MA 113 Prof. Ben Braun

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When you sit down:

1. Introduce yourself to the students sitting near you.

2. Discuss with your neighbors:

A: Why is the value of π a bit more than 3? i.e. why isn't $\pi = 5$? or 7.2? or something else?

B: Why is $\sin^2(x) + \cos^2(x) = 1$? ("My teacher told me" is not a good answer!)

C: Why is the Pythagorean Theorem true?

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Talk with your neighbors:

- without looking up the formula, how can you figure out the equation for converting °F to °Celsius?

what type of relationship do we expect?

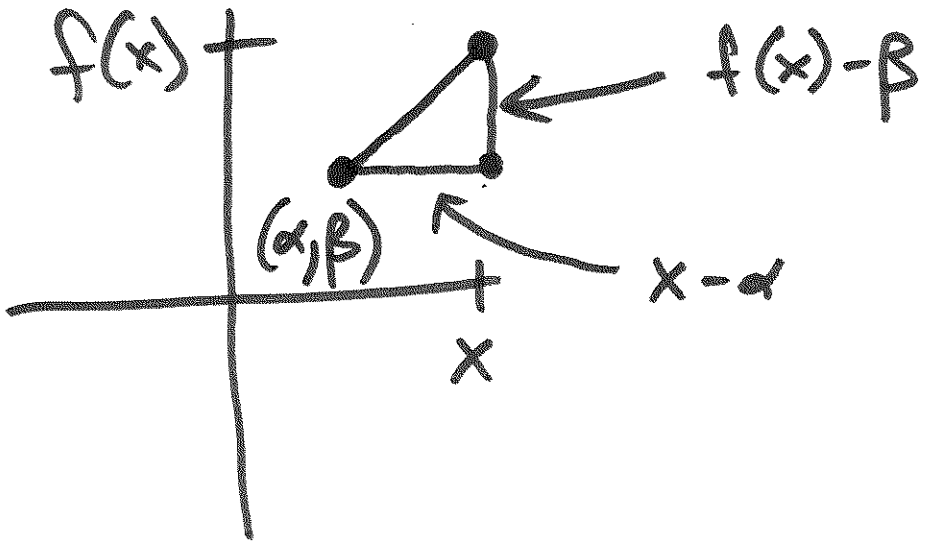
- Linear, because of definition of F and C.

What is a linear relationship, i.e. a linear function?

5 Responses

- one-to-one
- no x^2
- straight line
- constant slope / rate of change

Def^{n}: A function $f(x)$ is **linear** if there is a point (α, β) and a slope m so that



$$\frac{f(x)-\beta}{x-\alpha} = m.$$

Equivalent to

$$f(x)-\beta = m(x-\alpha)$$

point-slope form of a line.

Q: If we want to write

$f(x) = \text{slope} \cdot x + y\text{-intercept}$,

what are the coefficients?

Slope = m

y-intercept = $-m\alpha+\beta$

$f(x) = m(x-\alpha)+\beta$

$= mx - m\alpha + \beta$

$= \underline{m}\cdot x + \underline{(-m\alpha+\beta)}$

For °F to °C:

Know boiling pt of H_2O is 100°C, 212°F

" freezing " " " " 0°C, 32°F.

We have two points:

(32, 0) ← freezing

(212, 100) ← boiling

} Want line btwn them.

So, our slope m is $\frac{100-0}{212-32} = \frac{5}{9}$.

Pick either point!

$x°F \longmapsto f(x)\,°C$ has relation

$$f(x) - 0 = \frac{5}{9}(x-32)$$

OR

$$f(x) - 100 = \frac{5}{9}(x-212)$$

both give $f(x) = \frac{5}{9}x - \frac{160}{9}$.

In this case, it is easy to then derive °C to °F formula: $(x°F, y°C)$

$$y = \frac{5}{9}x - \frac{160}{9} \Rightarrow y + \frac{160}{9} = \frac{5}{9}x \Rightarrow \frac{9}{5}\left(y + \frac{160}{9}\right) = x$$

Q: Suppose after t seconds, a metal plate has a temperature of $f(t) = 2t^3 - 6t^2 + 4t$ °C.
Plate breaks at $\frac{1}{2}$ °C. When does it break?

Ideally: You compute time as a function of temp.
With this model, you can't.