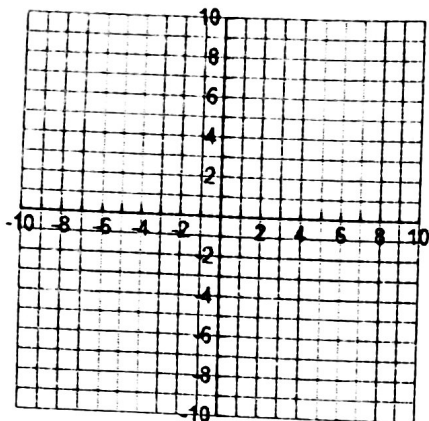


Graphing: Exponential Growth Functions

Graph and analyze the following exponential growth functions. Your graph should accurately show the y-intercept and the asymptote. Determine at least two additional points on the right side of the graph. USE A PENCIL!

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

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



y-intercept _____ asymptote _____

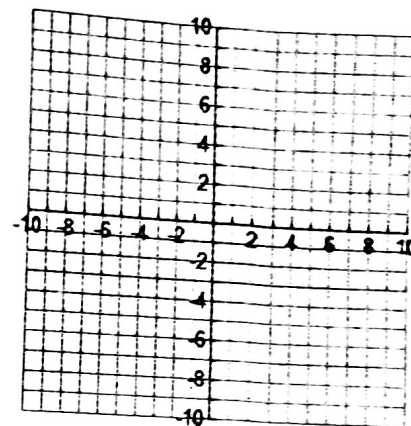
domain _____ range _____

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

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

2. $f(x) = -(2)^x$

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



y-intercept _____ asymptote _____

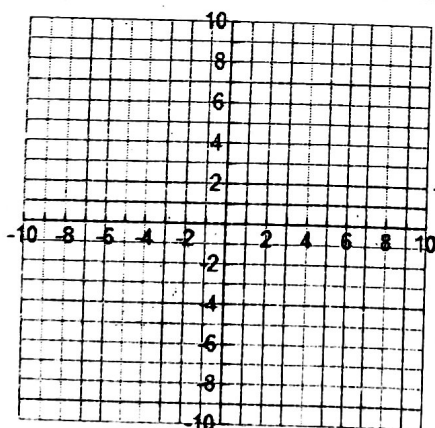
domain _____ range _____

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

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

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

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



y-intercept _____ asymptote _____

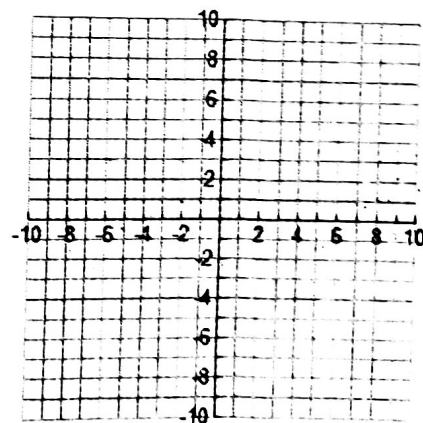
domain _____ range _____

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

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

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

x	f(x)
1	
2	
3	
4	
5	



y-intercept _____ asymptote _____

domain _____ range _____

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

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

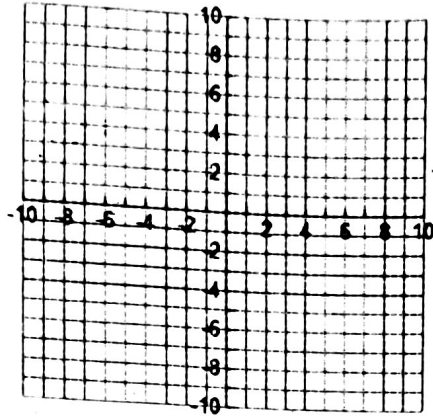
Name: _____ Date: _____ Class: _____

Graphing: Exponential Growth Functions Practice

Graph and analyze the following exponential growth functions. Your graph should accurately show the y-intercept and the asymptote. Determine at least two additional points on the right side of the graph. USE PENCIL!

