Office Hours:

Instructor:

Peter M. Garfield	Mondays 11AM–12PM
`garfield@math.ucsb.edu`	Tuesdays 1:30–2:30PM
South Hall 6510	Wednesdays 1–2PM

TAs:

Trevor Klar	Wednesdays 2–3PM
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Garo Sarajian	Mondays 1–2PM
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Sam Sehayek	To Be Announced
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Exam 1: Wednesday in class

Bring:

- A 3" $\times$ 5" card (both sides!) with your notes.
- A pen / pencil
- An ID

Don't bring:

- A calculator

Please Be Early!

See GauchoSpace and textbook for sample exams.

Straight Lines (§6.1) Continued

1. A line has slope $1/2$ and goes through the point $(2, 5)$. What is the y-coordinate of the point on this line where $x = 6$?

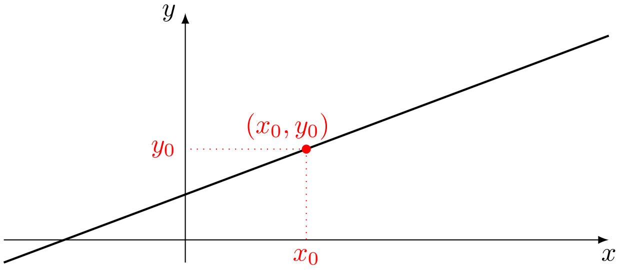
(A) 3 (B) 4 (C) 5 (D) 6 (E) 7 E

Plan: 1. Find equation of the line.
2. Plug in $x = 6$ to find y.

Another Equation of a Line

The Point-Slope Form

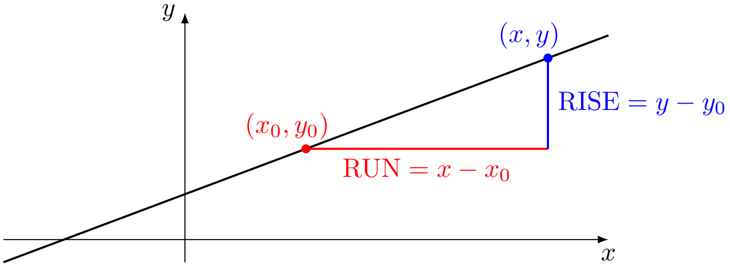
The **point slope** equation of a straight line is $\boxed{y = y_0 + m(x - x_0)}$.



m = the **slope**. Still CRUCIAL for calculus.

(x_0, y_0) = any point on the line.

Why Does This Work?



(x, y) lies on the line exactly when

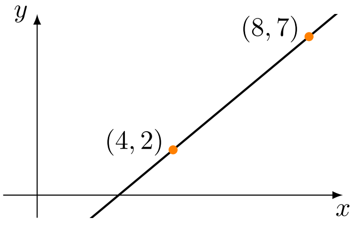
$$\frac{y - y_0}{x - x_0} = m$$

$$y - y_0 = m(x - x_0)$$

$$y = y_0 + m(x - x_0)$$

Examples

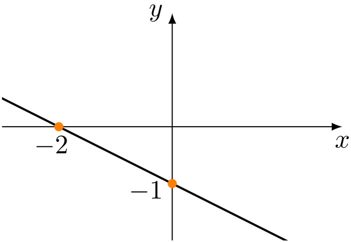
2. Find the equations of these lines (whose slopes we've already found):



$$m = 5/4$$

$$y - 2 = \frac{5}{4}(x - 4)$$

$$y = \frac{5}{4}x - 3$$



$$m = -1/2$$

$$y - (-1) = -\frac{1}{2}(x - 0)$$

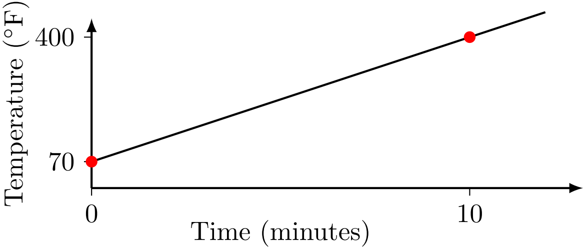
$$y = -\frac{1}{2}x - 1$$

And. . . ?

Yes, but what's this got to do with calculus?

Derivatives are about **rate of change** and that is what **slope** is!

Example: This graph shows the temperature in an oven as it heats up:



3. How quickly (in °F/min) is the oven heating up?

(A) 70 (B) 10 (C) 40 (D) 33 (E) Other D

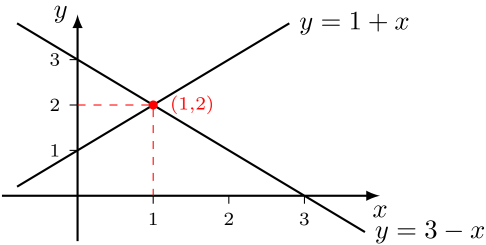
Moral: Rate of increase = **slope**

One More Example

4. Where does the line $y = 1 + x$ cross the line $y = 3 - x$? Find both the x and y coordinates of the crossing point.

Plan:

1. Draw a picture! showing two straight lines crossing.
2. Solve the two simultaneous equations
3. THINK why this gives the answer!

