

Linear	Linear	$y = 2.5x$ Linear																		
<table border="1"> <tr><th>x</th><th>y</th></tr> <tr><td>6</td><td>12</td></tr> <tr><td>12</td><td>20</td></tr> <tr><td>15</td><td>24</td></tr> </table> <p><math>\frac{6}{10} = \frac{4}{3} \quad \frac{4}{3}</math></p>	x	y	6	12	12	20	15	24	<table border="1"> <tr><th>x</th><th>y</th></tr> <tr><td>8</td><td>14</td></tr> <tr><td>12</td><td>17</td></tr> <tr><td>16</td><td>20</td></tr> <tr><td>20</td><td>23</td></tr> </table>	x	y	8	14	12	17	16	20	20	23	$y = 3x^3 + 2$ Nonlinear
x	y																			
6	12																			
12	20																			
15	24																			
x	y																			
8	14																			
12	17																			
16	20																			
20	23																			

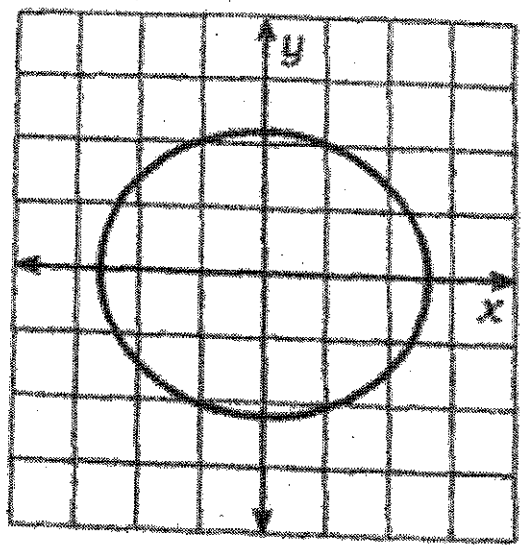
$y = \frac{10}{x}$ Nonlinear	$y = 5x(x - 2)$ Nonlinear	<p>When Lindsey was born, Aunt Emma put a dime in a piggy bank for her. She said she would double the amount she gave her on each birthday until she turns 13 Nonlinear</p>
---------------------------------	------------------------------	---

<p>Linear</p>	<table border="1"> <tr><th>x</th><td>2</td><td>4</td><td>6</td><td>8</td></tr> <tr><th>y</th><td>13</td><td>18</td><td>23</td><td>28</td></tr> </table> <p>Linear</p>	x	2	4	6	8	y	13	18	23	28
x	2	4	6	8							
y	13	18	23	28							
	<table border="1"> <tr><th>x</th><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><th>y</th><td>100</td><td>50</td><td>25</td><td>12.5</td></tr> </table> <p>Nonlinear</p>	x	1	2	3	4	y	100	50	25	12.5
x	1	2	3	4							
y	100	50	25	12.5							

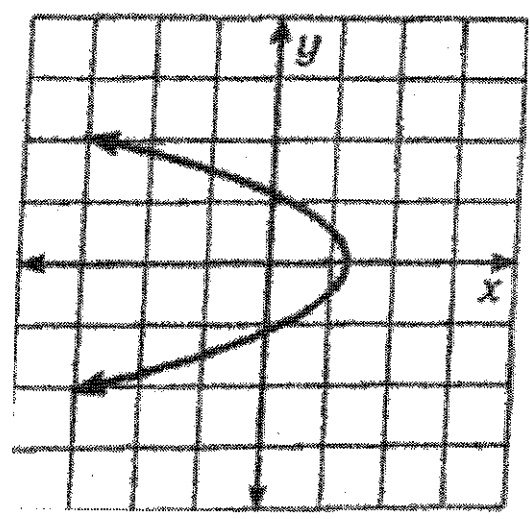
Nonlinear	<table border="1"> <tr><th>x</th><td>8</td><td>-3</td><td>-9</td><td>-3</td></tr> <tr><th>y</th><td>7</td><td>15</td><td>0</td><td>32</td></tr> </table>	x	8	-3	-9	-3	y	7	15	0	32	<p>Nonlinear</p>
x	8	-3	-9	-3								
y	7	15	0	32								
Linear	<table border="1"> <tr><th>x</th><td>-1</td><td>0</td><td>1</td><td>2</td></tr> <tr><th>y</th><td>1</td><td>0</td><td>-1</td><td>-2</td></tr> </table>	x	-1	0	1	2	y	1	0	-1	-2	
x	-1	0	1	2								
y	1	0	-1	-2								

