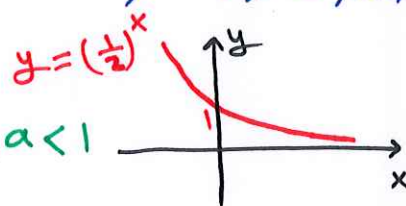


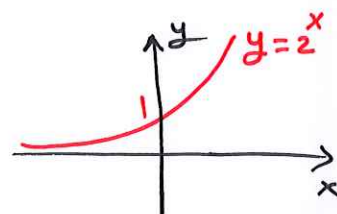
Exponential function has the form $f(x) = a^x$, $a > 0, a \neq 1$

→ is always positive function with $D = \mathbb{R}$
 $R = (0, \infty)$

→ is called **exponential decay** if $0 < a < 1$



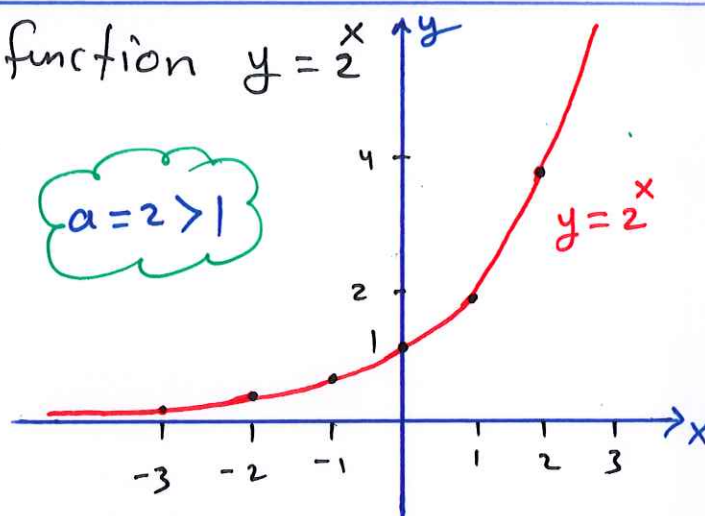
→ is called **exponential growth** if $a > 1$



Exp Graph the exponential growth function $y = 2^x$

x	-3	-2	-1	0	1	2	3
y	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8

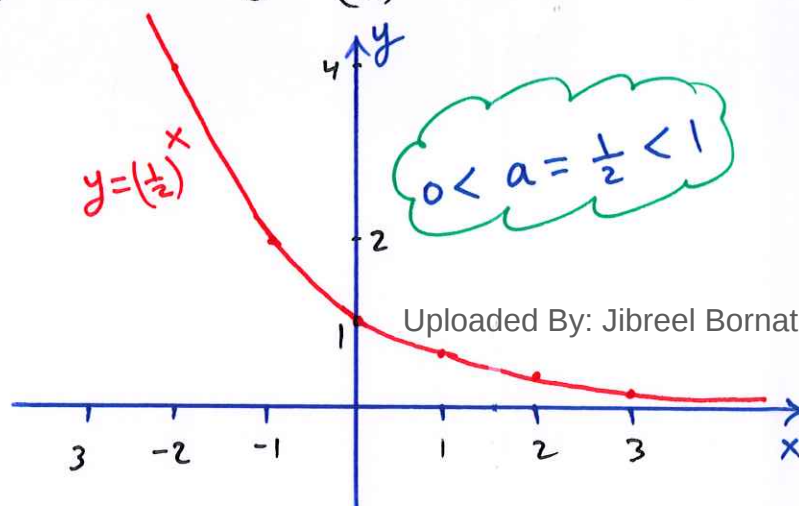
negative x-axis is the horizontal asymptote



Exp Graph the exponential decay function $y = (\frac{1}{2})^x = 2^{-x}$

x	-3	-2	-1	0	1	2	3
y	8	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$

positive x-axis is the horizontal asymptote



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Remark

Note that if $a = 1 \Rightarrow f(x) = 1^x = 1$

so the function becomes constant and not exponential

Exp Graph the exponential functions:

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① $y = e^x$ ② $y = 5^x$ ③ $y = 3e^x$ ④ $y = \left(\frac{3}{4}\right)^x$
 ⑤ $y = e^{-x}$ ⑥ $y = 2^{x-1}$ ⑦ $y = -e^x$ ⑧ $y = -5^{-x}$

① Since $e \approx 2.718 > 1 \Rightarrow$

② $a = 5 > 1 \Rightarrow$

③ $y = 3e^x$

④ $y = \left(\frac{3}{4}\right)^x \Rightarrow 0 < a = \frac{3}{4} < 1 \Rightarrow$

