

4.1, 4.2, 4.3: Exponential Functions (growth and decay)

$$f(x) = a \cdot b^x$$

$a \neq 0$                        $b > 0; b \neq 1$

In general, if  $x > 0$

Exponential growth:  $b > 1$

Exponential decay:  $0 < b < 1$

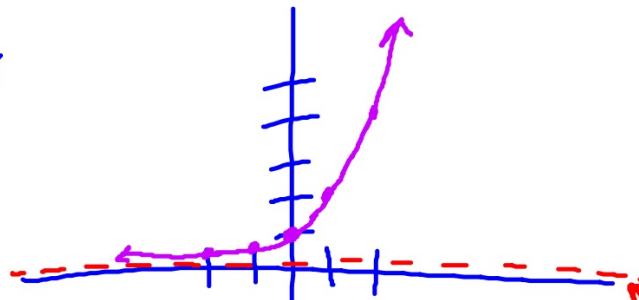
Sketch. State the domain and range, growth or decay, and increasing or decreasing.

①  $y = 2^x$

x	y
-2	1/4
-1	1/2
0	1
1	2
2	4

D:  $(-\infty, \infty)$   $\{x | x \in \mathbb{R}\}$   
R:  $(0, \infty)$   $\{y | y > 0\}$

growth;  $b=2$   $b > 1$   
increasing



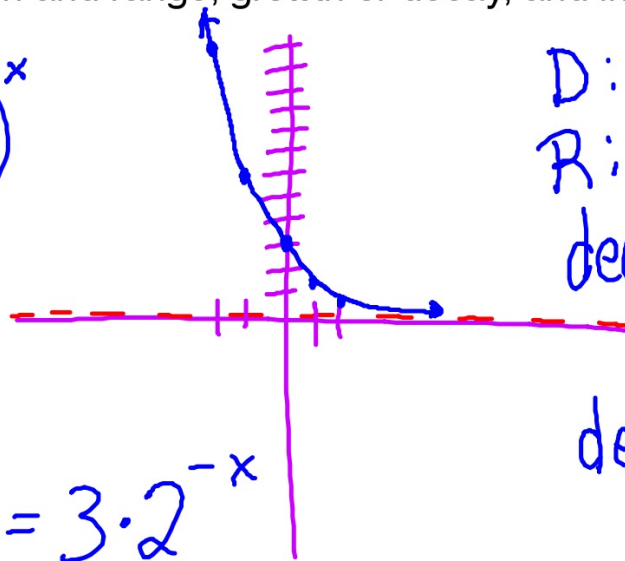
asymptote  
(a value a  
function  
approaches)

Sketch. State the domain and range, growth or decay, and increasing or decreasing.

②

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

x	y
-2	12
-1	6
0	3
1	1.5
2	.75



$D: \{x | x \in \mathbb{R}\}$   
 $R: \{y | y > 0\}$   
decay;  $b = \frac{1}{2}$   
 $0 < b < 1$

decreasing

$$y = 3 \cdot 2^{-x}$$

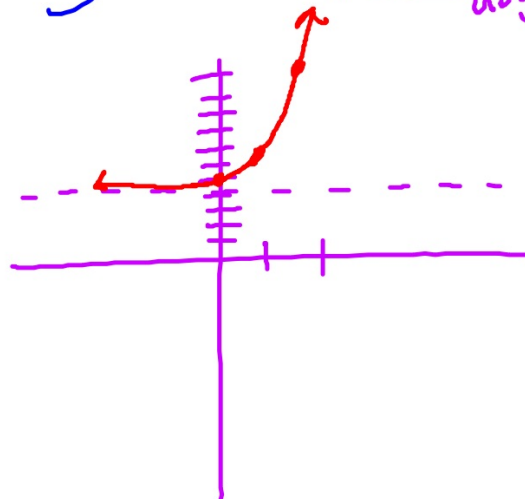
Sketch. State the domain and range, growth or decay, and increasing or decreasing.

3

$$y = 2 \cdot 3^{x-1} + 4$$

← asymptote

x	y
0	$4\frac{2}{3}$
1	6
2	10



$$D: (-\infty, \infty)$$
$$R: (4, \infty)$$

Growth  $b = 3$   
 $b > 1$   
increasing

Sketch. State the domain and range, growth or decay, and increasing or decreasing.

