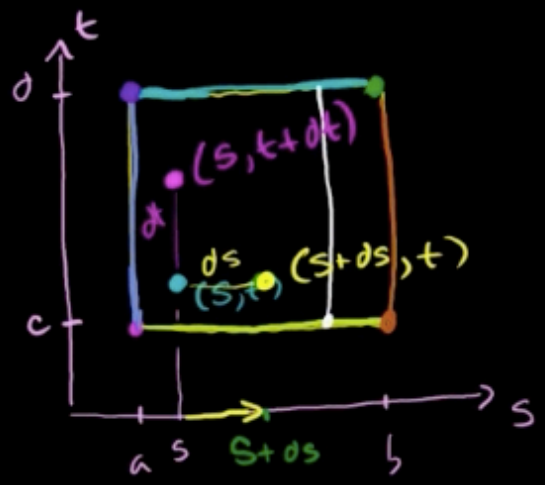
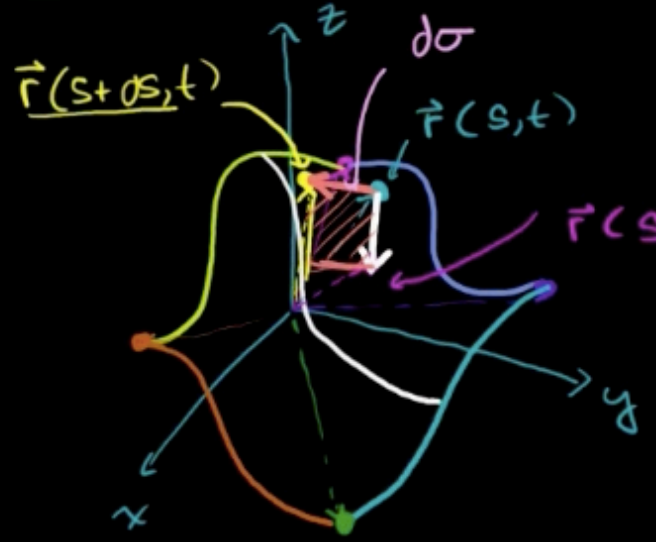
$$\frac{\partial \vec{r}}{\partial s}\,ds = \vec{r}(s+ds,t) - \vec{r}(s,t)$$

$$\frac{\partial \vec{r}}{\partial t}\,dt = \vec{r}(s,t+dt) - \vec{r}(s,t)$$





$\vec{r}(s,t)$

$|\vec{a} \times \vec{b}|$

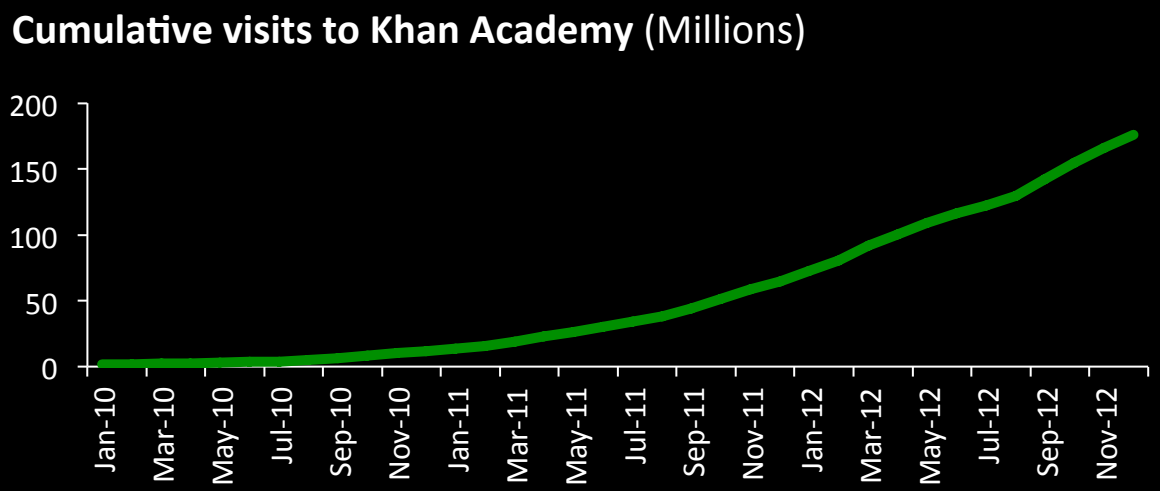
= area of parallelogram defined by $\vec{a}$ + $\vec{b}$

Surface area =

$$\vec{r}(s,t) = x(s,t)\,\hat{i} + y(s,t)\,\hat{j} + z(s,t)\,\hat{k}$$

Sal Khan (Multivariable Calculus)

