8.5 Notes

Linear, Exponential, and Quadratic Models

Linear equations, in slope-intercept form, are written: _____

Quadratic equations, in standard form, are written: _____

Exponential equations can be written: _____

1. To determine an appropriate model for a given set of data, examine the y-values for several consecutive values of x.

- The data is linear if the _____ of the y-values are constant
- The data is quadratic if the _____ of the y-values are constant
- The data is exponential if the _____ of the y-values are constant

2. For each of the following data sets, determine it if models linear, exponential, or quadratic data.

(a)

x	y
-1	11
0	9
1	7
2	5
3	3

(b)

x	y
1	0
2	3
3	8
4	15
5	24

(c)

t	f(t)
-1	.2
0	1
1	5
2	25
3	125

(d)

x	f(x)
-2	-13
-1	-4
0	3
1	8
2	11

(e)

m	j(m)
-2	.08
-1	.4
0	2
1	10
2	50

(f)

x	f(x)
2	11
3	16
4	21
5	26
6	31

(g)

x	1	2	3	4	5
h(x)	-1	5	15	29	47

(h)

x	1	2	3	4
y	2	8	32	128

3. Over what interval does $f(x) = 4^x$ increase faster than $g(x) = 16x$?

x	$y = 4^x$
0	1
1	4
2	16
3	64
4	256
5	1024
6	4096

x	y = 16x
0	0
1	16
2	32
3	48
4	64
5	80
6	96

A $0 < x < 4$ **B** $x > 3$ **C** $0 < x < 2$ **D** $1 < x < 3$

4. The data in the table represent the population of a town for the past five years. When the population reaches 100,000 the town can be reclassified as a city. Does this situation suggest a linear, exponential, or quadratic function model? Will the town be reclassified as a city in the next 8 years?

x	y
1	85,000
2	88,000
3	87,000
4	92,000
5	93,000

5. Compare the rates of change for $f(x) = 2x + 4$, $g(x) = 2x^2 + 4$, and $h(x) = 2^x$ over the interval $x = 3$ to $x = 5$. Which function has the greatest rate of change?

8.5 Notes

Linear, Exponential, and Quadratic Models

Linear equations, in slope-intercept form, are written: $y = mx + b$

Quadratic equations, in standard form, are written: $y = ax^2 + bx + c$

Exponential equations can be written: $y = a \cdot b^x$

1. To determine an appropriate model for a given set of data, examine the y-values for several consecutive values of x.
   - The data is linear if the 1st differences of the y-values are constant
   - The data is quadratic if the 2nd differences of the y-values are constant
   - The data is exponential if the ratio of the y-values are constant
     ↳ "are we multiplying by the same # each time"

2. For each of the following data sets, determine it if models linear, exponential, or quadratic data.

(a)

x	y	
-1	11	
0	9	-2
1	7	-2
2	5	-2
3	3	-2

1st differences → Linear

(b)

x	y		
1	0		
2	3	3	
3	8	5	2
4	15	7	2
5	24	9	2

2nd difference → Quad

(c)

t	f(t)	
-1	.2	×5
0	1	×5
1	5	×5
2	25	×5
3	125	

Exponential

(d)

x	f(x)		
-2	-13		
-1	-4	9	
0	3	7	-2
1	8	5	-2
2	13	3	-2

Quad.

(e)

m	j(m)	
-2	.08	×5
-1	.4	×5
0	2	×5
1	10	×5
2	50	×5

Exponential

(f)

x	f(x)	
2	11	
3	16	5
4	21	5
5	26	5
6	31	5

Linear

(a)

x	1	2	3	4	5
h(x)	-1	5	15	29	47
		6	10	14	18
			4	4	4

Quad

(b)

x	1	2	3	4
y	2	8	32	128
		×4	×4	×4

Exponential

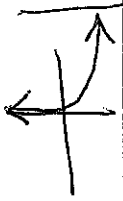
3. Over what interval does $f(x) = 4^x$ increase faster than $g(x) = 16x$?

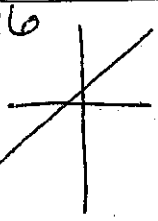
x	$y = 4^x$
0	1
1	4
2	16
3	64
4	256
5	1024
6	4096

+3, +12, +48

x	y = 16x
0	0
1	16
2	32
3	48
4	64
5	80
6	96

+16, +16, +16





A $0 < x < 4$ B $x > 3$ C $0 < x < 2$ D $1 < x < 3$

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	$2x+4$	$2x^2+4$	2^x
$x=3$	10	22	8
$x=5$	14	54	32
	+4	+32	+24

#d → h, 3, 5