

G.N.A.W.

GRAPHIC • NUMERIC • ALGEBRAIC • VERBAL

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G.N.A.W. on Relations Name: _____

Graph	Numeric
	Express the relation as a mapping. $\{(-1,5), (0,2), (1,1), (2,2), (3,5)\}$

Algebraic (Equations)

Assume the set of points in the relation above belongs to a parabola. Write the equation of the parabola with its transformations and find the inverse of the function.

1. What is the domain?
2. What is the range?
3. Does the function pass the vertical line test?
4. Explain why or why not.

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G.N.A.W. on Functions Name: _____

Graph	Numeric																				
Graph both equations below. 	Make a table of values for the line passing through the point (9, 2).																				
	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>9</td> <td>2</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	x	y	9	2																
x	y																				
9	2																				

Words (Verbal)

What is the slope of the line $3x + 2y = 5$?

Is the function increasing or decreasing?

State any other characteristics of this line.

G.N.A.W. on Quadratics

Graph	Algebraic (Equations)
	Assume the set of points in the relation above belongs to a parabola. Write the equation of the parabola with its transformations and find the inverse of the function.
	<ol style="list-style-type: none"> 1. What is the domain? 2. What is the range? 3. Does the function pass the vertical line test? 4. Explain why or why not.

Use completing the square to find vertex of the function: $f(x) = 2x^2 - 12x + 1$

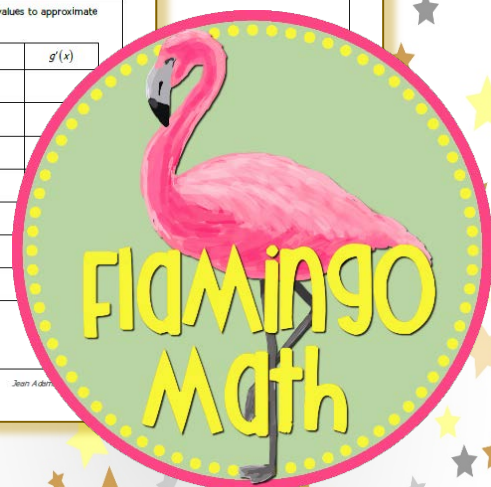
2. State the range of the function.
3. State the intervals where the function is increasing / decreasing.
4. What is the y-intercept of the function?

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G.N.A.W. on AROC or IROC Name: _____

Verbal Description	Graph																								
Given the piecewise equation, describe and discuss continuity and differentiability of the function at $x = 0$. $g(x) = \begin{cases} -x, & x < 0 \\ x - x^2, & x \geq 0 \end{cases}$	Draw your graph below: 																								
Algebraic	Table of Values																								
1. Determine the slope of $g(x)$ at $x = -1$, $x = -0.5$, $x = -0.1$, $x = -0.01$, $x = -0.001$	Complete the table of values to approximate																								
2. Determine the average rate of change in the interval from $[0, 2]$.	<table border="1"> <thead> <tr> <th>x</th> <th>g(x)</th> <th>g'(x)</th> </tr> </thead> <tbody> <tr> <td>-3</td> <td> </td> <td> </td> </tr> <tr> <td>-2</td> <td> </td> <td> </td> </tr> <tr> <td>-1</td> <td> </td> <td> </td> </tr> <tr> <td>0</td> <td> </td> <td> </td> </tr> <tr> <td>1</td> <td> </td> <td> </td> </tr> <tr> <td>2</td> <td> </td> <td> </td> </tr> <tr> <td>3</td> <td> </td> <td> </td> </tr> </tbody> </table>	x	g(x)	g'(x)	-3			-2			-1			0			1			2			3		
x	g(x)	g'(x)																							
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6. At what points, if any, are the tangents to the graph of $g(x)$ horizontal?																									

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G.N.A.W. - THE RULE OF FOUR

Here is a THANK YOU GIFT FOR 1000 FOLLOWERS! I truly appreciate your support. There is a GNAW Foldable[®], created for Algebra 1 or 2 students to introduce the concept of analyzing functions.