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

x	f(x)
0	
1	
2	
3	
4	



y-intercept _____ asymptote _____

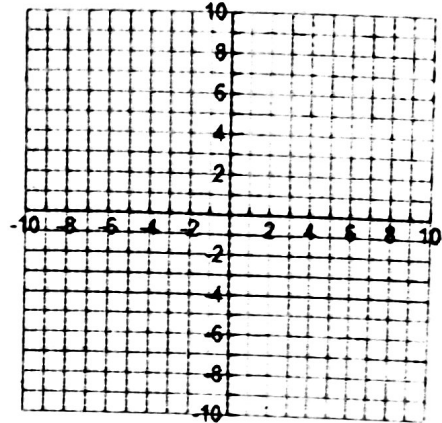
domain _____ range _____

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

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

2. $f(x) = -(2)^x + 8$

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



y-intercept _____ asymptote _____

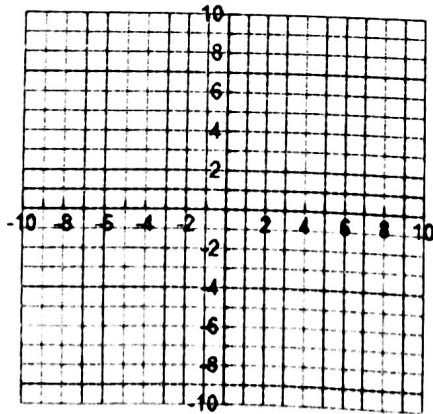
domain _____ range _____

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

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

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

x	f(x)
-4	
-3	
-2	
-1	
0	



y-intercept _____ asymptote _____

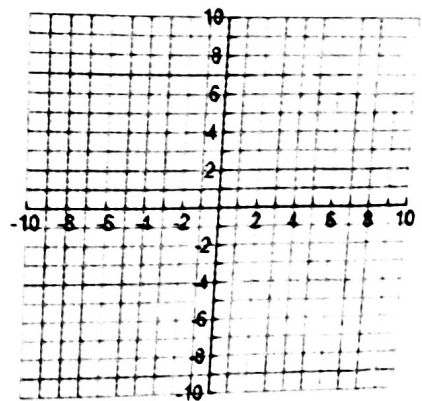
domain _____ range _____

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

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

4. $f(x) = -(4)^{x-1} + 5$

x	f(x)
-1	
0	
1	
2	
3	



y-intercept _____ asymptote _____

domain _____ range _____

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

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

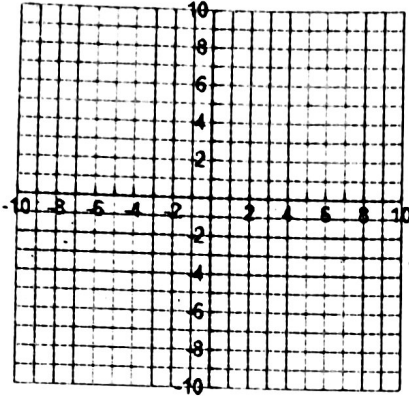
Name: _____ Date: _____ Class: _____

Graphing: Exponential Decay Functions Practice

Graph and analyze the following exponential growth functions. Your graph should accurately show the y-intercept and the asymptote. Determine at least two additional points on the right side of the graph. USE A PENCIL!

