Chapter 6.3 Notes
Exponential Functions

* Average rate of change formula: $\dfrac{\text{change in y}}{\text{change in x}}$ } used when determining if linear function

* Exponential function formula: f(x) = Ca Where c= constant, and a=growth factor.

1. Determine whether the function given by the table is linear, exponential, or neither. If the function is linear, find a linear function that models the data; if it is exponential, find an exponent entail function that models the data.

x	f(x) or y
-1	$\frac{1}{12}$ ← y_1
0	1 ← y_2
1	12 ← y_3
2	144 ← y_4
3	1728 ← y_5

For exponential:

$$\frac{y_2}{y_1} \ldots \frac{y_3}{y_2} \ldots \frac{y_4}{y_3} \ldots \frac{y_5}{y_4}$$

$$\frac{y_2}{y_1} = \frac{1}{\frac{1}{12}} = 12$$

$$\frac{y_3}{y_2} = \frac{12}{1} = 12$$

$$\frac{y_4}{y_3} = \frac{144}{12} = 12$$

$$\frac{y_5}{y_4} = \frac{1728}{144} = 12$$

these are the same..... so exponential

So....

a = 12

formula

unless the problem tells you otherwise, C = 1.

$$f(x) = Ca^x$$
$$= 1 \cdot 12^x$$ ← this x is an exponent
$$= \boxed{12^x}$$

2. Determine whether the function given by the table is linear, exponential, or neither. If the function is linear, find a linear function that models the data; if it is exponential, find an exponent entail function that models the data.

f(x) or

	x	y	
x_1	-1	$\frac{4}{7}$	y_1
x_2	0	1	y_2
x_3	1	$\frac{7}{4}$	y_3
x_4	2	$\frac{49}{16}$	y_4
x_5	3	$\frac{343}{64}$	y_5

For exponential:

$$\frac{y_2}{y_1} \cdots \frac{y_3}{y_2} \cdots \frac{y_4}{y_3}$$

$$\frac{y_2}{y_1} = \frac{1}{\frac{4}{7}} = \frac{7}{4}$$

$$\frac{y_3}{y_2} = \frac{\frac{7}{4}}{1} = \frac{7}{4}$$

$$\frac{y_4}{y_3} = \frac{\frac{49}{16}}{\frac{7}{4}} = \frac{7}{4}$$

$$\frac{y_5}{y_4} = \frac{\frac{343}{64}}{\frac{49}{16}} = \frac{7}{4}$$

These are all the same … so it's exponential

So ….

$a = \frac{7}{4}$

formula

$$f(x) = Ca^x$$

$$= 1 \cdot \left(\frac{7}{4}\right)^x$$

$$= \boxed{\left(\frac{7}{4}\right)^x}$$

unless the problem tells you otherwise, $C = 1$.

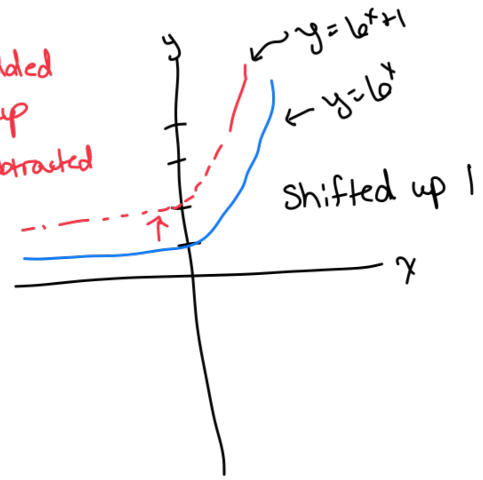
3. Use transformations to graph the function. Determine the domain, range, horizontal asymptote, and y-intercept of the function.

$f(x) = 6^x + 1$

↑ shifts up 1

* if something is just added at the end, shifts up

* if something is just subtracted from the end, shifts down.



Domain: $\boxed{(-\infty, \infty)}$

* Look at x-axis Left to right

Range: $\boxed{(1, \infty)}$

* Look at y-axis from bottom to top

Horizontal asymptote:

$\boxed{y = 1}$

* Should be same number as in your range.

y-intercept $= \boxed{2}$

* where graph crosses the y axis.

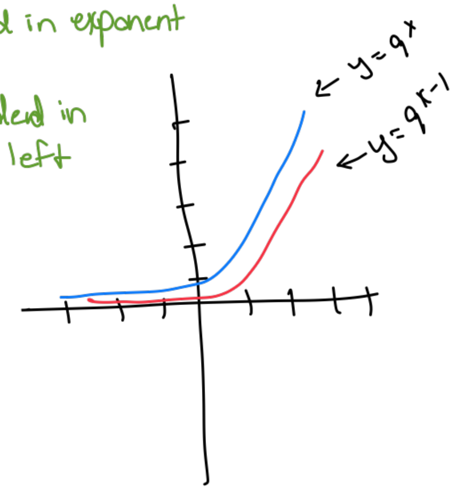
4. Use transformations to graph the function. Determine the domain, range, horizontal asymptote, and y-intercept of the function.

