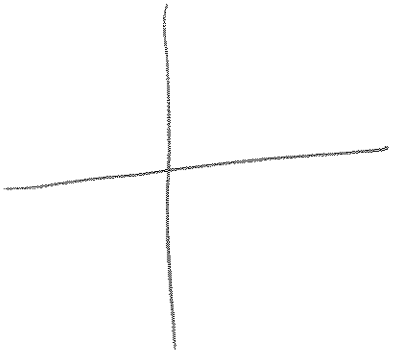
4.2 Exponential Functions

An exponential fn has a variable in the exponent.

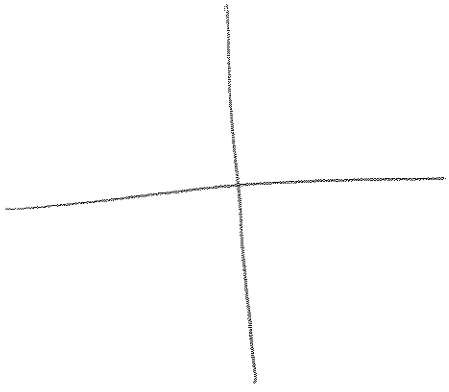
Defn If $a \in \mathbb{R}$, $a > 0$ and $a \neq 1$, then $y = f(x) = a^x$ is an exponential fn w/ base a.

Graphs of Exponential functions

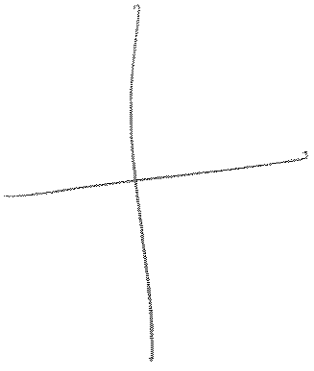
Ex 1 $y = 2^x$



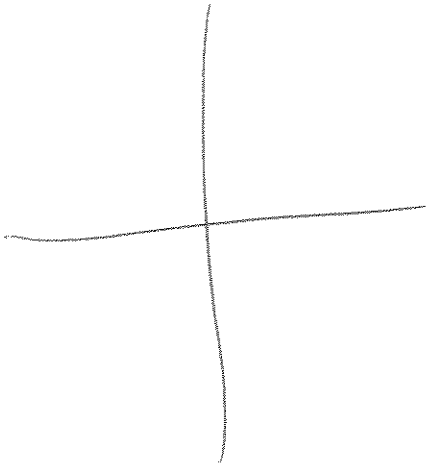
$y = 3^{-x}$



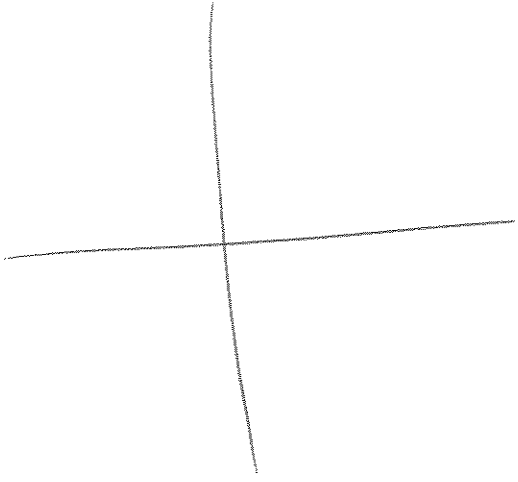
$y = \left(\frac{1}{3}\right)^x + 1$



$y = e^{-2x}$



$y = -e^{-x}$



4.2 (cont)

Ex 2 Simplify

(a) $\dfrac{4^{2-x}}{4^{3+x}}$

(b) $\left(2^{3x}\right)^{(x-2)}$

Ex 3 If $10,000 is invested for t years at 10% interest, compounded continuously, the future value will be $S = 10{,}000e^{0.10t}$. What will this account be worth in 5 years?

4.3 Logarithmic Functions

Defn For $a>0$, $a\neq 1$, the logarithmic fn $y=\log_a x$ has domain $x>0$, base a and is defined by $a^y = x$

i.e. $a^y = x \iff \log_a x = y$

* the logarithm "undoes" the exponential.

Ex 1 Write $8=2^3$ in logarithmic form.

Ex 2 Rewrite $\log_3\left(\frac{1}{27}\right) = -3$ in exponential form.

Ex 3 Evaluate

(a) $\log_5\left(\frac{1}{125}\right)$

(b) $\log_7 49$

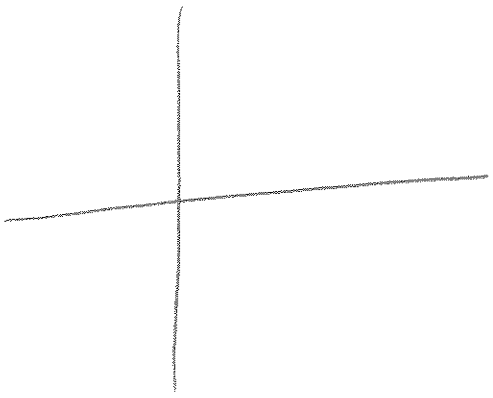
(c) $\log_2\left(16^{-1}\right)$

4.3 (cont)

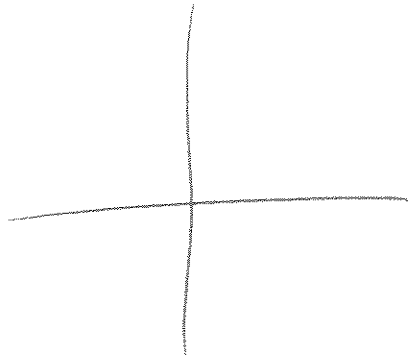
Ex 4 Graph and state domain.

Note:
$\log \rightarrow \log_{10}$
$\ln \rightarrow \log_e$

(a) $y = \log x$



(b) $y = -\log_3 x$



(c) $y = -\log_5(x+3)$