consider derivative function.

$f'(-2) = -1/4$

x	f(x)	f ′(x)
-1	-1	-1
-2	-1/2	-1/4
-3	-1/3	
-1/2	-2	
-1/3	-3	



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

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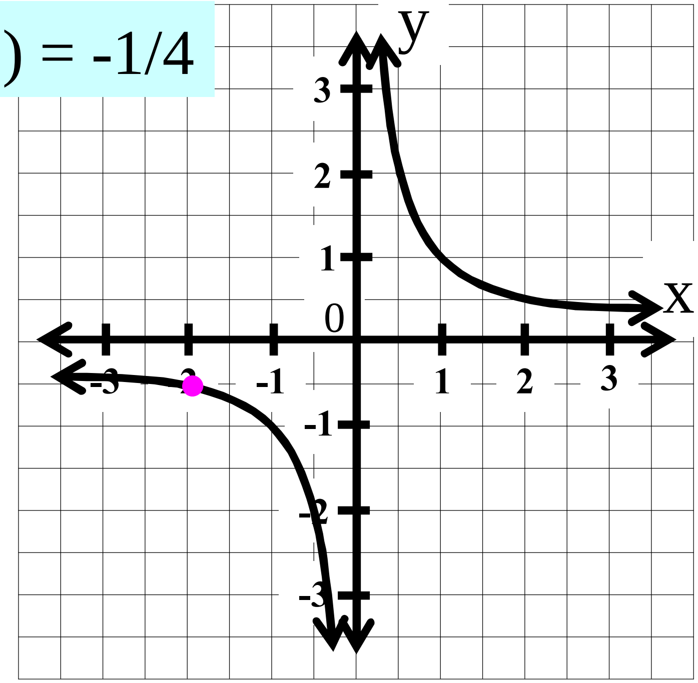
Consider the graph of the reciprocal function.
Now consider derivative function.

$f'(-2) = -1/4$

x	f(x)	f ′(x)
-1	-1	-1
-2	-1/2	-1/4
-3	-1/3	
-1/2	-2	
-1/3	-3	



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

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x	f(x)	f ′(x)
-1	-1	-1
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-3	-1/3	
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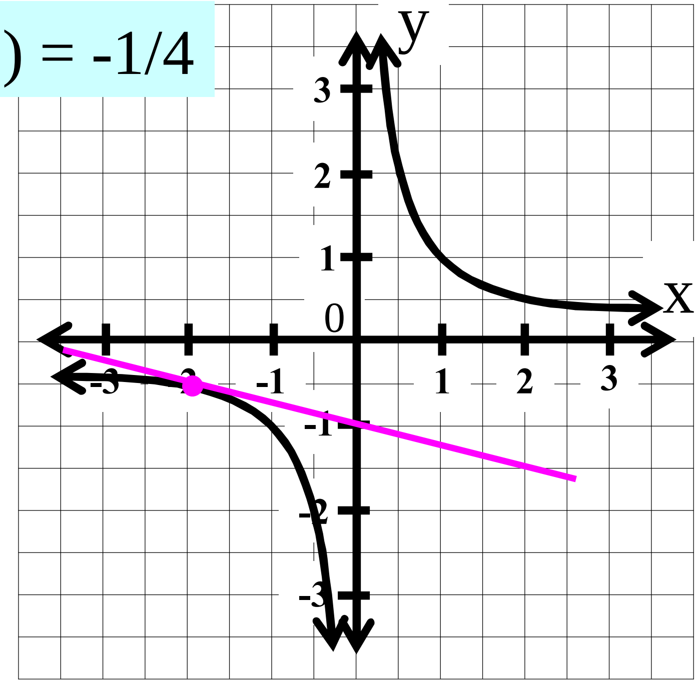
-1/3	-3	

f ′(-2) = -1/4



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

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x	f(x)	f ′(x)
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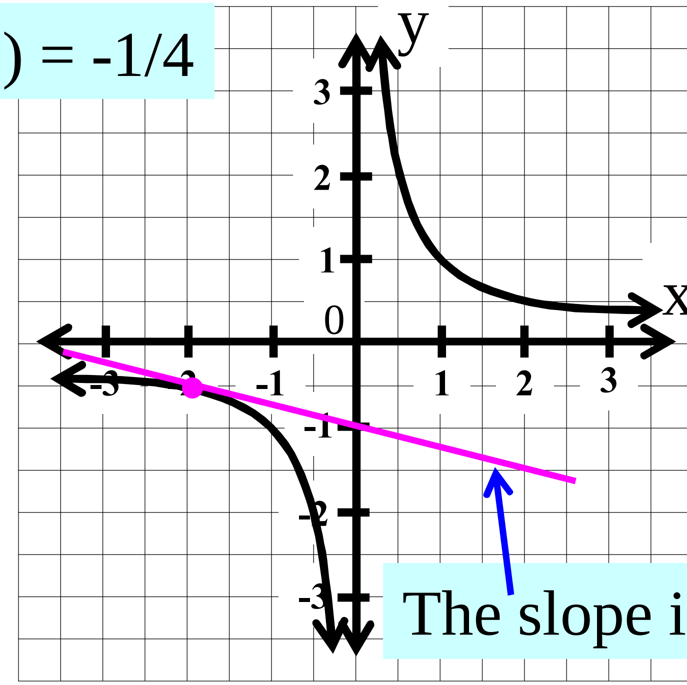
-3	-1/3	
-1/2	-2	
-1/3	-3	

