M10 - 6.1 - Determining if a Relation is Linear Notes

Method 1: Using a table of values

	x	y	
	-4	0	
$+2$			$+3$
	-2	3	
$+2$			$+3$
	0	6	
$+4$			$+6$
	4	12	
$+2$			$+3$
	6	15	

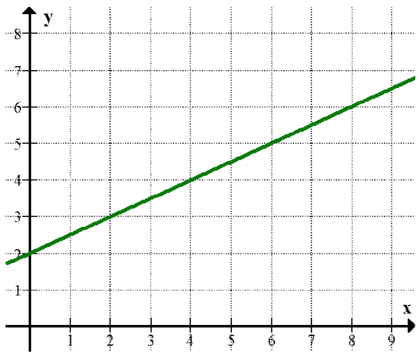
$$If\ the\ fraction\ \frac{\Delta y}{\Delta x} = \frac{\Delta y}{\Delta x},\ it\ is\ linear.$$

$$\frac{3}{2} = \frac{3}{2},\ it\ is\ linear$$

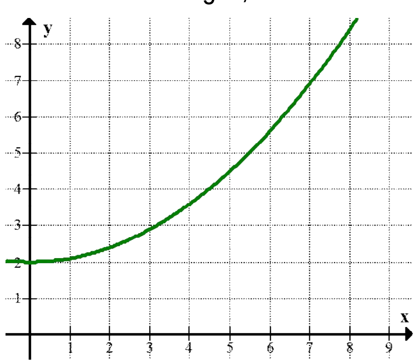
$$\frac{3}{2} = \frac{6}{4},\ it\ is\ linear$$
$$\frac{3}{2} = \frac{3}{2}$$

Method 2: Using a graph

Continuous (Graph is a line)

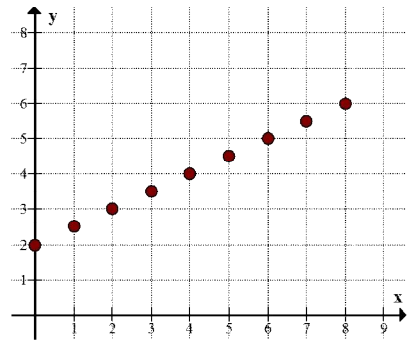


If the line is straight, the relation is linear

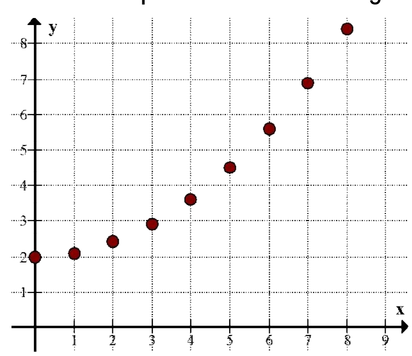


If the line is curved, or kinked, the relation is non-linear

Discrete (Graph is a series of points)



If the data points are in a straight line, the relation is linear



If the data points are not in a straight line, the relation is non-linear

Method 3: Inspecting an equation

If the equation is degree 0 or 1, the equation is linear. (i.e. the exponents on all variables in the equations are 0 or 1)

Examples:

$y = 3x + 1$ $\quad$ $y - 2x = 3$ $\quad$ $2y + 3x - 4 = 0$

If the equation is not degree 1, the equation is non-linear.

Examples:

$y = x^2$ $\quad$ $y^2 + x^2 = 1$ $\quad$ $y = x^3 - 2x + 4$

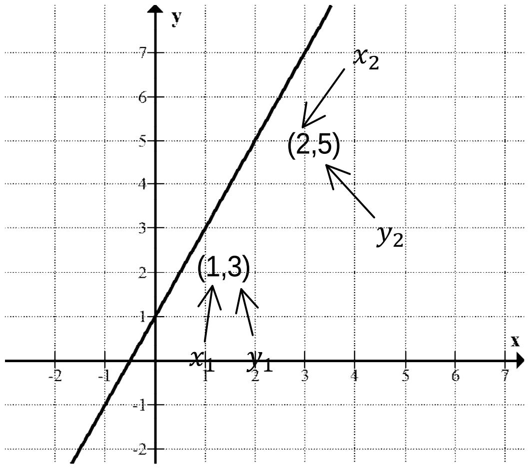
M10 - 6.2 - Slope Formula Notes

$$Slope = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

Vertical distance ($y_2 - y_1$)