$\frac{18}{6} = \frac{18}{6}$   
 $\frac{12}{6} = \frac{12}{6}$

Nonlinear



Nonlinear



Nonlinear

x	y
-6	4
-4	0
-2	-5
0	-5
2	0
4	4

+2 (circled around the table)

-4, -5, +0, +5, +4 (written to the right of the rows)

x	y
5	18
-2	-2
0	12
12	0
-40	17
-5	18

-7, +2, +12, -52, +35 (written to the left of the rows)

-20, +14, -12, +17, +1 (written to the right of the rows)

Nonlinear

$\{(-2, 7), (6, 2), (-2, -3), (0, 9)\}$

-5 -5 +12 Nonlinear

\*  $\updownarrow$

$\{(4, 0), (4, 3), (4, 10), (4, 15)\}$

Nonlinear

$\{(4, -5), (2, -5), (-3, -5)\}$

$\frac{0}{-2} = 0$   $\frac{0}{-5} = 0$   
Linear

A middle school chorus has a party after their concert. The cost per person for this party depends on the number of members who attend. The following table shows some sample (number attending, cost per person) values:

<sup>15</sup>  
~~Cost for Chorus Party~~

Number Attending	5	10	15	20	25	30
Cost per Person	\$24	\$12	\$8	\$6	\$4.80	\$4

Nonlinear

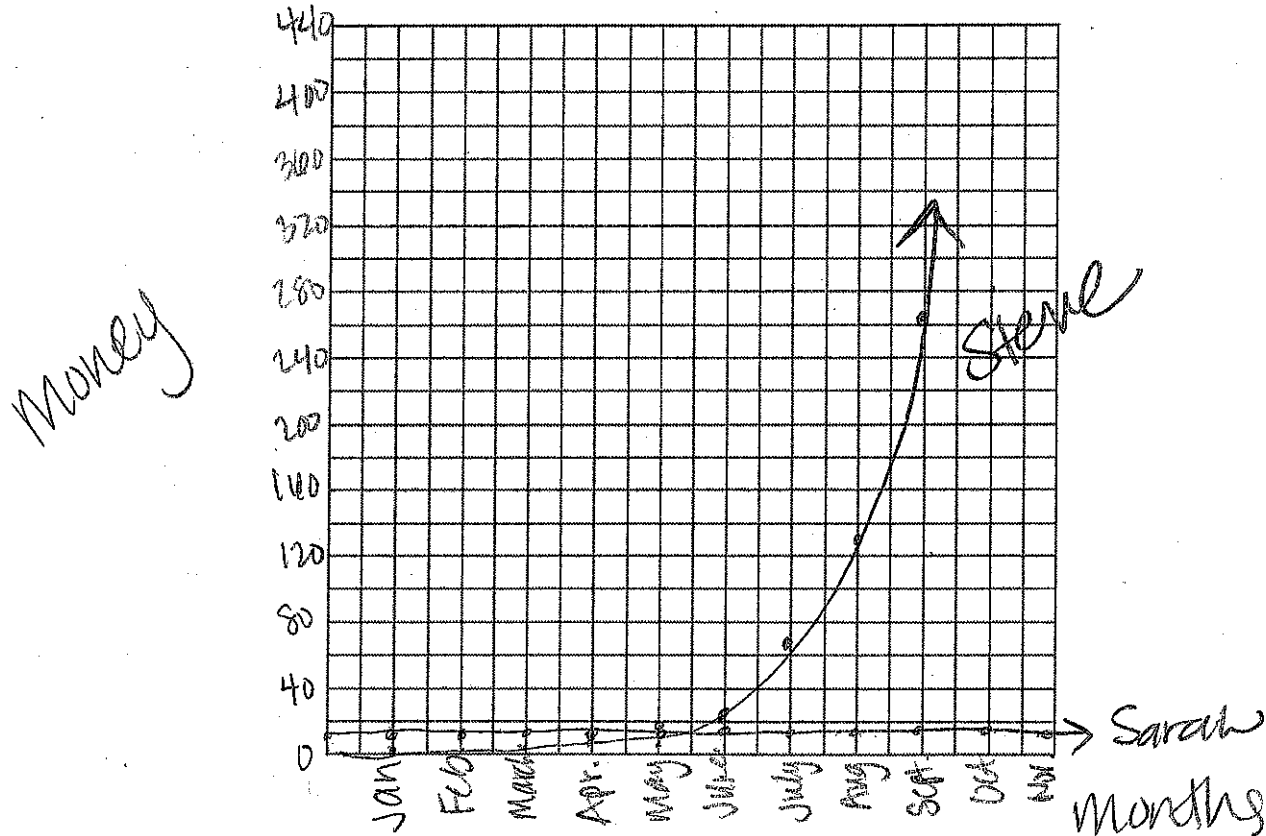
$\cup$   $\cup$   $\cup$   $\cup$   
 $-12$   $-4$   $-2$   $-1.2$   $-.8$

