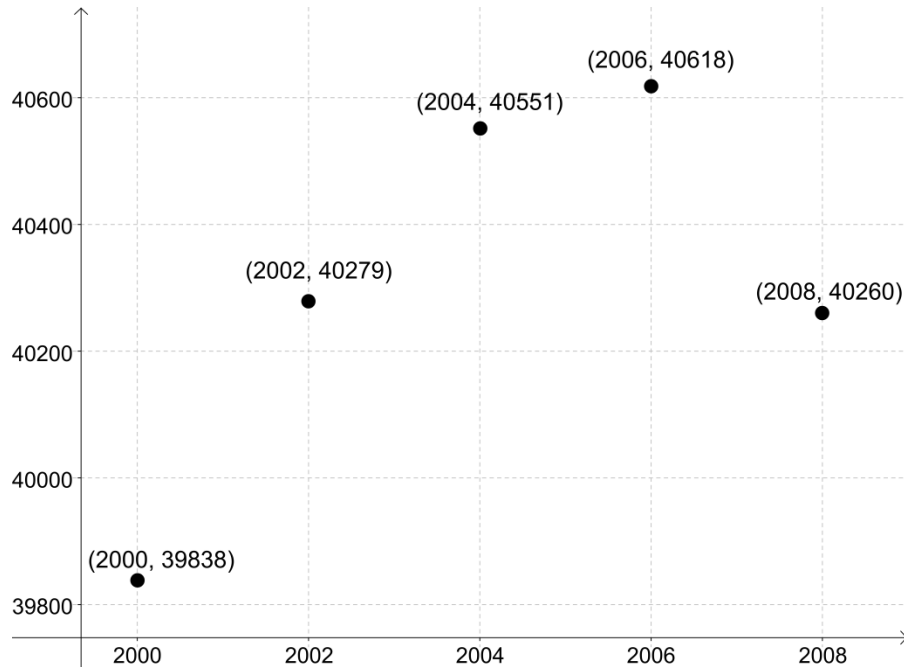


Average Rate of Change

Recall: For a linear function (or line), the rate of change is called the slope and it is always the same between any two points.



How do we interpret rate of change for this function?

What is the rate of change in population from 2000 to 2002?

For any function, $y=f(x)$, the average rate of change between two points (x_1, y_1) and (x_2, y_2) is calculated the same as the slope of a line:

Average rate of change =
between $x = x_1$ and $x = x_2$

Units of average rate of change =

What is the rate of change in population from 2002 to 2004?

What is the rate of change in population from 2004 to 2006?

What is the rate of change in population from 2006 to 2008?

Is the population increasing?

When is the population increasing?

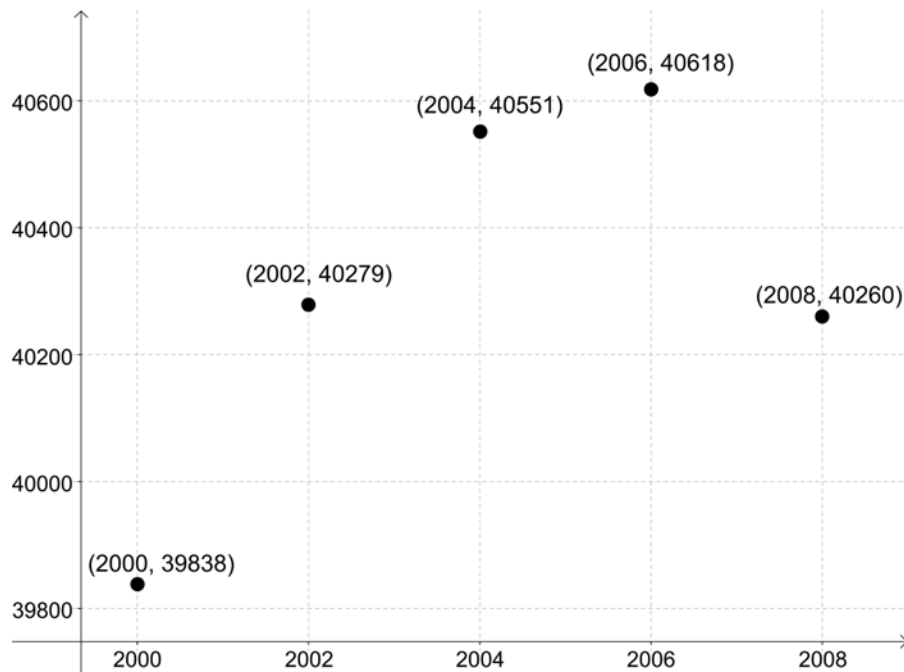
Old: We say that a linear function, $y = f(x) = mx + b$, is increasing if the slope

$$\frac{\Delta y}{\Delta x} > 0.$$

We say that a linear function, $y = f(x) = mx + b$, is decreasing if the slope

$$\frac{\Delta y}{\Delta x} < 0.$$

New:



Definition: We say that a function is concave down if the average rate of change is decreasing.

Definition: We say that a function is concave up if the average rate of change is increasing.

Example (Physics): Suppose that the height of a calculator thrown into the air is given by $s(t)$. The values of the height $s(t)$ are given by the table:

t (sec)	0	1	2	3	4
$s(t)$ (ft)	4	63	90	85	48

Average velocity between
 $t = 0$ and $t = 1$ =

Average velocity between
 $t = 1$ and $t = 2$ =

Average velocity between
 $t = 2$ and $t = 3$ =

Average velocity between
 $t = 3$ and $t = 4$ =

Relative Change

The population of, my hometown, Williamsburg, MA is 2482 (according to the 2010 census).

The population of New York City is 19,378,102.

Is there a difference between adding 2000 new residents to Williamsburg vs. adding them to NYC?

Def: The relative change from $x = a$ to $x = b$ of a function $y = f(x)$ is the ratio:

$$\frac{\Delta y}{y(a)} = \frac{y(b) - y(a)}{y(a)}$$

Williamsburg, MA:

Relative Change =

NYC:

Relative Change =