Horizontal distance ($x_2 - x_1$)

What is the slope of the line $y = 2x + 1$? Find it using positive points.



$$Slope = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

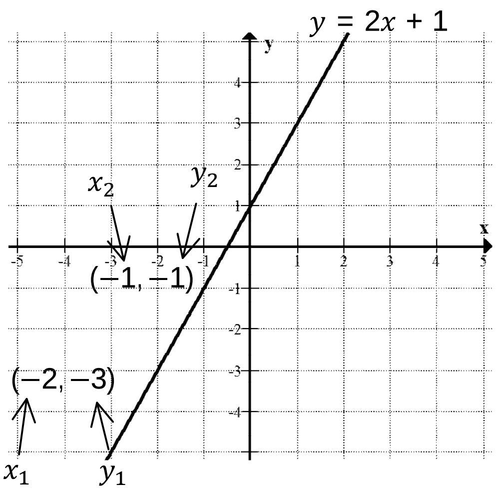
$$= \frac{5 - 3}{2 - 1}$$

$$= \frac{2}{1}$$

Slope $= 2$

Notice: the slope is the number in front of the x.

What is the slope of the line $y = 2x + 1$? Find it using negative points.



$$Slope = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

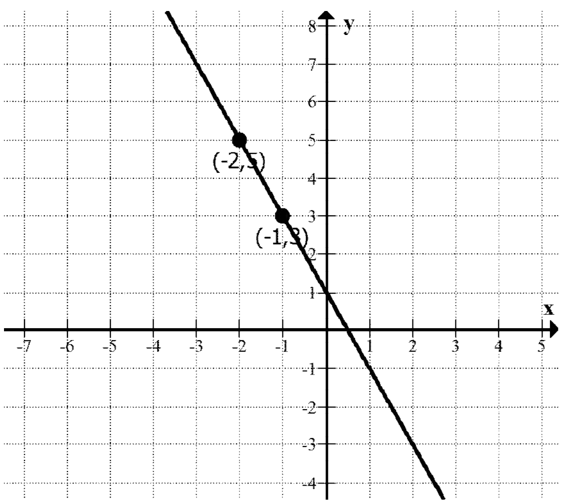
$$= \frac{(-1) - (-3)}{(-1) - (-2)}$$

$$= \frac{-1 + 3}{-1 + 2}$$

$$= \frac{2}{1}$$

Slope $= 2$

What is the slope of the line $y = -2x + 1$?



