SOLUTIONS

Day 1

1. a)

Day	Population	First Differences	Second Differences
0	20		
		60	
1	80		180
		240	
2	320		720
		960	
3	1 280		2 880
		3 840	
4	5 120		11 520
		15 360	
5	20 480		

Answers for parts b) to e) may vary. Sample answers:

b) Yes; the values in each difference column increase by a factor of 4.

c) Differences in each column are 4 times the previous difference in that column.

d) Yes.

e)

Third Differences	Fourth Differences
540	
	1620
2160	
	6480
8640	

Yes.

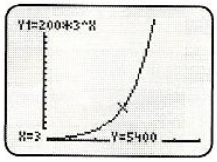
2. (a) (i) 10 people (ii) 20 people
(b) Answers may vary.
(c) Answers may vary.
Sample answer: Yes; the ratio of successive first differences is 2.

3. Answers may vary.
Sample answer: Take the Double Deal; it is worth the most after 2 weeks.

4.

a) $p = 200 \times 3^t$

b)



Answers for parts c) and d) may vary. Sample answers:

c) 961; the graph is easier to use.

d) 106 288 200; the equation is easier to use.

5. (a) approximately 5.7 days, approximate population 25 600 bacteria cells.
(b) approximately 2.6 days faster.

6. C

SOLUTIONS
Day 2

1. (a) B (b) D (c) C (d) A

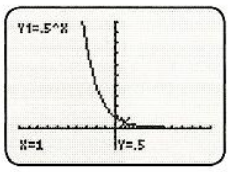
2. (a) Answers may vary.
(b) Answers may vary. Sample answer: No; there are many exponential functions with these properties.

3. (a) Answers may vary.
(b) Answers may vary. Sample answer: No; there are many exponential functions with these properties.

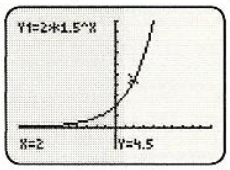
4. $y = 4(2^x)$

5. $y = 24\left(\frac{1}{2}\right)^x$

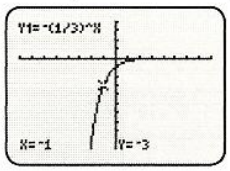
6. (a) C (b) approximately 2.2 mg

7. **a)** 

i) $\{x \in \mathbb{R}\}$
ii) $\{y \in \mathbb{R}, y > 0\}$
iii) no x-intercept; y-intercept 1
iv) always decreasing **v)** $y = 0$

b) 

i) $\{x \in \mathbb{R}\}$
ii) $\{y \in \mathbb{R}, y > 0\}$
iii) no x-intercept; y-intercept 2
iv) always increasing **v)** $y = 0$

c) 

i) $\{x \in \mathbb{R}\}$
ii) $\{y \in \mathbb{R}, y < 0\}$
iii) no x-intercept; y-intercept -1
iv) always increasing **v)** $y = 0$

8. A

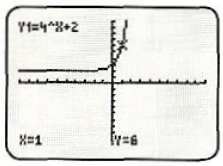
9. A

SOLUTIONS
Day 3

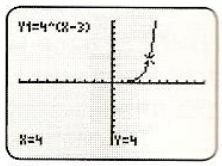
1. (a) translate 2 units up
(b) reflect through the y-axis
(c) translate 3 units right
(d) translate 4 units left (e) reflect through the x-axis
(f) translate 1 unit right and 5 units down

2.

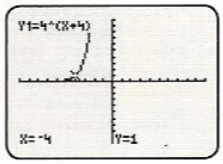
(a)



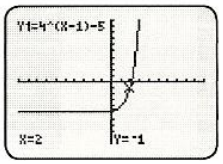
(c)



(d)



(f)



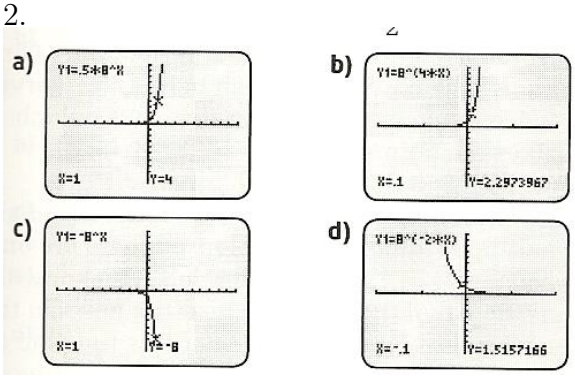
3. (a) $y = 5^x - 3$
(b) $y = 5^{x-2}$
(c) $y = -5^x$
(d) $y = 5^{x+\frac{1}{2}}$
(e) $y = 5^{-x} + 2$
(f) $y = 5^{x+2.5} + 1$

SOLUTIONS

Day 4

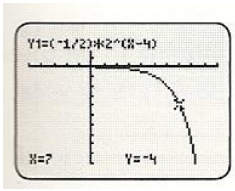
1. (a) vertical compression by a factor of $\frac{1}{2}$
(b) horizontal compression by a factor of $\frac{1}{4}$
(c) reflection in the x-axis
(d) reflection in the y-axis and horizontal compression by a factor of $\frac{1}{2}$

2.