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

x	f(x)
0	
1	
2	
3	
4	



y-intercept _____ asymptote _____

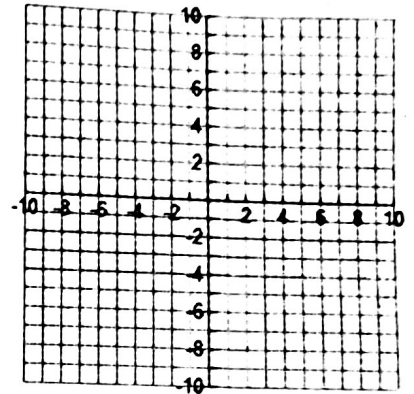
domain _____ range _____

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

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

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

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



y-intercept _____ asymptote _____

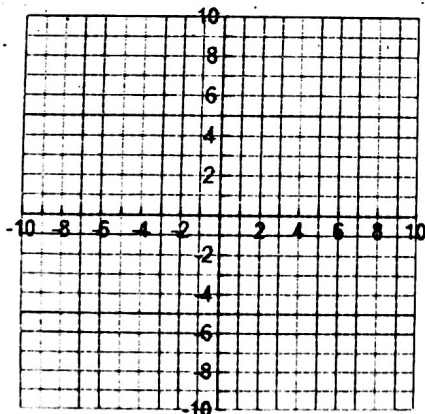
domain _____ range _____

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

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

3. $f(x) = \left(\frac{1}{2}\right)^{x+2} + 9$

x	f(x)
-4	
-3	
-2	
-1	
0	



y-intercept _____ asymptote _____

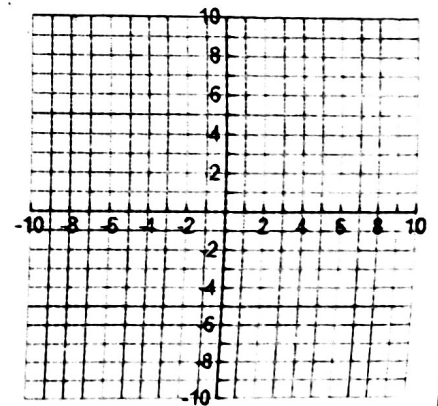
domain _____ range _____

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

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

4. $f(x) = -\left(\frac{1}{2}\right)^{x-1} + 5$

x	f(x)
-1	
0	
1	
2	
3	



y-intercept _____ asymptote _____

domain _____ range _____

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

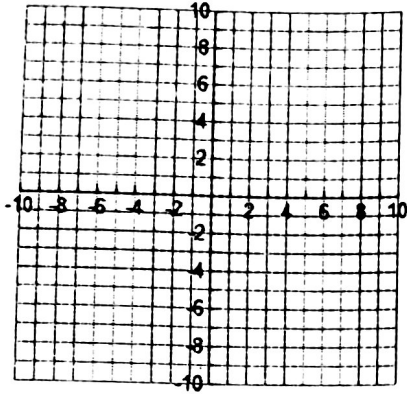
as $x \rightarrow -\infty$, $f(x) \rightarrow$ _____

Graphing: Exponential Decay Functions

Graph and analyze the following exponential growth functions. Your graph should accurately show the y-intercept and the asymptote. Determine at least two additional points on the right side of the graph. USE A PENCIL!