$$Slope = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

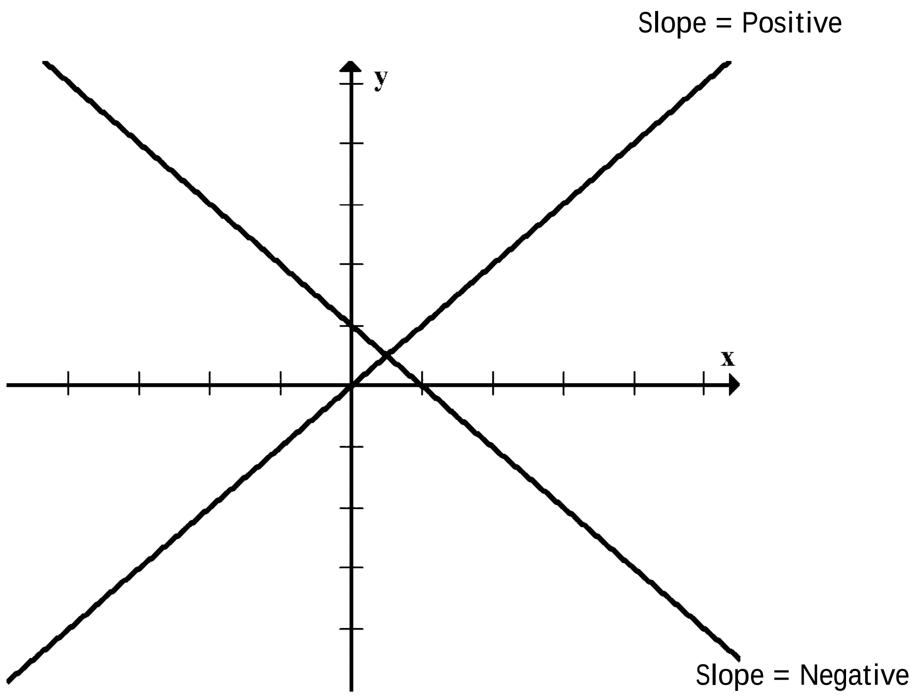
$$= \frac{5 - 3}{-2 - -1}$$

$$= \frac{2}{-1}$$

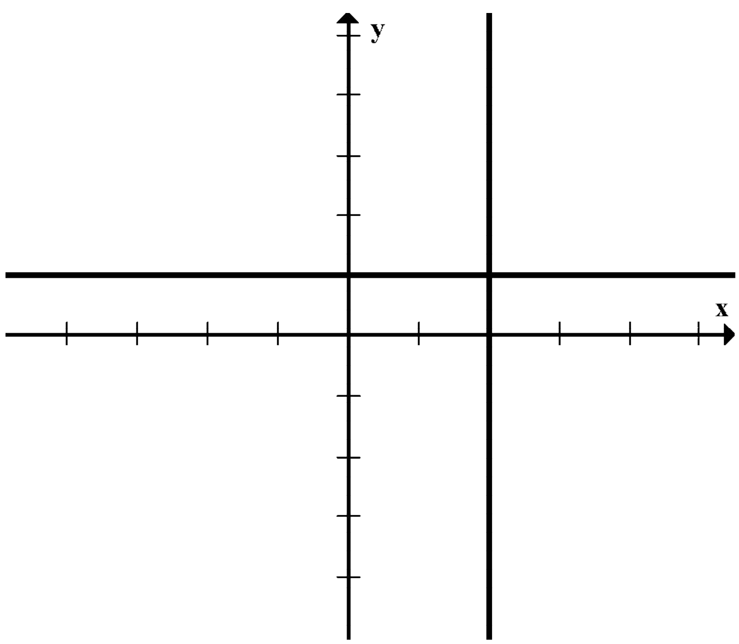
Slope $= -2$

Notice: the slope is the number in front of the x.

M10 - 6.2 - Pos, Neg, Zero, DNE Slope Notes



Slope = DNE $\quad m = \dfrac{rise}{run} = \dfrac{5}{0}, \dfrac{2}{0}, \dfrac{x}{0} = DNE$



Slope = Zero $\quad m = \dfrac{rise}{run} = \dfrac{0}{5}, \dfrac{0}{2}, \dfrac{0}{x} = 0$

M10 - 6.3 - Domain Range Notes

Domain: all possible x values.

Range: all possible y values.

<u>Expressing the domain:</u>

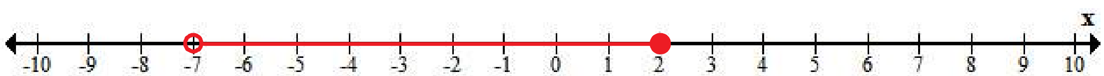
Method 1: In Words

x can be greater than -7 and less than or equal to 2.

Method 2:Number Lines

○ Open circles: value *is not* in the domain.

● Closed circles: value *is* in the domain.



The values of x that are allowed are all numbers that are greater than -7 and less than or equal to 2.
Note: x cannot equal -7, x *can equal* 2

Method 3: Interval Notation

Domain: $(-7,2]$

$\leq, \geq$	●	[ ]	———
Included		(closed, square, solid)	
$<, >$	○	( ) $(-\infty, \infty)$	– – – –
Not Included		(open, round, dotted)	

Method 4: Set Notation

Domain: $\{\, x \mid x > -7, x \leq 2, x \in \mathbb{R}\}$

$x > -7$ $x \leq 2$
$-7 < x$ $x \leq 2$
$7 < x \leq 2$

Method 5: A List

Eg. Domain is 0, 1, 2, 3, 4, 5.

This is useful when the data is discrete.

M10 - 6.3 - Number Line: Domain Notes

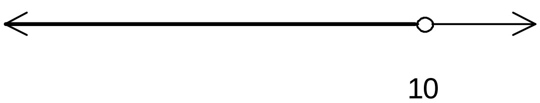
What is the domain of the following? In words, interval notation, set notation, and a list where necessary.

