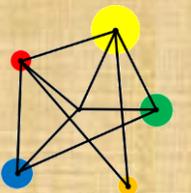


# Straight Line Graphs



Draw a linear graph given in an explicit form ( $y = ax + b$ )

Draw a linear graph given in an implicit form ( $cx + dy = e$ )

Understand and find the gradient of a straight line graph

# Vocabulary

## Graph

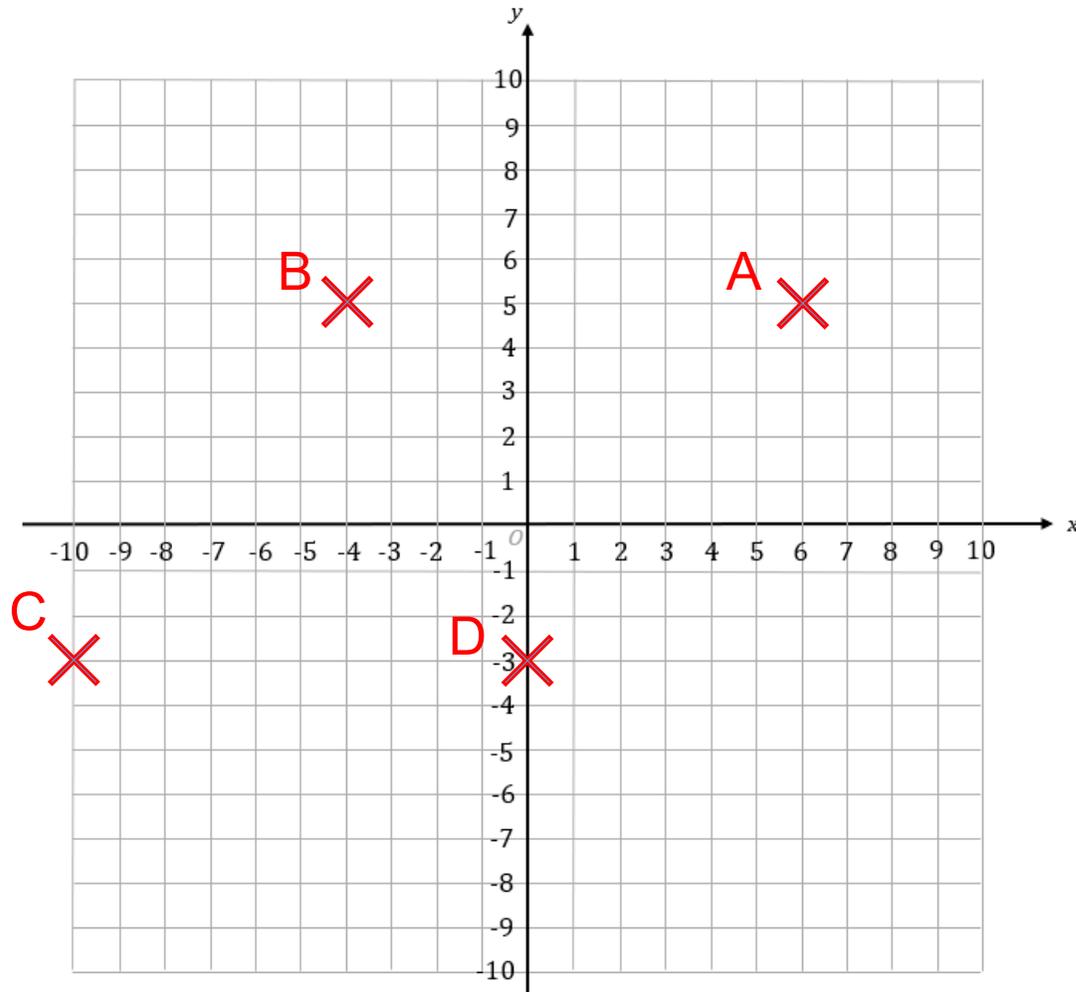
A line or curve drawn through a set of co ordinate points. The points are usually related by an equation.

## Linear

## Gradient

The steepness of a graph.

# Review

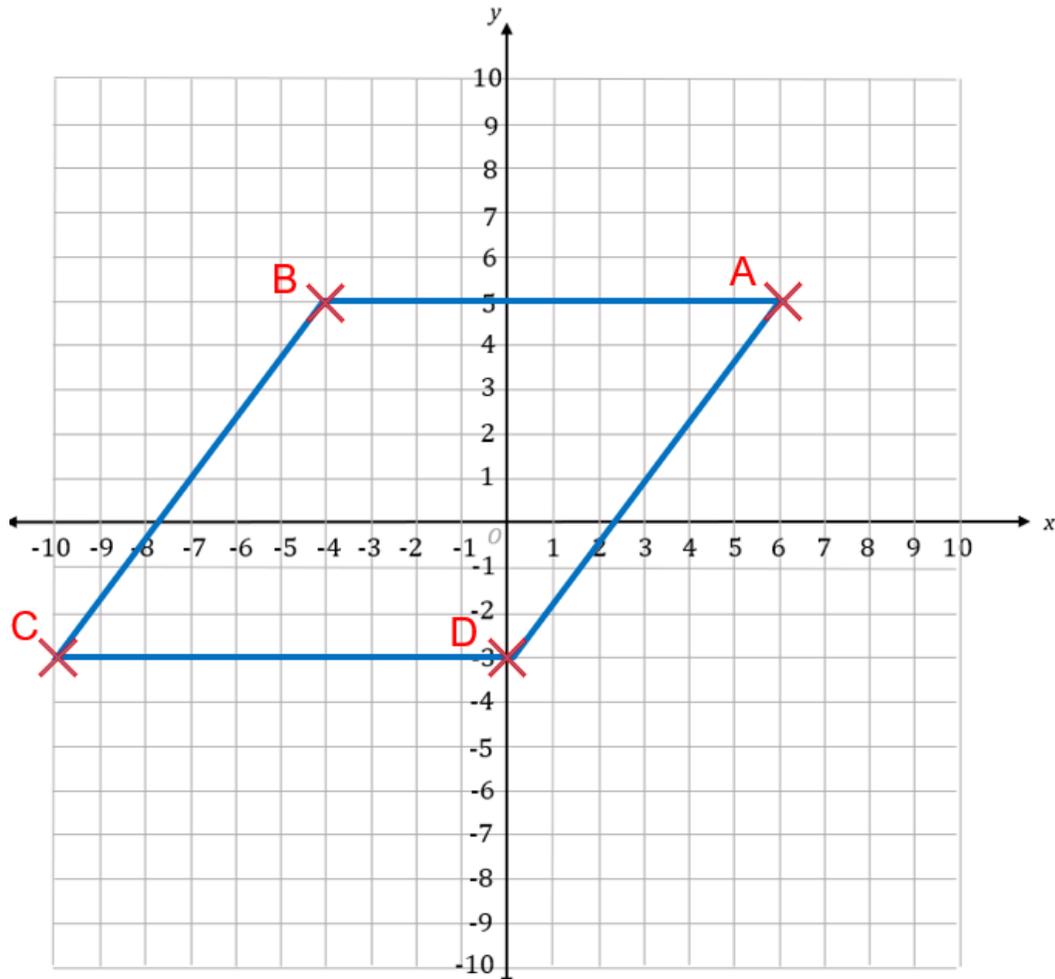


What are the co-ordinates of the points A , B , C and D ?

What is the name of shape ABCD?

What is the area of shape ABCD?