You will also find 5 different levels of GNAW activities using the Rule of Four approach to analyzing functions. You will find two activities that can be used in Algebra 2 or PreCalculus:

- GNAW on Functions
- GNAW on Relations
- GNAW on Quadratics

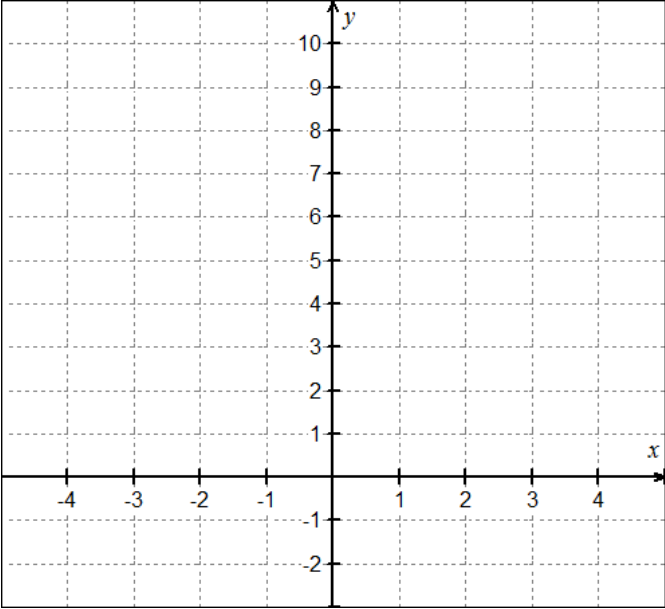
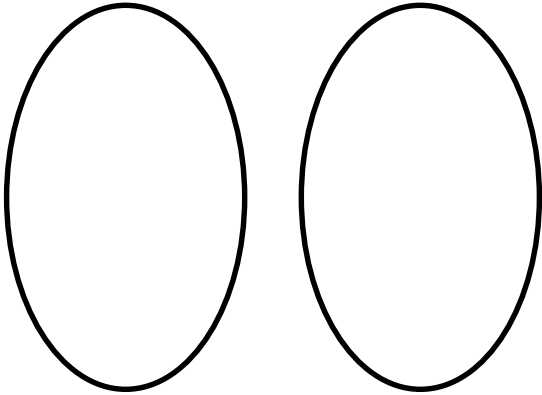
and two activities that can be used in Calculus:

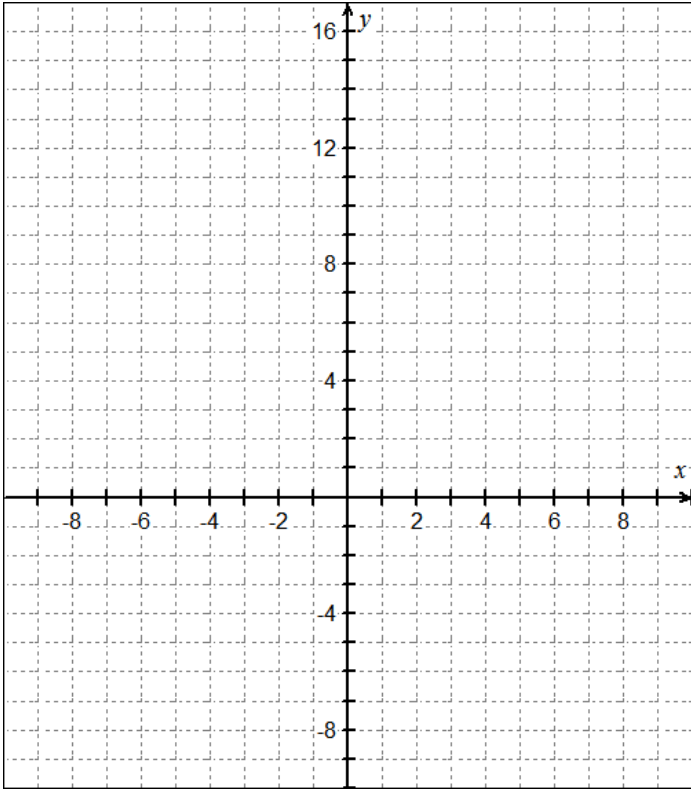
- GNAW on Limits
- GNAW on AROC IROC

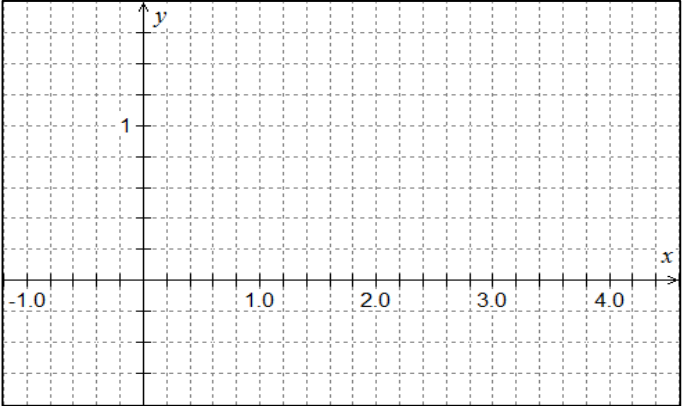
Please visit my store for more engaging task card activities.