gets \$15 allowance every month. Steve gets \$1 in January, and then each month the amount he gets doubles. Fill out a table showing how much money Sarah and Steve get each month.

**(Hint--this table is the amount they get each month, NOT the total amount they have received)**

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct
Sarah	15	15	15	15	15	15	15	15	15	15
Steve	1	2	4	8	16	32	64	128	256	512

Now, graph the information above on the grid below. Be sure to include a title, a scale, label each axis, and use a key to tell Sarah and Steve apart.



- Will Steve ever receive more money in a month than Sarah? If so, when will this happen?  
 Yes - he gets more money beginning in May.
- How much TOTAL money will each person receive at the end of October?  
 Sarah -  $15(10) = \$150$ . Steve -  $\$1023$ .
- How much TOTAL money will each person receive at the end of the year?  
 Sarah -  $15(12) = \$180$ . Steve -  $\$4095$ .
- Whose data is linear? Write the equation for this line.

Sarah:  $y = 15$

+1

(7) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & 4 & 8 & 10 & 32 & 12 & 28 & 50 \\ \hline \end{array}$$

+4 + 8 + 10 + 32 + 12 + 28 + 50

Nonlinear

+1

(13) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & 0 & 5 & 8 & 9 & 8 & 5 & 0 \\ \hline \end{array}$$

+5 + 3 + 1 - 1 - 3 - 5

Nonlinear

+1

(8) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & \frac{1}{27} & \frac{1}{9} & \frac{1}{3} & 1 & 3 & 9 & 27 \\ \hline \end{array}$$

+1/27 + 1/9 + 1/3 + 1 + 3 + 9 + 27

Nonlinear

(14) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & 30 & 10 & -10 & 0 & 3 & 8 & 15 \\ \hline \end{array}$$

-3 - 1 + 1 + 3 + 5 + 7

Nonlinear

(9) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & 30 & 20 & 8 & 0 & 2 & 0 & 10 \\ \hline \end{array}$$

-10 - 12 - 2 - 4 - 2 - 0

Nonlinear

(15) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & 1 & 0 & -1 & -2 & -1 & 0 & 1 \\ \hline \end{array}$$

-1 + 1 - 1 + 1 - 1 + 1

Nonlinear

+1

(10) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & 11 & 9 & 7 & 5 & 3 & 1 & -1 \\ \hline \end{array}$$

-2 - 2 - 2 - 2 - 2 - 2

Linear,  $y = -2x + 5$

(16) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & \frac{1}{8} & \frac{1}{4} & \frac{1}{2} & 1 & 2 & 4 & 8 \\ \hline \end{array}$$