# Solution



Write down the co-ordinates of the points A , B , C and D

**(6 , 5) , (- 4 , 5) , (- 10 , -3 ) , (0 , - 3)**

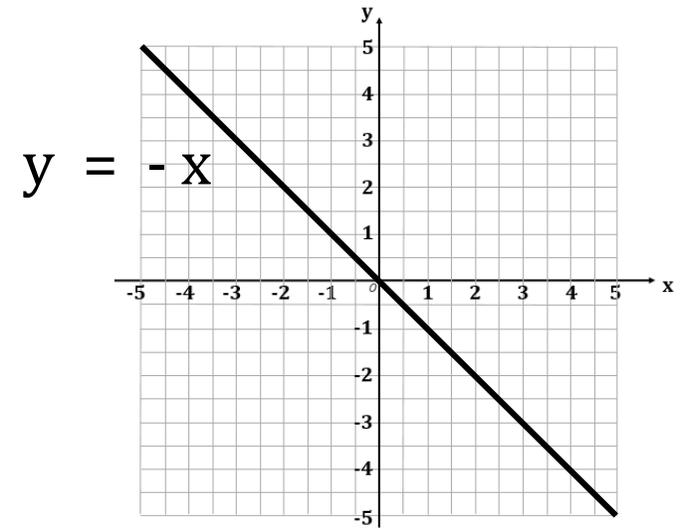
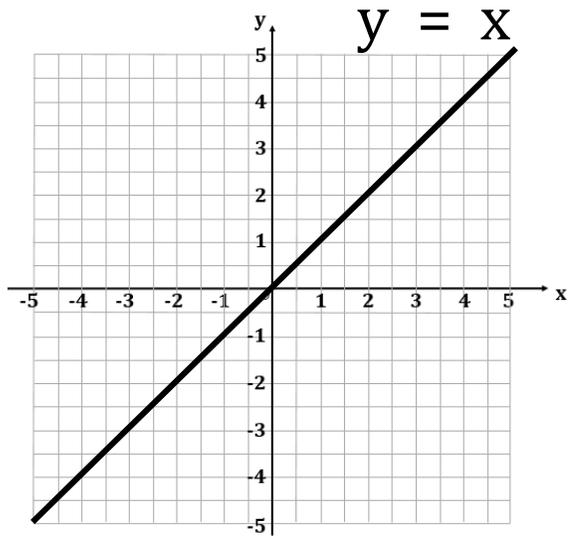
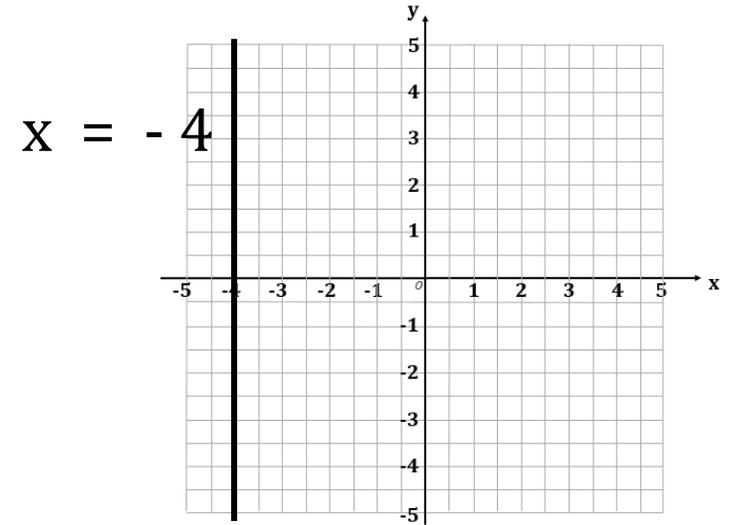
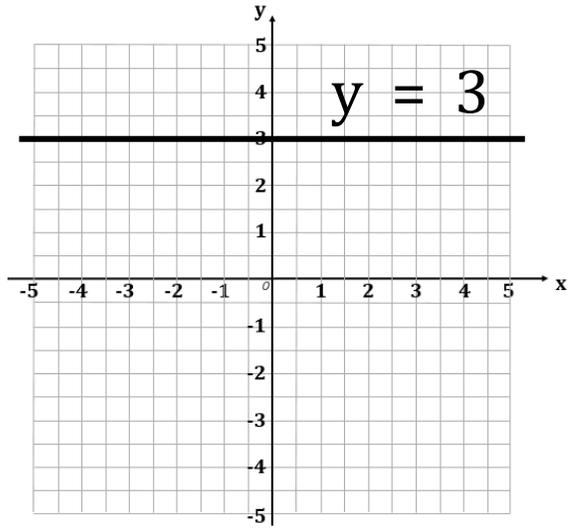
What is the name of shape ABCD?

**Parallelogram**

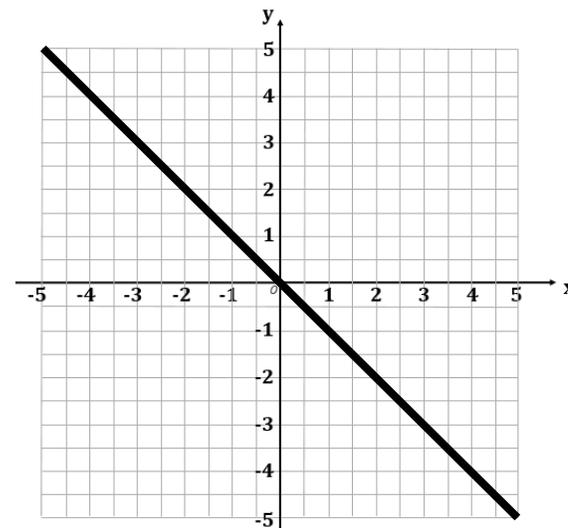
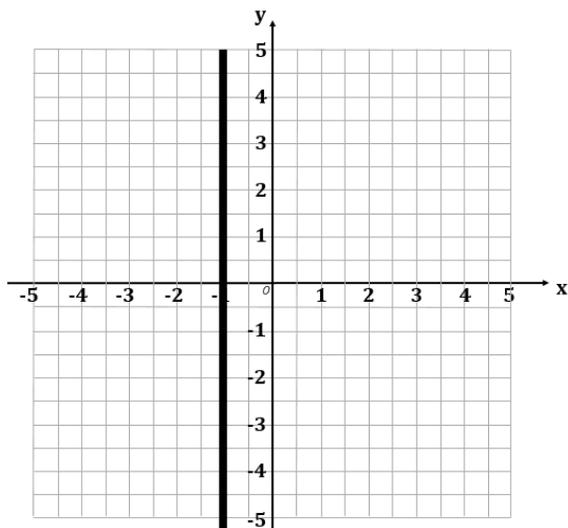
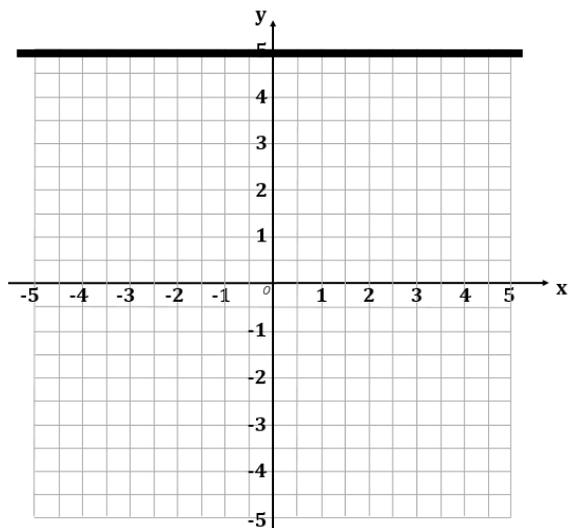
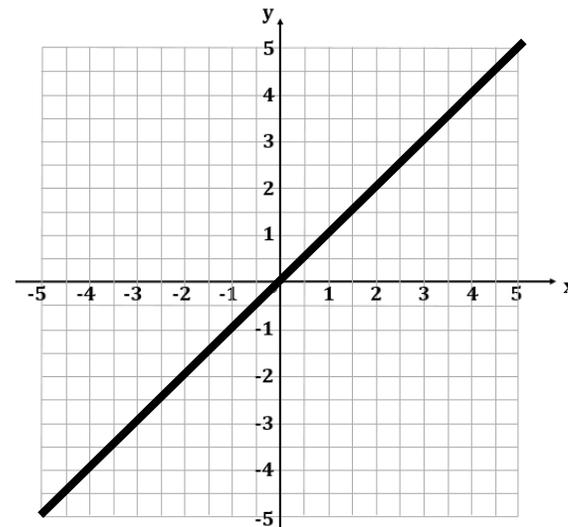
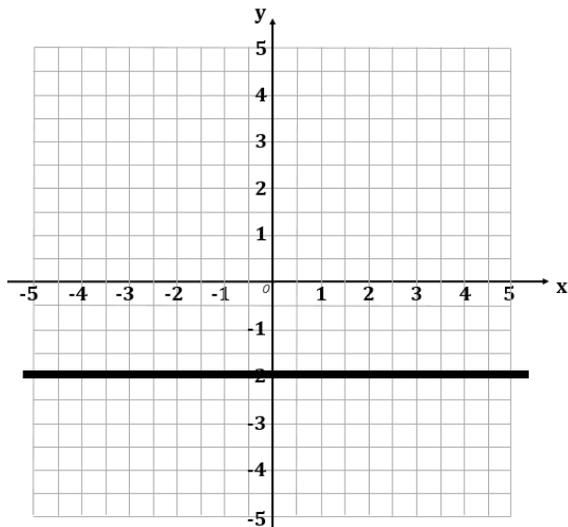
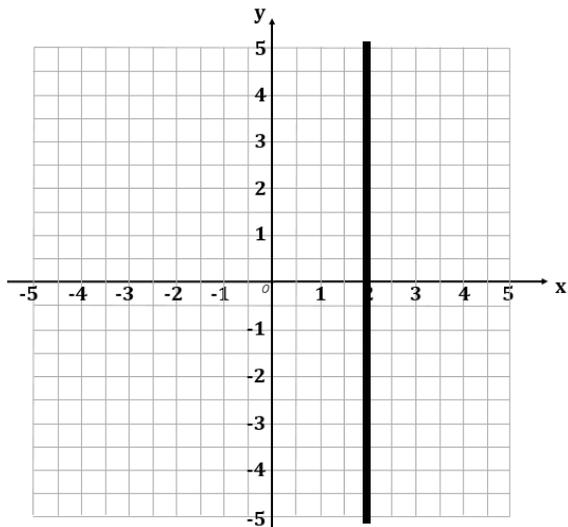
Extension: What is the area of shape ABCD?

