

Name \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

GROWTH: If base of exponent  $> 1$   
 IF base  $< 1$

Multiple Choice. Choose the best answer.

B 1. Is the following exponential function **growth or decay**?  $f(x) = \frac{1}{5}^{x-1} + 3$   
 A. growth                      B. decay                       $\uparrow$  base =  $\frac{1}{5}$

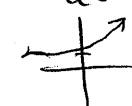
B 2. Is the following exponential function **growth or decay**?  $f(x) = 2\left(\frac{1}{2}\right)^{x+3} - 1$   
 A. growth                      B. decay                       $\uparrow$  base =  $\frac{1}{2}$


A 3. Is the following exponential function **growth or decay**?  $f(x) = \left(\frac{7}{2}\right)^{x+2} - 4$   
A. growth                      B. decay                      base =  $\frac{7}{2}$

B 4. Is the following exponential function **growth or decay**?  $f(x) = 0.34^{x-1} + 3$   
 A. growth                      B. decay                      base = .34

A 5. What is the horizontal asymptote of the function  $f(x) = -(2)^{x-3} + 7$ ?  $\uparrow$  HORIZONTAL LINES ALWAYS HAVE EQUATIONS  $y = c$   
A.  $y = 7$                       B.  $y = -2$                       C.  $y = 2$                       D.  $y = -7$

C 6. What is the domain of the function  $f(x) = -3^{x+2} - 4$ ? all real numbers  
 A.  $(-\infty, -3)$                       B.  $(-4, +\infty)$                       C.  $(-\infty, +\infty)$                       D.  $(-4, +\infty)$   
 same as

B 7. What is the range of the function  $f(x) = (2)^{x+2} + 1$ ?   
 A.  $(-\infty, 1)$                       B.  $(1, +\infty)$                       C.  $(-\infty, +\infty)$                       D.  $(2, +\infty)$

A 8. What is the range of the function  $f(x) = -\left(\frac{1}{2}\right)^{x+2} - 5$ ?   
A.  $(-\infty, -5)$                       B.  $(-2, +\infty)$                       C.  $(-\infty, +\infty)$                       D.  $(5, +\infty)$

Describe all transformations.



9.  $f(x) = -(2)^{x+4}$   
 - flipped upside down  
 - moved 4 left

10.  $f(x) = (3)^{x-7} - 8$   
 - moved 7 right  
 - moved 8 down

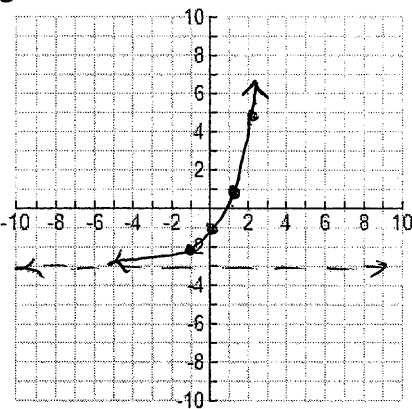
C  $f(x) = -\left(\frac{1}{2}\right)^x + 8$   
 - flipped upside down  
 - moved 8 up

12.  $f(x) = -\left(\frac{2}{5}\right)^{x-9}$   
 - flipped upside down  
 - moved 9 right

Graph and analyze.

13.  $f(x) = (2)^{x+1} - 3$

x	f(x)
-1	-2
0	-1
1	1
2	5



y-intercept  $(0, -1)$  asymptote  $y = -3$

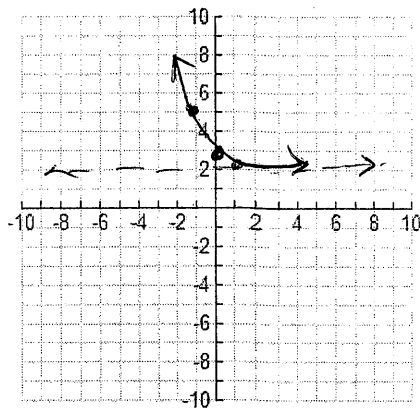
domain all  $\mathbb{R}$  range  $(-3, +\infty)$

