

Content and Language Objective:

SWBAT use their knowledge of functions, function notation, and rate of change to find the average rate of change over a given interval.

Warm - Up

1. Find the rate of change(slope) in the table below.

x	y
0	5
1	2
2	-1
3	-4
4	-7

Handwritten notes in purple ink next to the table:

- Between x=0 and x=1: $+1 <$ and > -3
- Between x=1 and x=2: $+1 <$ and > -3
- Between x=2 and x=3: $+1 <$ and > -3
- Between x=3 and x=4: $+1 <$ and > -3

$$\frac{\text{change in } y}{\text{change in } x} = \frac{-3}{1} = \textcircled{-3}$$

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When we find the **average rate of change of a function, we are given an interval to use to help us get a sense of whether the function values are mostly increasing or mostly decreasing on the interval.**

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AROC

**The Average Rate of Change of a function
Look at the formula below:**

$$\frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{f(b) - f(a)}{b - a} = \frac{\text{change in function values}}{\text{change in } x}$$

What does it remind you of?

What are the differences in this formula?

This formula is in function notation

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Let's try it together

Using the table, find the average rate of change over the following intervals.

x	$f(x)$
0	5
1	1
2	-3
3	-7
4	-11

What is the function doing over this interval?

mostly decreasing

$$\frac{f(2) - f(0)}{2 - 0} = \frac{-3 - 5}{2 - 0} = \frac{-8}{2} = -4$$

a) from $x = 0$ to $x = 2$

a b

$$AROC = -4$$

$$\frac{f(b) - f(a)}{b - a}$$

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Now with your table partners find the average rate of change using the same table for the following intervals, explain what the function is doing over each interval.

This is a linear function because the AROC is constant.

1. From $x = 1$ to $x = 4$

$$\text{AROC} = -4 \quad \frac{f(4) - f(1)}{4 - 1} = \frac{-11 - 1}{4 - 1} = \frac{-12}{3} = (-4)$$

2. From $x = 3$ to $x = 4$

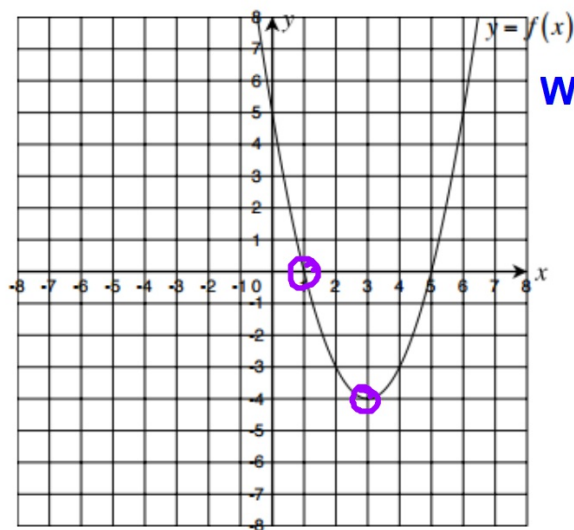
$$\text{AROC} = -4 \quad \frac{f(4) - f(3)}{4 - 3} = \frac{-11 - -7}{4 - 3} = \frac{-4}{1} = (-4)$$

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If you were given a quadratic function on a graph, would it work the same?

Consider the quadratic function whose graph is shown.



What is the function doing over this interval?

mostly decreasing

$$\frac{f(3) - f(1)}{3 - 1} = \frac{-4 - 0}{3 - 1} = \frac{-4}{2} = -2$$

- a) Find the average rate of change of $f(x)$ from $x = 1$ to $x = 3$.

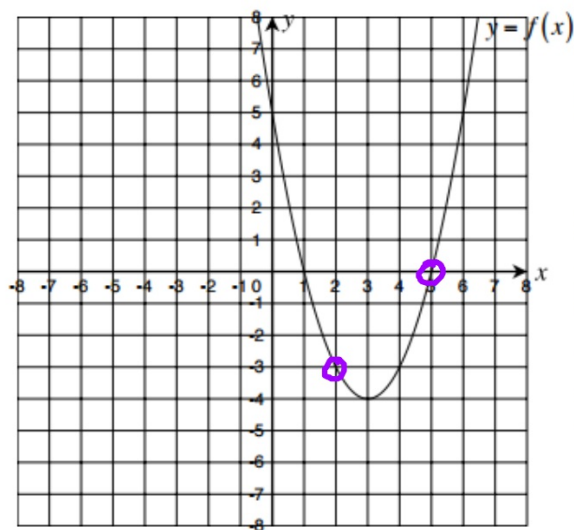
a b

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With your table partners find the average rate of change from $x = 2$ to $x = 5$

Consider the quadratic function whose graph is shown.



$$AROC = 1$$

Does your answer tell you that the function $y = f(x)$ is mostly increasing or mostly decreasing on the interval from $x = 2$ to $x = 5$?

mostly increasing

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If you are given a function without a graph or table, how would you approach it?

$g(x) = x^2 + 3$

find the average rate of change from $x = 1$ to $x = 5$

x	g(x)
1	4
5	28

$1^2 + 3 = 1 + 3 = 4$
 $5^2 + 3 = 25 + 3 = 28$

$$\frac{28 - 4}{5 - 1} = \frac{24}{4} = 6$$

What is the function doing over this interval?

mostly increasing

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In your table groups work through the following problem.

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

find the average rate of change from $x = 2$ to $x = 4$

AROC = 18

x	f(x)
2	12
4	48

$3(2)^2 = 3 \cdot 4 = 12$
 $3(4)^2 = 3 \cdot 16 = 48$

What is the function doing over this interval?

$$\frac{48 - 12}{4 - 2} = \frac{36}{2} = 18$$