**40 square units**

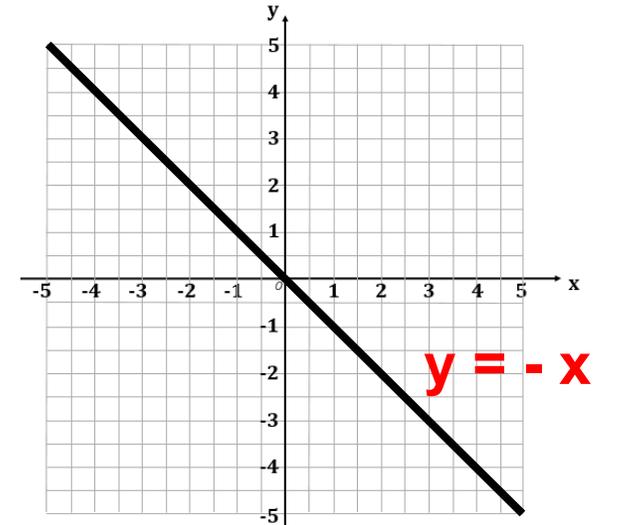
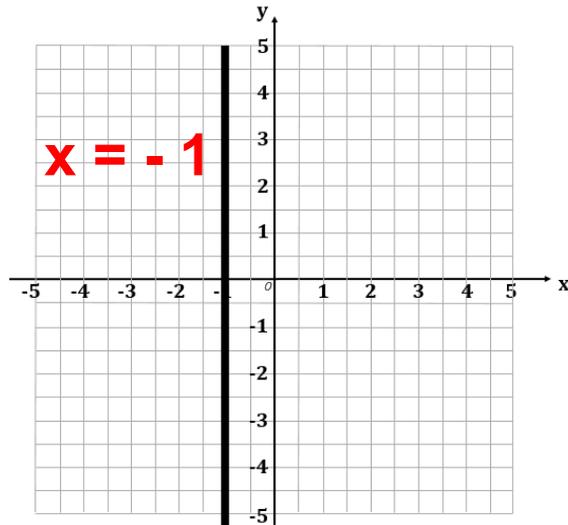
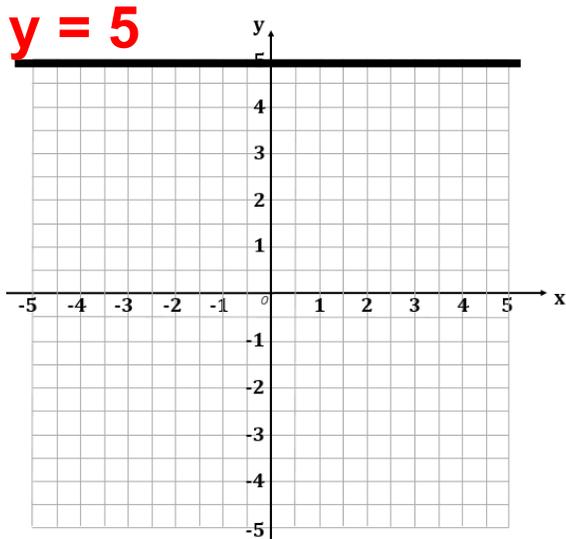
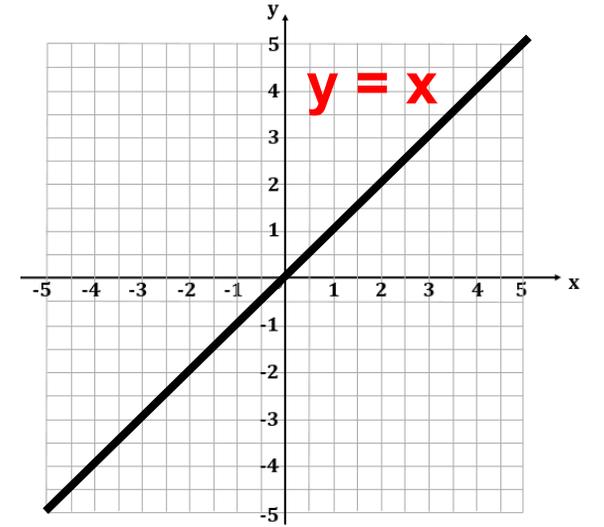
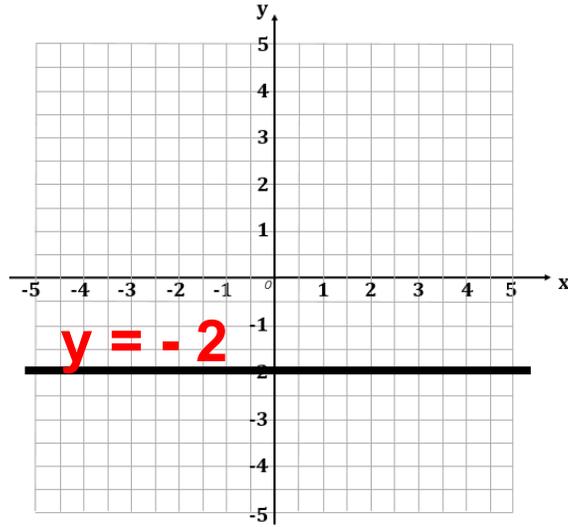
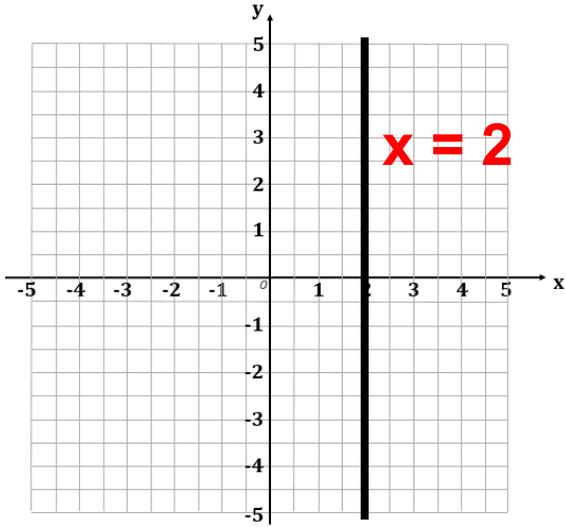
# 4 Important Graphs



Write down the equations of these graphs?



# Solutions



# Example

$$y = 2x + 6$$

Copy and complete the table.

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

If these points were plotted on a coordinate grid, what would this look like?

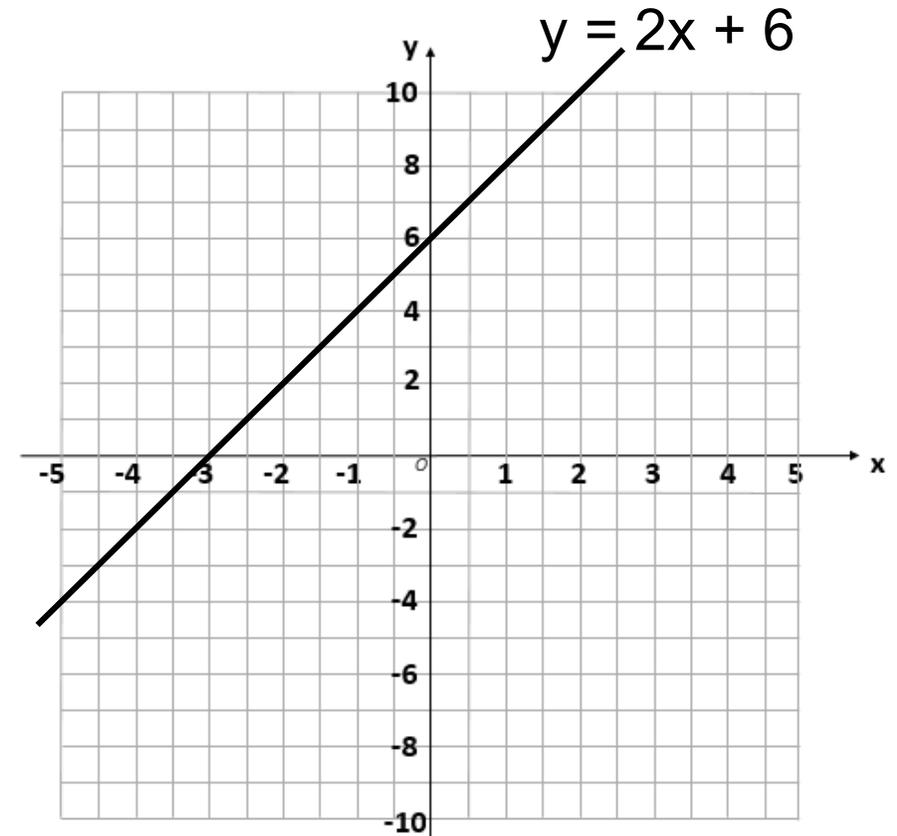
# Solution

$$y = 2x + 6$$

x	-3	-2	-1	0	1	2	3
y	<b>0</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>

The points all lie on a straight line.