$f'(-2) = -1/4$



The slope is -1/4.

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

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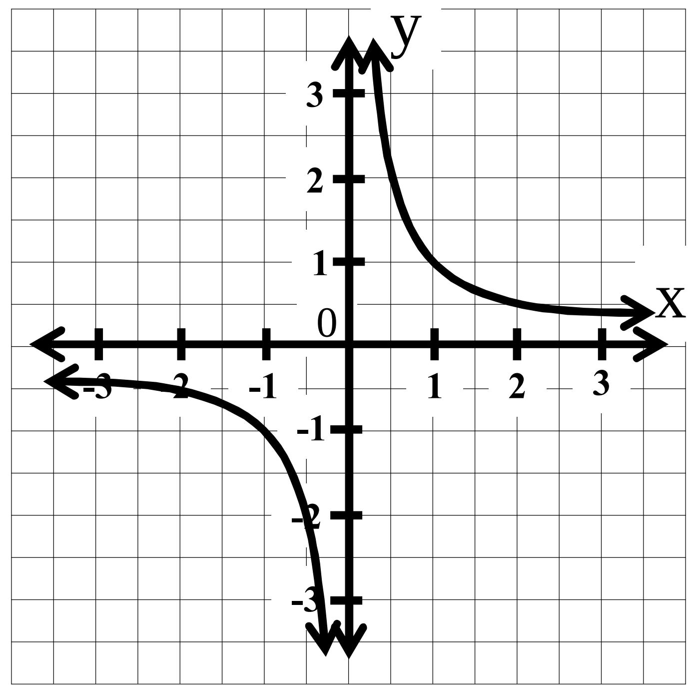

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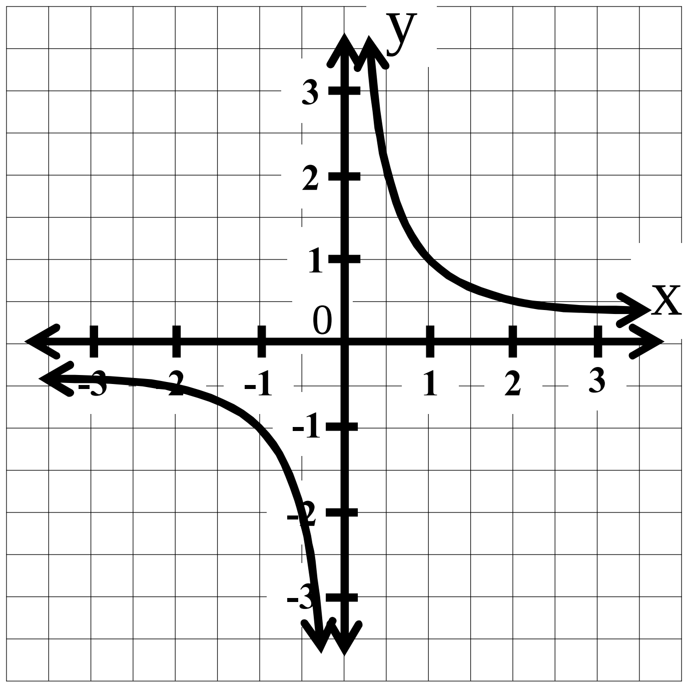

