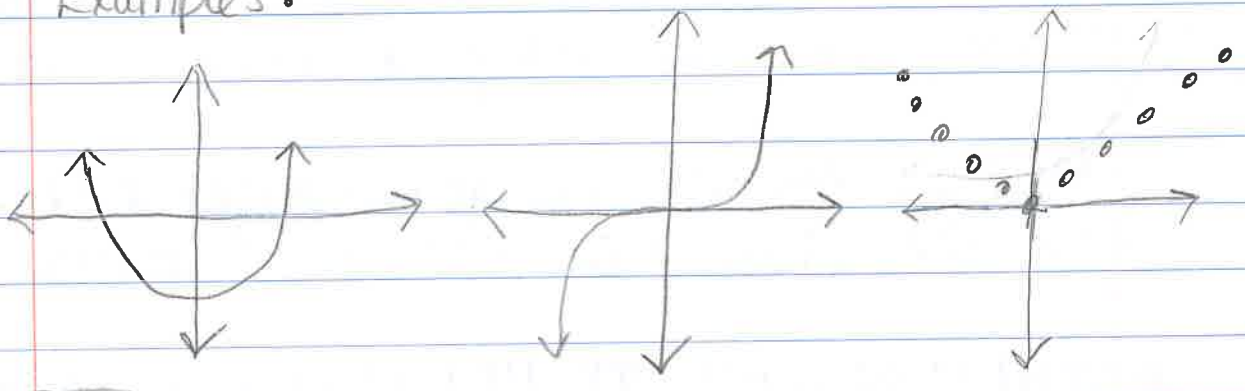
4.3 Patterns & Non-Linear Functions

Nonlinear function - a function whose graph is not a line or part of a line

Examples:



* Quadratic
  $y = ax^2 + bx + c$

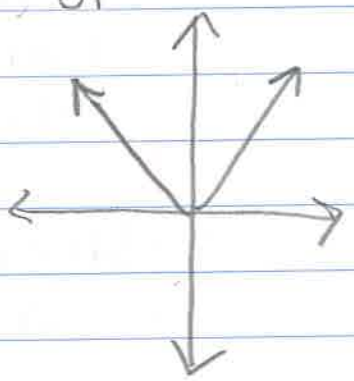
* parabola: the U-shaped curve of a quadratic function

* increasing - the part of the graph where the y-values get larger

* decreasing - the part of the graph where the y-values get smaller

* Cubic Functions
  $y = x^3$

or



Absolute value

$y = |x|$

Linear or Nonlinear Functions

* Review Problem #1 on pg. 247

* Is the change in the values of x & y constant in both tables?

Table 1 (Pizza Area): No, the change in radius is constant, but the change in area is not

Table 2 (Sauce Cost): Yes, the change in weight & the change in cost is constant.

* What is the cost for 11oz. of pizza sauce?
$4.40
(Every 2oz. cost $0.80, therefore, $4.00 + 0.40 for 1oz = $4.40).

* Which graph is a linear function?
Sauce Cost

* Got it? #1) a) See attached graph

b) No, the denominator of the fraction will get larger & larger (you can always multiply a number by $\frac{1}{2}$), so the value of the fraction will approach 0 but never reach it.

Representing Patterns & Nonlinear Functions

* Review Problem 2 on pg. 248

* Is the functional relationship shown in the table a linear function?
  No, because the change in x (# of blocks on edge) is constant, but the change in y (total # of blocks) is not.

* Got it? #2) (4, 81), (5, 243)

WORDS => The number of new branches is 3 raised to the x^{th} power.
(Example $3^4 = 81$
$3^5 = 243$)

EQUATION => $y = 3^x$

GRAPH => See attached

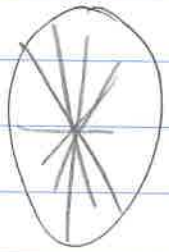
* A nonlinear function can be described in words or with an equation, just like a linear function.

Writing a Rule to Describe a Nonlinear Function

* Problem 3 on pg. 249

* Write a rule based on the first two rows & then see if the rule works for the other rows

* Got it? #3



- What pattern exists with the x-values?
  increase by 1
- what pattern exists with the y-values?
  increases but not at a constant rate
- Is there a mathematical operation, sequence of operations, or correlation between each x & y value?
  Yes, y is x^2

Rule $\Rightarrow$ $y = x^2$

Name _____ Class _____ Date _____

4-3 Standardized Test Prep

Patterns and Nonlinear Functions

Multiple Choice

For Exercises 1–5, choose the correct letter.

