PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

15. Make Sense and Persevere Let $f(x) = a^x$. Describe two ways you could identify the value of k in the transformation implied by $g(x) = a^x + k$ from the graphs of f and g.

16. Error Analysis Describe and correct the error a student made in analyzing the transformation $g(x) = a^{x-h}$.

> The graph of $g(x) = a^{x-h}$ is the graph of $f(x) = a^x$ translated h units to the left. ✗

17. Higher Order Thinking In Examples 1 and 2, the graph of $f(x) = 2^x$ was translated vertically and horizontally.

a. Compare the graph of $g(x) = 2^{x+3} + 4$ to the graph of $f(x) = 2^x$.

b. In general, when the graph of an exponential function is translated both vertically and horizontally, what is the effect on the asymptote?

c. In general, when the graph of an exponential function is translated both vertically and horizontally, what is the effect on the domain and the range?

18. a. Use Appropriate Tools Copy and complete the table. Compare the graphs of f and g.

x	$f(x) = 4^{\frac{1}{2}x}$	$g(x) = 4^x$
−1		
−2		
0		
2		
4		

b. What point do the functions have in common?

c. Describe the asymptote of each function.

PRACTICE

Compare the graph of each function to the graph of $f(x) = 2^x$. SEE EXAMPLES 1–3

19. $g(x) = 2^x - 6$

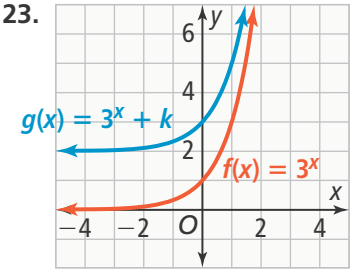
20. $p(x) = 2^{x+4}$

21. $g(x) = 2^{x-1}$

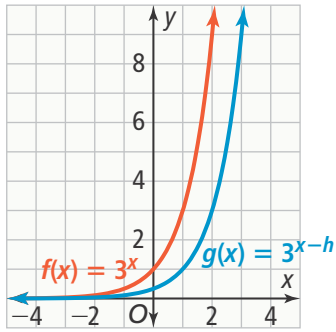
22. $j(x) = 2^x + \frac{3}{4}$

Find the value of k or h in each of the graphs. SEE EXAMPLES 1–3

23.



24.



Graph each function and its transformation. SEE EXAMPLES 1–3

25. $f(x) = 4^x$
$g(x) = 4^x + k$ for $k = -4$

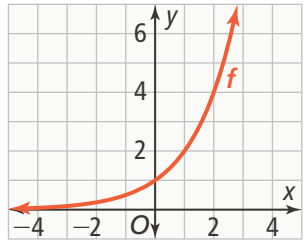
26. $f(x) = 0.5^x$
$g(x) = 0.5^{x-h}$ for $h = 5$

Compare the y-intercepts, asymptotes, and ranges for the graphs of f and g. SEE EXAMPLE 3

27. $f(x) = 4^x$

x	$g(x)$
−2	3.0625
−1	3.25
0	4
1	7
2	19

28.



The graph of g is a horizontal translation 3 units to the left of the graph of $f(x) = 2^x$.

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APPLY

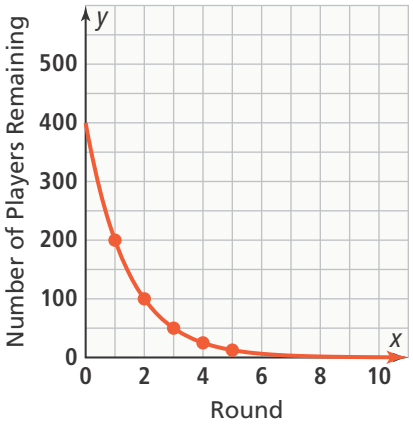
29. Reason How are graphs of $f(x) = 2^{x-h}$ similar and different for positive and negative values of h?

30. Communicate Precisely How does the graph of $f(x) = 2^{x+2}$ compare to the graph of $g(x) = 2^x + 2$?

31. Compare the function represented by the graph of $g(x) = 2^{x+0.5}$ to the graph of the function represented by the table.

x	$j(x)$
−2	0.088
−1	0.177
0	0.354
1	0.707
2	1.414

32. Model With Mathematics The function in the graph models an online gaming tournament that is expected to start with 400 players, with half of the players being eliminated in each round.



a. Describe how the graph will change if the starting number of players is 600 instead of 400. Explain your reasoning.

b. Describe how the graph will change if the starting number of players is 800 instead of 400?

ASSESSMENT PRACTICE

33. Consider the function $f(x) = 0.5^x$.

a. Graph $f(x)$, $g(x) = 0.5^x + k$ for $k = -1$, and $j(x) = 0.5^{x-h}$ for $h = 1$ in the same coordinate plane.

b. What are the y-intercepts of the graphs of g and j?

34. SAT/ACT The graph of g is a translation 4 units to the right of the graph of $f(x) = 5^x$. What is g?

Ⓐ $g(x) = 5^x + 4$
Ⓑ $g(x) = 5^x - 4$
Ⓒ $g(x) = 5^{x+4}$
Ⓓ $g(x) = 5^{x-4}$
Ⓔ $g(x) = 5^{4x}$

35. Performance Task Darnell is thinking about investing $500 in a savings plan. The graph shows how Darnell's $500 will grow if he invests his money in the plan today.

Part A How will the graph change if Darnell selects the same savings plan, but waits 5 years to invest his $500?

Part B If Darnell waits 5 years, in approximately how many years will his investment reach $1,000? Explain your reasoning.

Part C Suppose that instead of $500, Darnell invests $1,000 in the savings plan today. Describe how the graph will change. How can you use the transformed graph to estimate how many years will it take for his investment to reach $7,500?