

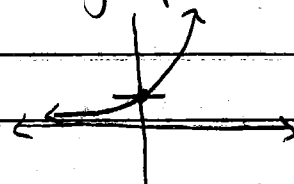
5.2 Exponential Functions

pg. 339 1-19 odd, 27-81 (x3)

Create a table of values $[-3, 3]$ and graph:

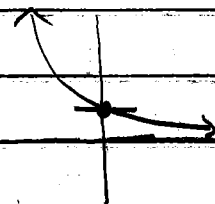
(A) $f(x) = 2^x$

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



(B) $f(x) = \left(\frac{1}{2}\right)^x$

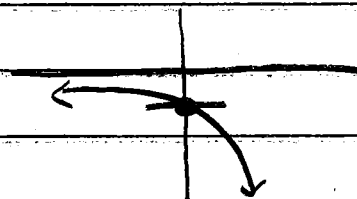
x	-3	-2	-1	0	1	2	3
y	8	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$



(C) $f(x) = -2^x$

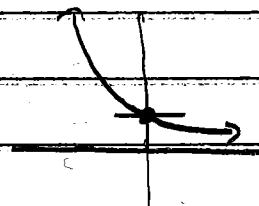
Reflection
in x-axis

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



(D) $f(x) = 2^{-x} = \left(\frac{1}{2}\right)^x$

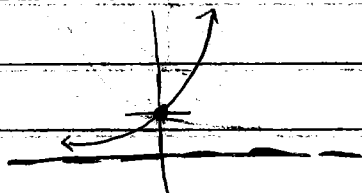
Reflection in y-axis



Exponential Graphs

Growth

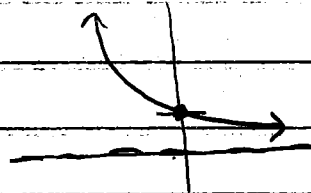
$$a > 1$$



$$f(x) = a^x$$

Decay

$$0 < a < 1$$



Domain: \mathbb{R} Range: $(0, \infty)$

critical point $(0, 1)$

asymptote $y = 0$

Reflections and Translations

Reflection in x-axis

$$\ominus a^x$$

Reflection in y-axis

$$a^{\ominus x}$$

Vertical (up/down) shift

$$a^x \pm b$$

Horizontal (left/right) shift

$$a^{x \pm c}$$

Graph reflections first

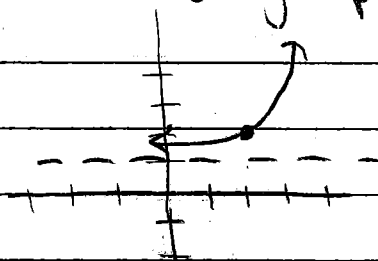
Example 1 List the transformations and graph

(A) $f(x) = 3^{x-2} + 1$

$3^x \Rightarrow$ growth \nearrow

$x-2 \Rightarrow$ right 2

$+1 \Rightarrow$ up 1



Domain: \mathbb{R}

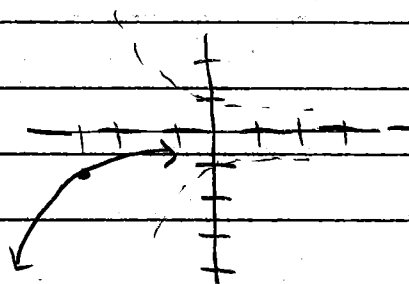
Range: $(1, \infty)$

(B) $f(x) = -\frac{1}{3}^{x+3}$

$\frac{1}{3}^x \Rightarrow$ Decay \searrow

$-\frac{1}{3} \Rightarrow$ Reflection in x

$+3 \Rightarrow$ Left 3



Domain: \mathbb{R}

Range: $(-\infty, 0)$

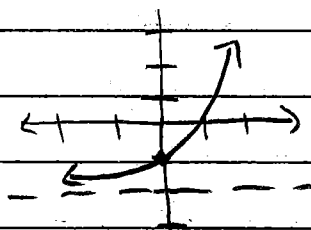
(C) $f(x) = \frac{2}{3}^{-x} - 2$

change to positive exponent or reflection in y-axis

$$\frac{3}{2}^x - 2$$

$\frac{3}{2} \Rightarrow$ growth

$-2 \Rightarrow$ Down 2



Domain: \mathbb{R}

Range: $(-2, \infty)$

5.2 cont'd

Solving exponential equations - Change of base
If $a^x = a^y$, then $x = y$

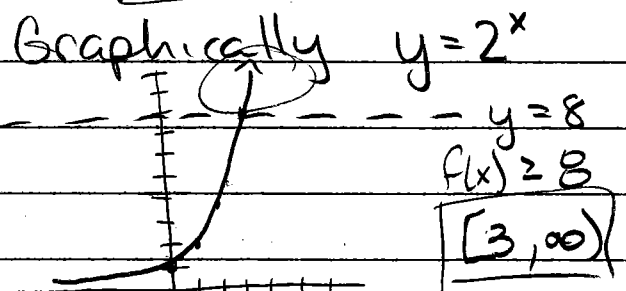
Example 2 Solve each equation or inequality

$$\begin{aligned} \textcircled{A} \quad 6^{3x} &= 216 \\ 6^{3x} &= 6^3 \\ 3x &= 3 \\ \boxed{x} &= \boxed{1} \end{aligned}$$

$$\begin{aligned} \textcircled{B} \quad 9^{x+4} &= 27^{x-1} \\ (3^2)^{x+4} &= (3^3)^{x-1} \\ 2(x+4) &= 3(x-1) \\ 2x+8 &= 3x-3 \\ \boxed{11} &= \boxed{x} \end{aligned}$$

$$\begin{aligned} \textcircled{C} \quad 7^{2x-1} &= 1 \\ 7^{2x-1} &= 7^0 \\ 2x-1 &= 0 \\ 2x &= 1 \\ \boxed{x} &= \boxed{\frac{1}{2}} \end{aligned}$$

$$\begin{aligned} \textcircled{D} \quad 2^x &\geq 8 \\ 2^x &\geq 2^3 \\ \boxed{x} &\geq \boxed{3} \end{aligned}$$



$$\begin{aligned} \textcircled{61} \quad 27^{4x} &= 9^{x+1} \\ 3^{3 \cdot 4x} &= 3^{2 \cdot (x+1)} \\ 12x &= 2x+2 \end{aligned}$$

$$10x = 2x$$

$$x = 5$$

$$27^{4x} > 9^{x+1}$$

$$x > 5$$

$$27^{4x} < 9^{x+1}$$

$$x < 5$$