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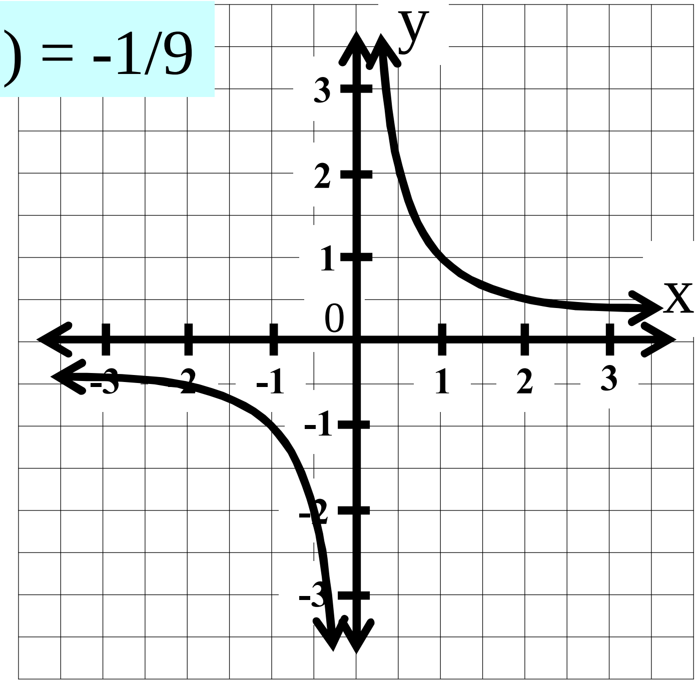
$$f'(x) = \frac{-1}{x^2}$$

Consider the graph of the reciprocal function.
Now consider derivative function.

$f'(-3) = -1/9$

x	f(x)	f ′(x)
-1	-1	-1
-2	-1/2	-1/4
-3	-1/3	-1/9
-1/2	-2	
-1/3	-3	



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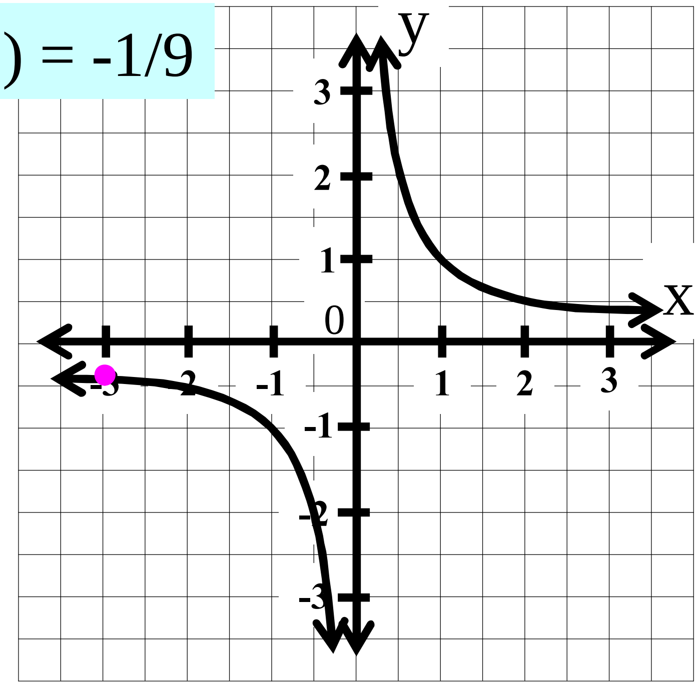
x	f(x)	f ′(x)
-1	-1	-1
-2	-1/2	-1/4
-3	-1/3	-1/9
-1/2	-2	
-1/3	-3	

$f'(-3) = -1/9$



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

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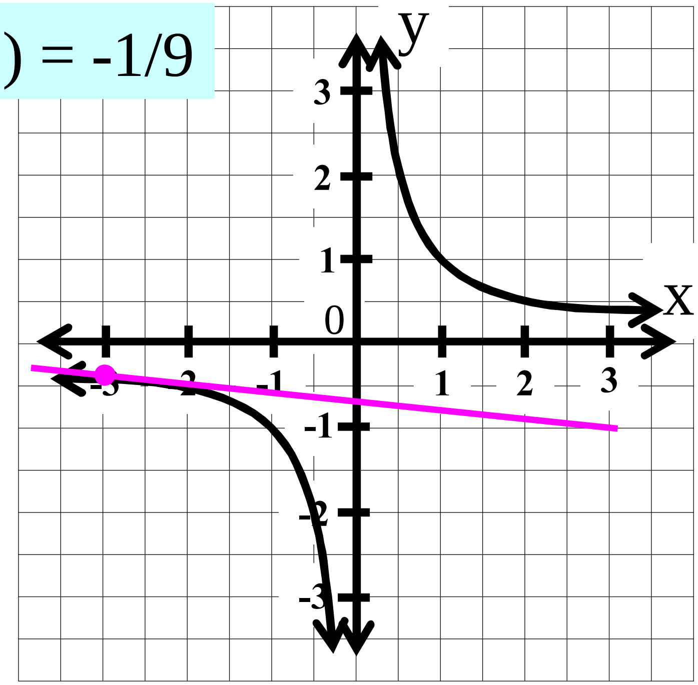

