

What's Going On?

Checking In

Minds on

What's Rate of Change?

Action!

Average Rate of Change

Consolidation

Types of Rate of Change

Learning Goal - I will be able to determine average rate of change from functions and graphs.

Minds on

Rate of Change

When have you heard rate of change before?

What does it mean?

↳ graph → slope

Action!

Average Rate of Change

The following table represents the growth of a bacteria population over a 10 h period.

Time (h)	0	2	4	6	8	10
Number of Bacteria	850	1122	1481	1954	2577	3400

Handwritten annotations: A blue circle highlights the 8 and 10 hour marks in the Time row, with a blue arrow pointing to the 10 mark. Red arrows connect the Number of Bacteria values between consecutive 2-hour intervals, with handwritten values below: 272 (0-2h), 359 (2-4h), 473 (4-6h), 623 (6-8h), and 623 (8-10h).

During which 2 hour period did the bacteria grow the fastest?

$$\text{roc btw } 6-10 \text{ hrs} = 411.5 \text{ b/h}$$

$$623 \text{ bacteria} \div 2 \text{ hours}$$

Action!

Average Rate of Change

Each value that we calculated is an

"average rate of change"

average rate of change - Change in the dependent variable divided by the corresponding change in the independent variable.

Action!

Average Rate of Change

average rate of change is calculated as:

$$\frac{\overset{\text{change in}}{\Delta y}}{\underset{\text{run}}{\Delta x}} = \frac{f(x_2) - f(x_1)}{x_2 - x_1} \quad \frac{y_2 - y_1}{x_2 - x_1}$$

Action!

Average Rate of Change

Given the function: $h(t) = -5t^2 + 10t + 120$

Determine the average rate of change for each time interval.

a. $0 \leq t \leq 1$

$$\frac{h(1) - h(0)}{1 - 0}$$

$$= \frac{(-5(1)^2 + 10(1) + 120) - (-5(0)^2 + 10(0) + 120)}{1}$$

$$= 125 - 120$$

$$= 5$$

b. $1 \leq t \leq 2$ c. $3 \leq t \leq 4$

$$h(t) = -5t^2 + 10t + 120$$

$$\text{b. } 1 \leq t \leq 2$$

$$\begin{aligned} & \frac{h(2) - h(1)}{2 - 1} \\ &= \frac{(-5(2)^2 + 10(2) + 120) - (-5(1)^2 + 10(1) + 120)}{1} \\ &= 120 - 125 \\ &= -5 \end{aligned}$$

$$h(t) = -5t^2 + 10t + 120$$

c. $3 \leq t \leq 4$

$$\begin{aligned} & \frac{h(4) - h(3)}{4 - 3} \\ &= \frac{(-5(4)^2 + 10(4) + 120) - (-5(3)^2 + 10(3) + 120)}{1} \\ &= 80 - 105 \\ &= -25 \end{aligned}$$

Action!

Average Rate of Change

↴

Given the function: $f(x) = -3x - 7$

Determine the average rate of change for each interval.