1. Which ordered pair represents a linear function?
   - **A.** $(-2, -15)$, $(-1, -9)$, $(0, -3)$, $(1, 3)$, and $(2, 9)$
   - **B.** $(-2, 4)$, $(-1, 1)$, $(0, 0)$, $(1, 1)$, and $(2, 4)$
   - **C.** $(-2, -1)$, $(-1, -4)$, $(0, -5)$, $(1, -4)$ and $(2, -1)$
   - **D.** $(-2, -8)$, $(-1, -1)$, $(0, 0)$, $(1, 1)$, and $(2, 8)$

2. The following ordered pairs represent a function: $(-2, 10)$, $(-1, 7)$, $(0, 6)$, $(1, 7)$, and $(2, 10)$. Which equation could represent the function?
   F. $y = -4x + 2$ **G.** $y = x^2 - 6$ **H.** $y = 5x$ **I.** $y = x^2 + 6$

3. Which rule could represent the function shown by the table at the right?
   - **A.** $y = -x^3$
   - **B.** $y = x^2 + 1$
   - **C.** $y = -x^2 + 1$
   - **D.** $y = -x - 1$

x	y
−2	−3
−1	0
0	1
1	0
2	−3

4. The ordered pairs $(-1, 1)$, $(0, 2)$, $(1, 1)$, $(2, -2)$, and $(3, -7)$ represent a function. Which rule could represent the function?
   F. $y = -x^2 - 2$ **G.** $y = -x^2 + 2$ **H.** $y = x^2 - 2$ **I.** $y = x^2 + 2$

5. Which ordered pair represents a nonlinear function?
   - **A.** $(0, 0)$, $(1, 1)$, $(2, 2)$, $(3, 3)$, and $(4, 4)$
   - **B.** $(0, 0)$, $(1, -1)$, $(2, -2)$, and $(4, -4)$
   - **C.** $(0, -1)$, $(1, 0)$, $(2, 1)$, $(3, 2)$, and $(4, 3)$
   - **D.** $(0, 0)$, $(1, 1)$, $(2, 8)$, $(3, 27)$, and $(4, 64)$

Short Response

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

x	1	2	3	4
y	−9	−8	−5	0

#5, 6-12 even & 4.3 Stand. prepwksht.

* Need Cal graph paper for students (1) sheet

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(#5) The equation for the table should be $y = x^2 + 1$

(• x values are constant by +1
• y values increase by are not constant
• relationship b/t x & y $\Rightarrow x^2 + 1$)

(#6) Linear Function

(#8) Linear Function (graphs attached)

(#10) Nonlinear

(12)

Figure #	total sm △	ordered pair
4	48	(4, 48)
5	75	(5, 75)

$y = 3x^2$ (See graph)

(14)

x	y
1	2/3
2	4/9
3	8/27
4	16/81
5	32/243

$y = \left(\frac{2}{3}\right)^x$

(16)