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

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



y-intercept _____ asymptote _____

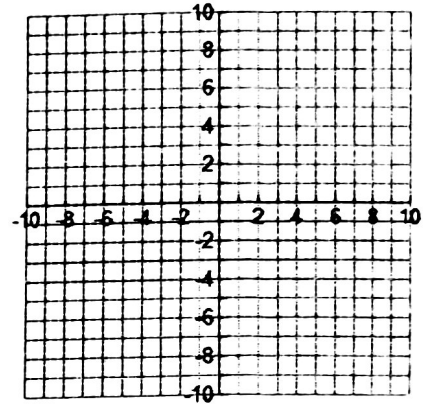
domain _____ range _____

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

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

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

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



y-intercept _____ asymptote _____

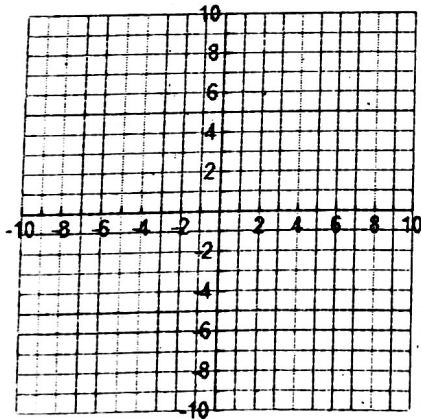
domain _____ range _____

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

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

3. $f(x) = \left(\frac{1}{2}\right)^x + 4$

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



y-intercept _____ asymptote _____

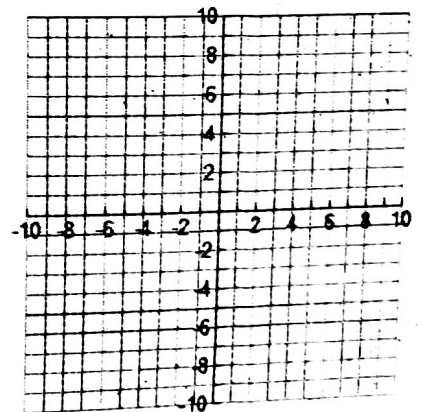
domain _____ range _____

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

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

4. $f(x) = \left(\frac{1}{2}\right)^{x-3}$

x	f(x)
1	
2	
3	
4	
5	



y-intercept _____ asymptote _____

domain _____ range _____

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

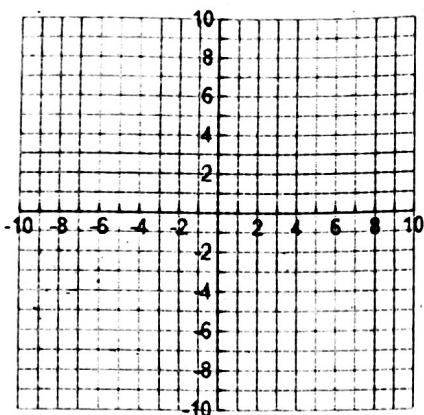
as $x \rightarrow -\infty$, $f(x) \rightarrow$ _____

Graphing: Natural Base/ Euler's Number

Graph and analyze the following exponential growth functions. Your graph should accurately show the y-intercept and the asymptote. Determine at least two additional points on the right side of the graph. USE A PENCIL!

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

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



y-intercept _____ asymptote _____

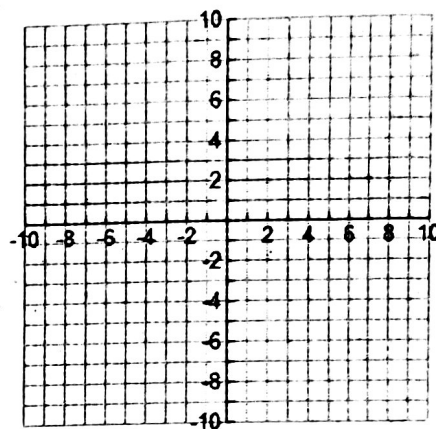
domain _____ range _____

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

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

2. $f(x) = (e)^x - 2$

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



y-intercept _____ asymptote _____

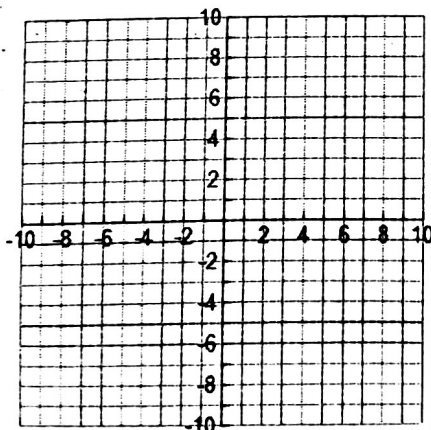
domain _____ range _____

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

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

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

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



y-intercept _____ asymptote _____

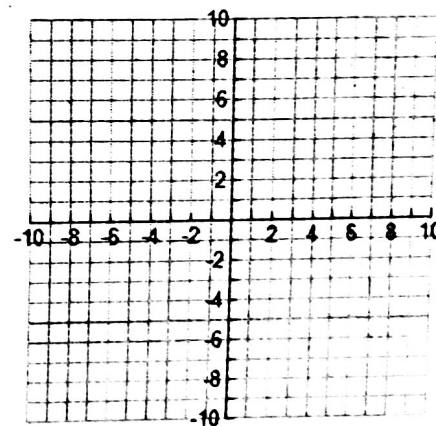
domain _____ range _____

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

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

4. $f(x) = -(e)^{x+1} + 3$

x	f(x)
1	
2	
3	
4	
5	



y-intercept _____ asymptote _____

domain _____ range _____

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

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

Algebra 2 with Support
REVIEW Exponential Functions Test C: Exponential Applications
Spring 2017

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**? $f(x) = 0.34x^{-1} + 3$
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. $f(x) = (3)^{x-7} - 8$

