Lesson 55 Objective: SWBAT transform exponential functions and list the key features of each.

**Reminder extra help is today after school!

Kickoff- Solve the following:

1) $4^{2x+3} = 1$

$4^{2x+3} = 4^0$

$2x+3 = 0$

$x = -\dfrac{3}{2}$

$4^{2(-\frac{3}{2})+3} = 1$ ✓

2) $\left(\dfrac{1}{6}\right)^{3x+2} \cdot 216^{3x} = \dfrac{1}{216}$

$(6^{-1})^{3x+2} \cdot (6^3)^{3x} = 6^{-3}$

$-1(3x+2) + 3(3x) = -3$

$-3x - 2 + 9x = -3$

$6x - 2 = -3$

$6x = -1$

$x = -\dfrac{1}{6}$ ✓

Transformations of Exponential Functions

Try This: Identify the transformations that maps $f(x) \to g(x)$ if $f(x) = x^2$

1) $g(x) = x^2 - 3$ ↓3

2) $g(x) = x^2 - 1$ ↓1

3) $g(x) = (x-2)^2$ →2

4) $g(x) = (x+5)^2$ ←5

5) $g(x) = -x^2$ reflection over x-axis

6) $g(x) = (-x)^2$ R over y

Transformations with Exponential Functions:

1) Vertical Shifts (up and down)

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

$b > 0$ up
$b < 0$ down

$a = $ # other than 1.

2) Horizontal Shifts (left + right)

$f(x) = a^{x \pm b}$

$b > 0$ left
$b < 0$ right

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3) Reflection over the x-axis

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

4) Reflection over the y-axis

$f(x) = a^x$ a^{-x}

Remember: $f(x) = a^x$ passes through the point (0, 1) start your shifts and reflections there!!!
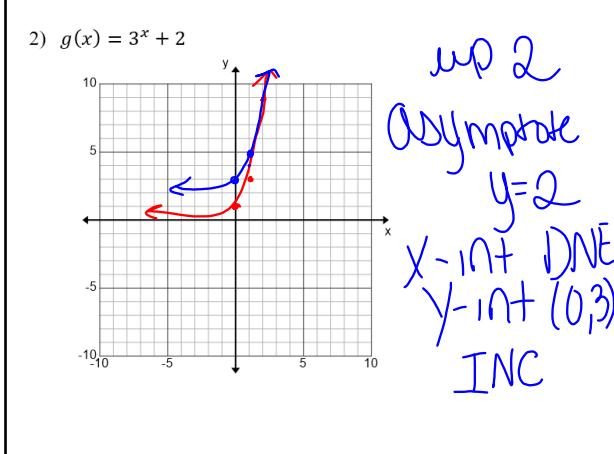
y-intercept!

Example: Sketch the graph of $f(x) = 3^x$ under the given transformations state the asymptotes, intercepts and whether the function is increasing or decreasing.

PF: $f(x) = 3^x$

1) $g(x) = 3^{x+2}$

left 2

asymptote → y = 0

x-int → DNE

y-int → (0,9)

Increasing

Asy: y = 0
yint (0,1)
xint DNE
Increasing
D → ℝ
R → (0,∞)

2) $g(x) = 3^x + 2$

up 2

asymptote y = 2

x-int DNE

y-int (0,3)

INC
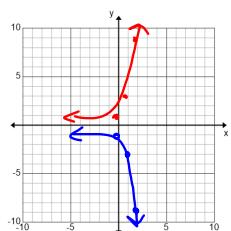
3) $g(x) = -3^x$

reflect x-axis

asym → y=0

x-int → DNE

y-int → (0,-1)

dec.
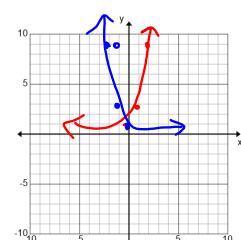
4) $g(x) = 3^{-x}$

reflect y-axis

asym → y=0

x-int → DNE
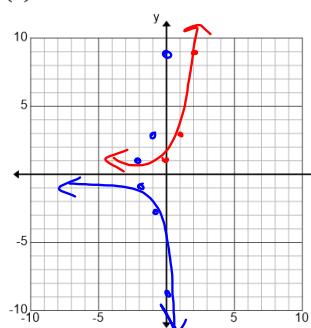
y-int → (0,1)

dec.

5) $g(x) = -3^{x+2}$

left 2

reflect x-axis

asym → y=0

x-int → DNE

y-int → (0,-9)

dec.

6) $g(x) = -3^x + 2$

reflect x-axis

up 2

asy → y=2

x-int (.63, 0)

y-int (0,1)

dec