We can join the points to make the graph of  $y = 2x + 6$ .



Copy and complete each table using the rule given.

Sketch each graph on a pair of axes.

Which one does not give a straight-line graph?

a)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x</b>			-1				

b)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x + 3</b>			2				

c)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = 2x</b>			-2				

d)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x - 3</b>		-5					

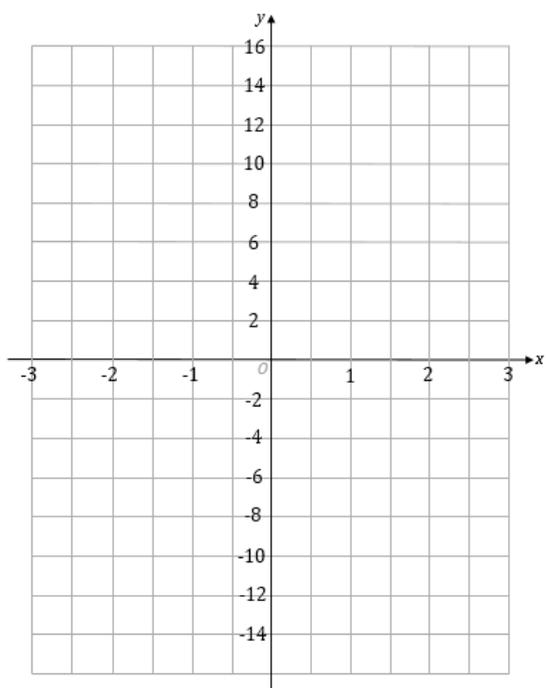
e)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = <math>\frac{1}{2}x + 2</math></b>		1					

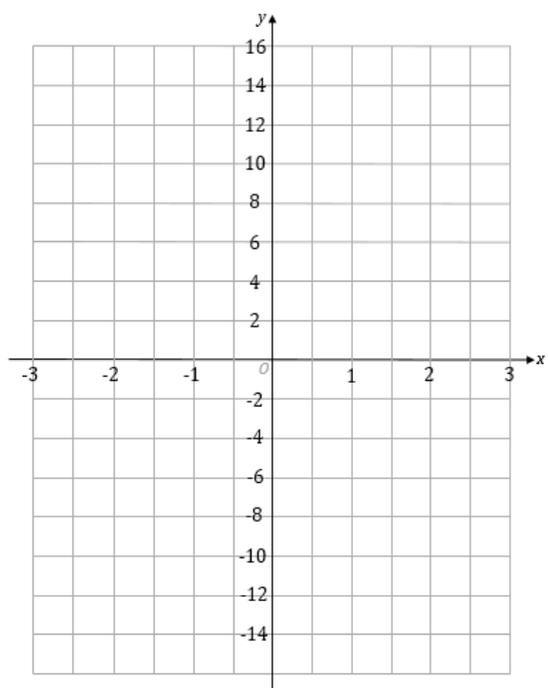
f)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x<sup>2</sup></b>			1				

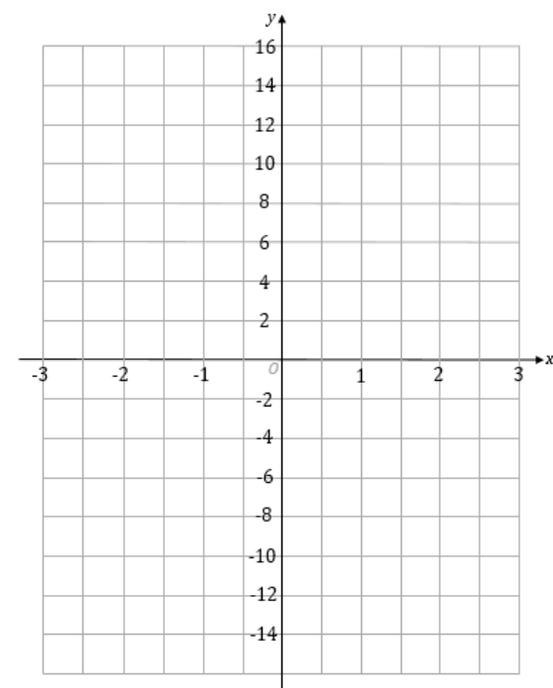
a)



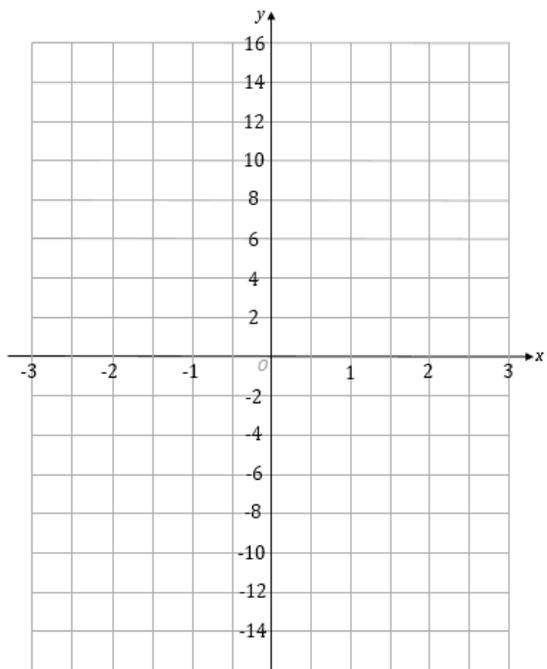
b)



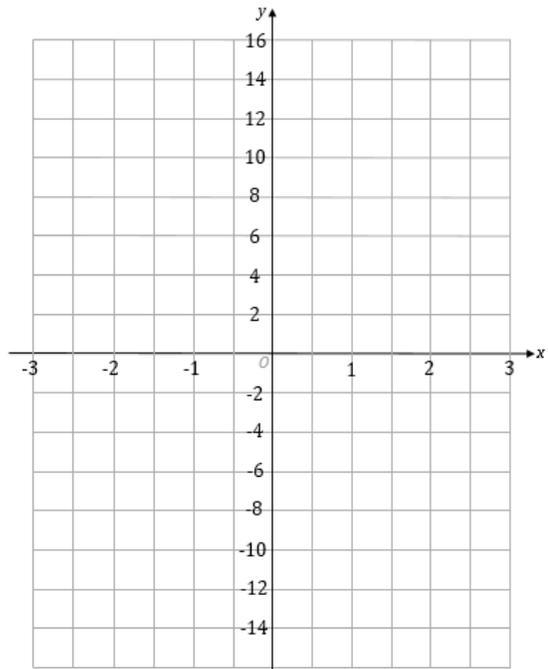
c)



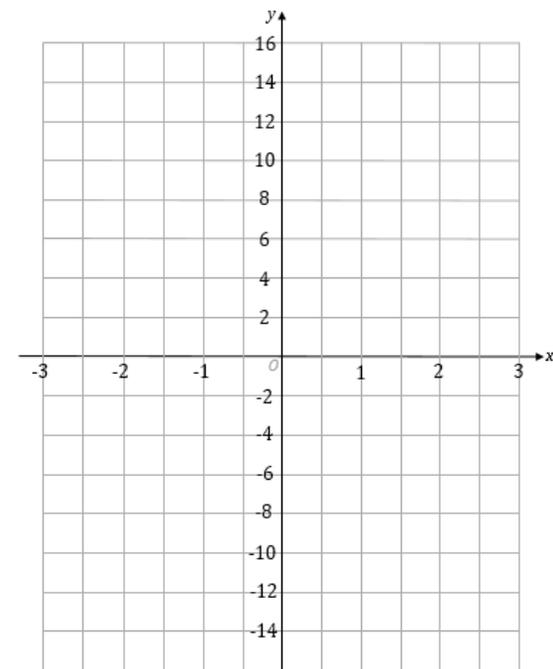
d)



e)



f)



Copy and complete each table using the rule given.

