Lesson #18

Aim: What ARE Exponential functions?

Do Now: graph by using the given Domain

1) $g(x) = 2^x$ $[-3, 3]$

2) $h(x) = \left(\frac{1}{2}\right)^x$ $[-3, 3]$

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

May 2-12:11 PM

| $x$ | $2^x$ | $(\frac{1}{2})^x$ | $-2^x$ |
|---|---|---|---|
| $-3$ | $2^{-3}=\frac{1}{8}$ | $(1/2)^{-3}=8$ | $-2^{-3}=-1/8$ |
| $-2$ | $2^{-2}=\frac{1}{4}$ | $(1/2)^{-2}=4$ | $=-1/4$ |
| $-1$ | $2^{-1}=\frac{1}{2}$ | $(1/2)^{-1}=2$ | $=-1/2$ |
| $0$ | $2^0=1$ | $(1/2)^0=1$ | $=-1$ |
| $1$ | $2^1=2$ | $(1/2)^1=1/2$ | $=-2$ |
| $2$ | $2^2=4$ | $(1/2)^2=1/4$ | $=-4$ |
| $3$ | $2^3=8$ | $(1/2)^3=1/8$ | $=-8$ |

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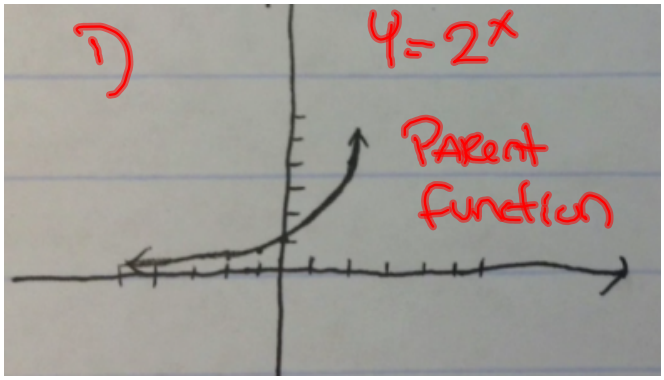
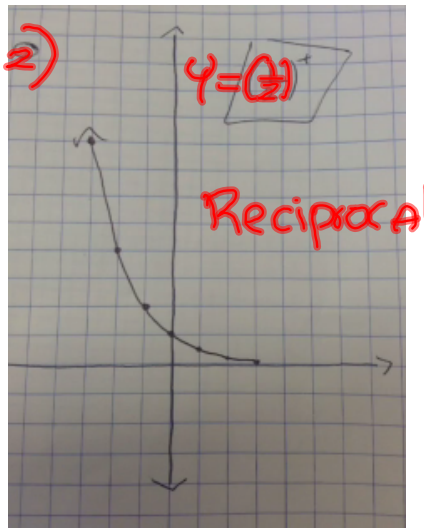
1) $y = 2^x$



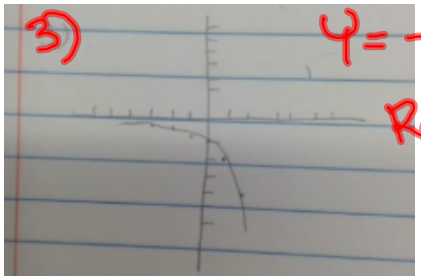
Parent function

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



Reciprocal

3) $y = -2^x$



Reflection x-Axis.

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# I- Exponential Function $f(x) = a^x$ $a \neq 1, 0$

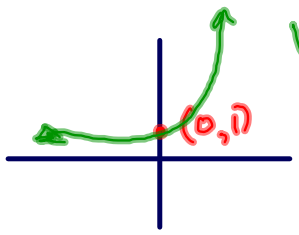
1) a) To show growth

b) to show Decay

c) to show compound interest

2) Answer for each question from the "Do Now"

| Function | y intercept | Any graphs go below the X-axis | explain the End Behavior |
|---|---|---|---|
| $g(x) = 2^x$ | $(0,1)$ Why? $2^0 = 1$ | No | UPWARDS |
| $h(x) = (\frac{1}{2})^x$ | $(0,1)$ | No | DOWNWARD |
| $f(x) = -2^x$ | $(0,-1)$ | YES | DOWNWARD |




When is $y = 2^x$ not crossing the y-int. at $(0,1)$?

eg $2^x + 7$ y-int. $(0,7)$

transformation

# II-Graphing Exponential functions

1) Exponential function $y = b^x$

2) When $b > 1$ or when $0 < b < 1$

3) Graph $f(x) = 1.3^x$, $g(x) = 2^x$, $h(x) = 10^x$
use your calculator

4) Complete top of PAGE 2 (Exercise/Table)

May 7-2:03 PM

**Example 1** $y = b^x$ YES/NO Exp. function $b \neq 1$

a) $f(x) = 2^x + 7$ YES

b) $g(x) = x^2$ NO "b" must a real # $> 0$

c) $h(x) = 1^x$ NO $b = 1$

d) $f(x) = x^x$ NO

e) $h(x) = 3 \cdot 10^{-x}$ YES

f) $f(x) = -3^{x+1} + 5$ YES

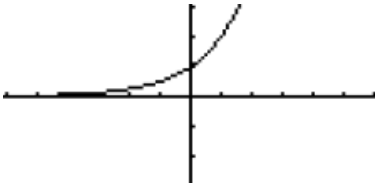
g) $g(x) = (-3)^{x+1} + 5$ NO $b > 0$

h) $h(x) = 2x - 1$ NO Linear function

May 7-2:32 PM

Example 2

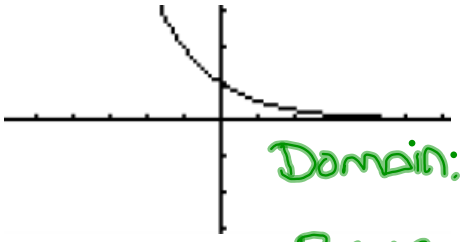
$f(x) = 2^x$



Domain: All Real #'s

Range: $y > 0$

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



Domain: All Real #'s

Range: $y > 0$

May 7-2:38 PM

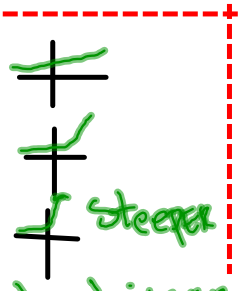
Graph (In your calculator)

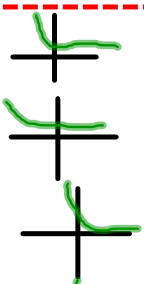
$f(x)=1.3^x$, $g(x)=2^x$, $h(x)=10^x$

Steep (Inclination)

examples

| $b>1$ | $0<b<1$ |
| --- | --- |
| $1.3^x$ | $(1/2)^x$ |
| $2^x$ | $(1/4)^x$ |
| $10^x$ | $(3/4)^x$ |




As "b" gets bigger it gets steeper

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