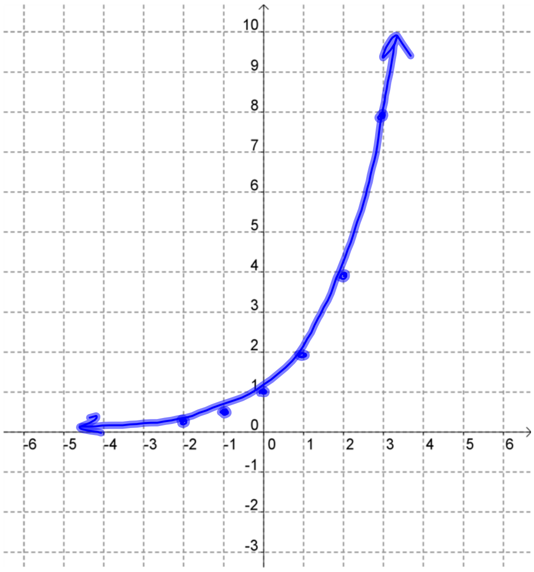
$y = 2^x$

x	y
-2	$\frac{1}{4} = 0.25$
-1	$\frac{1}{2} = 0.5$
0	1
1	2
2	4
3	8



$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

$2^{-1000} = \frac{1}{2^{1000}}$

$= +$

Mar 29-10:31 AM

$D = \{x \mid x \in \mathbb{R}\}$

$R = \{y \mid y \in \mathbb{R}, y > 0\}$

no x-intercepts

y-int at $(0,1)$, or $y = 1$.

