Guided Practice 4.11

Example 1

Which function increases faster, $f(x) = 4x - 5$ or $g(x) = 4^x - 5$? Justify your answer with a graph.

1. Make a general observation.

   $f(x) = 4x - 5$ is a linear function of the form $f(x) = mx + b$.

   The variable x is multiplied by the coefficient 4.

   $g(x) = 4^x - 5$ is an exponential function of the form $g(x) = ab^x + k$.

   The variable x is the exponent.

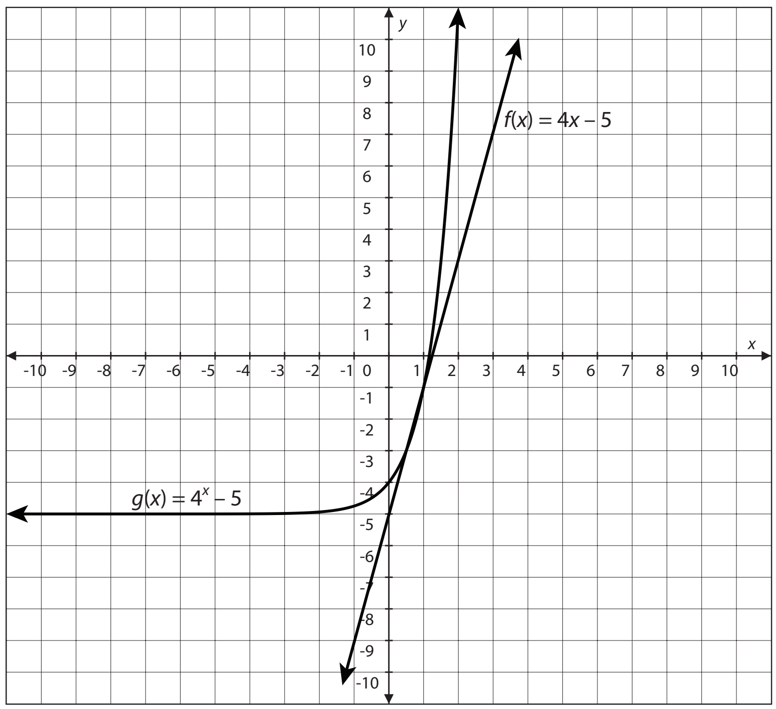
2. Create a table of values.

   Substitute values for x into each function.

$f(x) = 4x - 5$		$g(x) = 4^x - 5$	
x	$f(x)$	x	$g(x)$
–2	–13	–2	–4.9375
–1	–9	–1	–4.75
0	–5	0	–4
1	–1	1	–1
2	3	2	11

3. Graph both functions on the same coordinate plane.

   Use the tables of values created in order to plot both functions.



4. Compare the rate of change of each function.

   The graph of $f(x) = 4x - 5$ appears to be steeper than the graph of $g(x) = 4^x - 5$ until the point (1, –1). At this point, the graphs intersect and $f(x) = g(x)$. Once x is greater than 1, the graph of $g(x) = 4^x - 5$ becomes steeper. From there, $g(x) = 4^x - 5$ increases faster than $f(x) = 4x - 5$.

Example 2

At approximately what point does the value of *f*(*x*) exceed the value of *g*(*x*) if $f(x)=2(4)^{\frac{x}{20}}$ and $g(x) = 0.5x$? Justify your answer with a graph.

1. Make a general observation.

   $f(x)=2(4)^{\frac{x}{20}}$ is an exponential function of the form $g(x) = ab^x$.

   The variable *x* is part of the exponent.

   $g(x) = 0.5x$ is a linear function of the form $f(x) = mx + b$.

   The variable *x* is multiplied by the coefficient 0.5.

