

Transformations of Logarithmic Functions

Dec 2/2016

In general:  $y = af[k(x - p)] + q$ For the logarithmic function,  $y = \log_b x$ , this becomes:

$$y = a \log_b [k(x - p)] + q$$

(note the base can be represented as 'b' to avoid confusion with the scale factor 'a')

Key features of parent,  $y = \log_b x$ 

- (1) vertical asymptote:  $x = 0$
- (2) x-intercept at  $(1, 0)$
- (3) always a point at  $(b, 1)$

$$y = 3^x$$

$(1, 3)$

$$y = 17^x$$

$(1, 17)$

$$y = \log_3 x$$

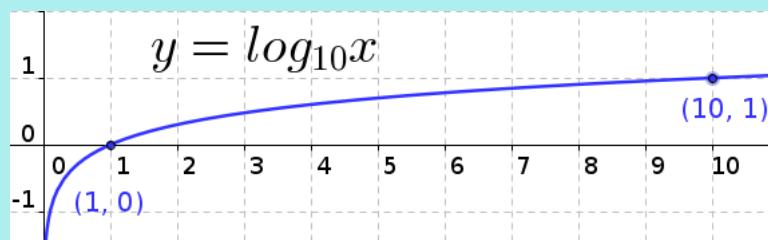
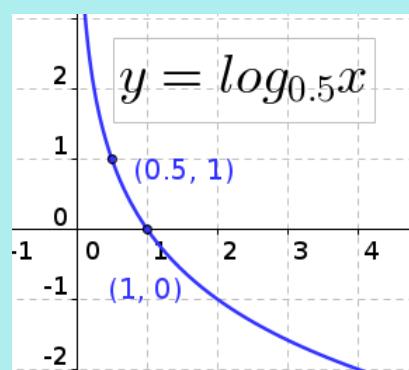
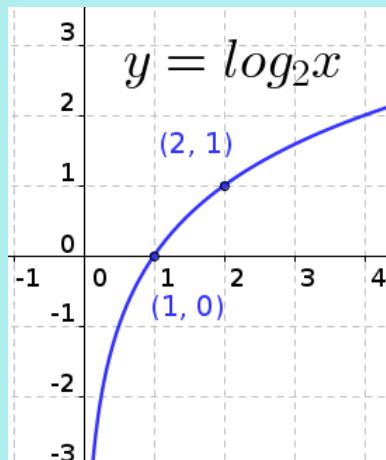
$(3, 1)$

$$y = \log_{17} x$$

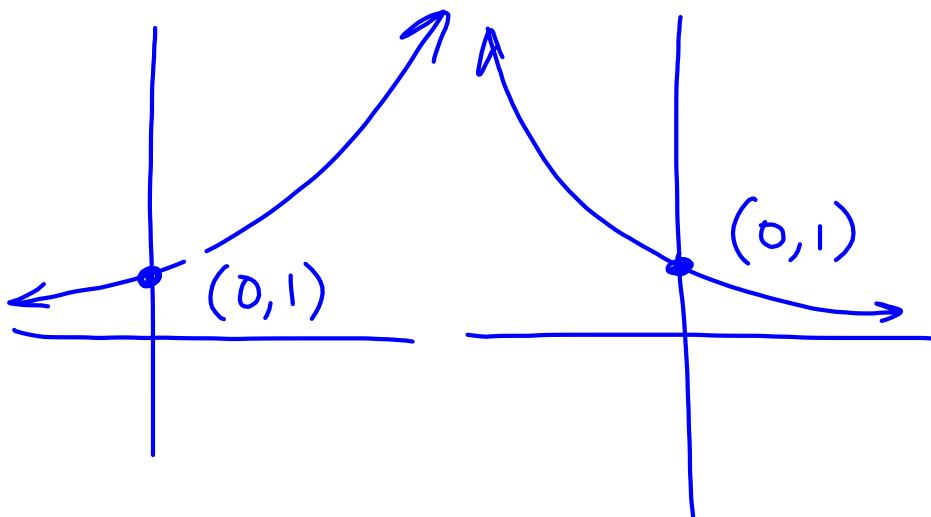
$(17, 1)$

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The parent logarithmic function  $y = \log_b x$   
 will have convenient key points at  $(1, 0)$  and  $(b, 1)$



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## Transformation Strategies:

- (1) Transform asymptote,  $x = 0$ , by horizontal shift  $p$ .
- (2) Transform key points  $(1,0)$  and  $(b,1)$  using

$$(x, y) \rightarrow \left( \frac{x}{k} + p, ay + q \right)$$

Note: A third point may be required.