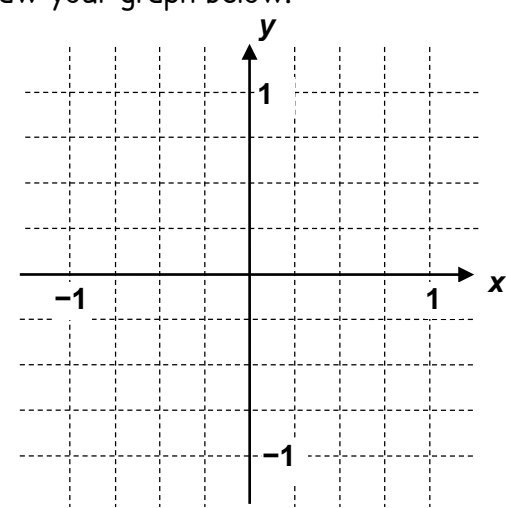
THANK YOU!



Graph	Numeric
	<p>Express the relation as a mapping.</p> $\{(-1,5), (0,2), (1,1), (2,2), (3,5)\}$ <div style="display: flex; justify-content: space-around; align-items: center; height: 150px;">  </div>
Algebraic (Equations)	Words (Verbal)
<p>Assume the set of points in the relation above belongs to a parabola. Write the equation of the parabola with its transformations and find the inverse of the function.</p>	<ol style="list-style-type: none"> 1. What is the domain of the relation? 2. What is the range of the relation? 3. Does the function have an inverse? 4. Explain why or why not.

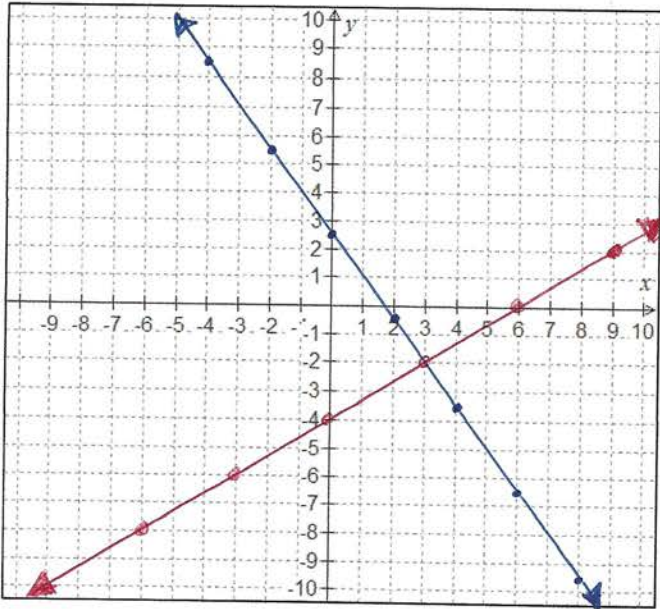
Graph	Numeric
	<p>Use any method you like to find the x-intercepts of the function. Show all work to support your answer.</p>
Algebraic (Equations)	Words (Verbal)
<p>Use completing the square to find vertex form of the function: $f(x) = 2x^2 - 12x + 15$</p>	<ol style="list-style-type: none">1. State the domain of the function.2. State the range of the function.3. State the intervals where the function is increasing / decreasing.4.) What is the y-intercept of the function?

Verbal Description	Graph														
<p>Explain the meaning of the following statement:</p> $\lim_{x \rightarrow 1^+} \frac{\sqrt{2x+1} - \sqrt{3}}{x-1}$	<p>Use a graphing utility to graph the function. Then, use the graph to estimate the limit. Draw your graph below:</p> 														
Algebraic	Table of Values														
<p>Rationalize the numerator to find the exact value of the limit.</p>	<p>Complete the table of values to approximate</p> $\lim_{x \rightarrow 1^+} \frac{\sqrt{2x+1} - \sqrt{3}}{x-1}$ <table border="1" data-bbox="938 1344 1393 1879"> <thead> <tr> <th>x</th> <th>$f(x)$</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td></td> </tr> <tr> <td>1.1</td> <td></td> </tr> <tr> <td>1.01</td> <td></td> </tr> <tr> <td>1.001</td> <td></td> </tr> <tr> <td>1.0001</td> <td></td> </tr> <tr> <td>1.00001</td> <td></td> </tr> </tbody> </table>	x	$f(x)$	1.0		1.1		1.01		1.001		1.0001		1.00001	
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Graph

Graph both equations below.