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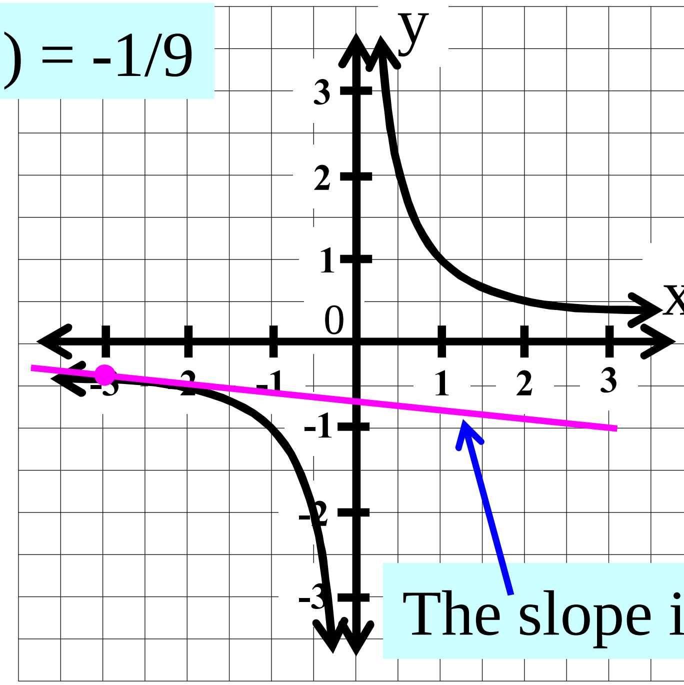

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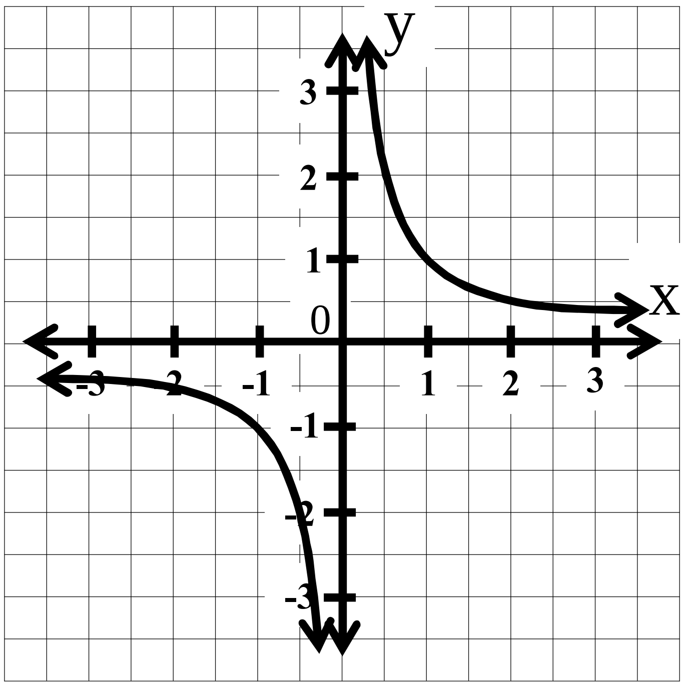

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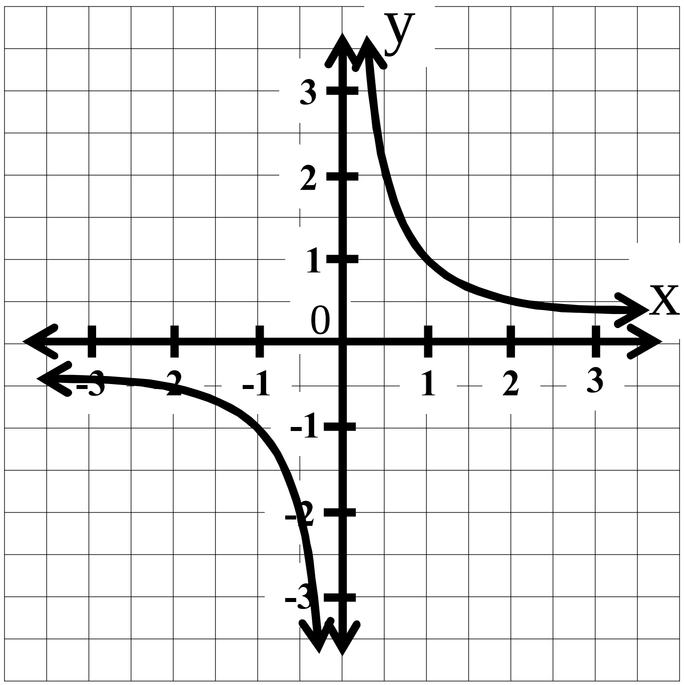