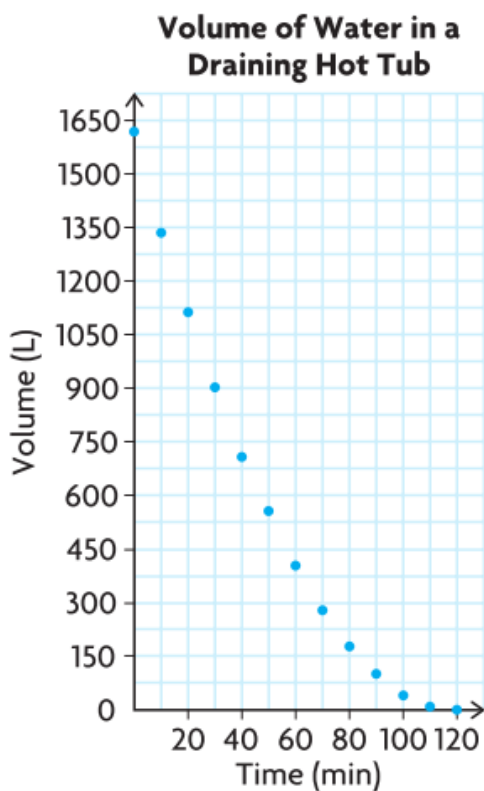
$$\boxed{-2 \leq x \leq 2}$$

$$\begin{aligned} & \frac{f(2) - f(-2)}{2 - (-2)} \\ &= \frac{(-3(2) - 7) - (-3(-2) - 7)}{2 + 2} \\ &= \frac{-13 - (-1)}{4} \\ &= \frac{-12}{4} \\ &= -3 \end{aligned}$$

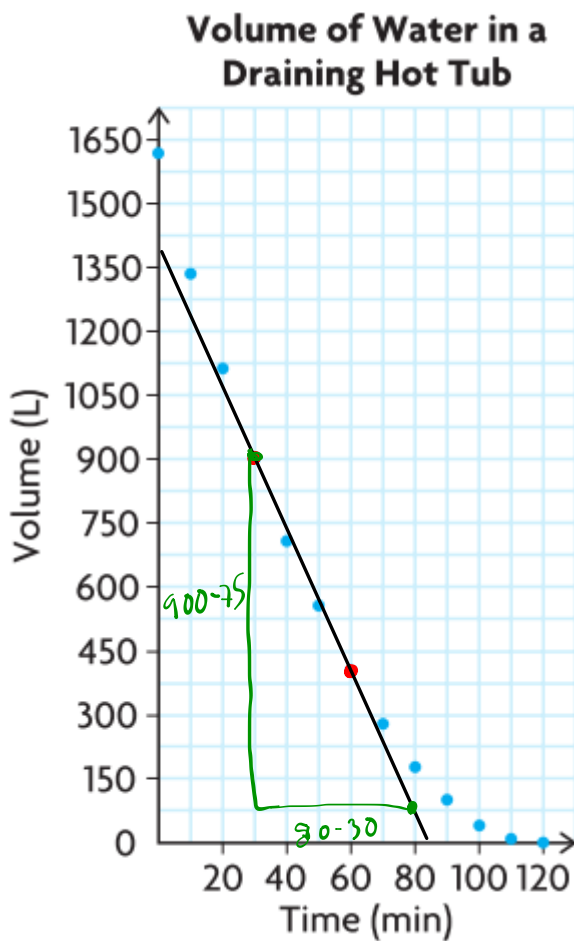
Action!

Average Rate of Change

How could you determine average rate of change from a graph?



Determine the average rate of change for the time interval: $30 \leq t \leq 60$



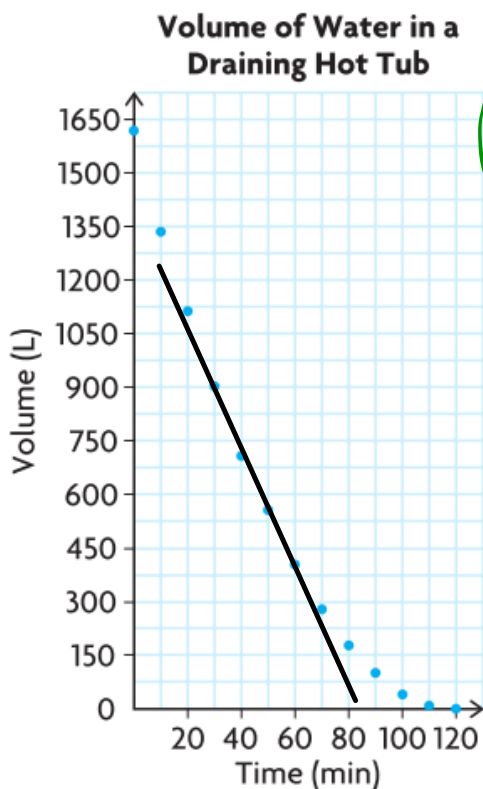
Determine the average rate of change for the time interval: $30 \leq t \leq 60$

$$\begin{aligned} \text{roC} &= \frac{900 - 300}{60 - 30} \\ &= 16.5 \text{ L/min.} \end{aligned}$$

Action!