no vertical asymptote

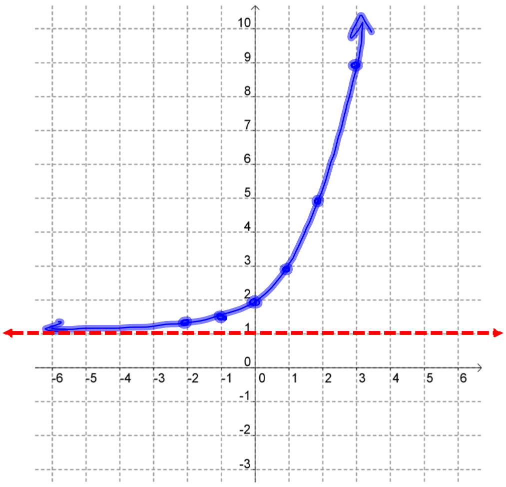
horizontal asymptote (HA) at $y = 0$

increasing for all x

Apr 5-2:07 PM

$y = 2^x + 1$

x	y
-2	1.25
-1	1.5
0	2
1	3
2	5
3	9



HA at $y=1$

v.shift up by 1

$R = \{y \mid y \in \mathbb{R}, y > 1\}$

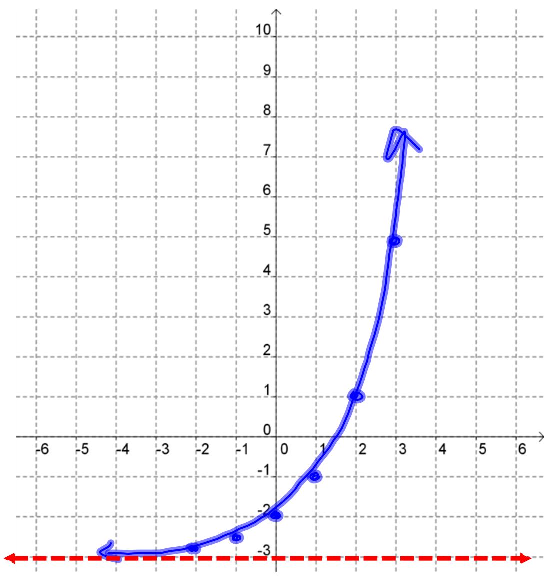
y-int = 2

* HA at $y = 1$ *

Mar 29-10:31 AM

$y = 2^x - 3$

x	y
-2	-2.75
-1	-2.5
0	-2
1	-1
2	1
3	5



v.shift down 3 : $R = \{y \mid y \in \mathbb{R}, y > -3\}$

y-int -2

* HA at $y = -3$

Mar 29-10:31 AM

$y = 2^x + q$

① HA at $y = q$

② $R = \{y \mid y \in \mathbb{R},\ y > q\}$

③ y-int is $q+1$

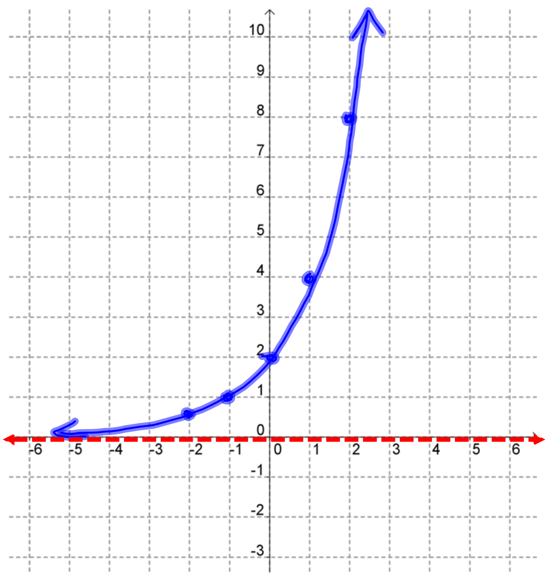
may be affected by other transformations

Mar 29-10:31 AM

$y = 2(2^x)$

$y = 2f(x)$

x	y
−2	0.5
−1	1
0	2
1	4
2	8
3	16

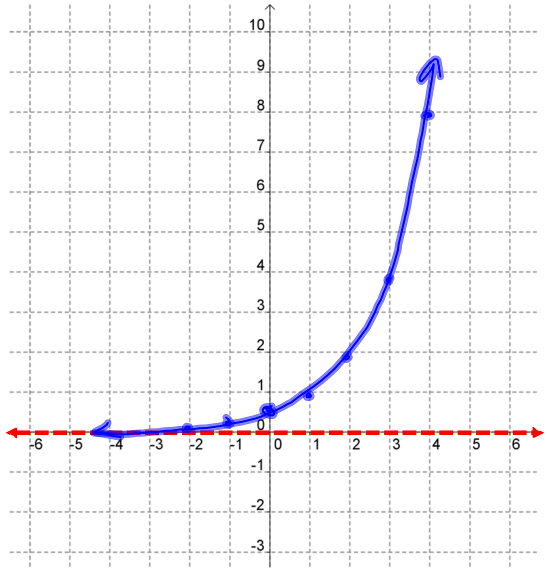


V. Stretch by 2 : y-int is 2

Mar 29-10:31 AM

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

x	y
−2	0.125
−1	0.25
0	0.5
1	1
2	2
3	4



V. scaling of $\frac{1}{2}$

V. compression by 2 : y-int = $\frac{1}{2}$

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$y = a(2^x),\ a > 1$

V. stretch by a or V. scaling by a

→ y-int changes from (0, 1)

to (0, a)

$y = a(2^x),\ 0 < a < 1$

V. compression by $\frac{1}{a}$ or V. scaling by a

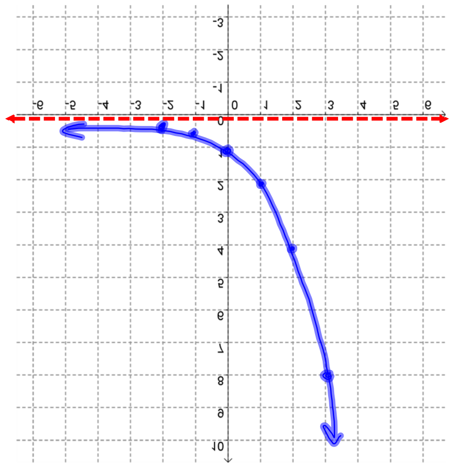
→ y-int changes from (0, 1) to (0, a)

Mar 29-10:31 AM

$f(x) = 2^x$

$y = -(2^x)$

x	y
-2	-0.25
-1	-0.5
0	-1
1	-2
2	-4
3	-8



V. reflection: $R = \{y \mid y \in \mathbb{R}, y < 0\}$

was $y > 0$

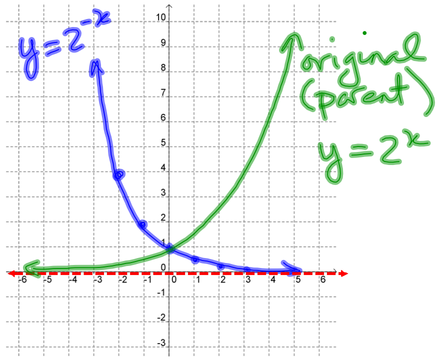
y-int is -1

always decreasing

Mar 29-10:31 AM

$y = 2^{-x}$

x	y
-2	4
-1	2
0	1
1	0.5
2	0.25
3	0.125



h. reflection: always decreasing

OR

algebraically

$y = 2^{-x}$

$= \frac{1}{2^x}$ applying exponent rules

$= \frac{1^x}{2^x}$

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

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$y = a(2^x)$

$a<0$ (negative) gives a vertical reflection

$y = 2^{kx}$

$k<0$ (negative) gives a horizontal reflection.