2. Create a table of values.

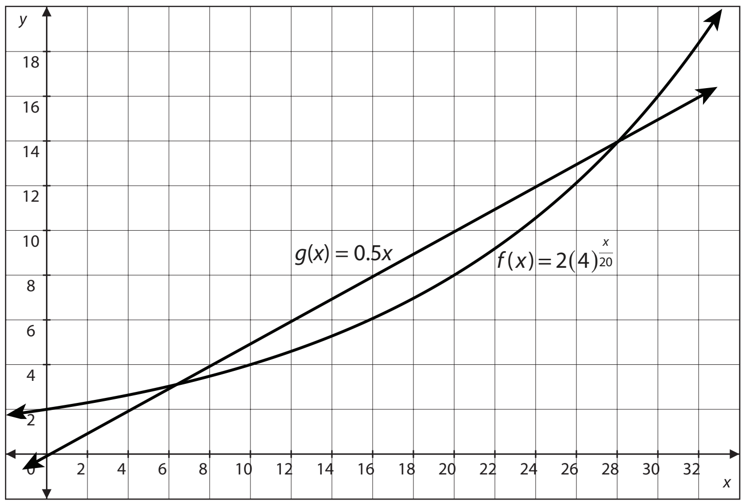
   Substitute values for *x* into each function.

$f(x)=2(4)^{\frac{x}{20}}$	
x	***f*(*x*)**
0	2
2	2.30
4	2.64
6	3.03

$g(x) = 0.5x$	
x	***g*(*x*)**
0	0
2	1
4	2
6	3

3. Graph both functions on the same coordinate plane.

   Use the tables of values created in order to plot both functions.



4. Identify the approximate point where $f(x)$ is greater than $g(x)$.

   It can be seen from the graph that both functions are equal where x is approximately equal to 28. When x is greater than 28, $f(x)$ is greater than $g(x)$.

Example 3

Lena has been offered a job with two salary options. The first option is modeled by the function $f(x) = 500x + 31{,}000$, where $f(x)$ is her salary in dollars after x years. The second option is represented by the function $g(x) = 29{,}000(1.04)^x$, where $g(x)$ is her salary in dollars after x years. If Lena is hoping to keep this position for at least 5 years, which salary option should she choose? Support your answer with a graph.

1. Make a general observation.

   $f(x) = 500x + 31{,}000$ is a linear function of the form $f(x) = mx + b$.

   The variable x is multiplied by the coefficient 500 and added to the constant 31,000.

   $g(x) = 29{,}000(1.04)^x$ is an exponential function of the form $g(x) = ab^x$.

   The variable x is the exponent.

   Use the two equations to create a table of values.

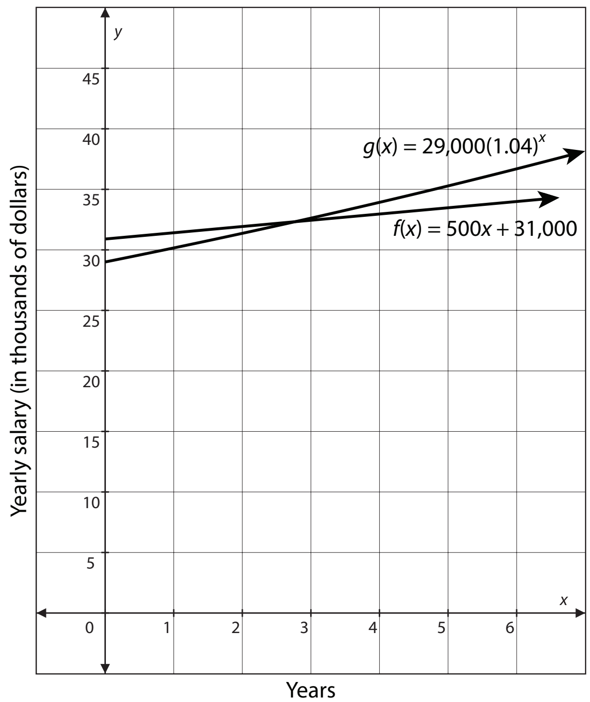
   Substitute the same values for x into each function.

$f(x) = 500x + 31{,}000$	
x	$f(x)$
0	31,000
2	32,000
4	33,000
6	34,000

$g(x) = 29{,}000(1.04)^x$	
x	$g(x)$
0	29,000
2	31,366.40
4	33,925.90
6	36,694.25

2. Graph both functions on the same coordinate plane.

   Use the tables of values created in order to plot both functions.



3. Identify the approximate point where $g(x)$ is greater than $f(x)$.

   It can be seen from the graph that after 3 years, $g(x)$ is greater than $f(x)$. If Lena is hoping to keep this position for at least 5 years, it is in her best interest to choose the salary option modeled by $g(x) = 29{,}000(1.04)^x$.