Average Rate of Change

To determine the average rate of change from a graph, determine the slope of the secant line between two points.



secant line - A line that passes through *two* points on the graph of a relation.

Consolidation

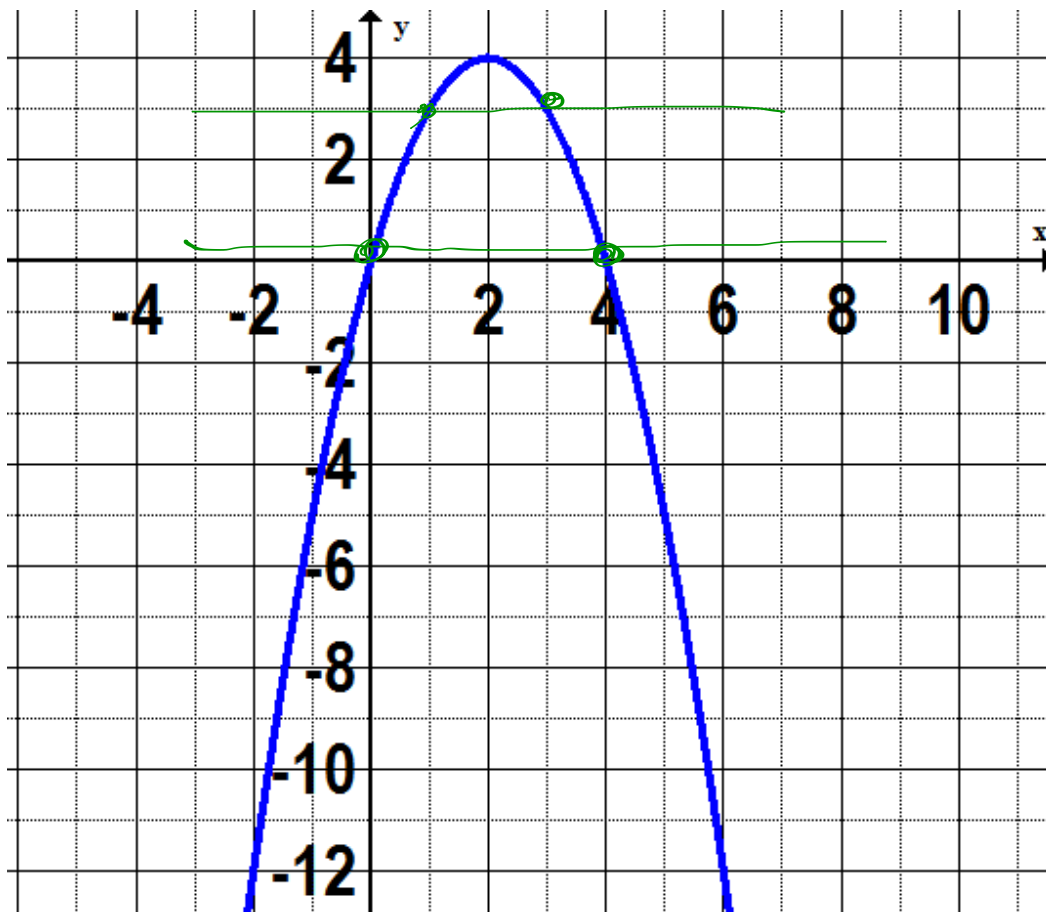
Types of Rate of Change

Given the graph below, determine intervals on which the average rate of change is

a. negative

b. positive

c. zero



$$0 \leq x \leq 3$$

a. negative

$$4 \leq x \leq 5$$

b. positive

$$-3 \leq x \leq 2$$

c. zero

$$0 \leq x \leq 4$$

Consolidation

Textbook Practice

Pg. 76 - 78

1, 4, 6, 8, 9, 13