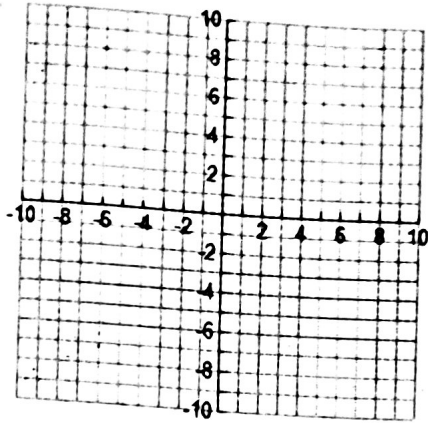
11. $f(x) = -\left(\frac{1}{2}\right)^x + 8$

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 _____

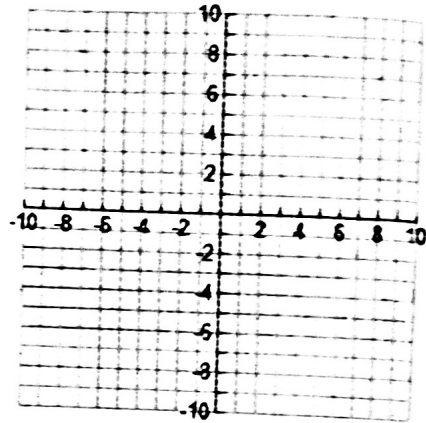
domain _____ range _____

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 _____

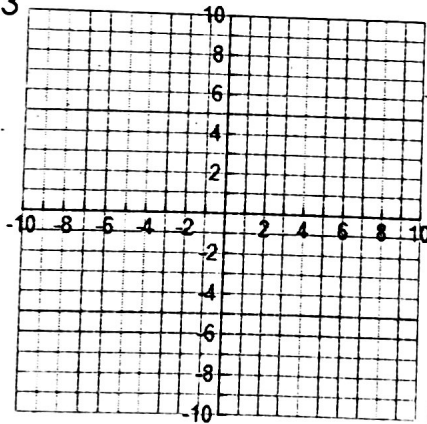
domain _____ range _____

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 _____

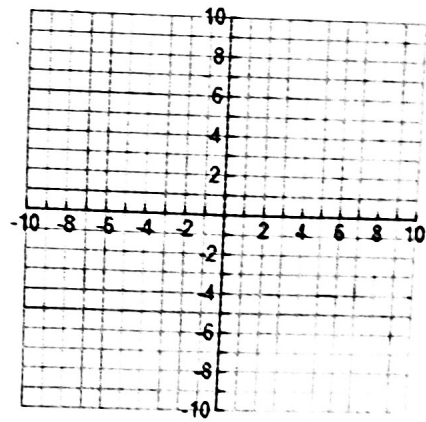
domain _____ range _____

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)

