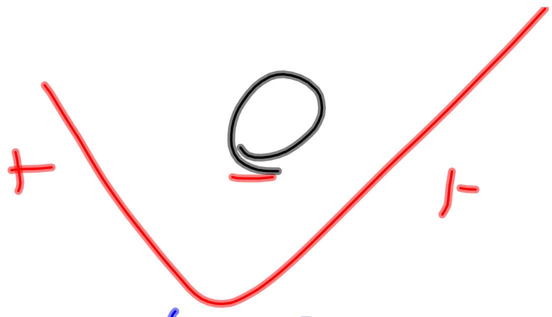
"Like" 3.6 #95, sort of.

$x^2 + 8x + 15 \geq 0$



$a = 1,\ b = 8,\ c = 15$

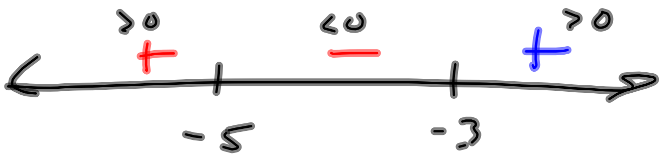
$b^2 - 4ac = 8^2 - 4(1)(15)$

$= 64 - 60$

$= 4$

$x = \dfrac{-8 \pm \sqrt{4}}{2(1)} = \dfrac{-8 \pm 2}{2} = \begin{cases} -\frac{6}{2} = -3 \\ -\frac{10}{2} = -5 \end{cases}$

$\Rightarrow (x+3)^1(x+5)^1$ is how it factors.



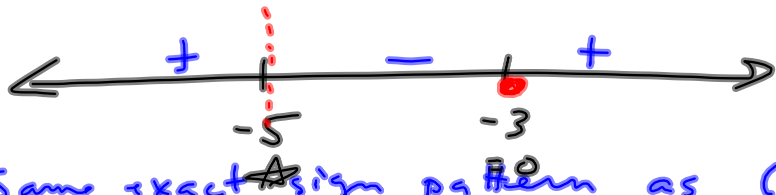
Pick $x = 0$: $(0+3)(0+5) = 15 > 0$ +

want "≥ 0"

$(-\infty, -5] \cup [-3, \infty)$

Solve $\dfrac{x+3}{(x+5)^1} \geq 0$

$x = -3, -5$ are "critical"



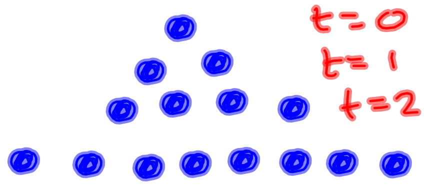
Same exact sign pattern as $(x+3)(x+5)$

Only thing different is $x = -5$ is forbidden

$x = -5 \notin \mathcal{D}$.

$x = 0$! $\dfrac{0+3}{0+5} = \dfrac{3}{5} > 0$

$(-\infty, -5) \cup [-3, \infty)$



$t=0 \quad n=1 \quad 2^0$

$t=1 \quad n=2 \quad 2^1$

$t=2 \quad n=4 \quad 2^2$

$t=3 \quad n=8 \quad 2^3$

⋮

$t=5 \quad n=32.$ How? $\quad 2^5=32$

Jesse doubled twice more.

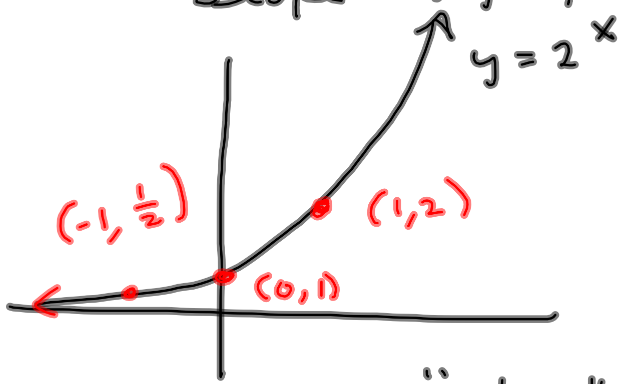
This is exponential growth.

Great for describing population growth

Compound interest

Anything where the rate of growth is linked to the present size.

Slope is proportional to height.



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

Doubles every "step"

Slope = K · function.

K = relative growth rate.

$$2^{-7} = \frac{1}{2^7}$$

Compound Interest

5% interest, compounded annually.

At the end of year...

1 $A = P + Pr = P(1+r) = P(1.05)$

2 $A = P(1+r) + P(1+r)r$

$= P(1+r)[1+r]$

$= P(1+r)^2$

3 $A = P(1+r)^2 + P(1+r)^2 r$

$= P(1+r)^2\left(\frac{P(1+r)^2}{P(1+r)^2} + \frac{P(1+r)^2 r}{P(1+r)^2}\right)$

$= P(1+r)^2(1 + r)$

$= P(1+r)^3$

After n years, it's compounded n times, and

$A = P(1+r)^n$

n = # of years = # of periods, when compounding ANNUALLY

When compounded more than once per year, then r needs to be divided by that number

r = annual rate
n = number of periods annually.

n = 2 semiannually
n = 12 monthly
n = 52 weekly
n = 365 daily
n = ∞ continuously

$i = \frac{r}{n}$ = interest rate per period.
nt = total number of periods, where t = time, in years.

Previous Version:

$$A = P(1+r)^n$$

New version

$$A = P\left(1+\frac{r}{n}\right)^{nt} = P(1+i)^{nt}$$

A = Accumulated Amount
= Future value of savings account.
P = Present Value = Principal

Future Value of \$500, invested at

5% APR, compounded

(a) Monthly $n=$

(b) Weekly

(c) Daily

(d) CONTINUOUSLY

for 10 yrs.

$nt = 12 \cdot 10 = 120$

$\frac{r}{n} = \frac{.05}{12} = .0041\overline{6}$

(a) $n = 12$, $r = .05$, $t = 10$

$A = P\left(1+\frac{r}{n}\right)^{nt} = 500\left(1+\frac{.05}{12}\right)^{120} \approx \$823.50$

```
500*(1+.05/12)^(
10*12)
         823.5047488
500*(1+.05/365)^
(10*365)
          824.332407
500*e^(.05*10)█
```

```
10*12)
         823.5047488
500*(1+.05/365)^
(10*365)
          824.332407
500*e^(.05*10)
         824.3606354
```

≈ \$824.33 DAILY

≈ \$824.36 Continuous

What up with that 'e' thingie?

Oct 23-10:46 AM

'e' stands for "Euler"

$$e = \lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^{n}$$

e has the magic property of e^x is Exactly as steep as it is tall!

e^x = slope of e^x

2^x = K (slope of 2^x)

$$\lim_{n\to\infty} \left(1 + \frac{r}{n}\right)^{nt} = e^{rt}$$