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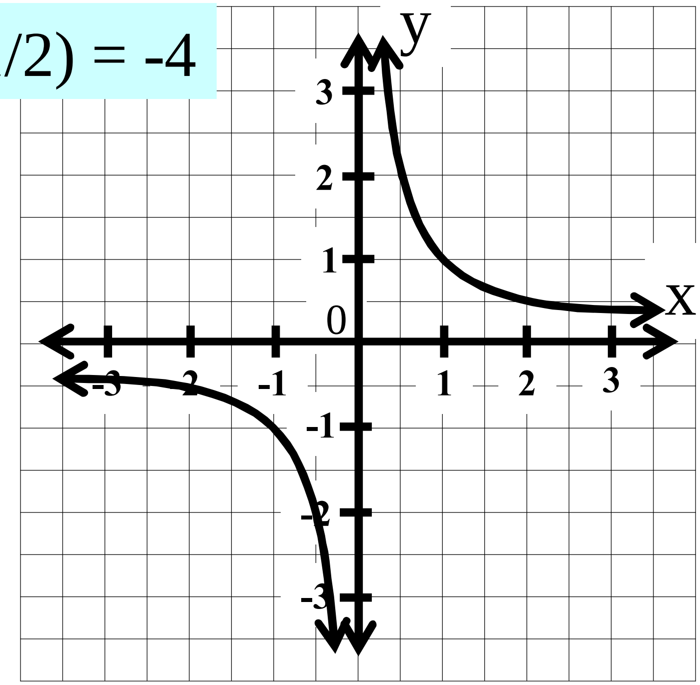

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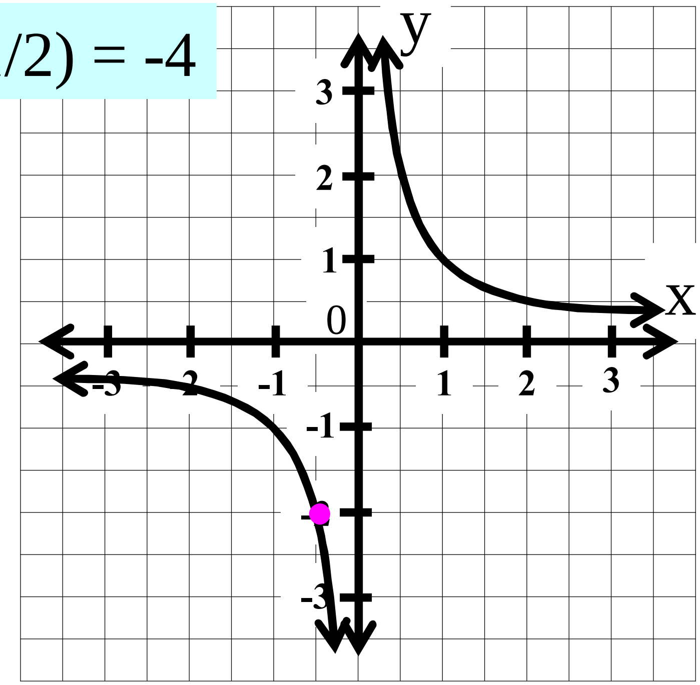

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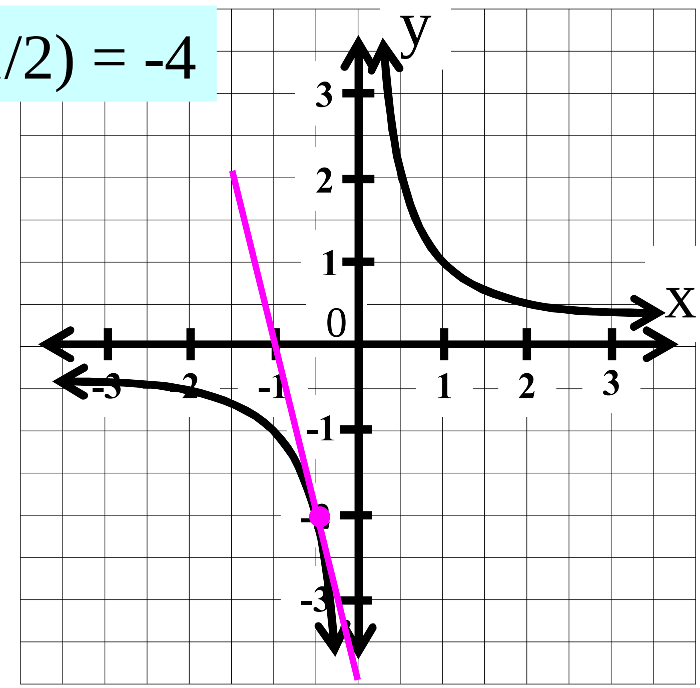

