NAME_____DATE_____HOUR___

Culinary Arts/Safety & Sanitation Worksheet Bacteria Growth/Exponential Growth

TABLES & GRAPHS

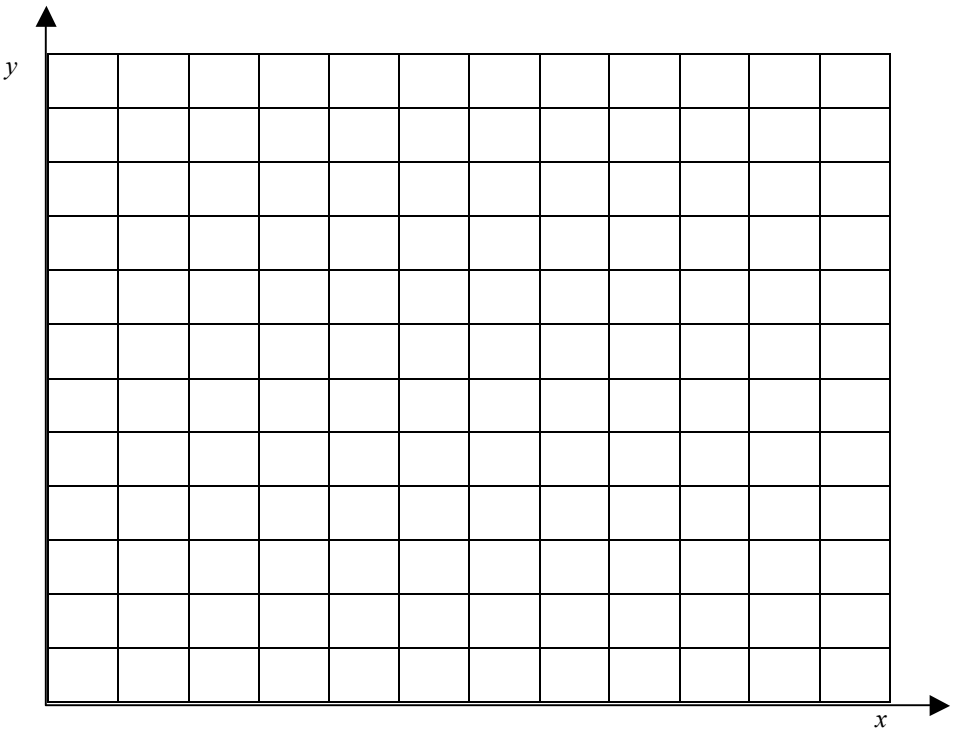
Temperature	Generation Time
40°*f.*	No growth
45°*f.*	12 h.
72°*f.*	65 m.
98.6°*f.*	**20 m.**
108°*f.*	24 m.

At optimal temperature (98.6°*f.*) Salmonella bacteria cells multiply by two every twenty minutes. Let us graph their growth for 2 hours.

Exponential Growth

Optimal Growth Temp. 98°*f*

Time (min.)	# of cells
x	*y*
0	
20	
40	
60	
80	
100	
120	



NAME_____DATE_____HOUR___

Culinary Arts/Safety & Sanitation Worksheet Bacteria Growth/Exponential Growth

Napkin Folding	
# of cuts	# of holes
X	Y
0	
1	
2	
3	
4	
5	
6	
7	

NAME_____DATE_____HOUR___

Culinary Arts/Safety & Sanitation Practice Bacteria Growth/Exponential Growth

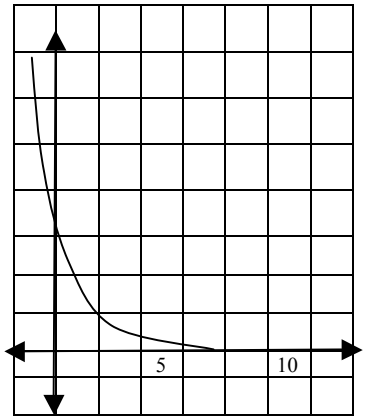
TABLES & GRAPHS

1. Clara's makes an apple pie every day for the senior citizen home. Each pie requires 8 apples. Graph the accumulation of apples Clara uses in a week.

Apples	
Day	# of apples
X	Y

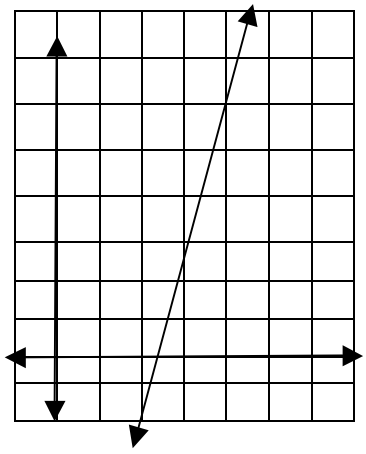
2. Visually decide which graphs are exponential and which graphs are linear. Circle the correct response.