Sketch each graph on the sheet.

Which one does not give a straight-line graph?

a)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x</b>	<b>-3</b>	<b>-2</b>	-1	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>

b)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x + 3</b>	<b>0</b>	<b>1</b>	2	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>

c)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = 2x</b>	<b>-6</b>	<b>-4</b>	-2	<b>0</b>	<b>2</b>	<b>4</b>	<b>6</b>

d)

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y = x - 3</b>	<b>-6</b>	-5	<b>-4</b>	<b>-3</b>	<b>-2</b>	<b>-1</b>	<b>0</b>

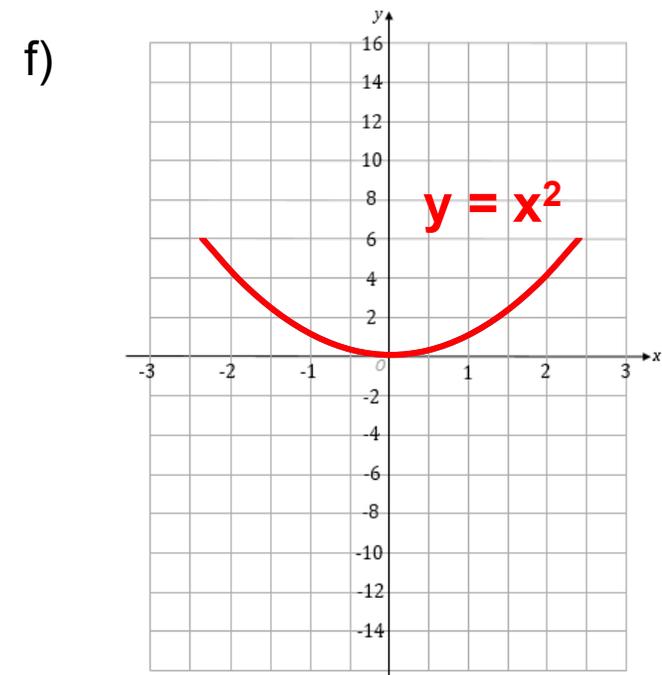
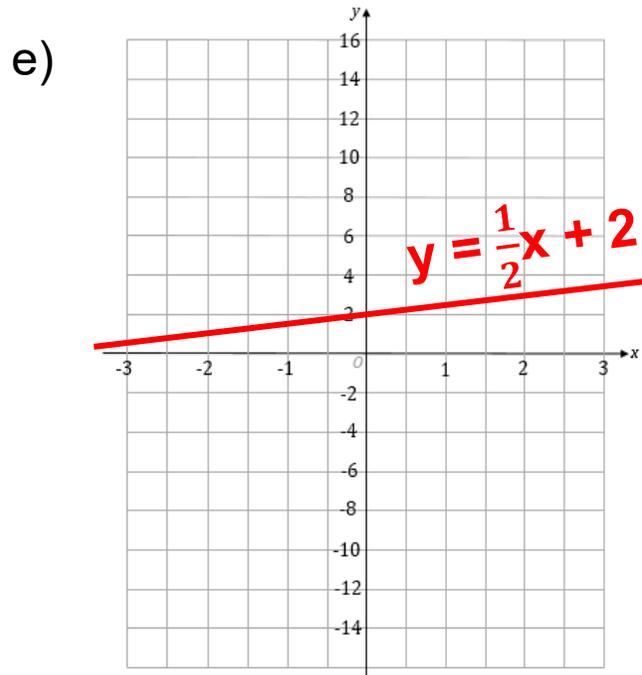
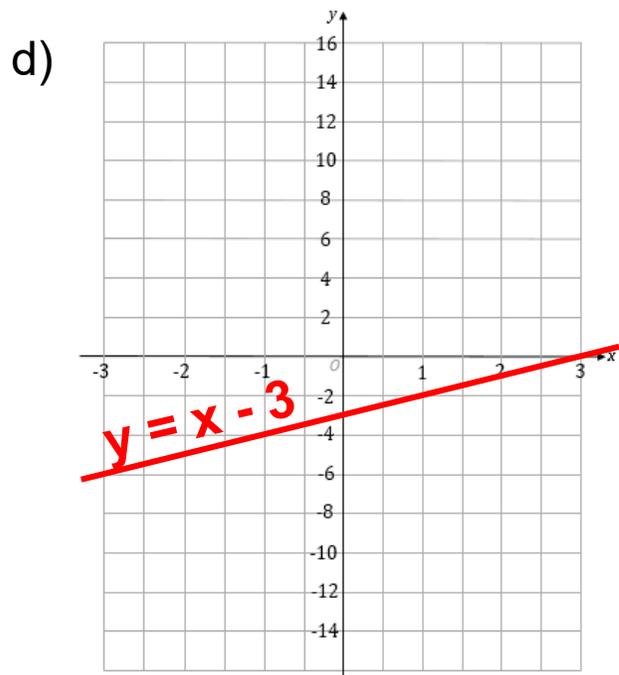
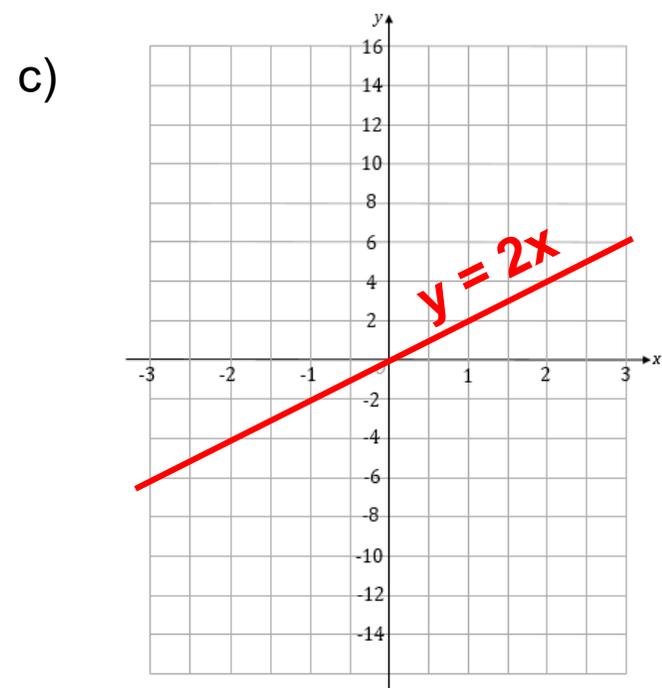
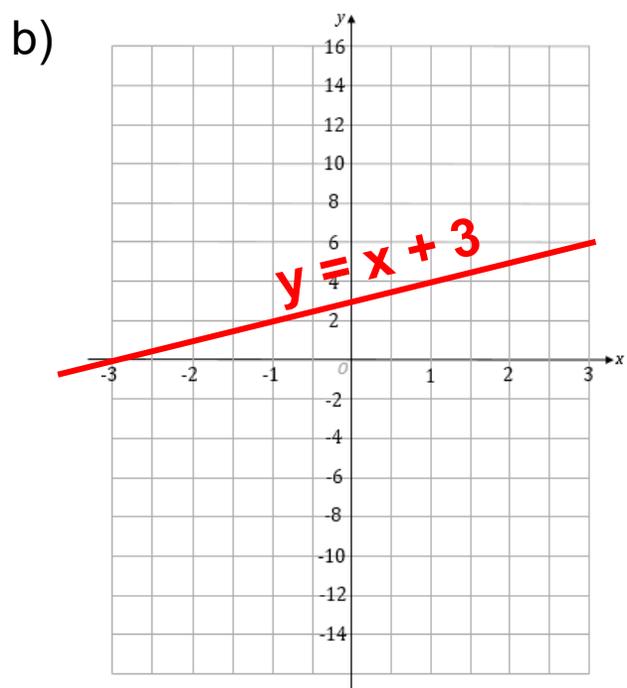
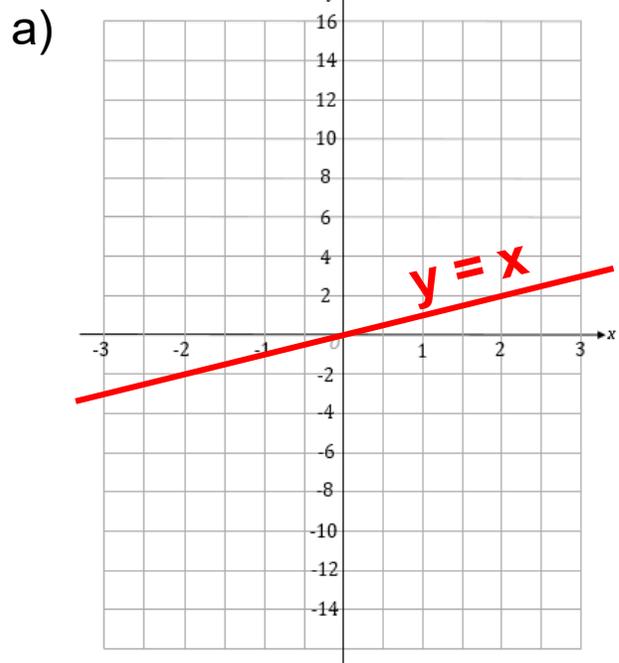
e)