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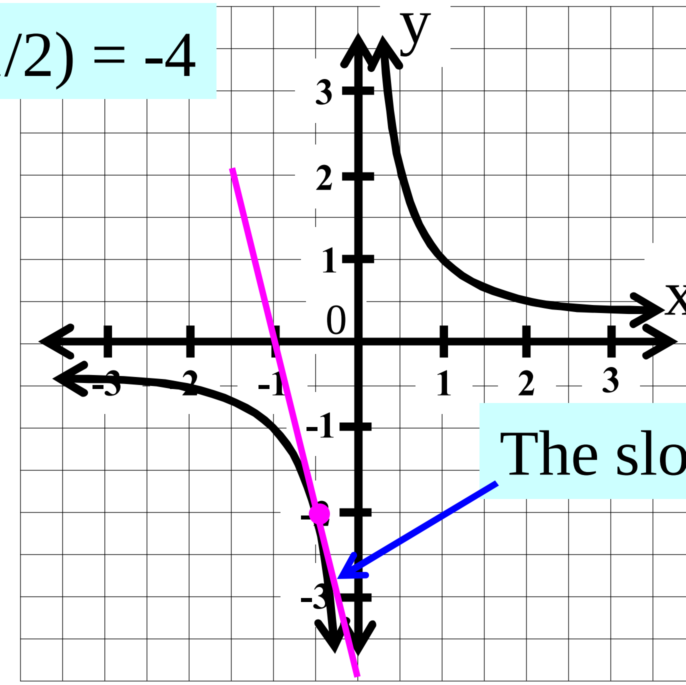

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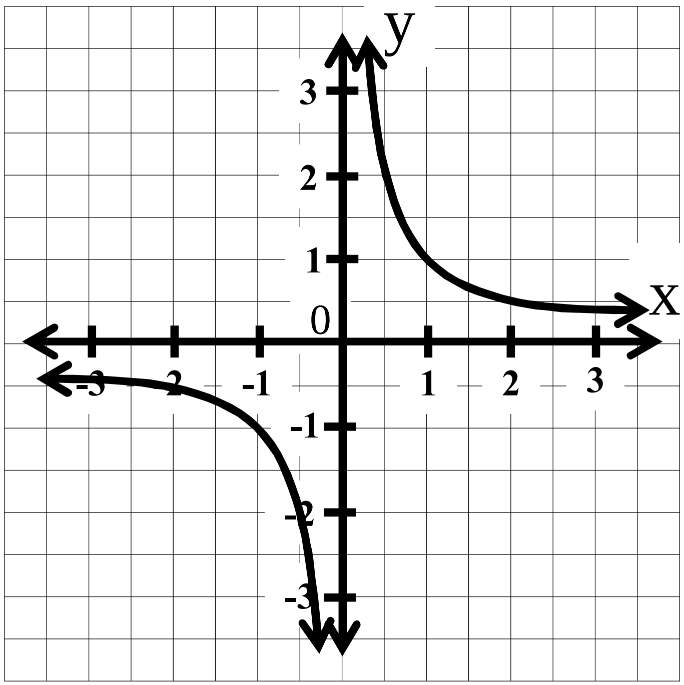

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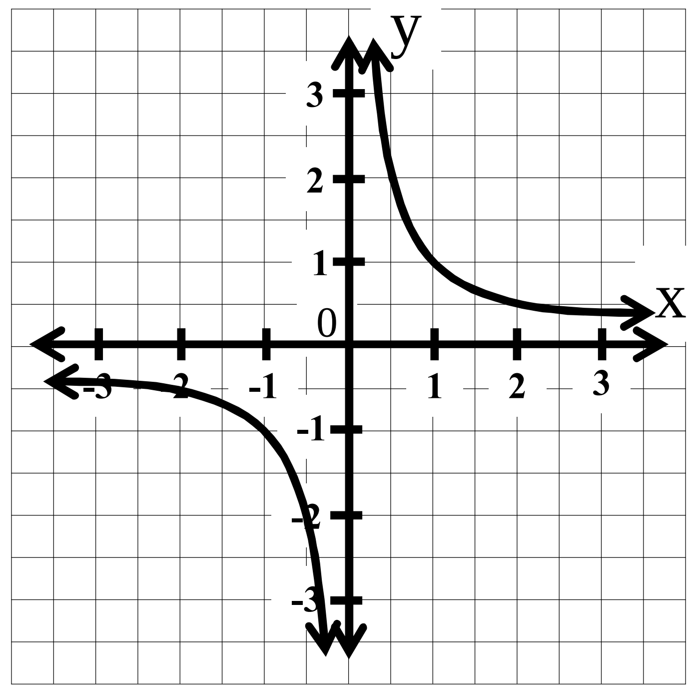