A.

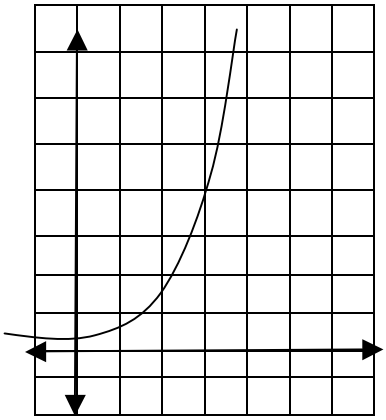
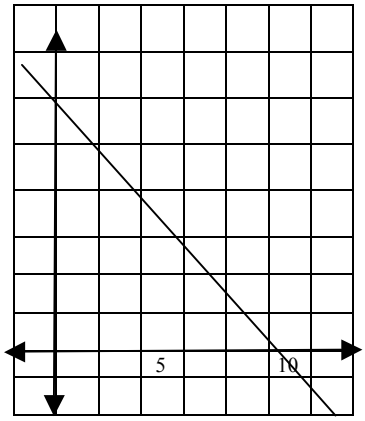
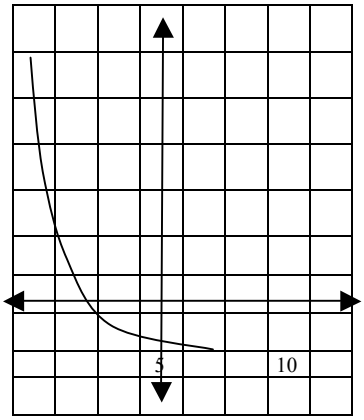


exponential linear

B.



exponential linear

C.	D.	E.
		
exponential linear	exponential linear	exponential linear

3. Perform the following calculations using exponents. Show your work.

A. 5^4	B. 11^2	C. 10^2	D. 4^3

Complete the following tables.

4. Exponential

X	3^x	Y
1	3^1	3
2		
3		
4		

5. Linear

X	3*x*	*Y*
1	3(1)	3
2		
3		
4		

NAME_____DATE_____HOUR___
Culinary Arts/Safety & Sanitation Homework Bacteria Growth/Exponential Growth

Homework.

1. Give three situations that would result in an exponential growth.

A.	B.	C.

Show your work for problems 2 - 4.

2. If Kyle wiped the table where the *salmonella* contaminated chicken had been and turned to shake hands with seven people, how many people now have traces of salmonella?

   If each one of those people (including Kyle) shook hands with 7 people, how many people now have traces of *salmonella*?

   Now, if each one of those people shook hands with 7 people, how many people now have traces of *salmonella*?

3. A bacteria culture doubles in size every 8 hours. The culture starts with 150 cells. How many will there be after 24 hours? After 72 hours?

4. A rapidly growing strain of bacteria quadruples every 40 minutes. A scientist starts with 10 bacteria.

   (A.) How long will it take for the bacteria to double in size?

   (B.) How many times will it quadruple in 6 hours?

   (C.) How many bacteria will there be at the end of 4 hours? 8 hours?