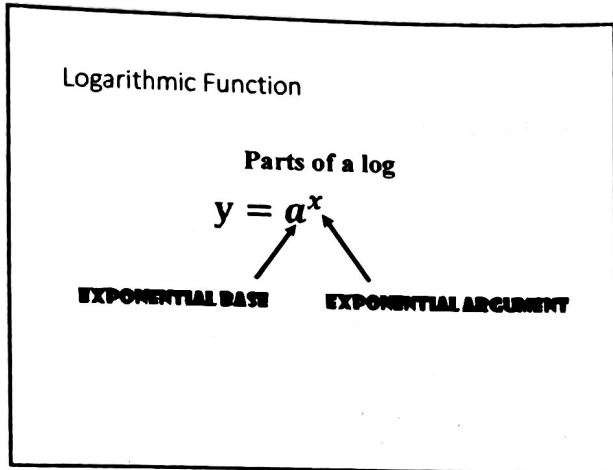


y-intercept _____ asymptote _____

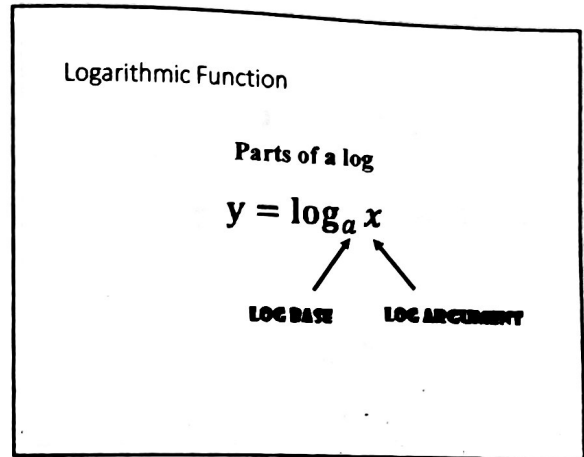
domain _____ range _____

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

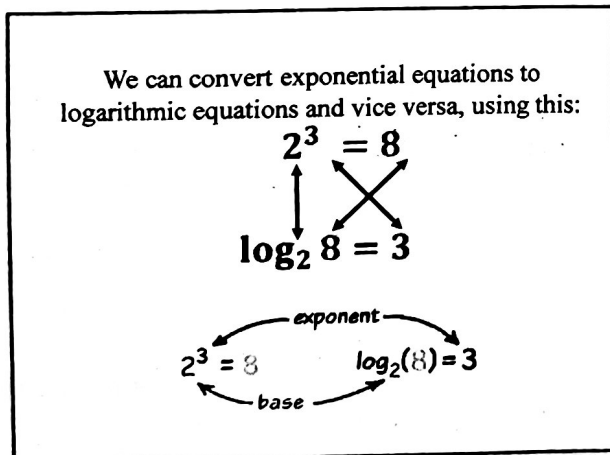
as $x \rightarrow -\infty$, $f(x) \rightarrow$ _____



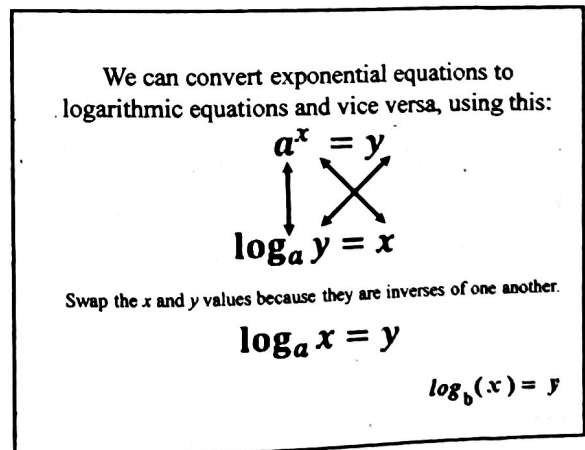
3



4



5



6

Convert to exponential form

$$1) y = \log_3 5 \quad 3^y = 5$$

$$2) -2 = \log_a 7 \quad a^{-2} = 7$$

$$3) a = \log_b d \quad b^a = d$$



7

Convert to logarithmic form

$$4) 10^3 = 1000 \quad 3 = \log_{10} 1000$$

$$5) 2^x = 8 \quad x = \log_2 8$$

$$6) y^{-1} = 4 \quad -1 = \log_y 4$$



8

Simplify

What is the exponent of base 2 that gives you 32?

$$\log_2 32 = x \quad 2^x = 32 \quad x = 5$$

What is the exponent of base 3 that gives you 27?

$$\log_3 27 = x \quad 3^x = 27 \quad x = 3$$

What is the exponent of base 4 that gives you 2?

$$\log_4 2 = x \quad 4^x = 2 \quad x = 1/2$$

What is the exponent of base 3 that gives you 1?

$$\log_3 1 = x \quad 3^x = 1 \quad x = 0$$

9

Assignment

ID: 1

Date _____ Period _____

Rewrite each equation in exponential form.

1) $\log_8 64 = 2$

2) $\log_{17} 289 = 2$

3) $\log_3 81 = 4$

4) $\log_{14} 196 = 2$

5) $\log_{361} \frac{1}{19} = -\frac{1}{2}$

6) $\log_{\frac{1}{7}} \frac{1}{49} = 2$

Rewrite each equation in logarithmic form.

7) $15^{-2} = \frac{1}{225}$

8) $9^2 = 81$

9) $14^2 = 196$

10) $2^{-3} = \frac{1}{8}$

11) $12^{-2} = \frac{1}{144}$

12) $18^2 = 324$

13) $12^v = u$

14) $k^8 = 191$

15) $\left(\frac{7}{4}\right)^x = y$

16) $x^{-9} = y$

17) $20^b = 199$

18) $14^x = 160$

Rewrite each equation in exponential form.