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow +\infty$ , and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -3$

14.  $f(x) = (\frac{1}{3})^x + 2$

x	f(x)
0	3
1	$2\frac{1}{3}$
-1	5



y-intercept  $(0, 3)$  asymptote  $y = 2$

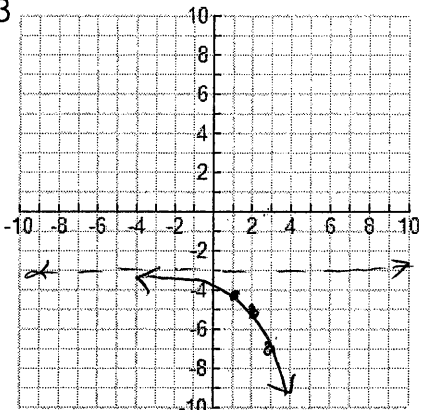
domain all  $\mathbb{R}$  range  $(2, +\infty)$

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow 2$ , and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow +\infty$

15.  $f(x) = -(2)^{x-1} - 3$

x	f(x)
1	-4
2	-5
3	-7
0	-3.5



y-intercept  $(0, -3.5)$  asymptote  $y = -3$

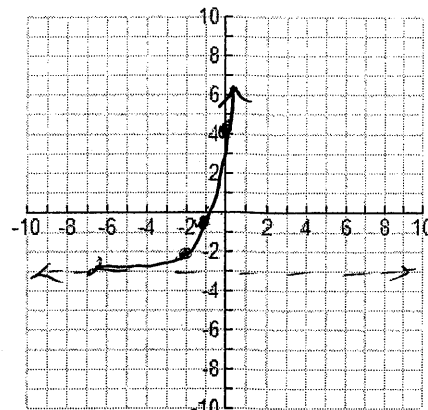
domain all  $\mathbb{R}$  range  $(-\infty, -3)$

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow -\infty$ , and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -3$

16.  $f(x) = (e)^{x+2} - 3$

x	f(x)
-2	-2
-1	-1.2
0	4.3



y-intercept  $(0, 4.3)$  asymptote  $y = -3$

domain all  $\mathbb{R}$  range  $(-3, +\infty)$

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow +\infty$ , and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -3$

Identify the asymptotes

~~Vertical~~  
 ~~$x = -3$~~   
 $y = -3$  Horizontal

For each function,

- Tell whether it's a growth or decay function by identifying the base
- List ALL the transformations.
- Identify the equation of the asymptote
- Find the y-intercept
- Identify the domain and range

1.  $f(x) = 2^x + 4$

Growth (base = 2)

- moved 4 spaces up
- Asymptote:  $y = 4$
- y-intercept  $(0, 5)$
- domain: all  $\mathbb{R}$
- range:  $(4, +\infty)$

2.  $f(x) = -2^{x-5} + 1$

Growth (base = 2)

- reflection across asymptote
- moved 5 right, 1 up
- Asymptote  $y = 1$
- y-intercept  $(0, \frac{31}{32})$
- domain: all  $\mathbb{R}$
- range:  $(-\infty, 1)$

3.  $f(x) = .5^{x+7} - 4$

Decay: (base = .5)

- moved 7 left, 4 down

Asymptote:  $y = -4$

y-intercept  $(0, -3\frac{127}{128})$

domain: all  $\mathbb{R}$ , range  $(-4, +\infty)$

4.  $f(x) = -(\frac{1}{4})^{x+3} + 8$

Decay: (base =  $\frac{1}{4}$ )

- 3 left, 8 up

Asymptote  $y = 8$

y-intercept  $(0, 7\frac{63}{64})$

domain: all  $\mathbb{R}$

range:  $(-\infty, 8)$

5.  $f(x) = -5^x + 11$

Growth (base = 5)

- reflection across asymptote
- 11 spaces up

Asymptote:  $y = 11$

y-intercept  $(0, 6)$

domain: all  $\mathbb{R}$ , range  $(-\infty, 11)$

6.  $f(x) = .9^{x-2}$

Decay (base = .9)