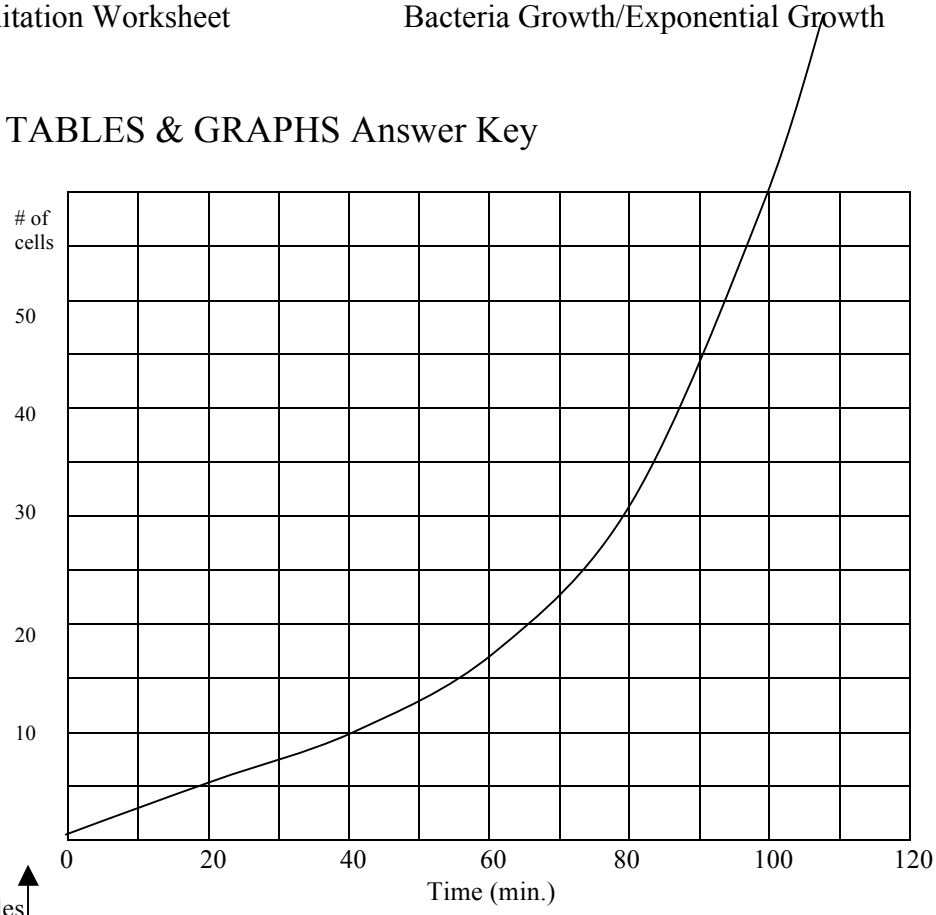
NAME_____DATE_____HOUR___

Culinary Arts/Safety & Sanitation Worksheet Bacteria Growth/Exponential Growth

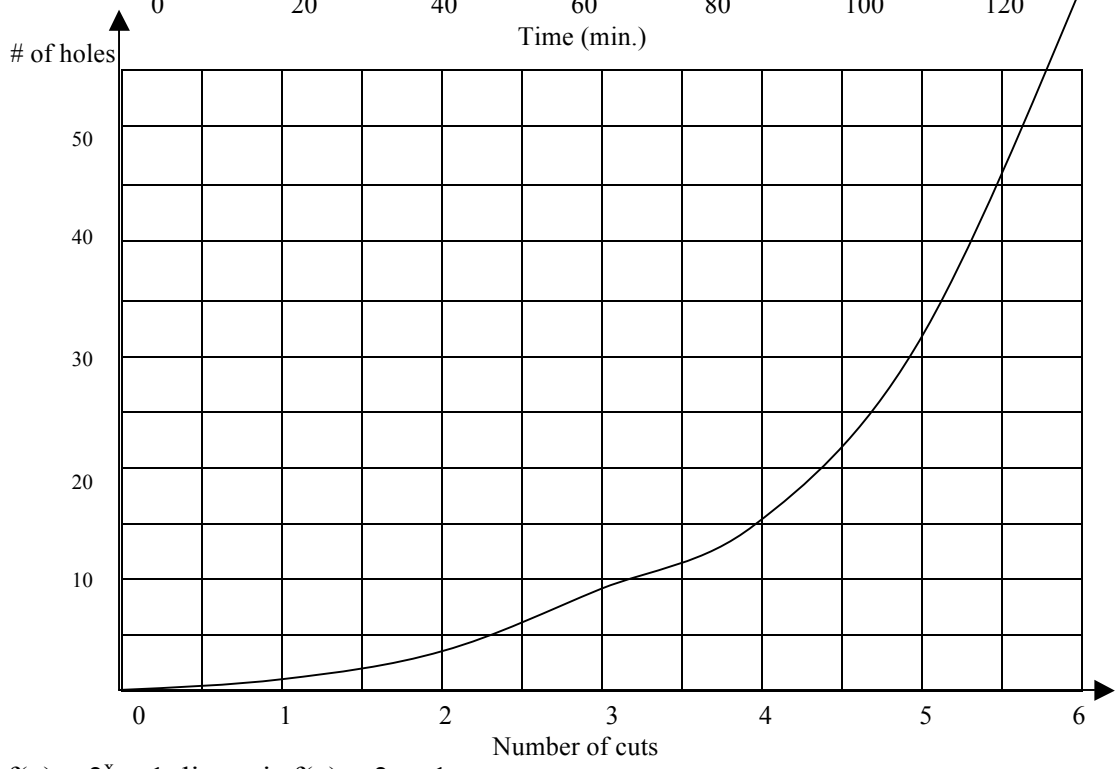
TABLES & GRAPHS Answer Key

Optimal Growth Temp. 98°F

Time (min.)	# of cells
x	*y*
0	$2^0=1$
20	$2^1=2$
40	$2^2=4$
60	$2^3=8$
80	$2^4=16$
100	$2^5=32$
120	$2^6=64$