Numeric

Make a table of values for the line passing through the point (9, 2).

x	y
9	2
6	0
3	-2
0	-4
-3	-6
-6	-8

Algebraic (Equations)

A line is perpendicular to the line $3x + 2y = 5$ and passes through the point (9, 2).

1. Find the slope-intercept form of the line.

$$y - 2 = \frac{2}{3}(x - 9)$$

$$y = \frac{2}{3}x - 6 + 2$$

$$y = \frac{2}{3}x - 4$$

2. Write the equation in standard form.

$$3y = 2x - 12$$

$$2x - 3y = 12$$

3. Name both x and y intercepts of the line.

$$(6, 0) \text{ and } (0, -4)$$

Words (Verbal)

1. Find the slope of the line
- $3x + 2y = 5$
- ?

$$2y = -3x + 5$$

$$y = -\frac{3}{2}x + \frac{5}{2}$$

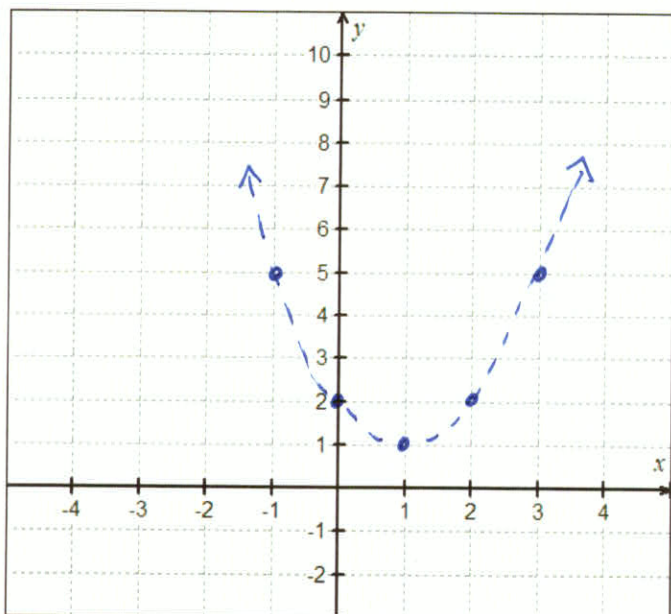
2. Is this function increasing or decreasing?

decreasing

3. Describe any other characteristics of this line.

the two lines intersect
(at 3, -2)domain $(-\infty, \infty)$ range $(-\infty, \infty)$ x-int $(\frac{5}{3}, 0)$ y-int $(0, \frac{5}{2})$

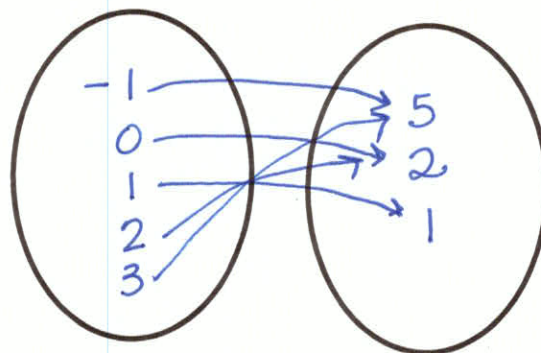
Graph



Numeric

Express the relation as a mapping.

$$\{(-1, 5), (0, 2), (1, 1), (2, 2), (3, 5)\}$$



Algebraic (Equations)

Assume the set of points in the relation above belongs to a parabola. Write the equation of the parabola with its transformations and find the inverse of the function.

$$y = (x-1)^2 + 1$$

$$x = (y-1)^2 + 1$$

$$x-1 = (y-1)^2$$

$$\pm \sqrt{x-1} = y-1$$

$$\underline{\underline{f^{-1}(x) = 1 \pm \sqrt{x-1}}}$$

Words (Verbal)