+1/8 + 1/4 + 1/2 + 1 + 2 + 4 + 8

Nonlinear

+1

(11) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & \frac{1}{8} & \frac{1}{3} & 1 & 3 & 9 & 27 & 81 \\ \hline \end{array}$$

+1/8 + 1/3 + 1 + 3 + 9 + 27 + 81

Nonlinear

+1

(12) 
$$\begin{array}{c|cccc|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline y & -27 & -9 & -3 & 0 & 3 & 9 & 27 \\ \hline \end{array}$$

+18 + 10 + 3 + 3 + 10 + 18

Nonlinear

+1

①	x	-3	-2	-1	0	1	2	3
	y	14	10	6	2	-2	-6	-10
		↓	↓	↓	↓	↓	↓	↓
		-4	-4	-4	-4	-4	-4	-4

Linear;  $y = -4x + 2$

②	x	-3	-2	-1	0	1	2	3
	y	$\frac{1}{2}$	1	2	4	8	16	32
		↓	↓	↓	↓	↓	↓	↓
		$+\frac{1}{2}$	+1	+2	+4	+8	+16	

Nonlinear

③	x	-3	-2	-1	0	1	2	3
	y	2	12	5	0	-3	-4	-3
		↓	↓	↓	↓	↓	↓	↓
		-9	-7	-5	-3	-1	+1	

Nonlinear

④	x	-3	-2	-1	0	1	2	3
	y	-16	-13	-10	-7	-4	-1	2
		↓	↓	↓	↓	↓	↓	↓
		+3	+3	+3	+3	+3	+3	

Linear;  $y = 3x - 7$

⑤	x	-3	-2	-1	0	1	2	3
	y	-4	-9	-14	-19	-24	-29	-34
		↓	↓	↓	↓	↓	↓	↓
		-5	-5	-5	-5	-5	-5	-5

Linear;  $y = 5x + 1$

⑥	x	-3	-2	-1	0	1	2	3
	y	-18	-16	-12	0	2	4	18
		↓	↓	↓	↓	↓	↓	↓
		+12	+4	+2	+2	+4	+12	

Nonlinear

# 4-3

## Practice

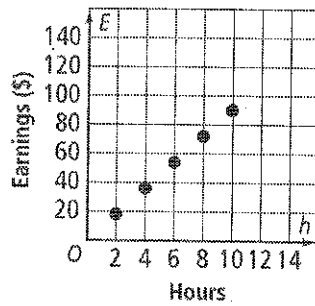
Form G

### Patterns and Nonlinear Functions

1. A student's earnings  $E$ , in dollars, is a function of the number  $h$  of hours worked. Graph the function shown by the table. Tell whether the function is *linear* or *nonlinear*.

Hours, $h$	2	4	6	8	10
Earnings (\$), $E$	18	36	54	72	90

linear;

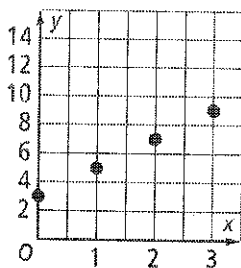


Graph the function shown by each table. Tell whether the function is *linear* or *nonlinear*.

2.

$x$	$y$
0	3
1	5
2	7
3	9

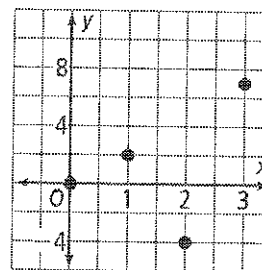
linear;



3.

$x$	$y$
0	0
1	2
2	-4
3	7

non-linear;



## 4-3

## Practice (continued)

Form G

## Patterns and Nonlinear Functions

Each set of ordered pairs represents a function. Write a rule that represents the function.