$y=f(x) \longrightarrow y=af[k(x-p)]+q$

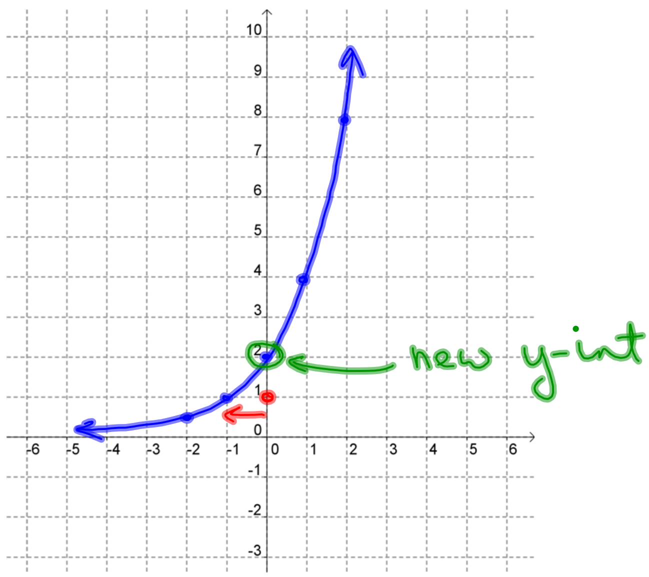
$y=b^x \longrightarrow y=ab^{k(x-p)}+q$

Mar 29-10:31 AM

B.4

$y = 2^{x+1}$

x	y
-2	0.5
-1	1
0	2
1	4
2	8
3	16



h.shift left by 1.

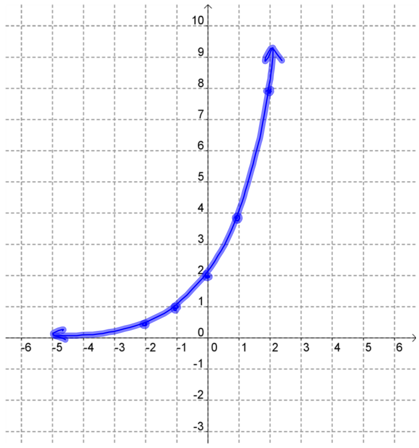
y-int: changed from $y=1$ to $y=2$

Mar 29-10:31 AM

B.4

$y = 2(2^x)$

x	y
-2	0.5
-1	1
0	2
1	4
2	8
3	16



$y=2(2^x)$ same as $y=2^{x+1}$

$y=2^1(2^x)$

$y=2^{1+x}$

$y=2^{x+1}$

$y=2^x \cdot 2^1$

$y=2^x \cdot 2$

$y=2(2^x)$

Mar 29-10:31 AM

Summarize $y = 2^{x-p}$ $y=f(x-p)$

h. shift by p

2^{x-5} : shift right 5

2^{x+3} : shift left by 3

Equivalent Transformation?