<b>x</b>	-3	-2	-1	0	1	2	3
<b><math>y = \frac{1}{2}x + 2</math></b>	<b>0.5</b>	1	<b>1.5</b>	<b>2</b>	<b>2.5</b>	<b>3</b>	<b>3.5</b>

f)

<b>x</b>	-3	-2	-1	0	1	2	3
<b><math>y = x^2</math></b>	<b>9</b>	<b>4</b>	1	<b>0</b>	<b>1</b>	<b>4</b>	<b>9</b>

**$y = x^2$  is a non linear graph**



# Key Fact

A **linear** equation is of the form  $y = ax + b$

$$y = 2x + 1$$

$$y = 10x - 4$$

$$y = -3x - \frac{1}{2}$$

Sometimes linear equations may look different.

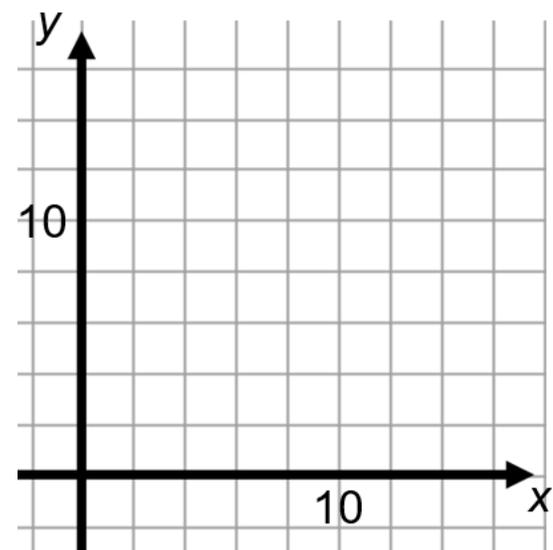
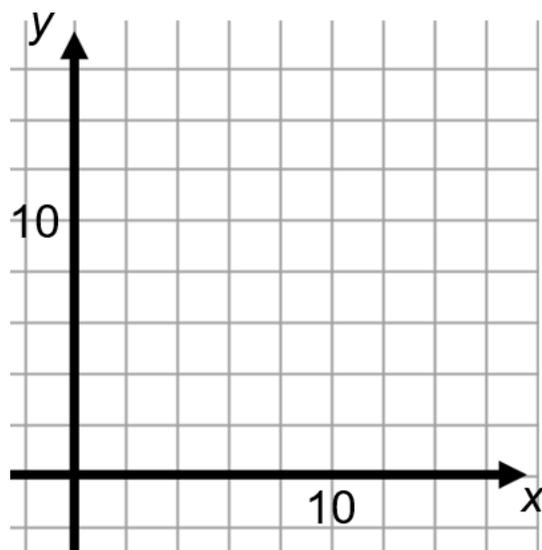
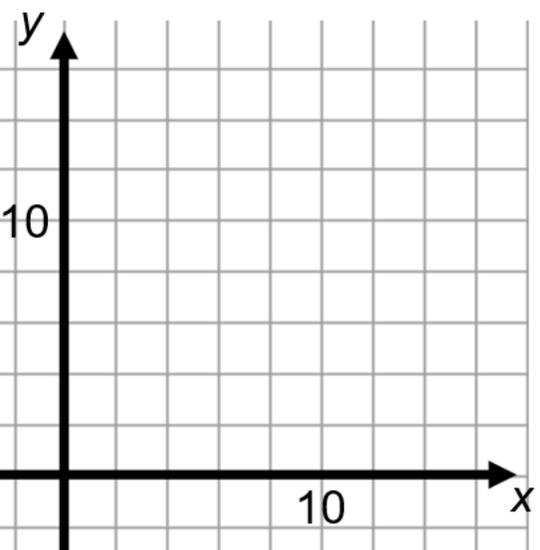
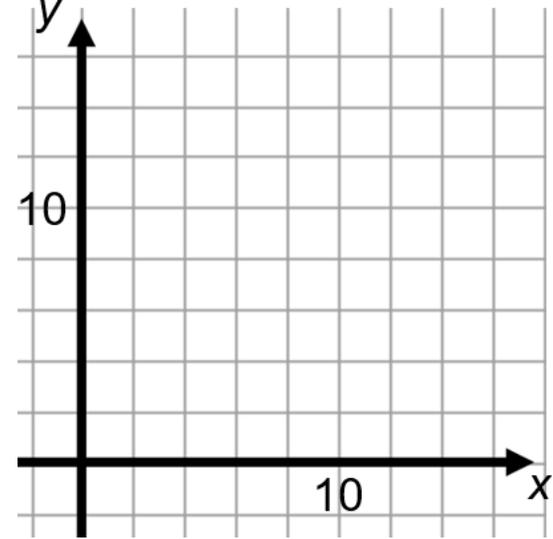
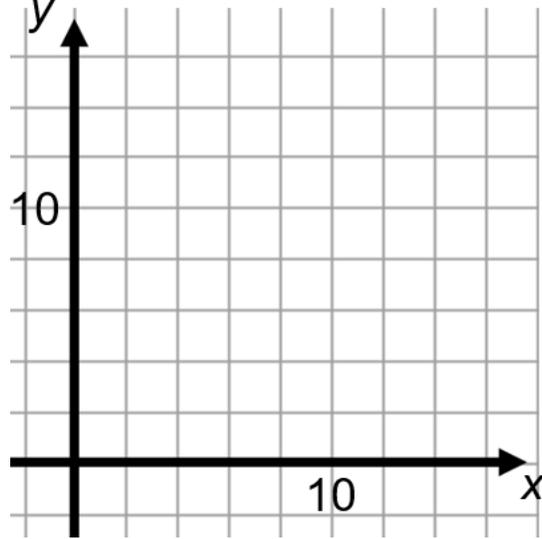
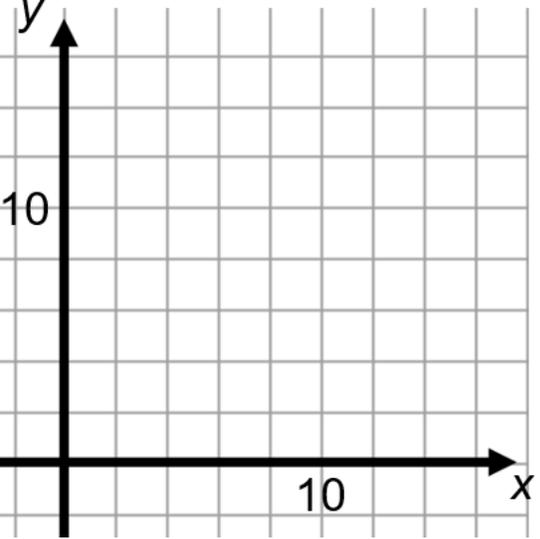
$$y = 5 - 6x$$

# Example

Copy and complete the table of values for the equation  $x + y = 12$

x	-2	0	2	4	6	8	10	12	14
y			10				2		

Draw the graph of  $x + y = 12$ .

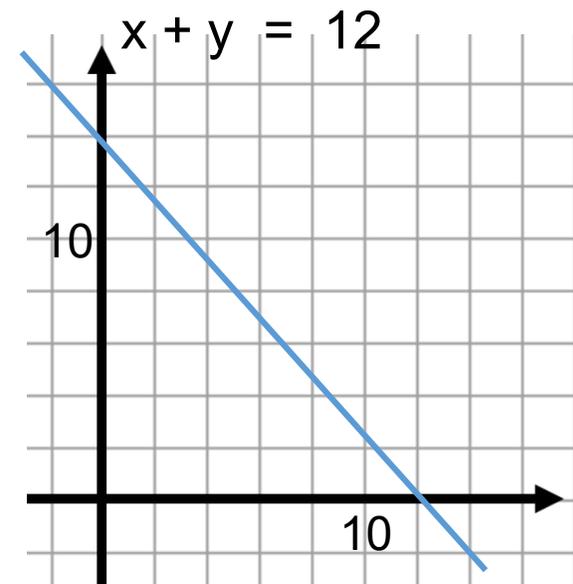


# Solution

Copy and complete the table of values for the equation  $x + y = 12$

x	-2	0	2	4	6	8	10	12	14
y	<b>14</b>	<b>12</b>	10	<b>8</b>	<b>6</b>	<b>4</b>	2	<b>0</b>	<b>-2</b>

Draw the graph of the equation.