1. What is the domain of the relation?

$$\{-1, 0, 1, 2, 3\}$$

2. What is the range of the relation?

$$\{5, 2, 1\}$$

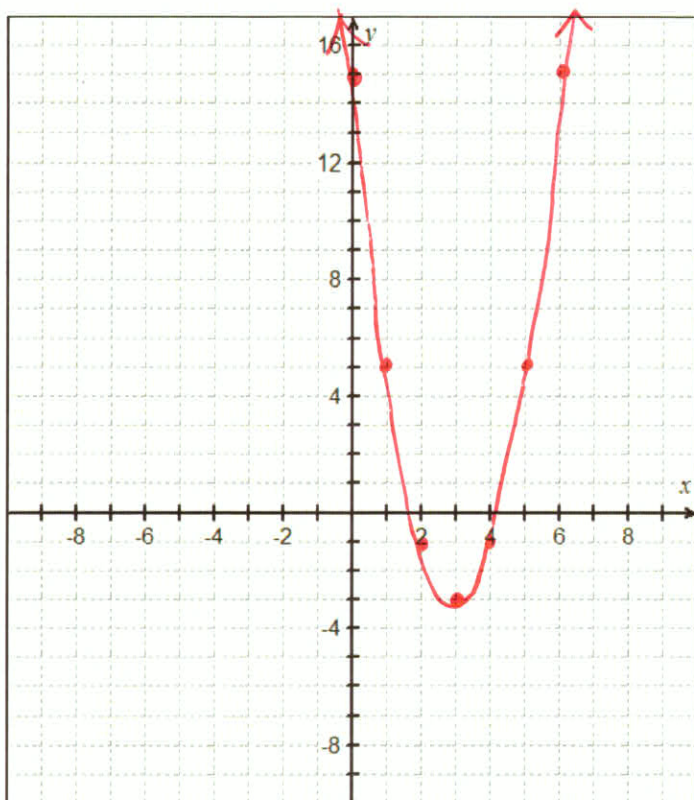
3. Does the function have an inverse?

Only if the domain is restricted as $x \geq 0$

- 4.) Explain why or why not.

Otherwise, the relation fails horizontal line test and has no inverse.

Graph



Numeric

Use any method you like to find the x-intercepts of the function. Show all work to support your answer.

$$f(x) = 2(x-3)^2 - 3$$

$$0 = 2(x-3)^2 - 3$$

$$3 = 2(x-3)^2$$

$$\frac{3}{2} = (x-3)^2$$

$$\pm\sqrt{\frac{3}{2}} = x-3$$

$$x = 3 \pm \frac{\sqrt{3}}{\sqrt{2}}$$

$$x = \frac{12 \pm 2\sqrt{6}}{4}$$

Algebraic (Equations)

Use completing the square to find vertex form of the function: $f(x) = 2x^2 - 12x + 15$

$$f(x) = 2(x^2 - 6x \quad) + 15$$

$$= 2(x^2 - 6x + 9) + 15 - 18$$

$$\underline{\underline{f(x) = 2(x-3)^2 - 3}}$$

Words (Verbal)

1. State the domain of the function.

$$(-\infty, \infty)$$

2. State the range of the function.

$$[-3, \infty)$$

3. State the intervals where the function is increasing / decreasing.

$$\text{increase } [3, \infty)$$

$$\text{decrease } (-\infty, 3]$$

- 4.) What is the y-intercept of the function?

$$(0, 15)$$

Verbal Description

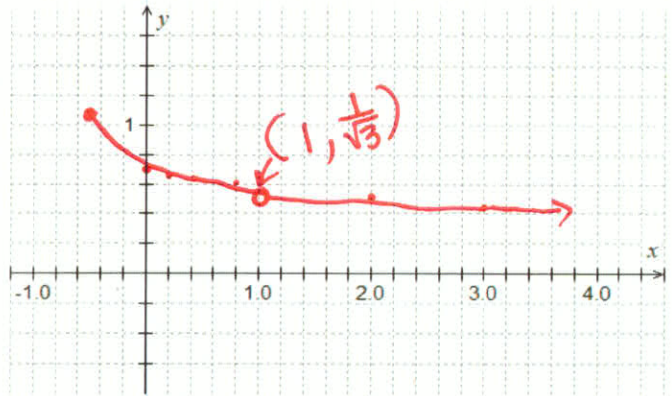
Explain the meaning of the following statement:

$$\lim_{x \rightarrow 1^+} \frac{\sqrt{2x+1} - \sqrt{3}}{x-1}$$

The limit as x approaches 1 from the right for a function with a point discontinuity at $x=1$. The limit is the intended height, or y -value, of the function at $x=1$