$y=2^{x+1}$

$=2^x \cdot 2^1$

$=2^x \cdot 2$

$=2(2^x)$

$\therefore$ h. shift is equivalent to a vertical scaling

Apr 10-12:51 PM

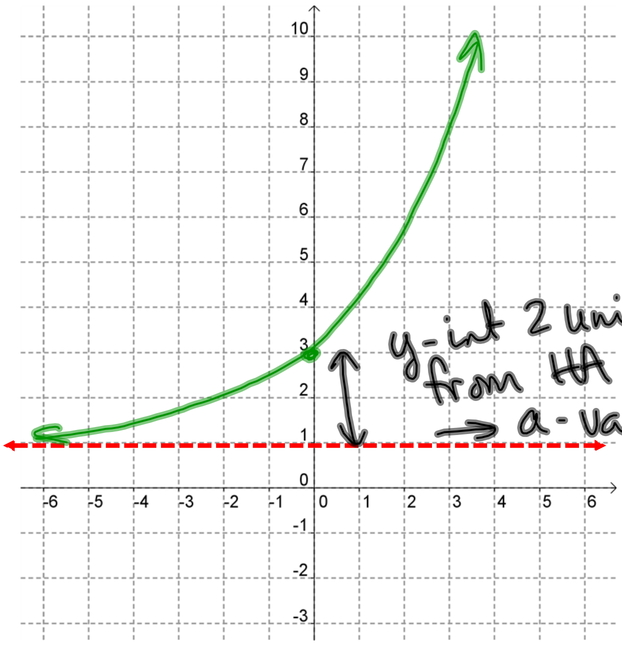
$y = 2(2^x) + 1$

if $f(x) = 2^x$

$y = 2f(x) + 1$

① v. scaling (stretch) by 2

② v. shift up by 1 → HA: $y = 1$



y-int $(0,1) \xrightarrow{y \times 2} (0,2) \xrightarrow{y+1} (0,3)$

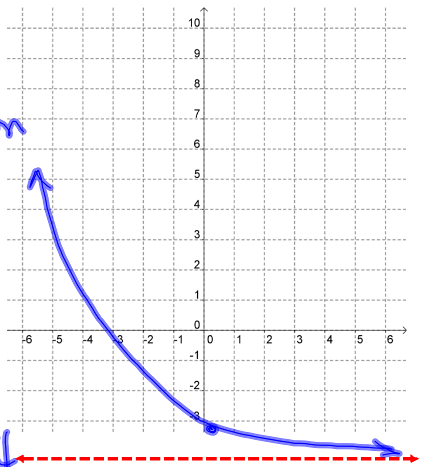
Apr 10-12:52 PM

$y = 2^{-x} - 4$

2: base, not transformation

① h. reflection $(k=-1)$

② v. shift down by 4 $(q=-4)$



HA: $y=0 \rightarrow y=-4$

y-int: $(0,1) \xrightarrow{x \times (-1)} (0,1) \xrightarrow{y-4} (0,-3)$

* for additional points:

(a) sub a value (TOV)

OR (b) transform additional points from parent function

Apr 10-12:53 PM

Assigned Work:

see last page of handout
4, 5, 6, 9, 11

5cd

Apr 5-11:59 AM

5(c) $g(x) = -2f(\underline{2x-6}), \quad f(x) = 4^x$

$= -2f[2(x-3)]$

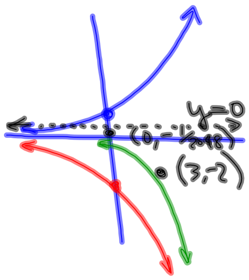
$= -2\left(4^{2(x-3)}\right)$

transformations?

① v. reflect
② v. stretch by 2
③ h. compress by 2
④ h. shift right 3

base of exponential, NOT a transformation

$\frac{1}{4^6} = 4^{-6} = \frac{1}{4096}$



HA : $y=0$

y-int : set $x=0$

$y = -\frac{1}{2048}$

$(0,1) \rightarrow (0,-1) \rightarrow (0,-2)$

original y-int

$\rightarrow (0,-2)$

$\rightarrow (3,-2)$

Apr 11-1:53 PM

5(a) $h(x) = f(-0.5x+1)$, $f(x) = 4^x$

$= f[-0.5(x-2)]$

$= 4^{-0.5(x-2)}$

① h.reflect
② h.stretch by 2
③ h.shift right by 2

HA: $y=0$

y-int: set $x=0$, $y = 4^1$
$= 4$

$(0,4)$ new y-int

$(0,1) \to (0,1) \to (0,1) \to (2,1)$

old y-int $\xrightarrow{\text{moved to}}$

Apr 11-2:05 PM

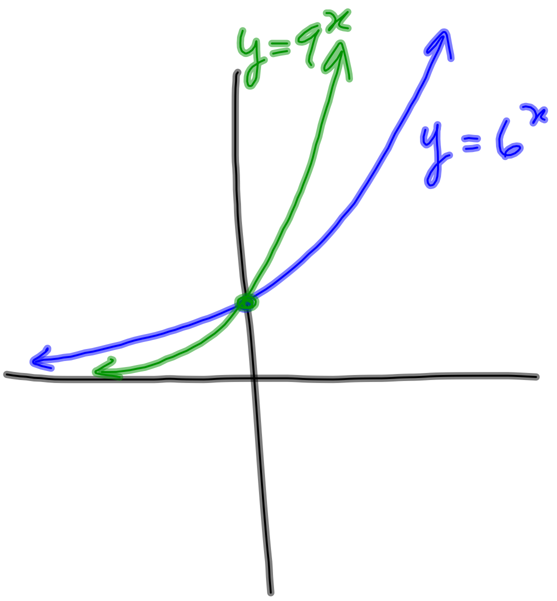
6. Compare $f(x) = 6^x$ $g(x) = 3^{2x}$

$= 3^x \cdot 3^x$

$= (3^2)^x$

$= (3^x)^2$

$= 9^x$



Apr 11-2:12 PM

11.

Apr 11-2:18 PM