- 2 spaces right

Asymptote:  $y = 0$

y-intercept  $(0, \frac{100}{81})$

domain: all  $\mathbb{R}$

range  $(0, +\infty)$



Name \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

**Multiple Choice. Choose the best answer.**

\_\_\_\_\_ 1. Is the following exponential function **growth or decay**?  $f(x) = \frac{1}{5}^{x-1} + 3$

A. growth

B. decay

\_\_\_\_\_ 2. Is the following exponential function **growth or decay**?  $f(x) = 2\left(\frac{1}{2}\right)^{x+3} - 1$

A. growth

B. decay

\_\_\_\_\_ 3. Is the following exponential function **growth or decay**?  $f(x) = \left(\frac{7}{2}\right)^{x+2} - 4$

A. growth

B. decay

\_\_\_\_\_ 4. Is the following exponential function **growth or decay**?  $f(x) = 0.34^{x-1} + 3$

A. growth

B. decay

\_\_\_\_\_ 5. What is the horizontal asymptote of the function  $f(x) = -(2)^{x-3} + 7$ ?

A.  $y = 7$

B.  $y = -2$

C.  $y = 2$

D.  $y = -7$

\_\_\_\_\_ 6. What is the domain of the function  $f(x) = -3^{x+2} - 4$ ?

A.  $(-\infty, -3)$

B.  $(-4, +\infty)$

C.  $(-\infty, +\infty)$

D.  $(-4, +\infty)$

\_\_\_\_\_ 7. What is the range of the function  $f(x) = (2)^{x+2} + 1$ ?

A.  $(-\infty, 1)$

B.  $(1, +\infty)$

C.  $(-\infty, +\infty)$

D.  $(2, +\infty)$

\_\_\_\_\_ 8. What is the range of the function  $f(x) = -\left(\frac{1}{2}\right)^{x+2} - 5$ ?

A.  $(-\infty, -5)$

B.  $(-2, +\infty)$

C.  $(-\infty, +\infty)$

D.  $(5, +\infty)$

Describe all transformations.

9.  $f(x) = -(2)^{x+4}$

10.  $f(x) = (3)^{x-7} - 8$

\_\_\_\_\_

\_\_\_\_\_

11.  $f(x) = -\left(\frac{1}{2}\right)^x + 8$

12.  $f(x) = -\left(\frac{2}{5}\right)^{x-9}$

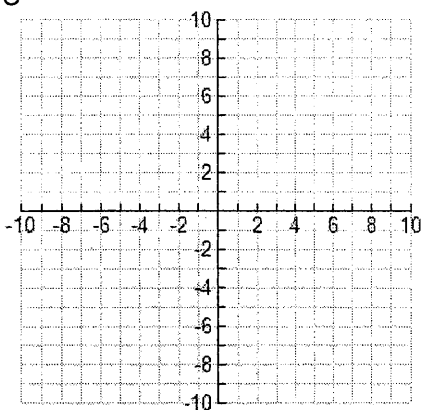
\_\_\_\_\_

\_\_\_\_\_

Graph and analyze.

13.  $f(x) = (2)^{x+1} - 3$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

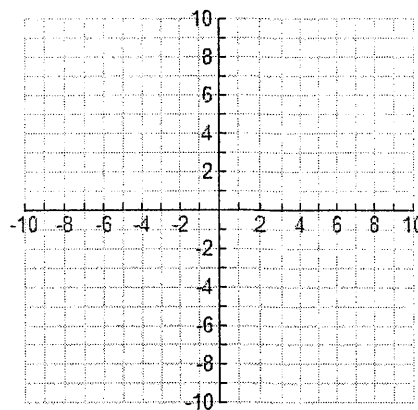
domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_

14.  $f(x) = (\frac{1}{3})^x + 2$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