Copy and complete each table using the rule given.

Sketch each graph on the sheet.

Which one does not give a straight-line graph?

a)  $x + y = 4$

<b>x</b>	-1	0	1	2	3	4	5
<b>y</b>			3				

b)  $y - x = 3$

<b>x</b>	-2	-1	0	1	2	3	4
<b>y</b>			3				

c)  $2x = y$

<b>x</b>	-1	0	1	2	3	4	5
<b>y</b>			2				

d)  $xy = 12$

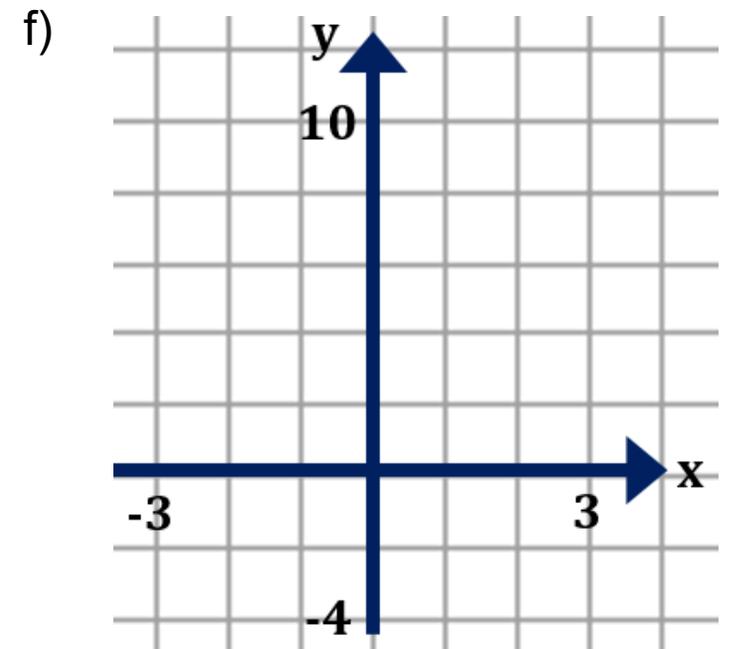
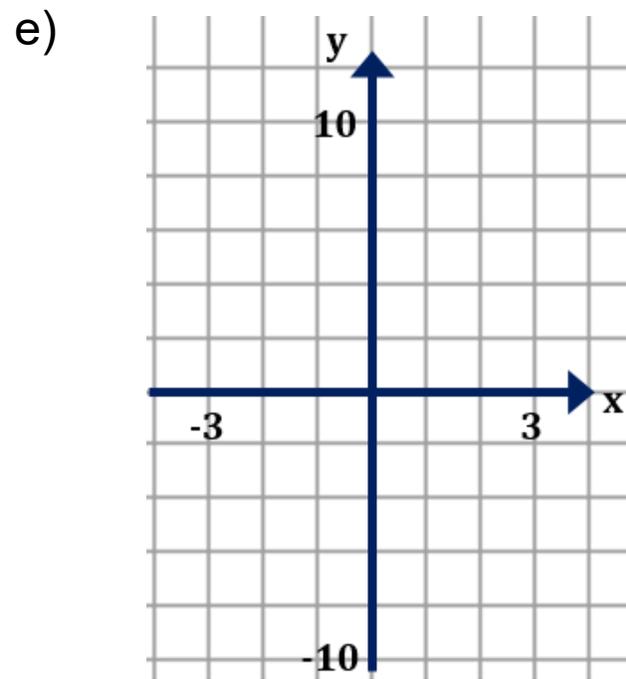
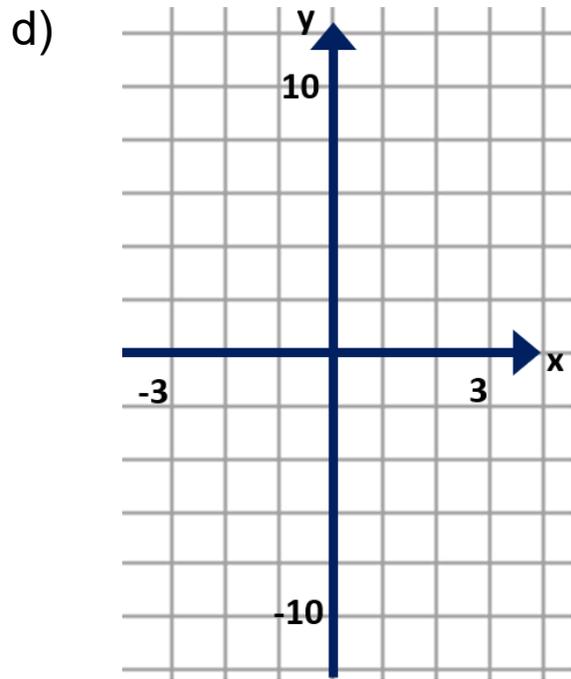
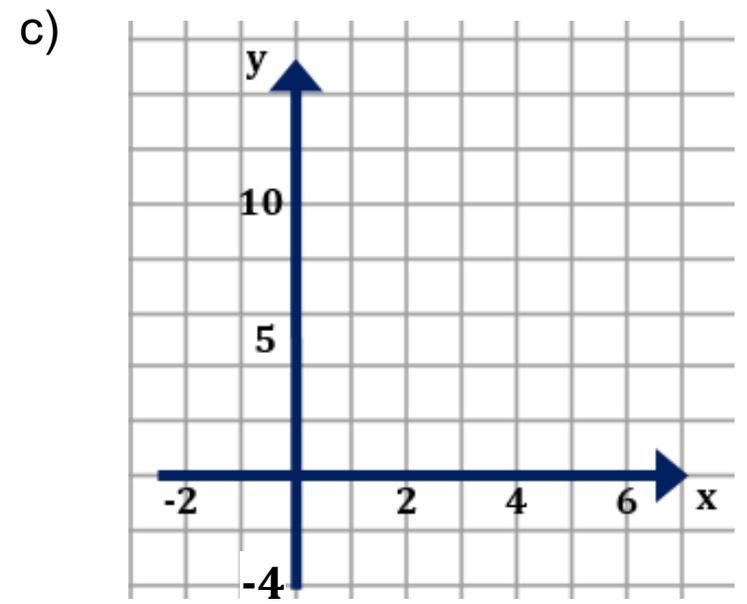
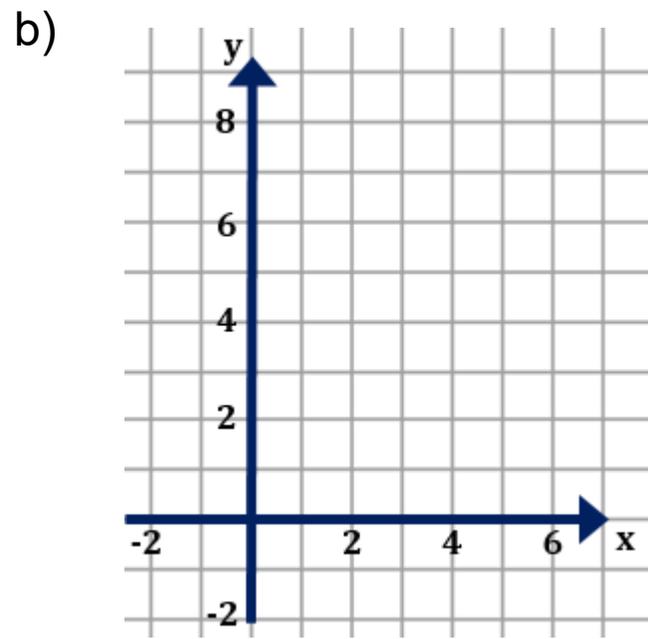
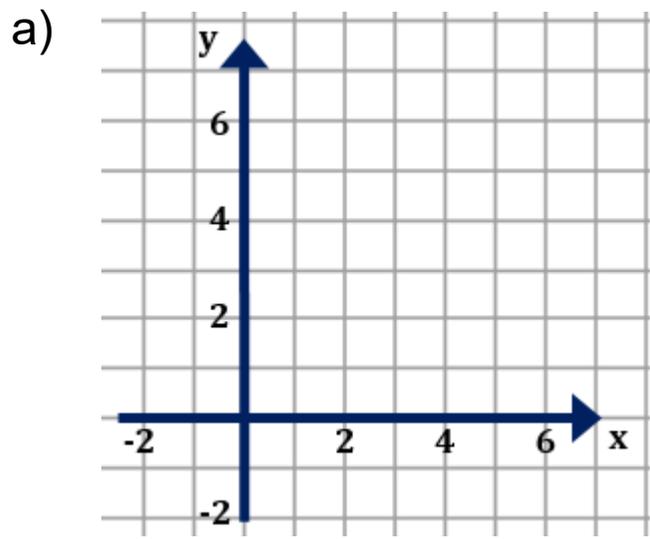
<b>x</b>	-3	-2	-1	0	1	2	3
<b>y</b>		-6					