Words: Any real number greater than or equal to -2 and less than or equal to 10

Interval Notation: $[-2, 10]$

Set Notation: $\{x| -2 \leq x \leq 10, x \in \mathbb{R}\}$

$-2 \leq x \leq 10$

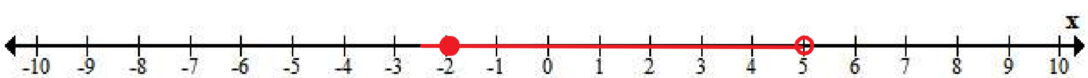


Words: Any real number less than 10

Interval Notation: $(-\infty, 10)$

Set Notation: $\{x|x < 10, x \in \mathbb{R}\}$

$x < 10$

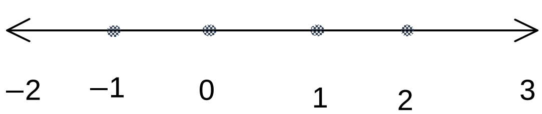


Words: Any real number greater than or equal to -2, and less than 5.

Interval Notation: [-2,5)

Set Notation: $\{x| -2 \leq x < 5, x \in \mathbb{R}\}$

$-2 \leq x < 5$



Words: Any integer greater than or equal to -1 and less than or equal to 2.

Interval Notation: Not an interval

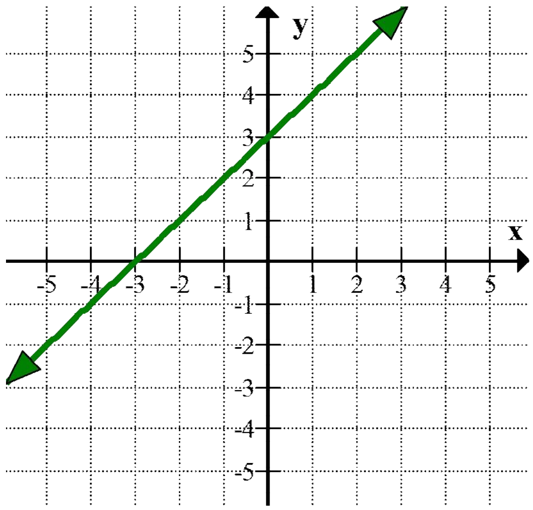
Set Notation: $\{x|-1 \leq x \leq 2, , x \in \mathbb{Z}\}$ $\mathbb{Z} = integers$

List: $\{-1,0,1,2\}$

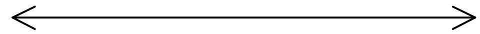
M10 - 6.3 - Graph: Domain and Range Notes

2. What is the domain and range of the following? In words, a number line, interval notation and set notation.

a)



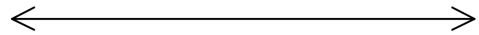
Domain:

Number Line: 

Interval Notation: $(-\infty, \infty)$

Set Notation: $\{x \mid x \in \mathbb{R}\}$

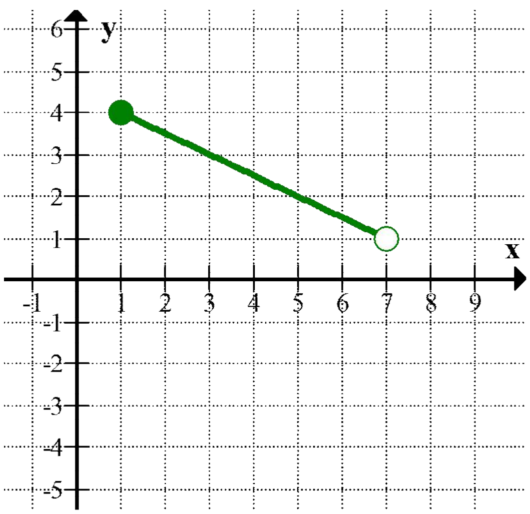
Range:

Number Line: 

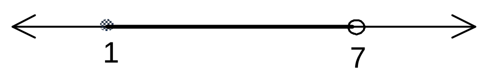
Interval Notation: $(-\infty, \infty)$

Set Notation: $\{y \mid y \in \mathbb{R}\}$

b)



Domain:

Number Line: 

Interval Notation: [1,7)

Set Notation: $\{x \mid 1 \leq x < 7, x \in \mathbb{R}\}$

Range:

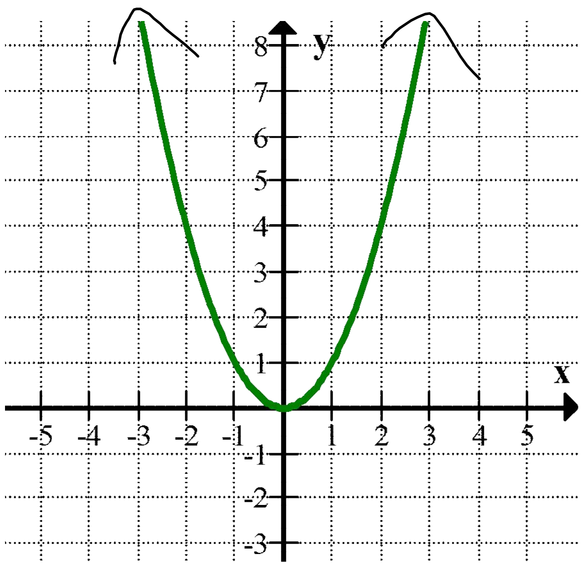
Number Line: 

Interval Notation: (1,4]

Set Notation: $\{y \mid 1 < y \leq 4, x \in \mathbb{R}\}$

M10 - 6.3 - Graph: Domain and Range Notes

c)



Domain:

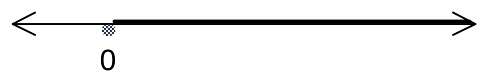
Number Line:

Interval Notation: $(-\infty, \infty)$

Set Notation: $\{x |\ x \in \mathbb{R}\}$

Range:

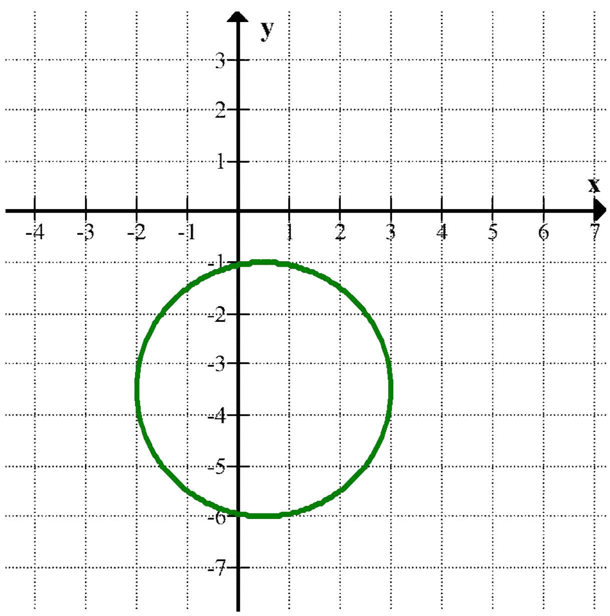
Number Line:



Interval Notation: $[0, \infty)$

Set Notation: $\{y |\ y \geq 0, x \in \mathbb{R}\}$

d)



Domain:

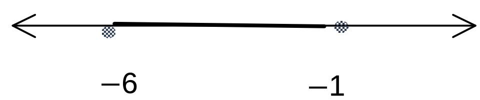
Number Line:

Interval Notation: $[-2,3]$

Set Notation: $\{x | -2 \leq x \leq 3, x \in \mathbb{R}\}$

Range:

Number Line:

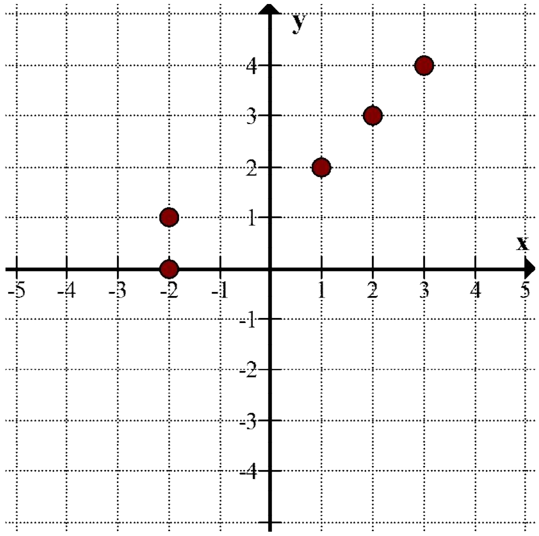


Interval Notation: $[-6, -1]$

Set Notation: $\{y |\ -6 \leq y \leq -1, x \in \mathbb{R}\}$

M10 - 6.3 - Graph: Domain and Range Notes

What is the domain and range of the following? As a list.