$f(x) = 9^{x-1}$

shift right 1

* if something subtracted in exponent shifts right

* If something added in exponent, shifts left



Domain: $\boxed{(-\infty, \infty)}$

* Look at x-axis Left to right

Range: $\boxed{(0, \infty)}$

* Look at y-axis from bottom to top

Horizontal asymptote:

$\boxed{y = 0}$

* Should be same number as in your range.

y-intercept $= 9^{x-1} \rightarrow 9^{0-1} \rightarrow 9^{-1} \rightarrow \boxed{\frac{1}{9}}$

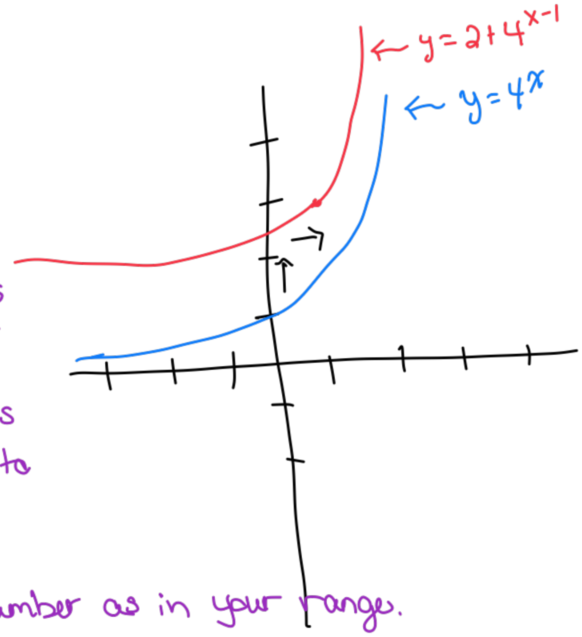
* replace x with 0 and solve for y.

5. Use transformations to graph the function. Determine the domain, range, horizontal asymptote, and y-intercept of the function.

$f(x) = 2 + 4^{x-1}$

Shift right 1

Shift up 2



Domain: $\boxed{(-\infty, \infty)}$ * Look at x-axis Left to right

Range: $\boxed{(2, \infty)}$ * Look at y-axis from bottom to top

Horizontal asymptote: $\boxed{y = 2}$ * Should be same number as in your range.

y-intercept: $2 + 4^{x-1} \rightarrow 2 + 4^{0-1} \rightarrow 2 + 4^{-1} \rightarrow \boxed{\frac{9}{4}}$

* replace x with 0 and solve for y.

6. Solve the equation.

$4^{-x} = 256$

$4 \cdot 4 \cdot 4 \cdot 4 = 256$

• If bases are the same, then set exponents = to each other

$4^{-x} = 4^{4}$

$-x = 4$

$\frac{-x}{-1} = \frac{4}{-1}$

$x = \boxed{-4}$

• We want the bases the same.

• Take the base on the left & see how many times you must multiply it by itself to get the number on the right.

• Write down that base, & make the exponent the # of times you had to multiply it together.

* Now, since your bases are the same, your exponents will = each other.

7. Solve the equation.

$$5^{5x+1} = 125$$

$$5 \cdot 5 \cdot 5 = 125$$

1 2 3

$$5^{5x+1} = 5^3$$

$$5x+1 = 3$$

$$-1 \quad -1$$

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

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

- We want the bases the same.
- Take the base on the left + see how many times you must multiply it by itself to get the number on the right.
- Write down that base, + make the exponent the # of times you had to multiply it together.

* Now, since your bases are the same, your exponents will = each other.

- Then solve for x.

8. Solve the equation.

$$\left(\frac{3}{2}\right)^x = \left(\frac{27}{8}\right)$$

$$\frac{3}{2} \cdot \frac{3}{2} \cdot \frac{3}{2} = \frac{27}{8}$$

1 2 3

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

$$x = \boxed{3}$$

- We want the bases the same.
- Take the base on the left + see how many times you must multiply it by itself to get the number on the right.
- Write down that base, + make the exponent the # of times you had to multiply it together.

* Now, since your bases are the same, your exponents will = each other.

9. Solve the equation.

$$8^{-x+30} = 128^{x}$$

$\underset{1}{2}\cdot\underset{2}{2}\cdot\underset{3}{2}$

$$2^{3(-x+30)} = \underset{1}{2}\cdot\underset{2}{2}\cdot\underset{3}{2}\cdot\underset{4}{2}\cdot\underset{5}{2}\cdot\underset{6}{2}\cdot\underset{7}{2}$$

$$2^{3(-x+30)} = 2^{7x}$$

$$3(-x+30) = 7x$$

$$-3x + 90 = 7x$$

$$+3x \qquad\qquad +3x$$

$$90 = 10x$$

$$\frac{90}{10} = \frac{10x}{10}$$

$$\boxed{9} = x$$

- We must come up with a base that could be the base of both.
- Write down that base + the exponent. It will be multiplied by what the original exponent was.
- Take the base on the left + see how many times you must multiply it by itself to get the number on the right.
- Write down that base, + make the exponent the # of times you had to multiply it together.

* Now, since your bases are the same, your exponents will = each other.

- Now solve for x.