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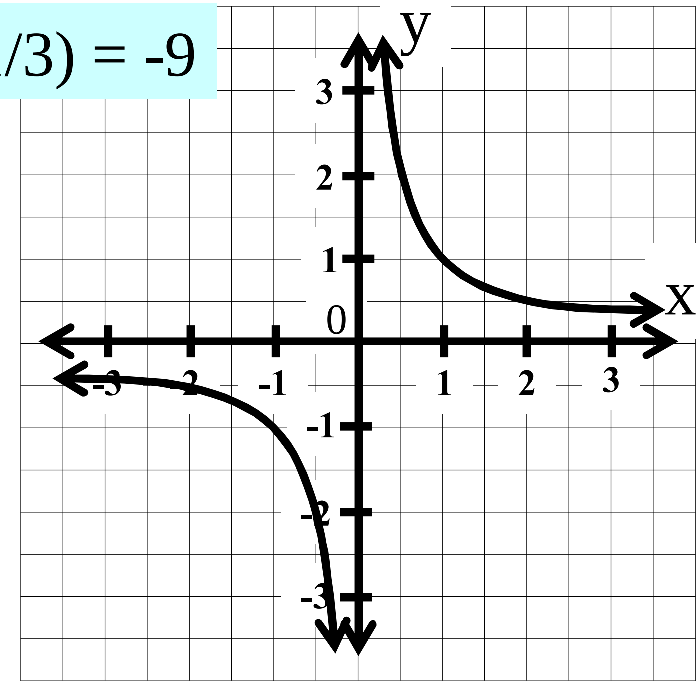

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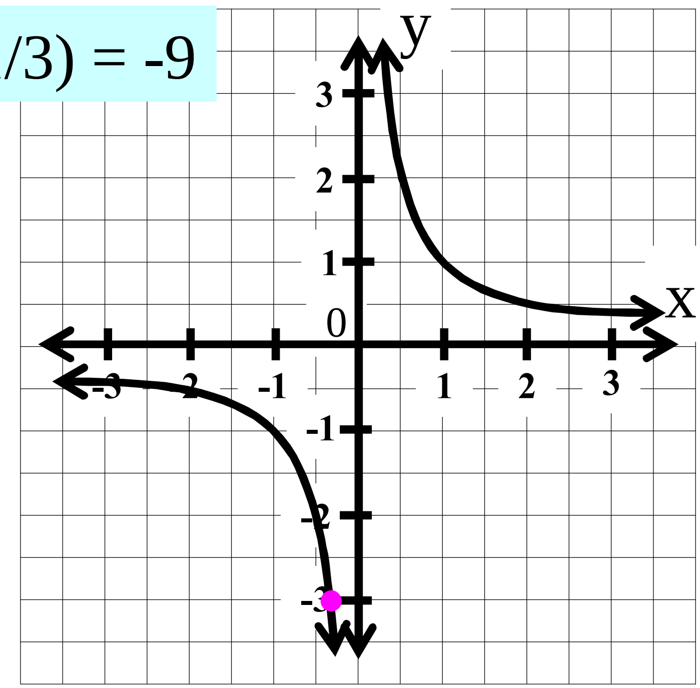

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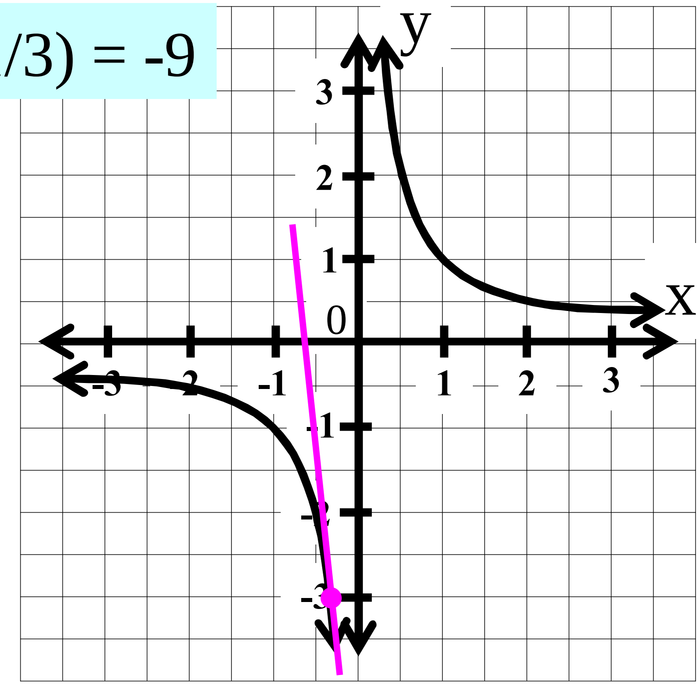

