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Simplify each expression.

4. $3^2 \cdot 9$ $\frac{1}{5^3} \rightarrow \frac{5 \cdot 5^{-3}}{125}$

6. $2 \cdot 3^4 = 162$ 7. $2 \cdot (3^{-2}) = \frac{2}{9}$

8. $3 \cdot (2^{-1}) = \frac{3}{2}$ 9. $10 \cdot 3^2 = 90$

8.7 Notes Page 468 Day 71

1 ACTIVITY

1. Fold a piece of paper in half. How many layers are there?
2. Continue folding the paper. Copy and complete the table.

0	1
1	2
2	4
3	8
4	16
5	32
6	64

$r=2$

1, 2, 4, 8, 16, 32, 64, ...
 $\times 2 = \text{ratio}$

3. In the graphs below, the scale of the horizontal axis is from 0 to 6 and the scale of the vertical axis is from 0 to 10. Which graph best models the data in the table? Explain.

A.

B.

5. Write a rule for this sequence.

$A(n) = a \cdot r^{n-1}$
 $A(n) = 1 \cdot 2^{n-1}$

0	1
1	2
2	4
3	8

6. Revise your sequence rule to write a function rule so that the number of layers $f(x)$ is a function of the number of folds x . The function rule should give $f(0) = 1$ and $f(1) = 2$.

$y = 2^x$
 $f(x) = 2^x$

7. Find the number of layers in 12 folds.

$y = 2^{12} = 4096$ layers

8. If there were 256 layers, how many folds would there be?

$256 = 2^x$ $2^8 = 256$

9. Is it physically possible to fold an $8\frac{1}{2}$ in. \times 11 in. piece of paper in halves and get 144 layers? Explain.

$$1, 2, 4, 8, 16, 32, 64, 128, 256$$

$$2^0, 2^1, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7, 2^8$$

10. Describe a reasonable domain for the function in Exercise 6.

$\{0, 1, 2, 3, 4, 5, 6, 7\}$

~~$[0, 7]$~~

144
 $\begin{matrix} & 12 & & 12 & \\ & \wedge & & \wedge & \\ 2 & & 6 & & 6 & & 2 \\ & \wedge & & \wedge & & & \wedge \\ & 3 & & 2 & & 3 & & 2 \end{matrix}$

Drop #	Number of M&M's Remaining	Ratio
0	88	$\frac{45}{88} = .51$
1	45	$\frac{18}{45} = .40$
2	18	$\frac{8}{18} = .67$
3	12	$\frac{8}{12} = .67$
4	8	$\frac{5}{8} = .5$
5	4	$\frac{3}{4} = .75$
6	3	$\frac{2}{3} = .67$
7	2	$\frac{1}{2} = .5$
8	1	$\frac{1}{2} = .5$

Average of Ratios: $.51 + .40 + .67 + .67 + .5 + .75 + .67 + .5$

$$= \frac{4.67}{8} = .58$$

$y = 88(.58)^x$

Exponential Growth/Decay

$y = a \cdot b^x$

initial value \uparrow ratio

$b \geq 1$

$y = 2^x$ Growth
 reference point at $(0, 1)$

$y = 2^x + 1$
 R.P. $(0, 2)$ up 1
 $y = 1$ asymptote

$y = 2^x - 2$
 down 2
 Asymptote $y = -2$

$b \leq 1$ Decay
 $y = (\frac{1}{2})^x$

$y = a \cdot b^x$

$y = 2^{x+1}$ left 1
 R.P. $(-1, 1)$

$y = 2^{x-3}$ right 3
 R.P. $(3, 1)$

$$47/86 = 0.55$$

$$29/47 = 0.62$$

$$15/29 = 0.52$$

$$8/15 = .53$$

$$4/8 = .5$$

$$1/4 = .25$$

Average

$$.55 + .62 + .52 + .53 + .5$$

$$\frac{2.72}{5} = .54$$

$$f(x) = 86(.54)^x$$

Exponential
Growth/Decay

$$\begin{matrix} 8.7 \\ + 8.8 \end{matrix}$$

$$y = a \cdot b^x$$

initial value ratio

reference point is at
(0, 1)

If $b \geq 1$
If b is a whole #: Growth
If b is a fraction or decimal
less than 1: Decay

$$y = 2^x$$

R.P. (0, 1)