x	y
0	0
1	0.5
2	2
3	4.5
4	8

$y = 0.5x^2$

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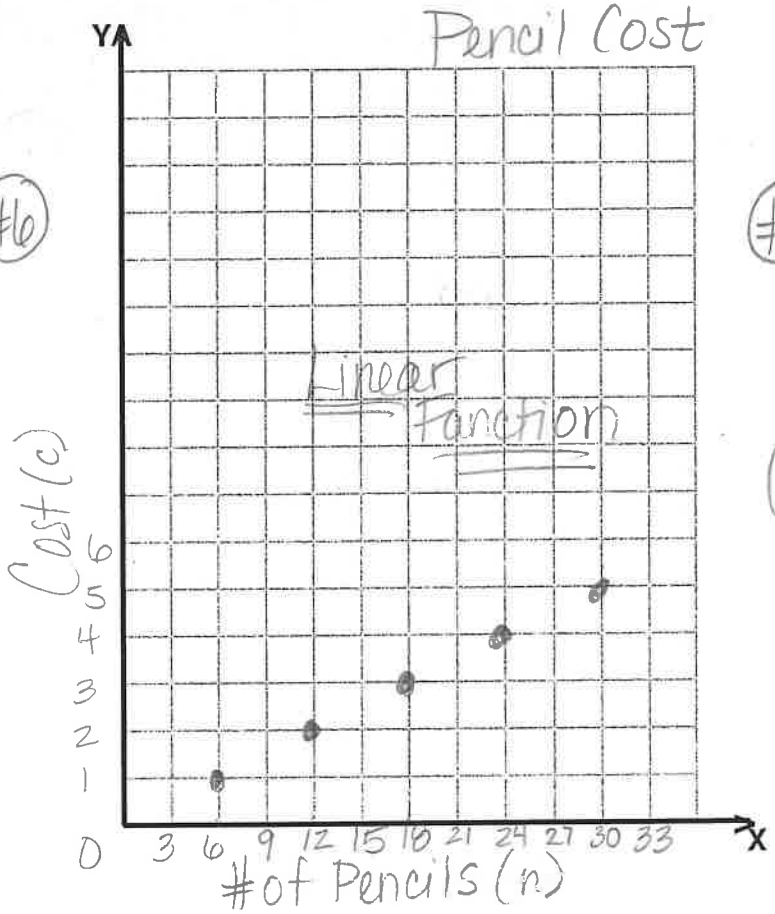
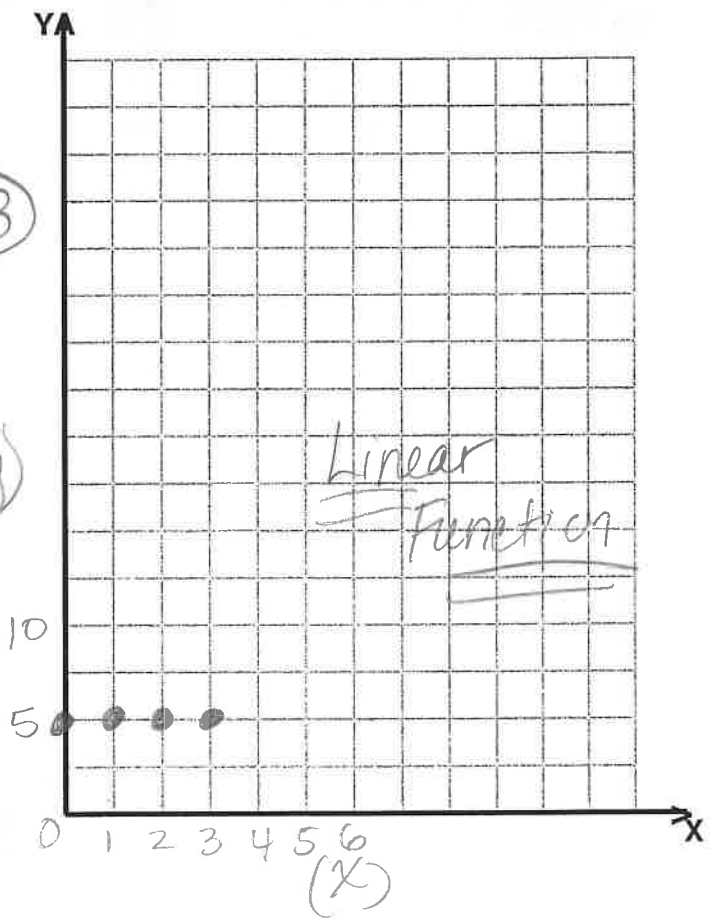
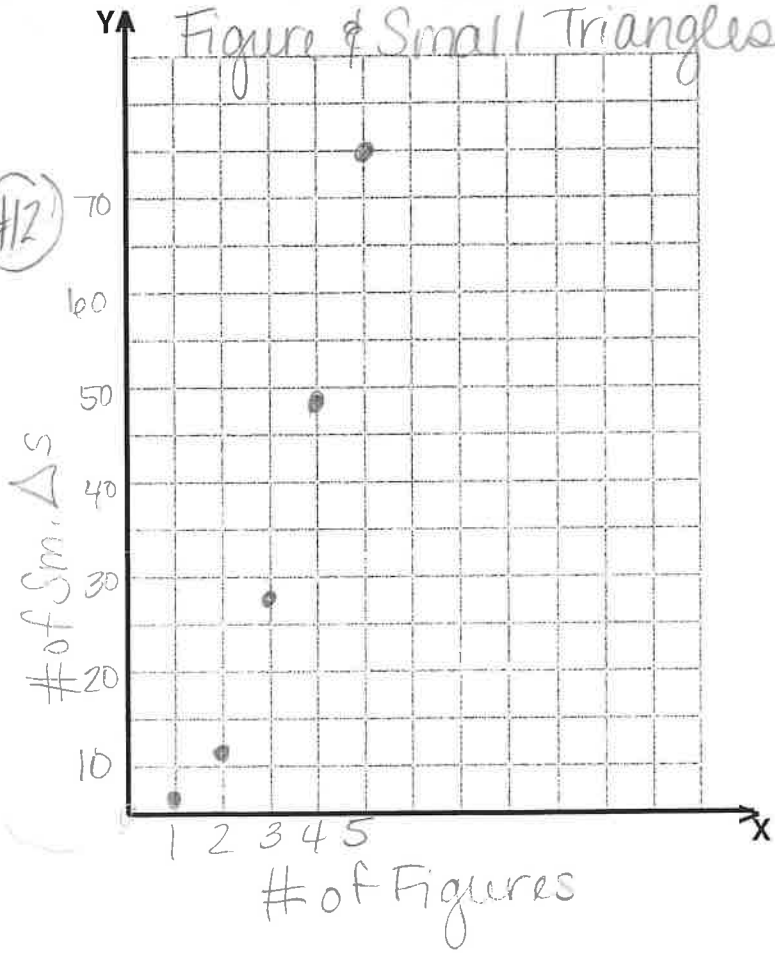
#6