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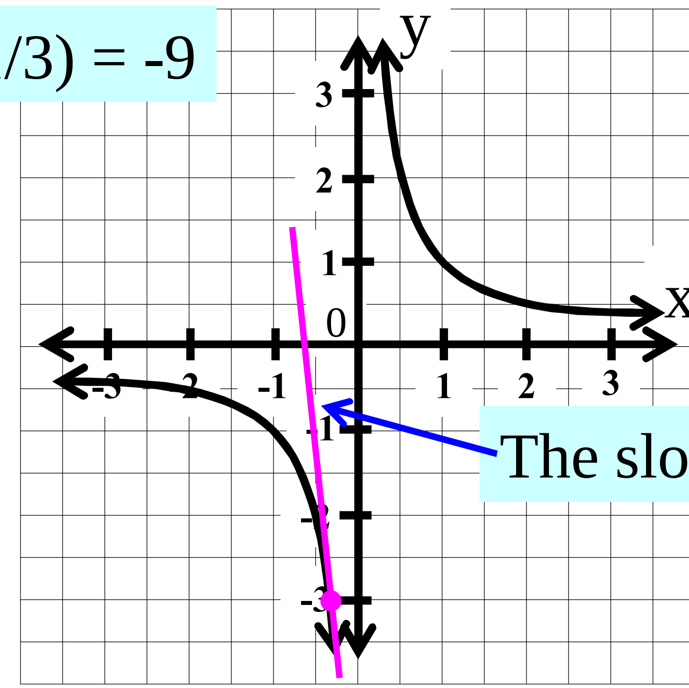

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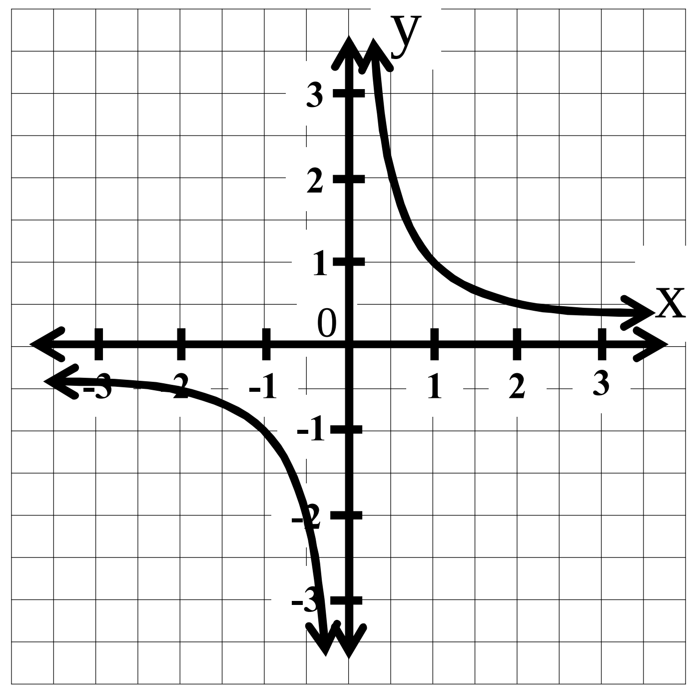

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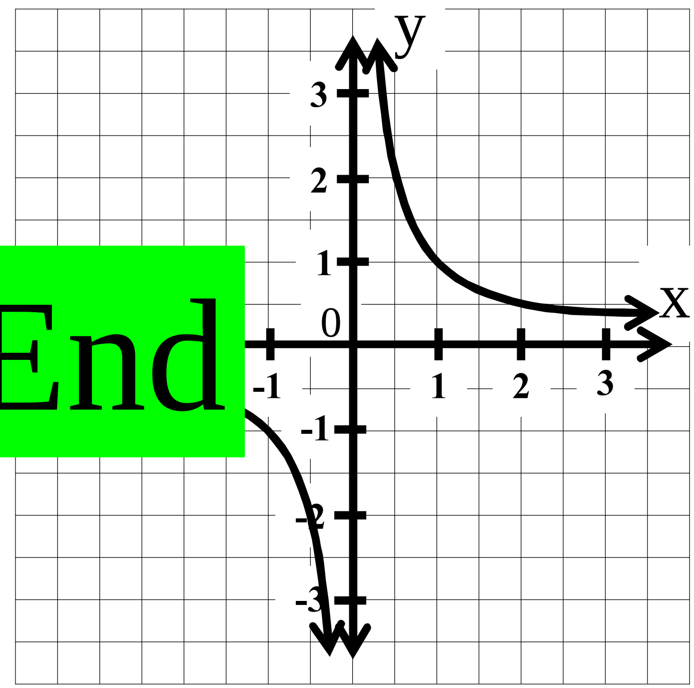
The End



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