19) $\log_{11} x = y$

20) $\log_3 x = y$

21) $\log_{14} x = y$

22) $\log_4 143 = v$

23) $\log_v u = -7$

24) $\log_{\frac{5}{3}} v = u$

Properties of Logarithms

$\log_a(uv) = \log_a u + \log_a v$	Product Property
$\ln(uv) = \ln u + \ln v$	
$\log_a \frac{u}{v} = \log_a u - \log_a v$	Quotient Property
$\ln \frac{u}{v} = \ln u - \ln v$	
$\log_a u^n = n \log_a u$	Power Property
$\ln u^n = n \ln u$	

4

Strategies when expanding logarithms

- Change radicals to rational (fraction) exponents.
- Expand the multiplication and/or division
- Move the exponent(s) LAST

Example 1: $\log \frac{\sqrt[6]{x}}{y^2}$

5

Expand.

2. $\log_3 2x^3$
3. $\log_{10} 5x^3y$
4. $\log_7 \frac{x^3}{y}$

6

Expand.

5. $\log_4 \frac{5a^2}{b^5}$
6. $\ln \frac{3\sqrt[3]{x}}{yz^3}$

7

Ex. 7

Expand.

$$\log \frac{\sqrt{3x-5}}{7} = \log \left[\frac{(3x-5)^{\frac{1}{2}}}{7} \right]$$

$$= \log(3x-5)^{\frac{1}{2}} - \log 7$$

$$= \frac{1}{2} \log(3x-5) - \log 7$$

8

Ex. 3

Use $\log_3 5 \approx 1.465$ and $\log_3 6 \approx 1.631$ to evaluate the logarithm.

A. $\log_3 \frac{6}{5}$

B. $\log_3 30$

C. $\log_3 36$

$\log_3 6 - \log_3 5$

$\log_3 (5 \cdot 6)$

$\log_3 6^2$

$1.631 - 1.465$

$\log_3 5 + \log_3 6$

$2 \log_3 6$

0.166

$1.465 + 1.631$

$2(1.631)$

3.096

3.262

9

Name: _____ Per: _____ Date: _____

Use the properties of logarithms to rewrite the expression in terms of $\log 2$ and $\log 7$.
Then use $\log 2 \approx 0.301$ and $\log 7 \approx 0.845$ to approximate the expression.

1. $\log 4$

2. $\log 14$

3. $\log\left(\frac{7}{2}\right)$

4. $\log\left(\frac{2}{7}\right)$

5. $\log 7^{-3}$

6. $\log 49$

Expand the following expressions:

7. $\log_2(3x)$

8. $\log_3(9x)$

9. $\log_2(x^3\sqrt{x-1})$

10. $\log_3 3x^{\frac{2}{3}}y^5$

11. $\log_3 x^5$

12. $\log_4 2y^2\sqrt{x}$

13. $\log x^{\frac{1}{2}}y^4$

14. $\log\left(\frac{6}{x}\right)$

15. $\log\left(\frac{x}{5}\right)$

$$16. \log \frac{x^2}{yz^3}$$

$$17. \log x^{-3}$$

$$18. \log_2(x^4\sqrt{x+1})$$

Convert Log to Exponential:

$$19. \log_3(x-2) = 4$$

$$20. \log_x \frac{1}{81} = -4$$

$$21. \log a = z$$

Convert Exponential to Log

$$22. x^{-3} = \frac{1}{64}$$

$$23. 9^x = w$$

$$24. b^t = k$$

Solve:

$$25. 4(3^{x-2}) - 11 = 313$$

$$26. 5^{x-18} = \left(\frac{1}{625}\right)^{2x}$$

$$27. 3\log_4(x+3) + 16 = 22$$

Properties of Logarithms

$$\log_a(uv) = \log_a u + \log_a v$$

$$\ln(uv) = \ln u + \ln v$$

Product Property

$$\log_a \frac{u}{v} = \log_a u - \log_a v$$

Quotient Property

$$\ln \frac{u}{v} = \ln u - \ln v$$

$$\log_a u^n = n \log_a u$$

Power Property

$$\ln u^n = n \ln u$$

5

Strategies for condensing logarithms

- If there is a number in front of the log, move it back to an exponent FIRST.
- Write fraction exponents as radicals.
- If there is a number raised to a power, simplify.
- Condense addition back to multiplication and subtraction back to division.
- The final answer will have log written only ONCE and will have no fractions as exponents.