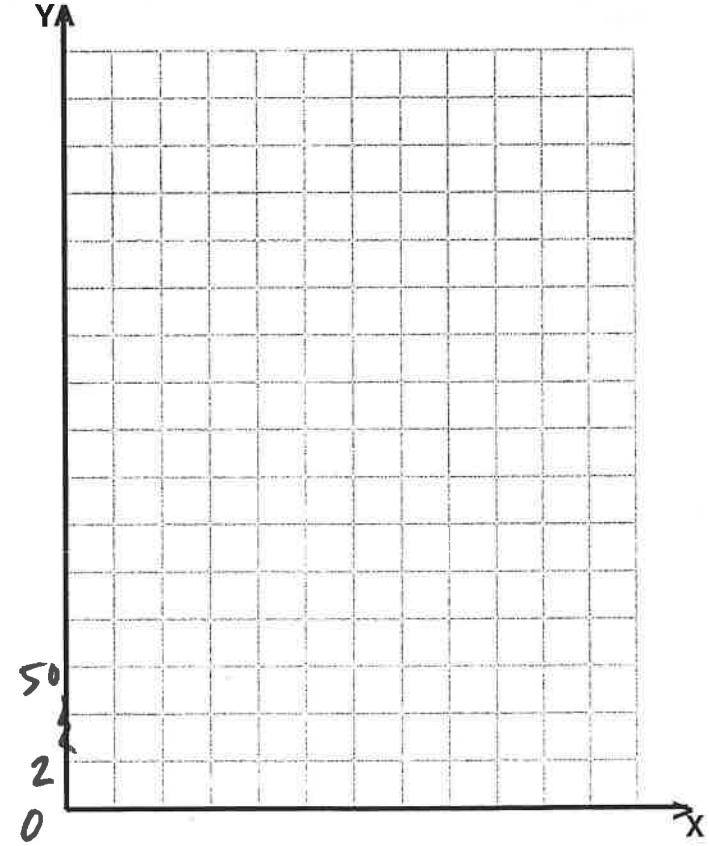


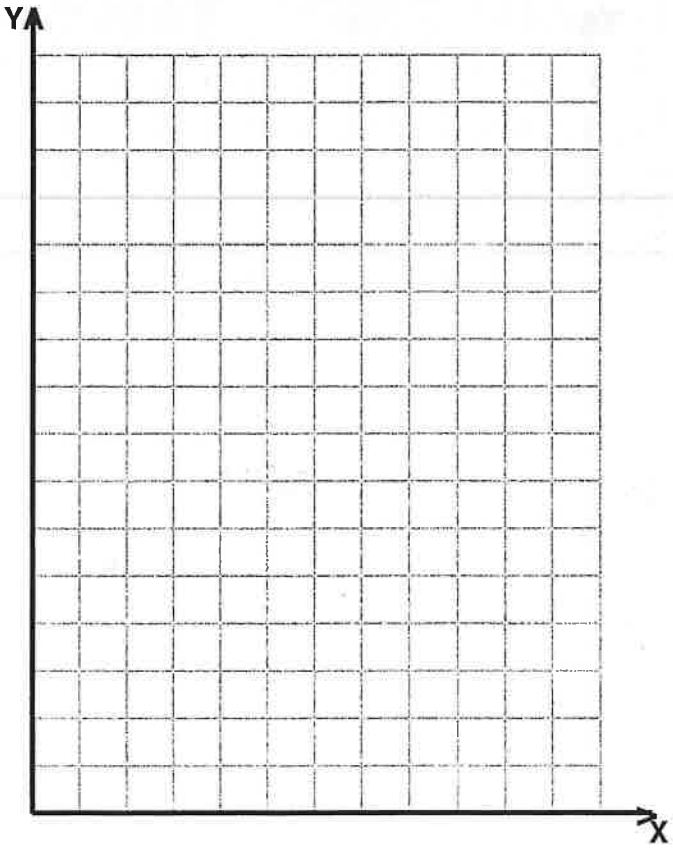
#8

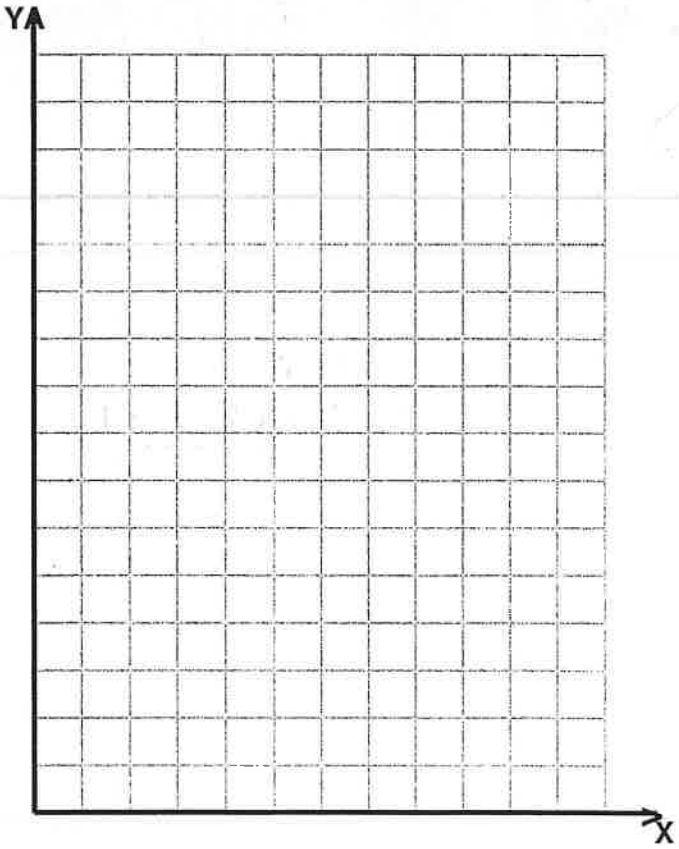


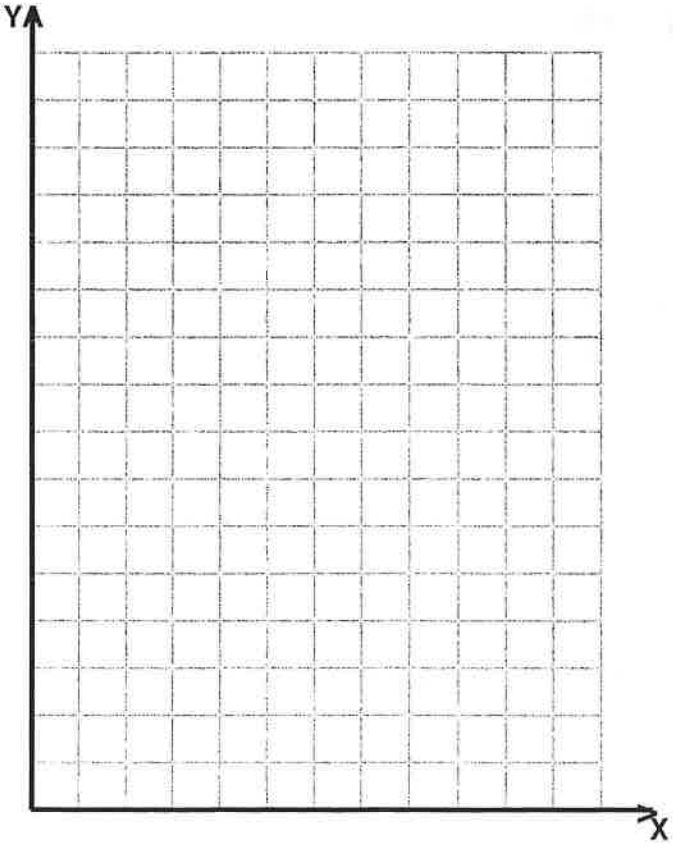
#12