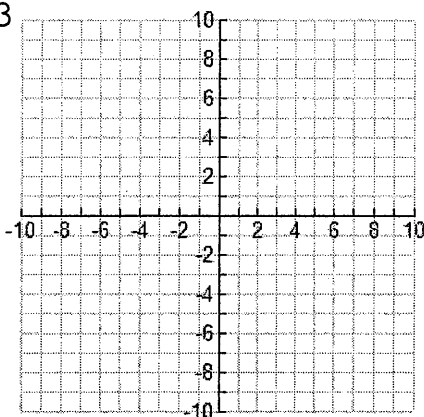
domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_

15.  $f(x) = -(2)^{x-1} - 3$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

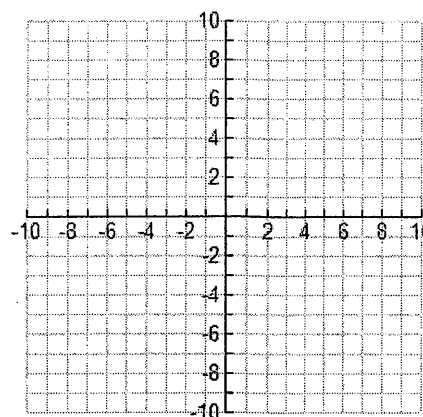
domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_

16.  $f(x) = (e)^{x+2} - 3$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

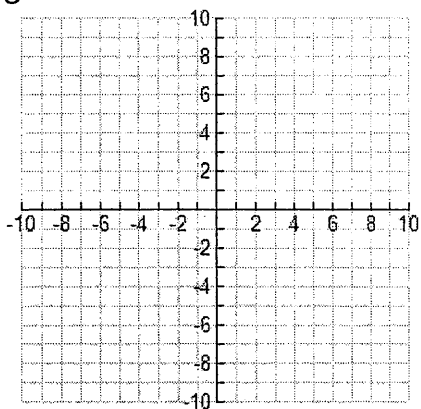
as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_



Graph and analyze.

13.  $f(x) = (2)^{x+1} - 3$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

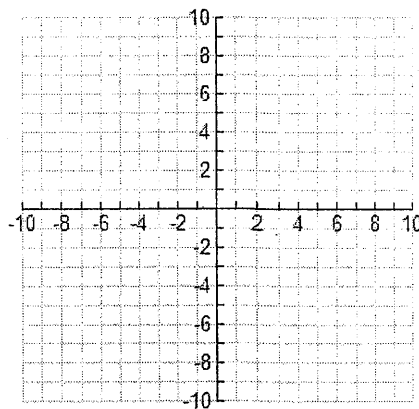
domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_

14.  $f(x) = (\frac{1}{3})^x + 2$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

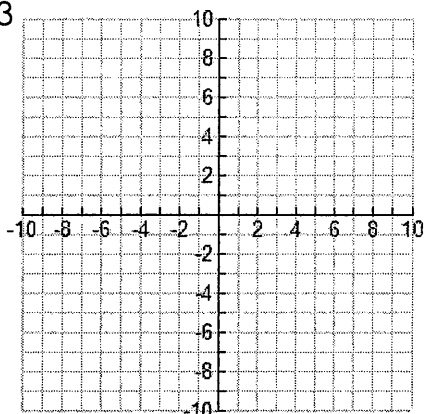
domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_

15.  $f(x) = -(2)^{x-1} - 3$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

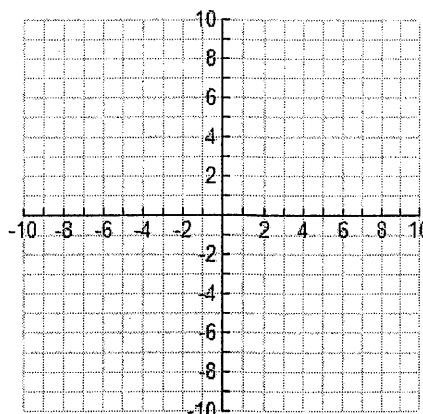
domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_

16.  $f(x) = (e)^{x+2} - 3$

x	f(x)



y-intercept \_\_\_\_\_ asymptote \_\_\_\_\_

domain \_\_\_\_\_ range \_\_\_\_\_

end behavior: as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_, and

as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow$  \_\_\_\_\_