

Precalculus: Exponential Functions

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Let's play money making game

You are the winner of a game show, and you are given an option for your winnings.

- **Option 1** is you get 1,000 dollars every day for a month.
- **Option 2** is you start with a promise of 1 dollar on day 1, which doubles on each day, up until the end of the month when you finally get your money.

Which option should you pick?

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$$w(t) = 1000t$$

$$w(t) = 2^t$$

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Exponential Functions

An **exponential function** is one of the form

$$f(x) = b^x$$

for some positive base $b \neq 1$.

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[[Desmos Graphs](#)]

Big Picture Properties of Exponential Functions

$f(x) = b^x$, with $b > 1$ is an exponential function.

- $\text{dom } f = (-\infty, \infty)$
- $\text{ran } f = (0, \infty)$
- $f(x) \rightarrow 0$ as $x \rightarrow -\infty$
- $f(x) \rightarrow \infty$ as $x \rightarrow \infty$
- $f(x)$ is increasing everywhere and decreasing nowhere
- $f(x)$ is concave up everywhere and concave down nowhere
- $f(x)$ grows faster than any polynomial: if $p(x)$ is a polynomial then for large enough x , $f(x) > p(x)$