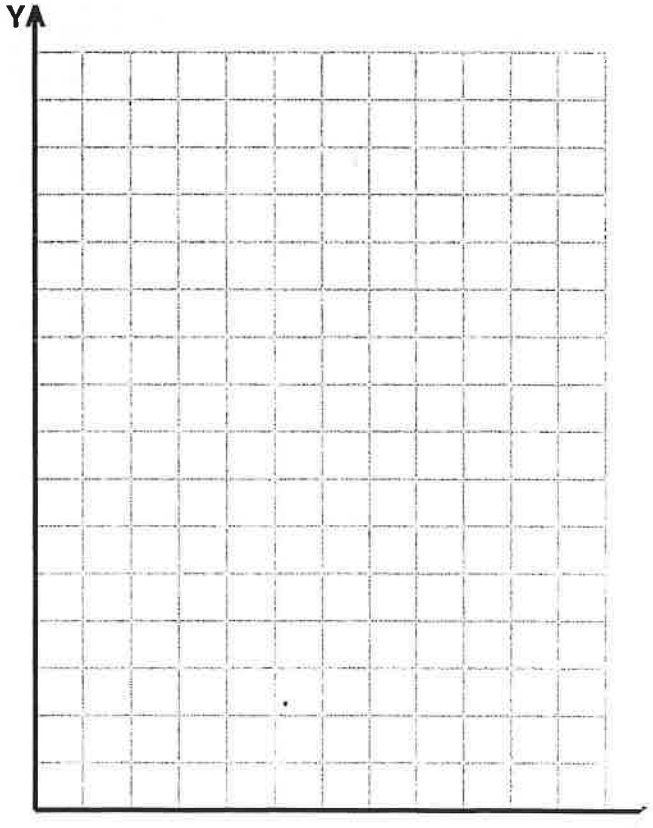






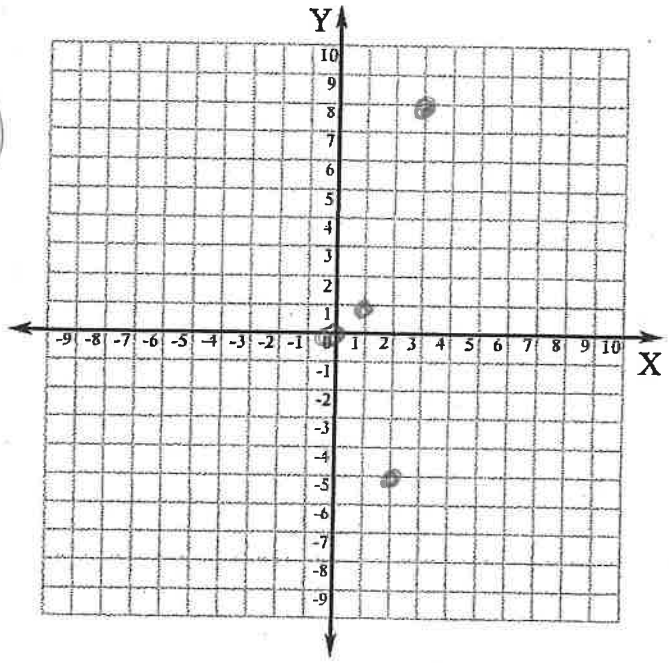


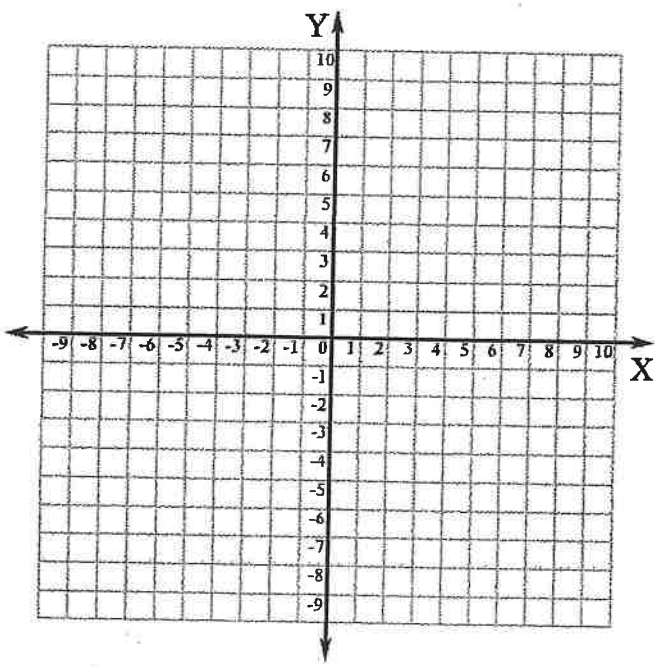


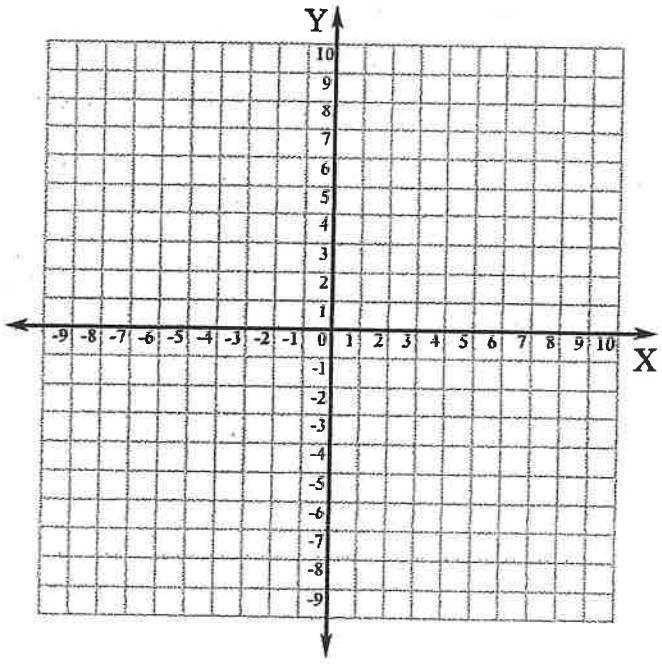