4.  $(0, 1), (1, 3), (2, 9), (3, 27), (4, 81)$   $y = 3^x$

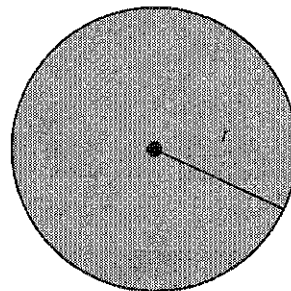
5.  $(0, 0), (1, 1), (2, 4), (3, 9), (4, 16)$   $y = x^2$

6.  $(0, 1), (1, 0.5), (2, 0.25), (3, 0.125), (4, 0.0625)$   $y = 0.5^x$

7.  $(0, 0), (1, 1), (2, 8), (3, 27), (4, 64)$   $y = x^3$

8. **Reasoning** A certain function fits the following description: *As the value of  $x$  increases by 1 each time, the value of  $y$  decreases by the square of  $x$ .* Is this function *linear* or *nonlinear*? Explain your reasoning.  
nonlinear; There is a squared term in the function.

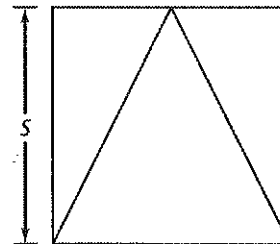
9. **Writing** The rule  $C = 6.3r$  gives the approximate circumference  $C$  of a circle as a function of its radius  $r$ . Identify the independent and dependent variables in this relationship. Explain your reasoning.  
independent:  $r$ ; dependent:  $C$ ; The circumference of a circle depends on its radius.



10. **Open-Ended** What is a rule for the function represented by  $(0, -2), (1, -1), (2, 2), (3, 7)$ ? Explain your reasoning.  
 $y = x^2 - 2$ ; The graph of the ordered pairs makes it clear that the function is nonlinear. The output is two less than the square of the input.

11. A landscape architect wants to make a triangular garden inside a square of land as shown at the right. What is a rule for the area  $A$  of the garden as a function of  $s$ ?

$$A = \frac{s^2}{2}$$





# 4-3 Standardized Test Prep

## Patterns and Nonlinear Functions

### Multiple Choice

For Exercises 1-5, choose the correct letter.

- Which ordered pair represents a linear function? **A**
  - $(-2, -15), (-1, -9), (0, -3), (1, 3),$  and  $(2, 9)$
  - $(-2, 4), (-1, 1), (0, 0), (1, 1),$  and  $(2, 4)$
  - $(-2, -1), (-1, -4), (0, -5), (1, -4)$  and  $(2, -1)$
  - $(-2, -8), (-1, -1), (0, 0), (1, 1),$  and  $(2, 8)$
- The following ordered pairs represent a function:  $(-2, 10), (-1, 7), (0, 6), (1, 7),$  and  $(2, 10)$ . Which equation could represent the function? **I**
  - $y = -4x + 2$
  - $y = x^2 - 6$
  - $y = 5x$
  - $y = x^2 + 6$

- Which rule could represent the function shown by the table at the right? **C**

- $y = -x^3$
- $y = x^2 + 1$
- $y = -x^2 + 1$
- $y = -x - 1$

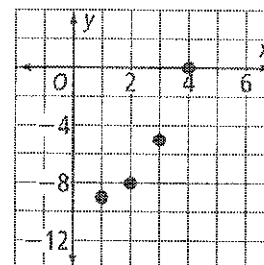
x	y
-2	-3
-1	0
0	1
1	0
2	-3

- The ordered pairs  $(-1, 1), (0, 2), (1, 1), (2, -2),$  and  $(3, -7)$  represent a function. Which rule could represent the function? **G**
  - $y = -x^2 - 2$
  - $y = -x^2 + 2$
  - $y = x^2 - 2$
  - $y = x^2 + 2$
- Which ordered pair represents a nonlinear function? **D**
  - $(0, 0), (1, 1), (2, 2), (3, 3),$  and  $(4, 4)$
  - $(0, 0), (1, -1), (2, -2),$  and  $(4, -4)$
  - $(0, -1), (1, 0), (2, 1), (3, 2),$  and  $(4, 3)$
  - $(0, 0), (1, 1), (2, 8), (3, 27),$  and  $(4, 64)$

### Short Response

- Graph the function shown in the table below. Is the function *linear* or *nonlinear*? **nonlinear**

x	1	2	3	4
y	-9	-8	-5	0



- [2] Question answered correctly.  
 [1] Answer is incomplete.  
 [0] Answer is wrong.

121