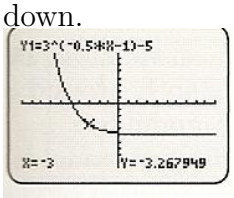


3. (a) $y = -7^x$
(b) $y = 3(7^x)$
(c) $y = 7^{\frac{x}{2.4}}$
(d) $y = \frac{1}{7}(7^{-x}$

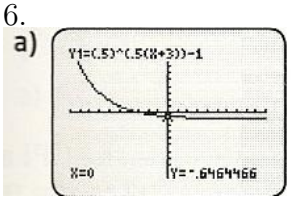
4. Reflection in the x-axis; vertical compression of $\frac{1}{2}$; translate 4 units right.



5. Reflection in the y-axis; horizontal stretch of factor 2, translate 2 units left and 5 units down.



6.



b) i) $\{x \in \mathbb{R}\}$
ii) $\{x \in \mathbb{R}, y > 21\}$
iii) $y = -1$

SOLUTIONS

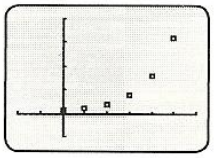
Day 6

1.

a)

Time (half-hour intervals)	Number of People Who Just Heard the News
0	1
1	2
2	4
3	8
4	16
5	32

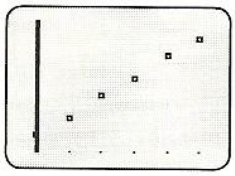
Answers for parts b) to d) may vary. Sample answers:

b)  The trend is increasing.

(c) The data seem to follow an exponential function, since the ratio of successive first differences is constant.
(d) $P = 2^n$, where P represents the number of people that know and n represents the number of half-hour increments.

2.

Answers may vary. Sample answers:

a)  The data appear to be linear.

b) The data seem to follow a linear relation, as the increase in y-values is consistently around 30 to 40 pandas per year. A linear model is $P = 35x + 800$ and an exponential model is $P = 800(1.04^x)$, where x is the number of years and P is the number of pandas.

c) linear model: 1220 pandas; exponential model: 1281 pandas

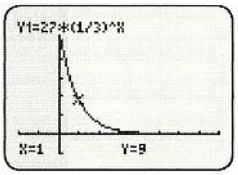
d) Answers may vary. Sample answer: linear model: 34.3 years, exponential model: 23.4 years

3. Answers will vary.

SOLUTIONS

Day 7

1.

a) 

b) **i)** $\{x \in \mathbb{R}\}$ **ii)** $\{y \in \mathbb{R}, y > 0\}$

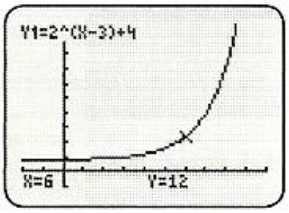
iii) no x-intercepts; y-intercept 27

iv) The function is decreasing over its domain.

v) $y = 0$

2. $y = 10(2)^{2x}$ OR $y = 10(4)^x$

3.

a) 

b) **i)** $\{x \in \mathbb{R}\}$

ii) $\{y \in \mathbb{R}, y > 4\}$

iii) $y = 4$

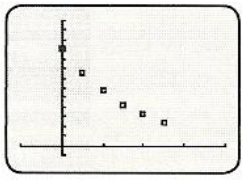
4. (a) vertical stretch by a factor of 2
(b) horizontal compression by a factor of $\frac{1}{2}$
(c) reflection in the x-axis and the y-axis
(d) reflection in the y-axis, horizontal compression by a factor of $\frac{1}{5}$, translation of 2 units left

5.

a)

Number of Bounces, n	Height, h (cm)	First Differences	Second Differences
0	100		
		−24	
1	76		5
		−19	
2	57		5
		−14	
3	43		3
		−11	
4	32		3
		−8	
5	24		

Answers for parts b) to f) may vary. Sample answers:

b) 

The data seem to follow an exponential curve.

c) $y = 100(0.75)^x$

d) **i)** According to the mathematical model, the ball should never stop bouncing, as it will always bounce to a height that is 75% of the previous bounce, which will never equal 0.

ii) In the real situation, the ball will eventually stop bouncing.

e) There is also a slight loss of energy due to air resistance and friction. Eventually, these factors will cause the ball to stop bouncing.