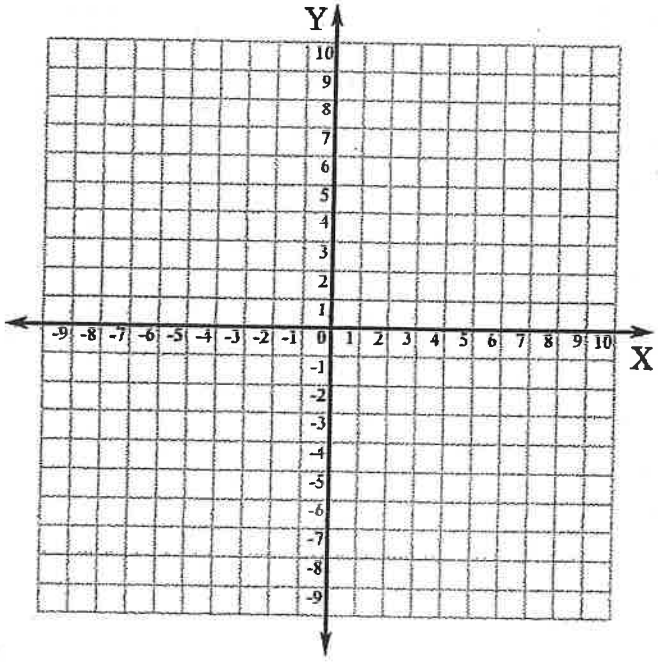
Non-linear

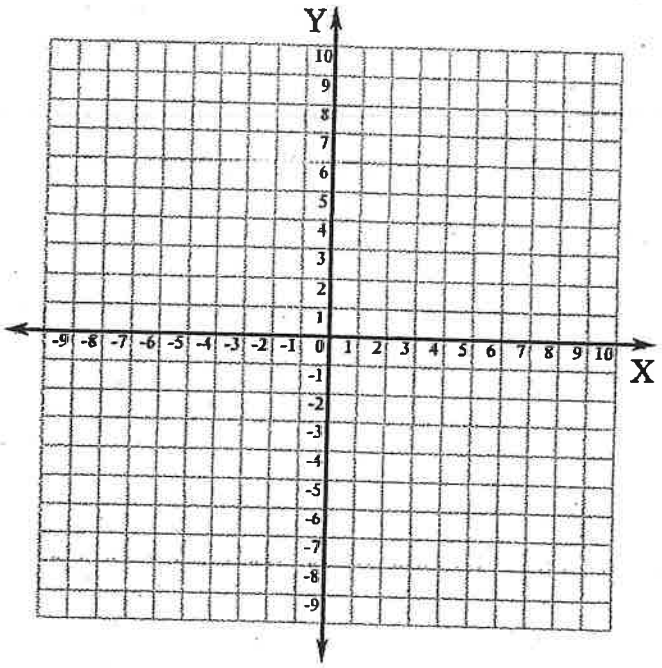
#10

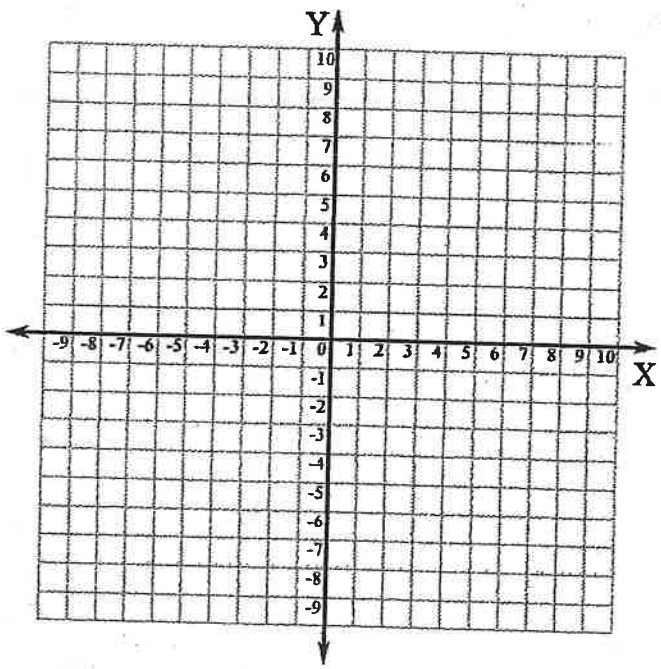









Y
X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