Napkin Folding	
# of cuts	# of holes
X	*Y*
0	0
1	1
2	3
3	7
4	15
5	31
6	63
7	127



Cuts; Exponential is $f(x) = 2^x - 1$, linear is $f(x) = 2x - 1$

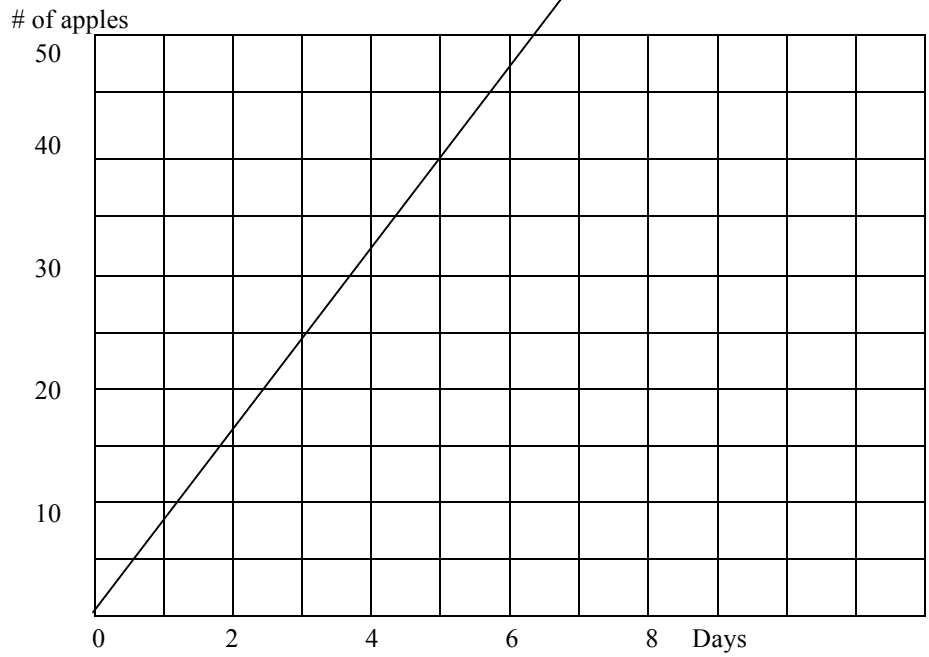
NAME_____DATE_____HOUR___

Culinary Arts/Safety & Sanitation Practice Bacteria Growth/Exponential Growth

TABLES & GRAPHS Answer key

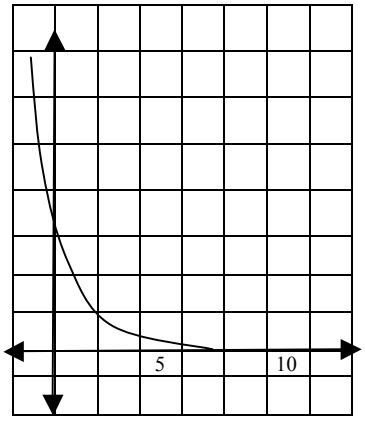
5. Clara's makes an apple pie every day for the senior citizen home. Each pie requires 8 apples. Graph the accumulation of apples Clara uses in a week.

Apples	
Day	# of apples
X	Y
1	8
2	16
3	24
4	32
5	40
6	48
7	56



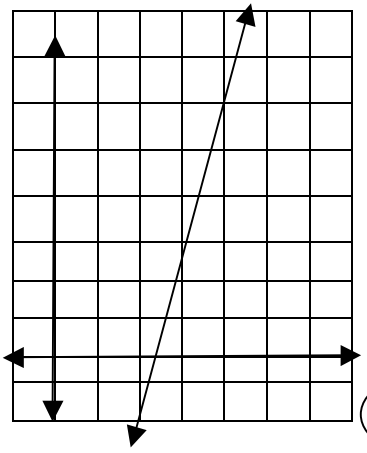
2. Visually decide which graphs are exponential and which graphs are linear. Circle the correct response.

A.