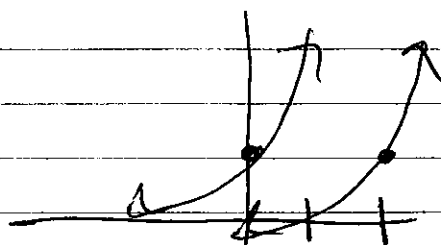


* $y = 2^x + 1$ R.P. (0, 2) up 1

* $y = 2^x - 2$ R.P. (0, -1) down 2

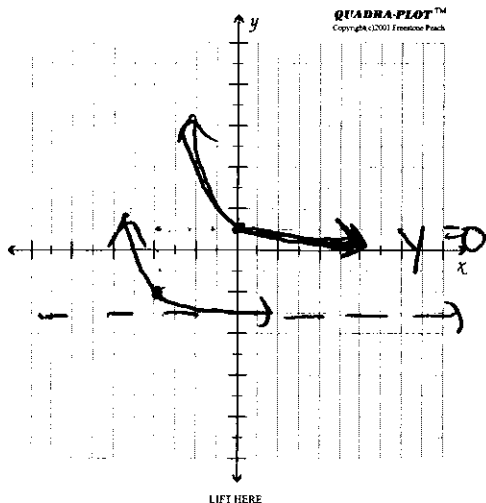
$$y = 2^{x+1} \quad \text{left 1} \quad \text{R.P. } (-1, 1)$$

$$y = 2^{x-2} \quad \text{right 2} \quad \text{R.P. } (2, 1)$$



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

decay, left 4, down 3



asymptote

$$y = -3$$

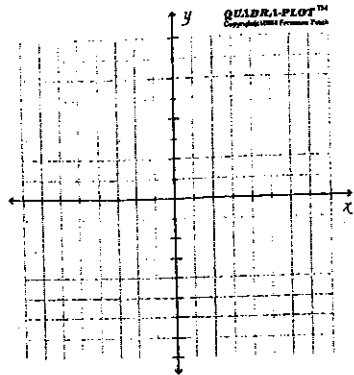
Name: _____
Shifts, R.P. (1-7)

Exponential Growth and Decay Graphing Investigations

Exponential Growth Examples:

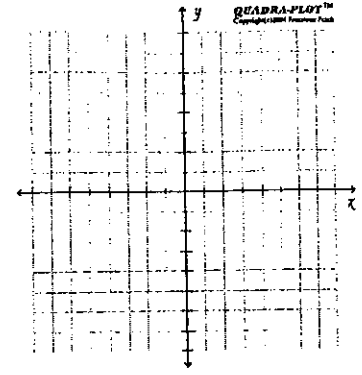
1. $y = 2^x$

2.



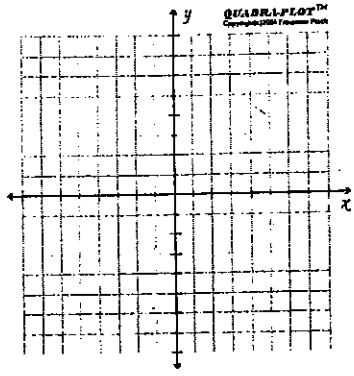
2. $y = 2^{x-4}$

3.

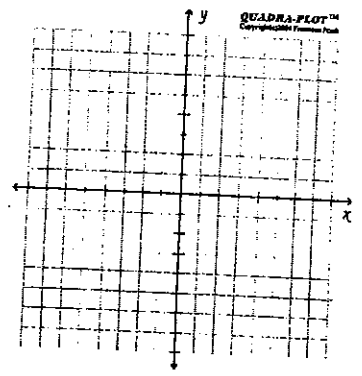


3. $y = 2^{x+1}$

4.



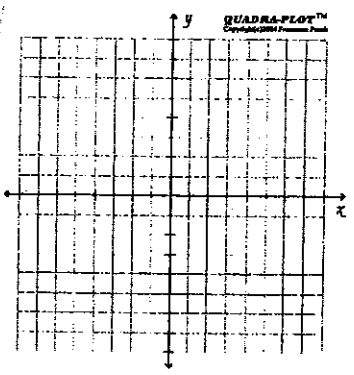
5.



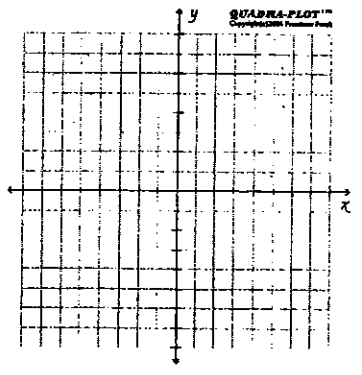
4. $y = 2^x + 4$

5. $y = 2^x - 5$

6.



7.

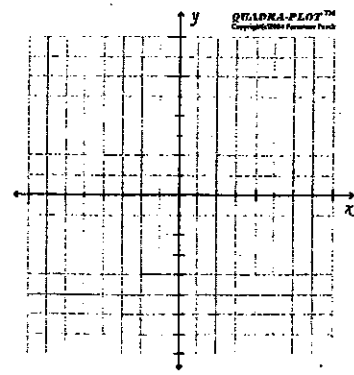


6. $y = 2^{x+1} - 3$

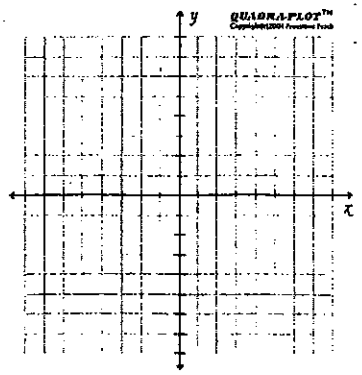
7. $y = 2^{x-3} + 5$

8. $y = -2^{x+1} - 3$

8.