6

EXAMPLE #1

$$\log_2 20 + 2 \log_2 2 + \frac{1}{3} \log_2 x$$

7

EXAMPLE #2

$$\log_3 x + 2 \log_3 y - 4 \log_3 z$$

EXAMPLE #3

$$\ln 2 + \frac{1}{2} \ln a - 4 \ln b - 3 \ln c$$

8

EXAMPLE #4

$$2 \log_3 x + \frac{1}{3} \log_3 (x + 2)$$

EXAMPLE #5

$$4 \ln d - \ln a - 2 \ln k - 3 \ln m$$

9

EXAMPLE #6

$$\frac{1}{2} \log_{10} x + 3 \log_{10} (x + 1)$$

EXAMPLE #7

$$2 \log(x + 2) - \log x$$

10

Last Ones!!!

$$8. \log_8 3 + \frac{1}{2} \log_8 x - 2 \log_8 3$$

$$9. 3 \log x + \frac{1}{3} \log(x - 1) - 2 \log 3 - 3 \log x$$

11

Name _____

Date _____

1. Condense: $\ln 3 + \ln x - \ln y - 2 \ln z$	2. Condense: $\ln 5 + \frac{1}{2} \ln x + 2 \ln z$
3. Condense: $\log_5 9 + \frac{1}{2} \log_5 k + 2 \log_5 p$	4. Condense: $\ln 4 + 3 \ln x - 5 \ln y$
5. Condense: $\log_3 a - 2 \log_3 b - 3 \log_3 c$	6. Condense: $\log x + 2 \log y + 3 \log z - \log 5$
7. Condense: $2 \log_3 x + \log_3 y$	8. Condense: $\log 5 + \log x - \log y$
9. Condense: $3 \log_3 x - \log_3 7 - 4 \log_3 y$	10. Condense: $3 \log_5 3 + 2 \log_5 a - \log_5 b - 2 \log_5 c$



Name _____

Date _____

11. Solve

$$3^{3x-5} + 2 = 83$$

12. Solve

$$\log_4(5x-4) = 2$$

13. Solve

$$2(5^{x-2}) + 11 = 261$$

14. Solve

$$-15\log_2(3x+2) = -45$$

15. Expand

$$\ln 2a^2b^3$$

16. Expand

$$\log_2 \frac{3\sqrt{b}}{a^4c^2}$$

17. Expand

$$\log \frac{3x^4}{y\sqrt[3]{z}}$$

18. Expand

$$\log_2 w^3k^5\sqrt[4]{n}$$



Properties of Logs Quiz REVIEW

Expand each logarithm.

1) $\log_7 x^6$

3) $\log_3 \sqrt[3]{u}$

5) $\log_9 \sqrt[3]{u}$

Name _____
Date _____ Period _____

2) $\log \frac{x}{y}$

4) $\log_4 \frac{x}{y}$

6) $\log_9 (x \cdot y)$

Condense each expression to a single logarithm.

7) $4 \log x$

8) $\log x - \log y$

9) $5 \log a$

10) $\frac{\log a}{3}$

Expand each logarithm.

11) $\log_9 (xy^3)^4$

12) $\log_2 (z^6 \sqrt{x})$

13) $\log_5 \left(\frac{u^6}{v} \right)^4$

14) $\log_3 (z \sqrt[3]{x \cdot y})$

15) $\log_4 \sqrt{x \cdot y \cdot z}$

16) $\log_5 (u^4 v^6)$

Condense each expression to a single logarithm.

17) $6 \log_6 a + 5 \log_6 b$

18) $5 \log_3 x - 15 \log_3 y$

19) $3 \log_2 a - 3 \log_2 b$

20) $15 \log_9 u - 5 \log_9 v$