Domain: {−2,1,2,3}
Range: {0,1,2,3,4}

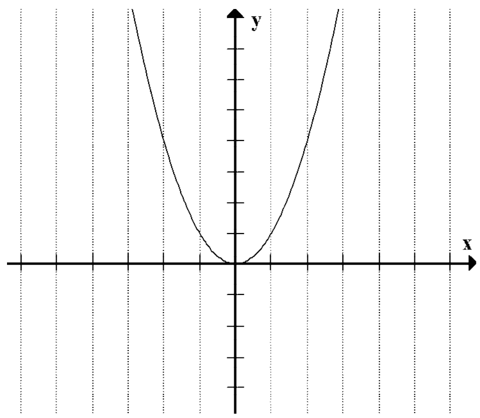
m	n
−4	0
−2	1
0	2
3	7
4	10

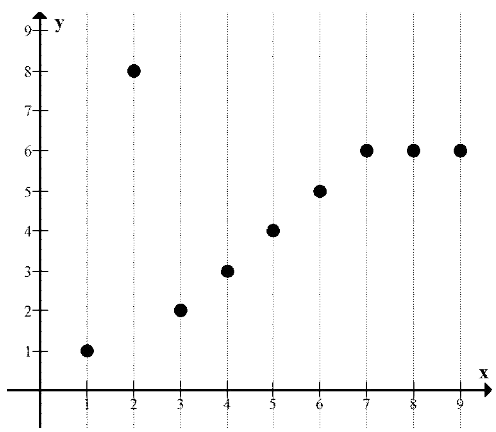
Domain: {, −4, −2,0,3,4}
Range: {0,1,2,7,10}

M10 - 6.4 - Vertical Line Test Notes

A **relation** is a **function** if you run your pencil vertically along the page and only cross the line once.
A **relation** is a **function** if you only have one y value for every x value.
e.g. If you have an x value at $x = 3$, you can only have one y value at $x = 3$.

<u>Is a function</u>

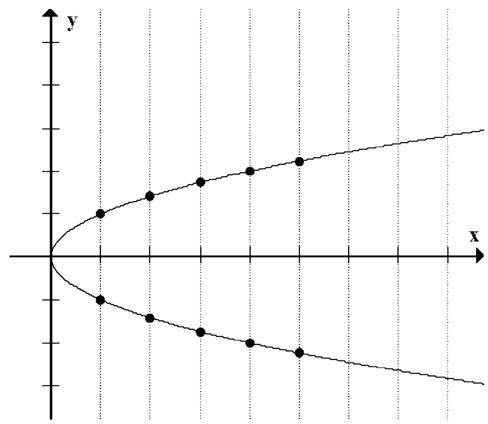


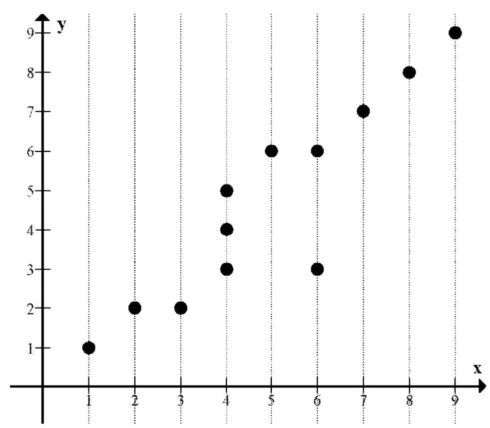


(0,1), (1,2), (2,3), (3,3), (4,5)

x	y
1	1
2	2
4	3
5	6

<u>Is not a function</u>





(0,1), (1,2), (1,3), (2,4), (3,5)

x	y
1	1
2	3
2	5
3	9