- (3) The domain depends on the asymptote and any horizontal reflections.

$$y = \log_3 x$$

$$(1, 0)$$

$$(3, 1)$$

$$(9, 2)$$

$$(3^{-1}, -1)$$

$$(3^0, 0)$$

$$(3^1, 1)$$

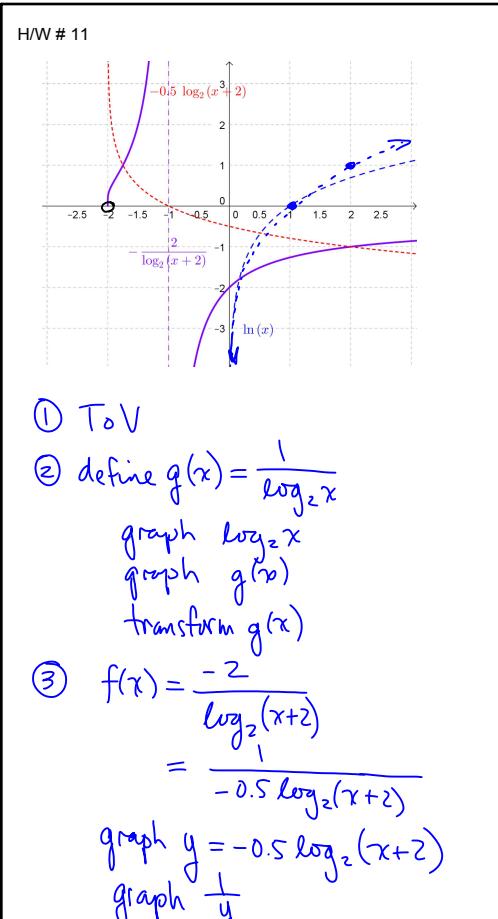
$$(3^2, 2)$$

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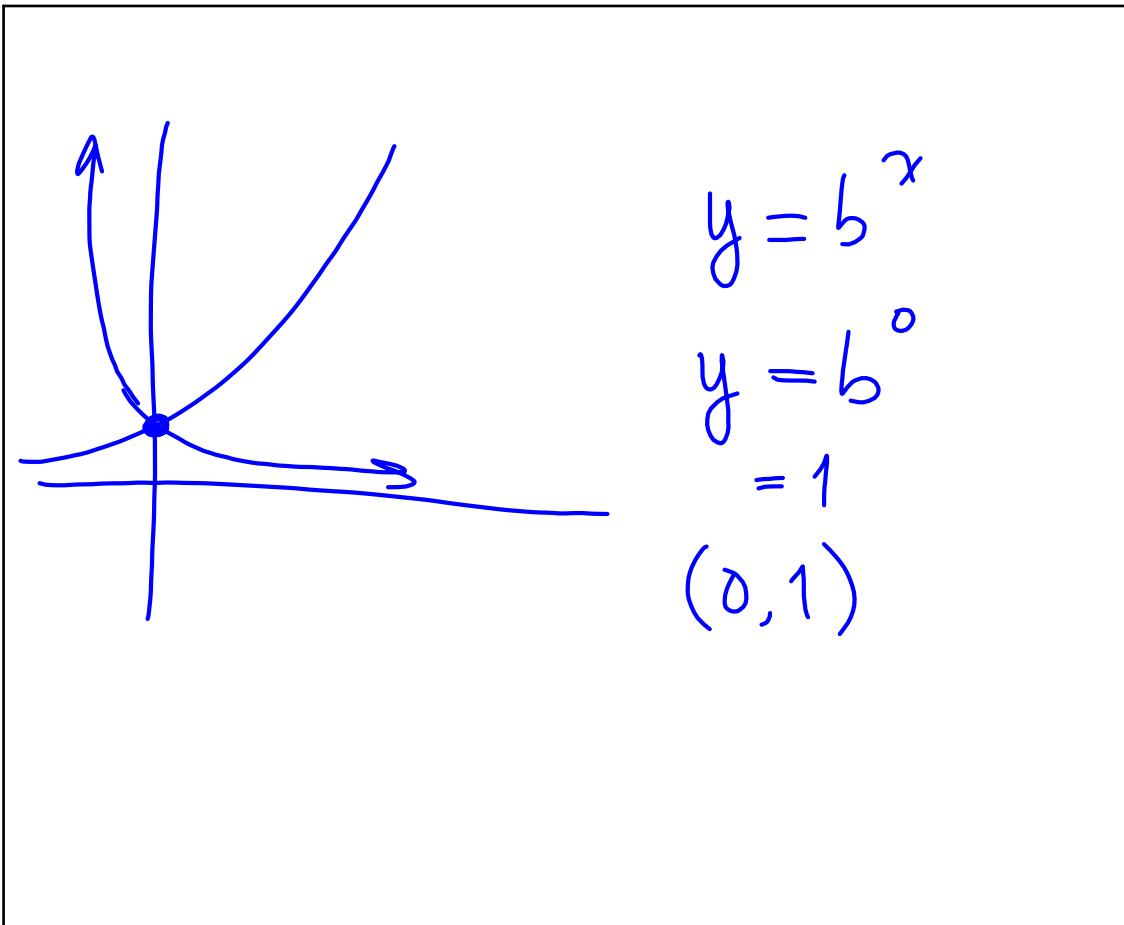
Assigned Work:

p.456 # 1 - 3, 4, 5, 8, 9, 11

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