

The Exponential Function

Of primary importance in this course is the exponential function

$$x(t) = e^{at},$$

where a is a constant. We will assume you are completely familiar with the properties and graphs of this function.

Properties:

1. $e^0 = 1$.
2. $e^{at+c} = e^c e^{at}$.
3. e^{at} is never 0.
4. If $a > 0$ then $\lim_{t \rightarrow \infty} e^{at} = \infty$ and $\lim_{t \rightarrow -\infty} e^{at} = 0$.
5. If $a < 0$ then $\lim_{t \rightarrow \infty} e^{at} = 0$ and $\lim_{t \rightarrow -\infty} e^{at} = \infty$.
6. For any positive a , e^{at} grows much faster than any polynomial.
Examples. $\lim_{t \rightarrow \infty} e^t / t^3 = \infty$, $\lim_{t \rightarrow \infty} t e^{-t} = 0$.

Graphs

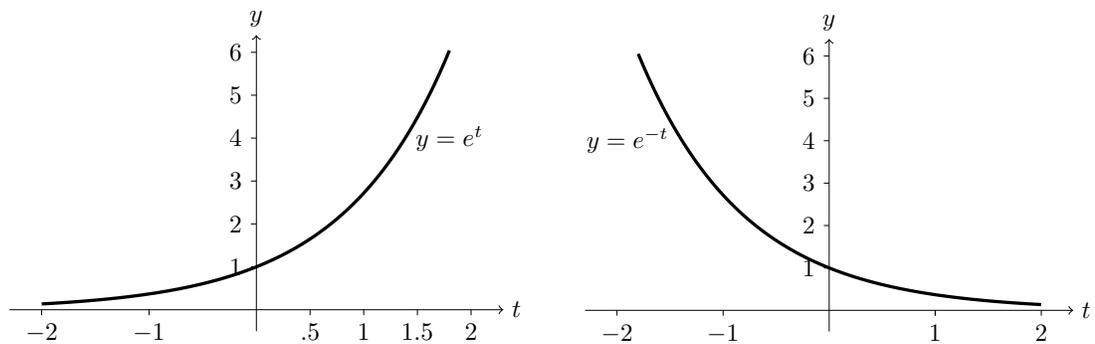


Fig. 1. Graphs of e^t and e^{-t} .

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