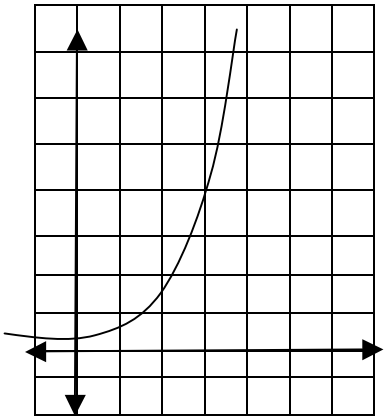
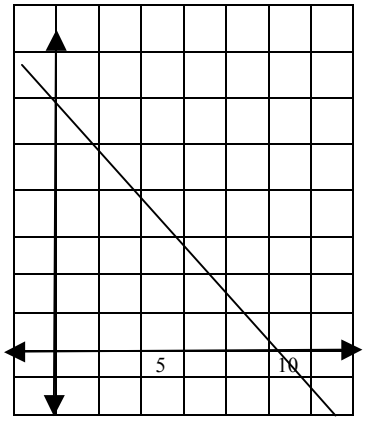
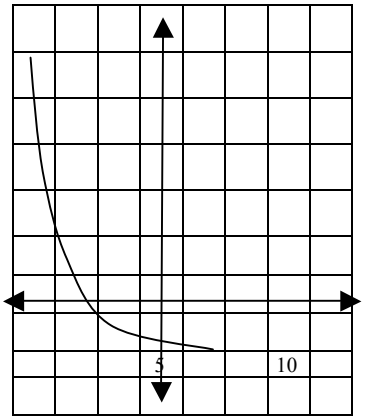


exponential linear

B.



exponential linear

C.	D.	E.
		
exponential linear	exponential linear	exponential linear

3. Perform the following calculations using exponents. Show your work.

A. 5^4*	B. 11^2	C. 10^2	D. 4^3
$5 \cdot 5 \cdot 5 \cdot 5 = 625$ Graphing calculator: 5^4 = 625	$11 \cdot 11 = 121$ Graphing calculator: 11^2 = 121	$10 \cdot 10 = 100$ Graphing calculator: 10^2 = 100	$4 \cdot 4 \cdot 4 = 64$ Graphing calculator: 4^3 = 64

Complete the following tables.

4. Exponential

X	3^x	Y
1	3^1	3
2	3^2	9
3	3^3	27
4	3^4	81

5. Linear

X	3*x*	*Y*
1	$3 \cdot 1$	3
2	$3 \cdot 2$	6
3	$3 \cdot 3$	9
4	$3 \cdot 4$	12

NAME_____DATE_____HOUR___
Culinary Arts/Safety & Sanitation Homework Bacteria Growth/Exponential Growth

Homework.

1. Give three situations that would result in an exponential growth.

A.	B.	C.
Roaches; any species that procreates at a rate of more than one at a time.	Compound interest on a credit card or loan	Number of text messages sent collectively by teenagers. The Verizon "network"

Show your work for problems 2 - 5.

2. If Kyle wiped the table where the *salmonella* contaminated chicken had been and turned to shake hands with seven people, how many people now have traces of salmonella?

   8

   If each one of those people (including Kyle) shook hands with 7 people, how many people now have traces of *salmonella*?

   $\mathbf{8 + (8 \cdot 7) = 64}$

   Now, if each one of those people shook hands with 7 people, how many people now have traces of *salmonella*?

   $\mathbf{64 + (64 \cdot 7) = 512}$

# of people	Formula
1	8^1
64	8^2
512	8^3

3. A bacteria culture doubles in size every 8 hours. The culture starts with 150 cells. How many will there be after 24 hours? After 72 hours?

1200 cells; 76,800 cells

time (hours	bacteria
0	150
8	300
16	600
24	1200
32	2400
40	4800
48	9600
56	19200
64	38400
72	76800

4. A rapidly growing strain of bacteria quadruples every 40 minutes. A scientist starts with 10 bacteria.

(A.) How long will it take for the bacteria to double in size?

20 min

(B.) How many times will it quadruple in 6 hours?

9

(C.) How many bacteria will there be at the end of 4 hours? 8 hours?

Time (min)	Bacteria	Hours
0	10	
20	20	
40	40	
80	160	$1.\overline{3}$ hours
120	640	2 hours
160	2560	
200	10,240	
240	**40960**	**4 hours**
280	163840	
320	655360	
360	2621440	6 hours
400	10485760	
440	41943040	
480	**167,772,160**	**8 hours**

$10 \cdot 4^6$ **=40960**

$10 \cdot 412$ **=167,772,160**