3.2 Exponential Functions

Ex/ 1000 cells in petri dish. Cells double every hour. $N(t)$ is the number of cells after t hours.

t	0	1	2	- - -
$N(t)$	1000	2000	4000	- - -

$$N(t) = 1000 \times \underbrace{(2 \times 2 \times \cdots 2)}_{t\text{-times}} = 1000 \times 2^t$$

def/ exponential function is of the form

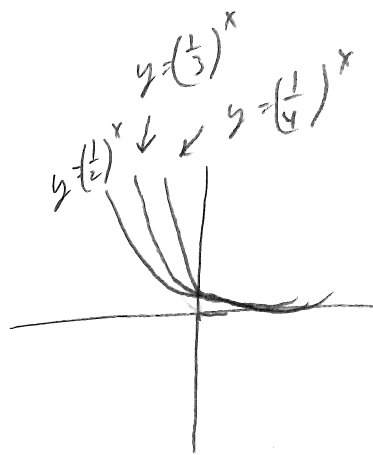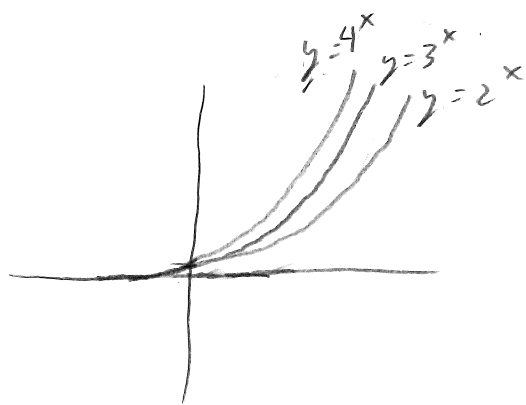$$f(x) = ab^x, \quad a \neq 0, \ b > 0, \ b \neq 1$$

$$b = \text{base}, \qquad a = \text{initial value}$$

Property: $f(x+1) = bf(x)$

For plots, see textbook

See worksheet Q1, Q2

Graphs)

3.2

Ex

$y=4^x$ $y=3^x$ $y=2^x$

$y=(\frac{1}{3})^x$ $y=(\frac{1}{4})^x$ $y=(\frac{1}{2})^x$

$b>1$

$y=b^x$ is increasing and concave up

$b^x \rightarrow \infty$ as $x \rightarrow \infty$

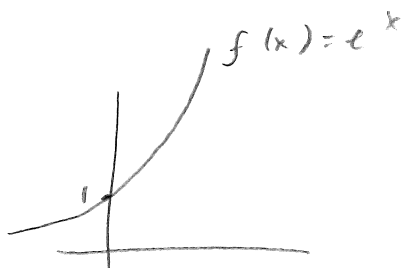$b^x \rightarrow 0$ as $x \rightarrow -\infty$

$0<b<1$

$y=b^x$ is decreasing and concave down

$b^x \rightarrow 0$ as $x \rightarrow \infty$

$b^x \rightarrow \infty$ as $x \rightarrow -\infty$

Groupwork   Q1 and Q2

Def] $f(x)=e^x$ is the natural exponential function.

$e \approx 2.71828....$

$f(x)=e^x$

Groupwork   Q3

②