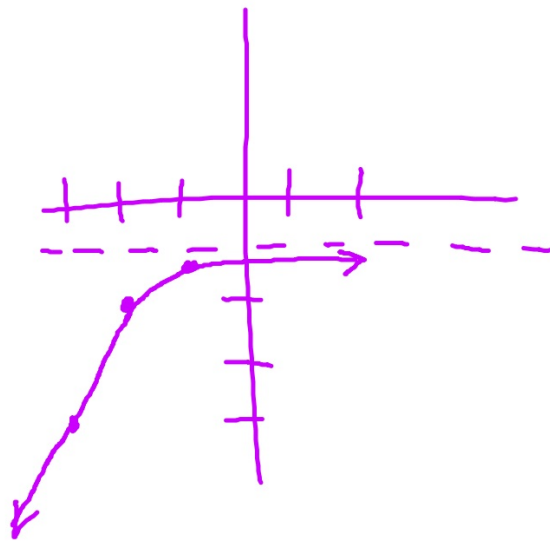
4

$$y = -\left(\frac{1}{3}\right)^{x+2} - 1 \leftarrow \text{asympt.}$$

$$D: (-\infty, \infty) \{x | x \in \mathbb{R}\}$$

$$R: (-\infty, -1) \{y | y < -1\}$$

X	y
-3	-4
-2	-2
-1	$-1\frac{1}{3}$

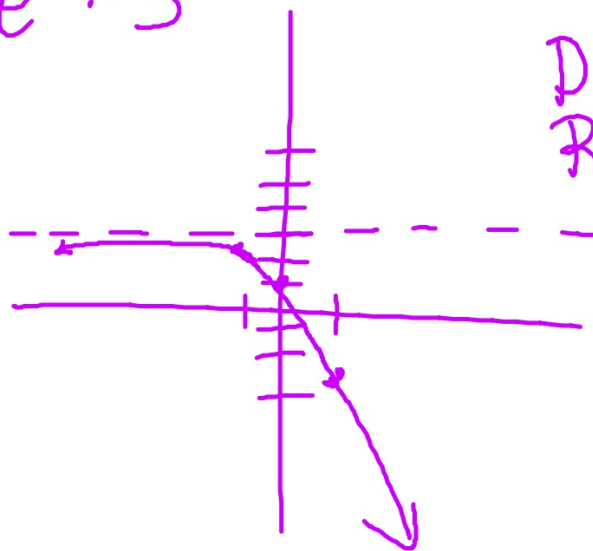


decay  $b = \frac{1}{3}$   
 $0 < b < 1$   
 increasing

Sketch. State the domain and range, growth or decay, and increasing or decreasing.

⑤  $y = -2e^x + 3$

x	y
-1	2.3
0	1
1	-2.4



D:  $(-\infty, \infty)$   
R:  $(-\infty, 3)$

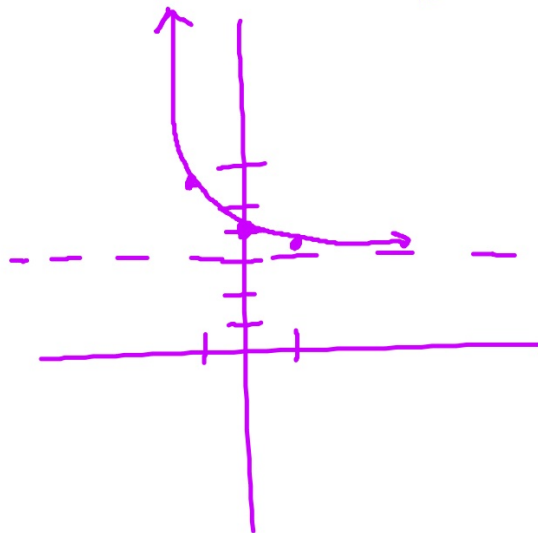
growth  
decreasing

Sketch. State the domain and range, growth or decay, and increasing or decreasing.

⑥  $y = e^{-x} + 3$

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

x	y
-1	5.7
0	4
1	3.4



D:  $\{x | x \in \mathbb{R}\}$   
R:  $\{y | y > 3\}$

decay

decreasing



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

shift  $f(x)$  down 3 units :  $y = 2^x - 3$

shift  $f(x)$  to the left 4 units :  $y = 2^{x+4}$

shift  $f(x)$  to the right 3 units :  $y = 2^{x-3}$

shift 3 units up and 2 units left :  $y = 2^{x+2} + 3$

$$2e^{2x} + e^x - 15 = 0$$

$$(2e^x - 5)(e^x + 3) = 0$$

$$2e^x - 5 = 0$$

$$\ln e^x = \ln \frac{5}{2}$$

$$x = \ln \frac{5}{2}$$

$$e^x + 3 = 0$$

~~$$\ln e^x = \ln -3$$~~