Scale



75 million
users to date

>6 million
Unique users / month

>220 million
lessons delivered

1 billion
problems answered

216
countries

20,000
classrooms around the world

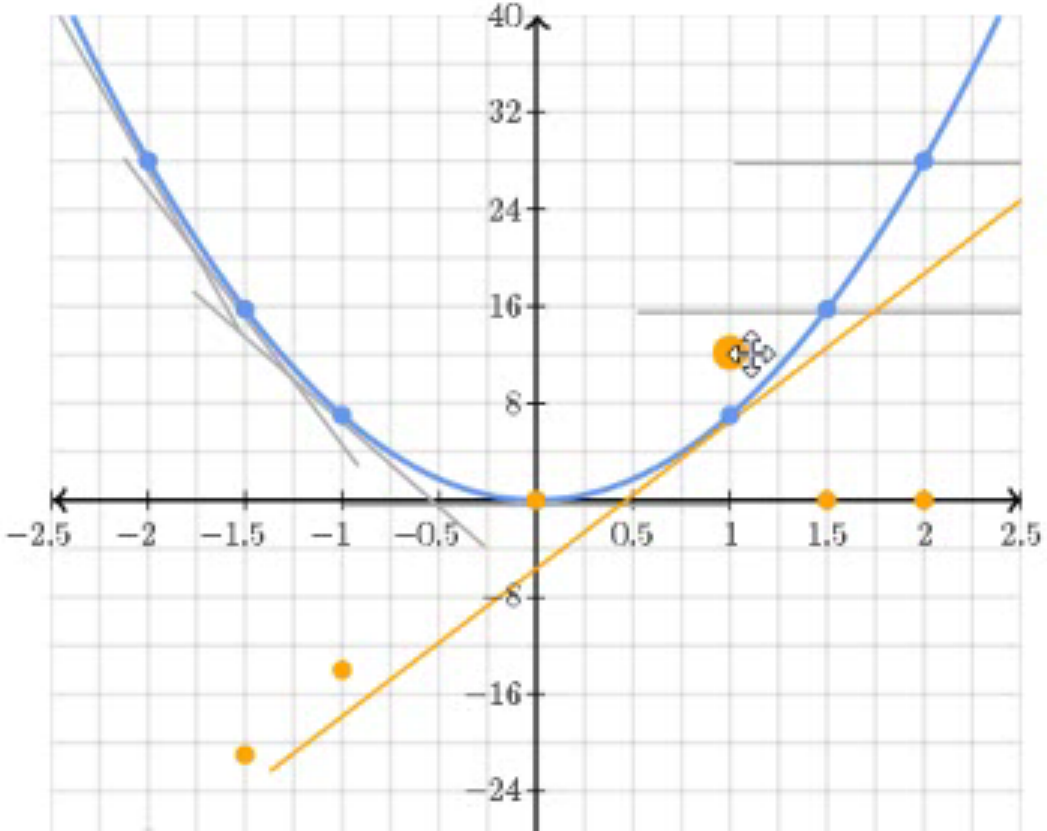
Derivative intuition

Related videos: Calculus: Derivatives 1 (new HD version), Calculus: Derivatives 1

$f(x) = 7x^3$

Drag each one of the 7 orange points up and down to adjust the slope of the corresponding tangent line.

The derivative of a function is defined as the slope of a line tangent to the curve at each point. Adjust the slopes of the lines to visually find the derivative $\frac{d}{dx} f(x)$ at each point.



Answer

$\frac{d}{dx} f(-2) =$ -28

$\frac{d}{dx} f(-1.5) =$ -21

$\frac{d}{dx} f(-1) =$ -14

$\frac{d}{dx} f(0) =$ 0

$\frac{d}{dx} f(1) =$ 12.17

$\frac{d}{dx} f(1.5) =$ 0

$\frac{d}{dx} f(2) =$ 0

Check Answer

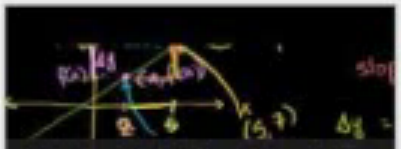
Need help? Get a hint.

This ***will*** reset your streak!

I'd like a hint

Stuck? Watch a video.