9.

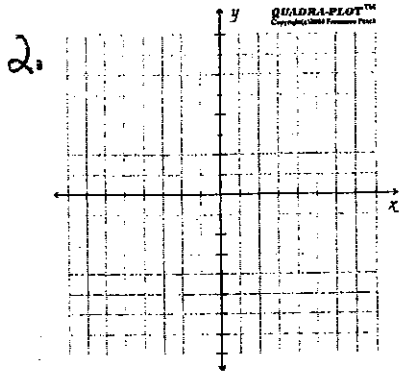


9. $y = -2^{x-3} + 5$

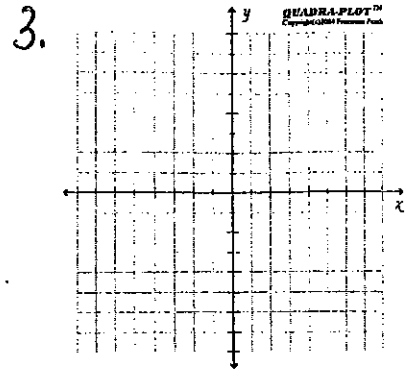
shifts, R.P. (1-7)

Exponential Decay Examples:

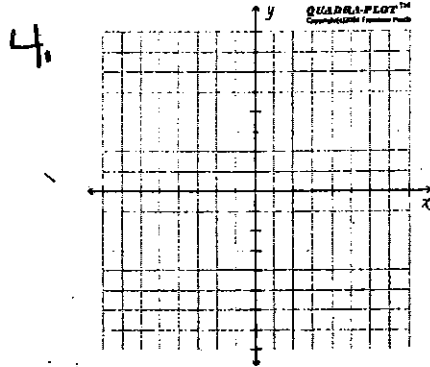
1. $y = \frac{1}{2}^x$



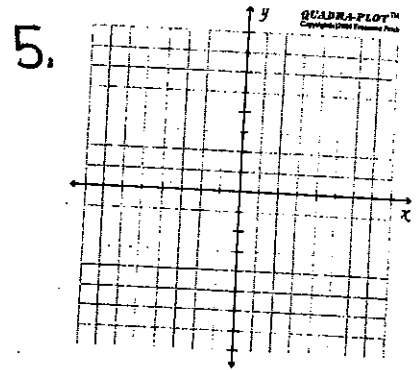
2. $y = \frac{1}{2}^{x-2}$



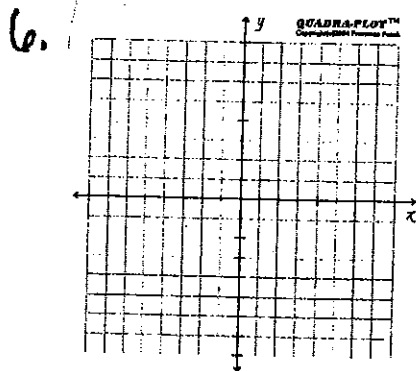
3. $y = \frac{1}{2}^{x+4}$



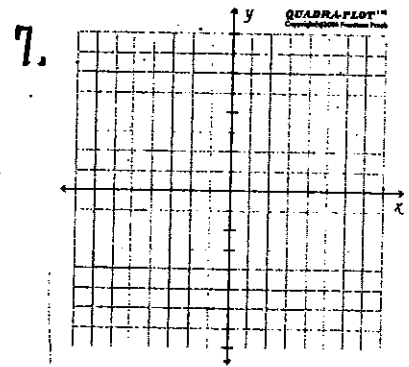
4. $y = \frac{1}{2}^x - 4$



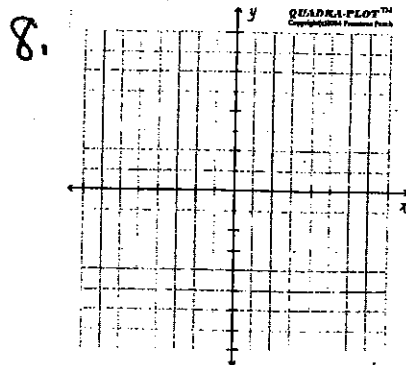
5. $y = \frac{1}{2}^x + 3$



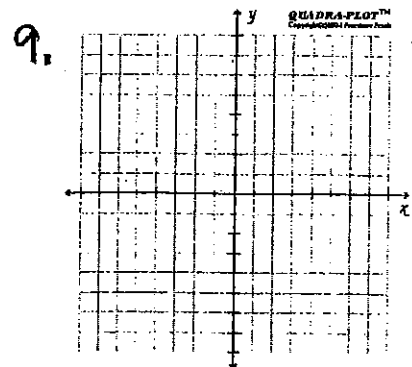
6. $y = \frac{1}{2}^{x-2} + 3$



7. $y = \frac{1}{2}^{x+3} - 7$



8. $y = -\frac{1}{2}^{x-4} + 3$



9. $y = -\frac{1}{2}^{x+1} - 3$