Graph

Use a graphing utility to graph the function. Then, use the graph to estimate the limit. Draw your graph below:



Algebraic

Rationalize the numerator to find the exact value of the limit.

$$\lim_{x \rightarrow 1^+} \left(\frac{\sqrt{2x+1} - \sqrt{3}}{x-1} \right) \left(\frac{\sqrt{2x+1} + \sqrt{3}}{\sqrt{2x+1} + \sqrt{3}} \right)$$

$$= \lim_{x \rightarrow 1^+} \frac{2x+1 - 3}{(x-1)(\sqrt{2x+1} + \sqrt{3})}$$

$$= \lim_{x \rightarrow 1^+} \frac{2(x-1)}{(x-1)(\sqrt{2x+1} + \sqrt{3})}$$

$$= \lim_{x \rightarrow 1^+} \frac{2}{\sqrt{2x+1} + \sqrt{3}}$$

$$= \frac{2}{\sqrt{3} + \sqrt{3}} \Rightarrow \frac{1}{\sqrt{3}}$$

Table of Values

Complete the table of values to approximate

$$\lim_{x \rightarrow 1^+} \frac{\sqrt{2x+1} - \sqrt{3}}{x-1}$$

x	$f(x)$
1.1	0.568
1.01	0.576
1.001	0.577
1.0001	0.577
1.00001	0.577

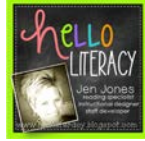
Verbal Description	Graph
<p>Given the piecewise equation, describe and discuss continuity and differentiability of the function at $x = 0$.</p> $g(x) = \begin{cases} -x, & x < 0 \\ x - x^2, & x \geq 0 \end{cases}$ <p style="margin-left: 40px;">$x(1-x) = 0$ $x = 0 \quad x = 1$</p>	<p>Draw your graph below:</p>

Algebraic	Table of Values
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<ol style="list-style-type: none"> 1. Determine the slope of $g(x)$ at $x = -1, x = -0.5, x = -0.1, x = -0.01, x = -0.001$ $g'(x) = -1$ 2. Determine the average rate of change in the interval from $[0, 2]$. $AROC = \frac{-3-1}{2-0} = \frac{-4}{2} = -2$ 3. Determine $g'(0^+)$ and $g'(0^-)$ $g'(0)^+ = 1 \quad g'(0)^- = -1$ 4. Determine the slope of $g(x)$ at $x = 2$. $g'(2) = -3$ 5. Write the equation of the tangent line of $g(x)$ at $x = 2$. $y + 2 = -3(x - 2)$ 6. At what points, if any, are the tangents to the graph of $g(x)$ horizontal? $\text{at } x = \frac{1}{2} \quad g'(x) = 0$ 	<p>Complete the table of values to approximate</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">x</th> <th style="padding: 5px;">$g(x)$</th> <th style="padding: 5px;">$g'(x)$</th> </tr> </thead> <tbody> <tr><td style="padding: 5px;">-3</td><td style="padding: 5px;">3</td><td style="padding: 5px;">-1</td></tr> <tr><td style="padding: 5px;">-2</td><td style="padding: 5px;">2</td><td style="padding: 5px;">-1</td></tr> <tr><td style="padding: 5px;">-1</td><td style="padding: 5px;">1</td><td style="padding: 5px;">-1</td></tr> <tr><td style="padding: 5px;">0</td><td style="padding: 5px;">0</td><td style="padding: 5px;">1</td></tr> <tr><td style="padding: 5px;">1</td><td style="padding: 5px;">0</td><td style="padding: 5px;">-1</td></tr> <tr><td style="padding: 5px;">2</td><td style="padding: 5px;">-2</td><td style="padding: 5px;">-3</td></tr> <tr><td style="padding: 5px;">3</td><td style="padding: 5px;">-6</td><td style="padding: 5px;">-5</td></tr> </tbody> </table>	x	$g(x)$	$g'(x)$	-3	3	-1	-2	2	-1	-1	1	-1	0	0	1	1	0	-1	2	-2	-3	3	-6	-5
x	$g(x)$	$g'(x)$																							
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CREDITS

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 Jean

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