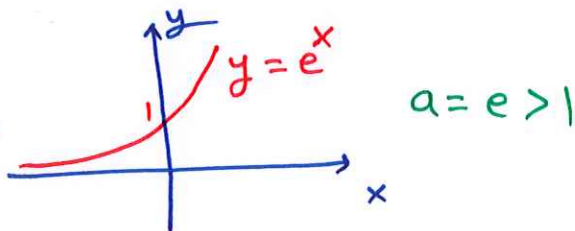
⑤ $y = e^{-x} = \left(\frac{1}{e}\right)^x \Rightarrow 0 < a = \frac{1}{e} < 1 \Rightarrow$

⑥ $y = 2^{x-1} = 2^x \cdot 2^{-1} = \frac{1}{2} 2^x$

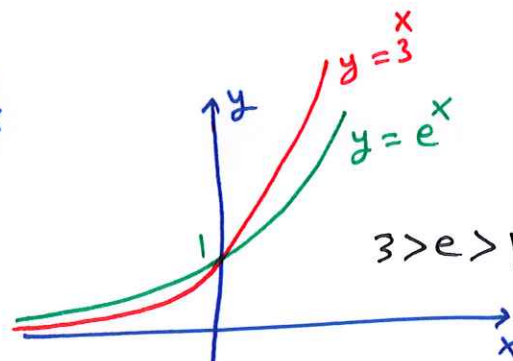
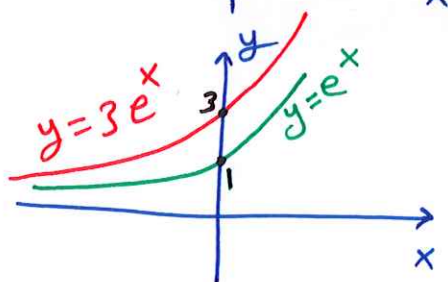
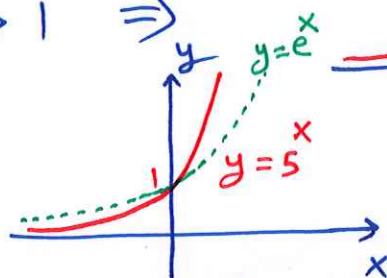
$a = 2 > 1$

⑦ $y = -e^x$

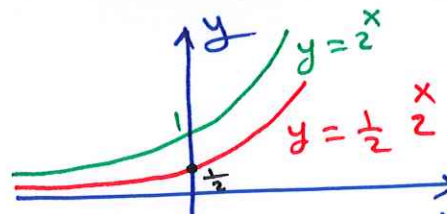
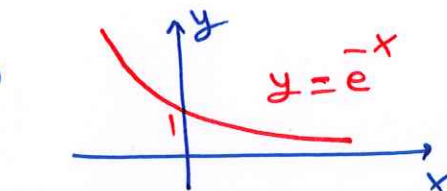
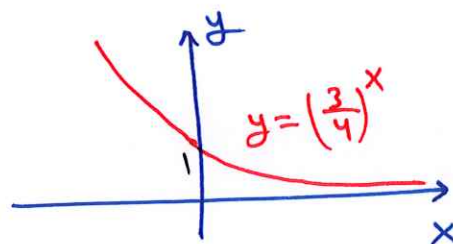
⑧ $y = -5^{-x} = -\left(\frac{1}{5}\right)^x \Rightarrow 0 < a = \frac{1}{5} < 1$



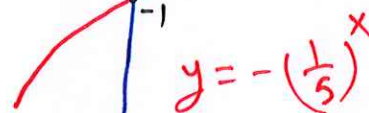
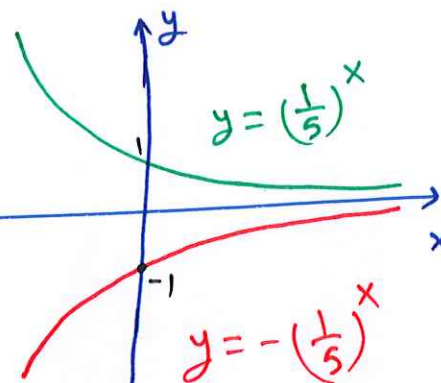
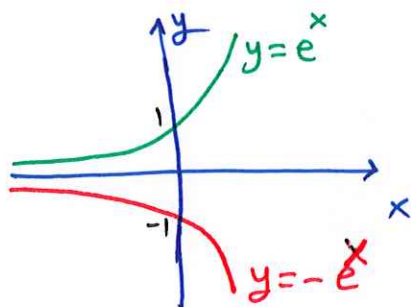
$a = e > 1$



$3 > e > 1$



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