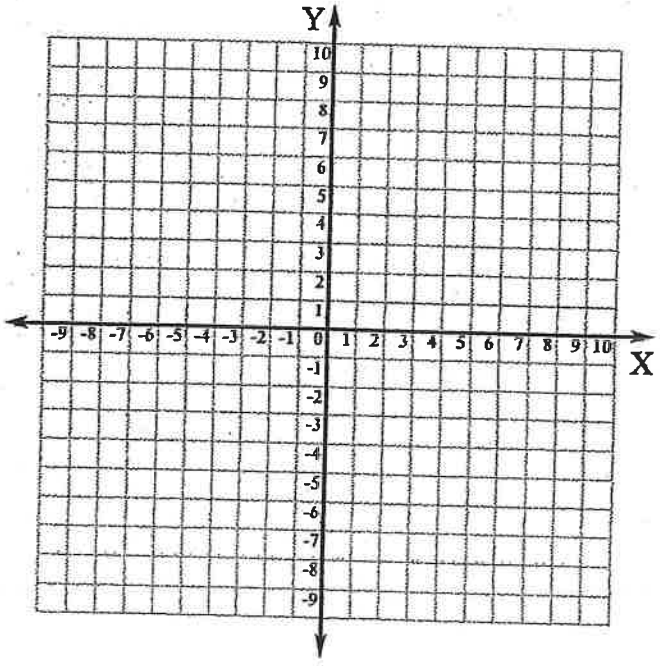
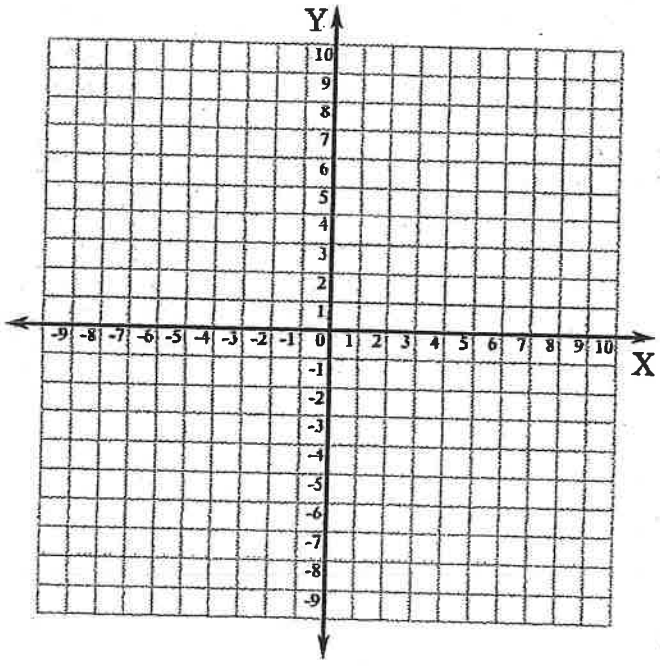
X


Y
X


Y
X

Name Key Class _____ Date _____

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Short Response

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

Nonlinear

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y	−9	−8	−5	0