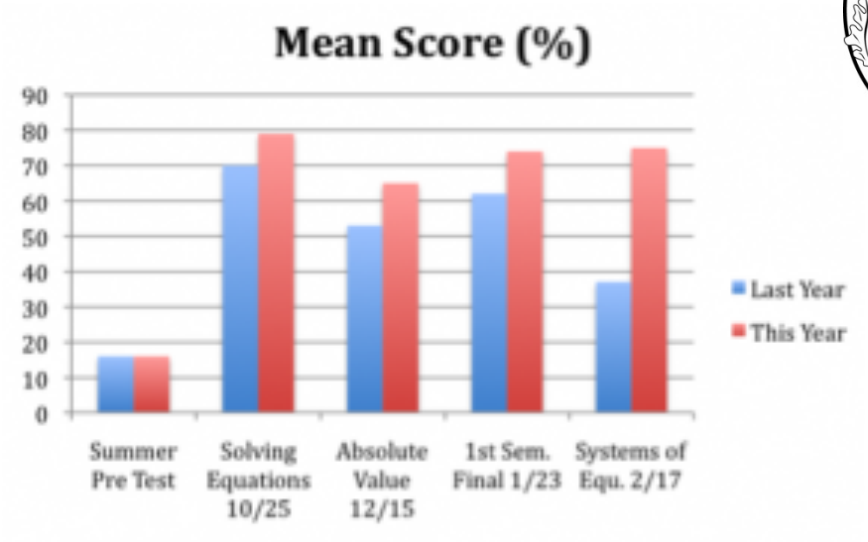
This ***does not*** reset your streak.

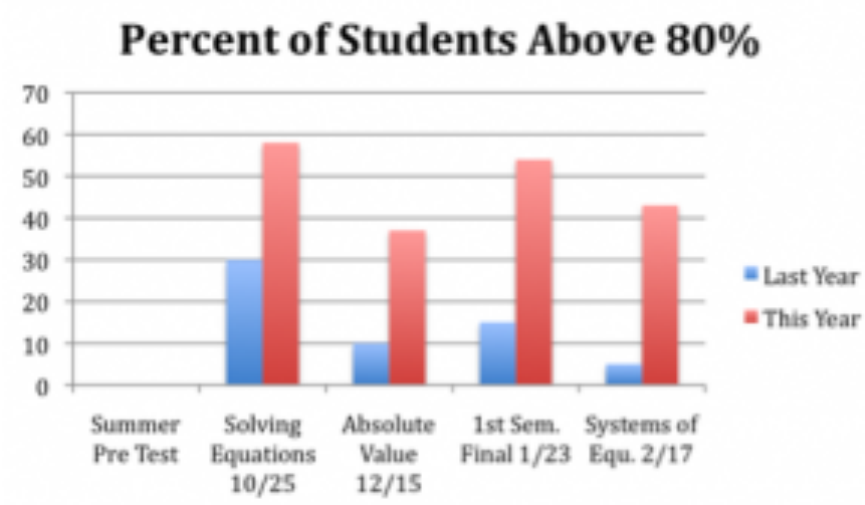


Calculus: Derivatives 1 (new HD

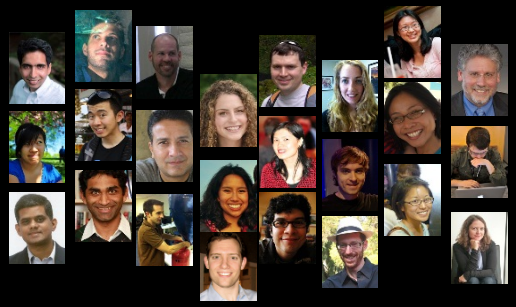
Changing lives

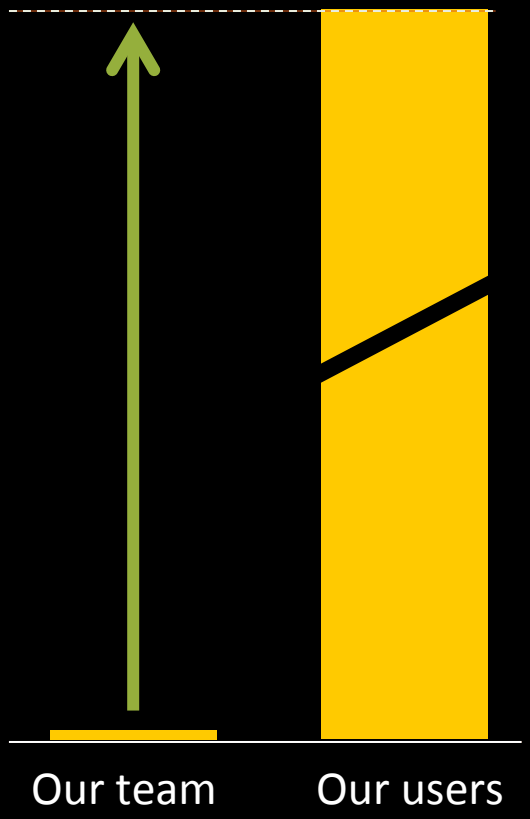
"We recognized that we had found a powerful tool that reached students and changed their habits in ways we had never even considered possible."





Small team. Huge scale.





In the last year,

24 employees reached

43 million

unique students in 216 countries