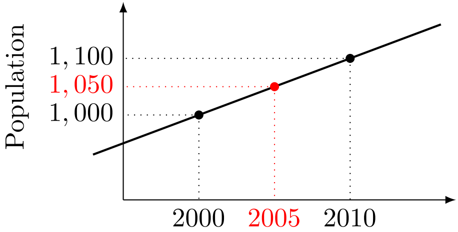


Linear Interpolation

5. In 2000, a population was 1000. In 2010, it was 1100. What would you guess the population was in 2005?

(A) 1005 (B) 1020 (C) 1050 (D) 2050 (E) 2010

Answer: C

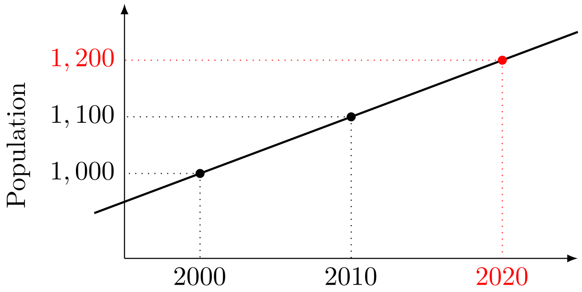


Linear Extrapolation

6. In 2000, a population was 1000. In 2010, it was 1100. What would you guess the population will be in 2020?

(A) 1150 (B) 1200 (C) 1250 (D) 2020 (E) Other

Answer: B



Again: a guess based on the assumption that population grows at a constant rate.

A Problem

You can't tell someone you just "guessed" the answer or just "drew a straight line". You need to make it sound more "scientific" so give it a complicated sounding name to impress people.

Linear Interpolation and Linear Extrapolation.

Linear means straight line
inter means between like intercity
extra means beyond like extraordinary

The idea is to assume the population (or whetever) grows at a constant rate.
Then use this to predict.

Method:

(1) Use given data to draw a straight line and find equation $y = mx + b$

(2) Use the equation to make predictions.

Wiktionary: interpolo (Latin)

Latin [edit]

Etymology [edit]

From *inter-* + *poliō* + *-ō*.

Pronunciation [edit]

- (*Classical*) IPA(key): /inˈter.po.loː/, [ɪnˈtɛr.pɔ.ɫoː]

Verb [edit]

interpolō (*present infinitive* **interpolāre**, *perfect active* **interpolāvī**, *supine* **interpolātum**); *first conjugation*

1. I give a new form, shape, or appearance
2. I polish, furbish, dress up
3. (*of writing*) I alter, falsify, insert text

Linear Extrapolation

7. In 2000, a population was 1000. In 2010, it was 1100. Let

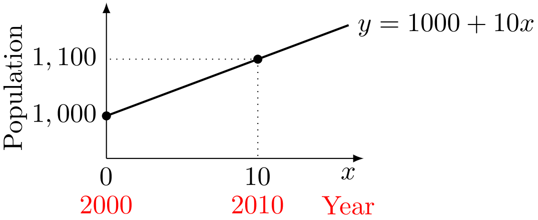
x = number of years after 2000 (Ex: $x = 3$ is the year 2003)

y = population in the year x

Find the equation of a line $y = mx + b$:

(A) $2000 + 100x$ (B) $2000 + 10x$ (C) $1000 + 100x$ (D) $1000 + 10x$

Answer: D



8. When will population be 1350?

(A) 2015 (B) 2025 (C) 2035 (D) 3350 (E) Other

C

Another Example

9. The number of unemployed in LA on January 1, 2015 was $50,000$. After 100 days, it was $45,000$.

(a) Estimate the number of unemployed 300 days after Jan. 1.

(A) $40,000$ (B) $35,000$ (C) $30,000$ (D) $25,000$ (E) 300 $\boxed{\text{B}}$

Another Example

9. The number of unemployed in LA on January 1, 2015 was $50,000$. After 100 days, it was $45,000$.

(b) Suppose $x =$ the number of days after January 1

$y =$ number of unemployed people on day x.

Then the equation of the line used for this linear extrapolation is $y =$

(A) $-100 + 50,000x$ (B) $50,000 - 100x$ (C) $45,000 - 100x$

(D) $50,000 - 50x$ (E) $45,000 - 50x$ D

Another Example

9. The number of unemployed in LA on January 1, 2015 was $50,000$. After 100 days, it was $45,000$.

(c) How many days until unemployed reaches $30,000$?

(A) 40 (B) 140 (C) 200 (D) 300 (E) 400 $\boxed{\text{E}}$