e)  $\frac{y}{x} = 3$

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y</b>		-6					

f)  $y - 2x = 3$

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y</b>			1				



# Solutions

a)  $x + y = 4$

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

b)  $y - x = 3$

x	-2	-1	0	1	2	3	4
y	1	2	3	4	5	6	7

c)  $2x = y$

x	-1	0	1	2	3	4	5
y	-2	0	2	4	6	8	10

d)  $xy = 12$  **Non linear**

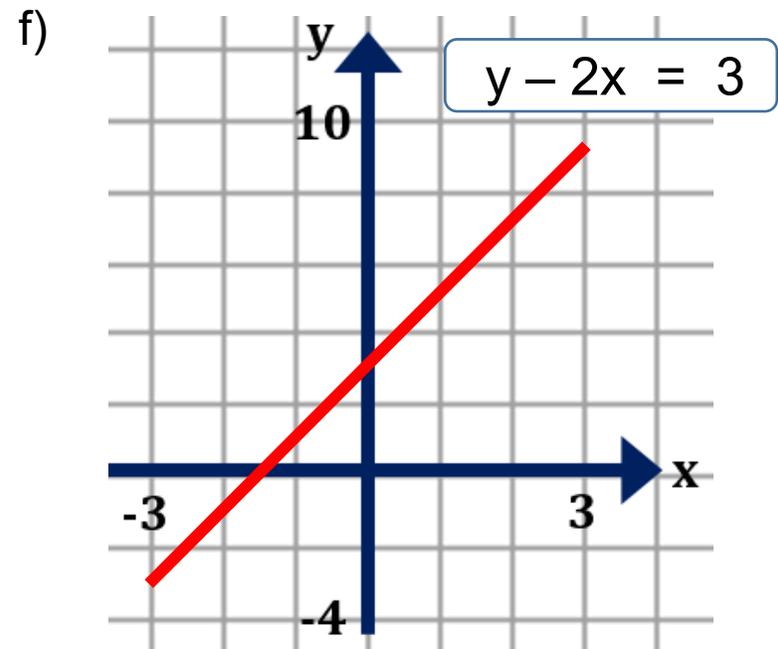
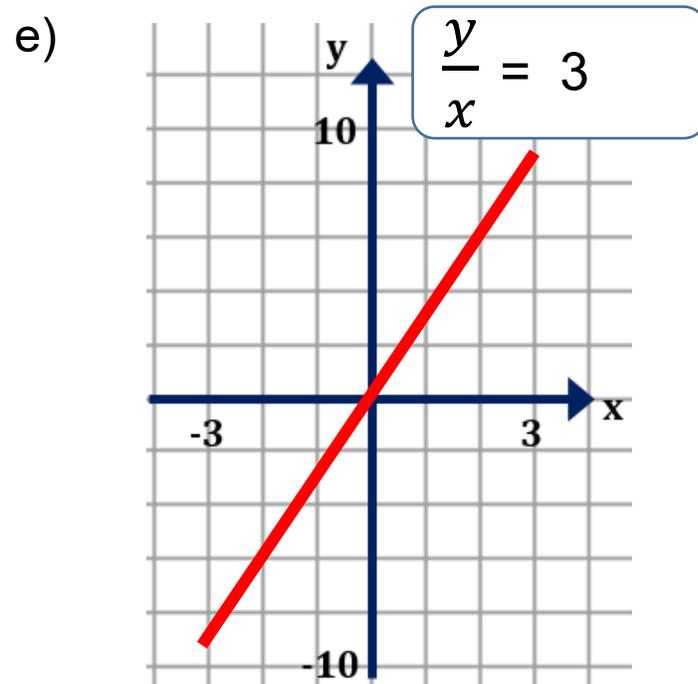
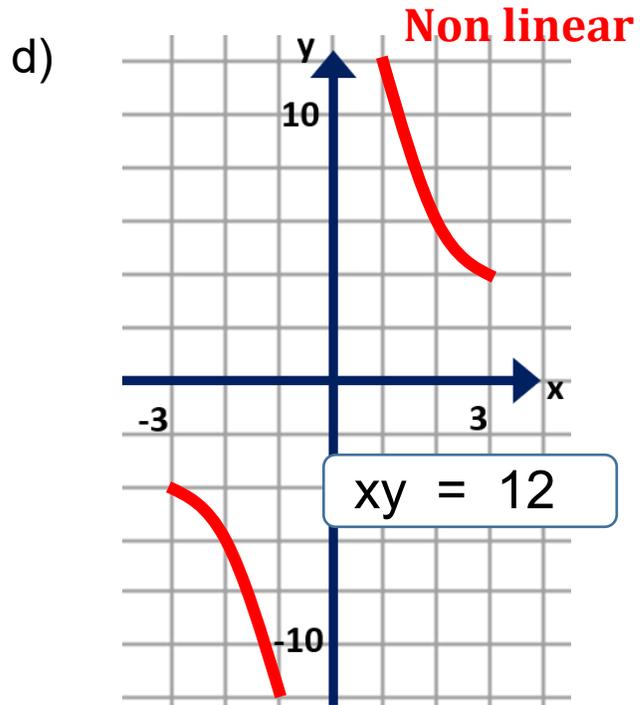
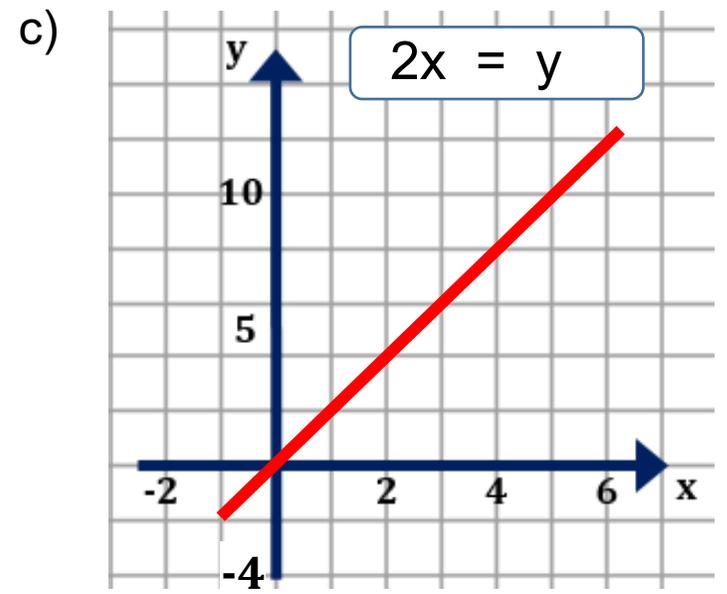
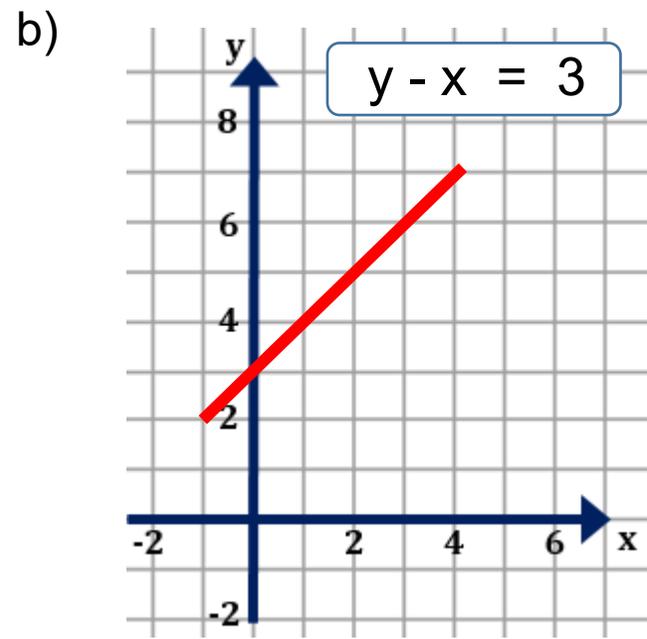
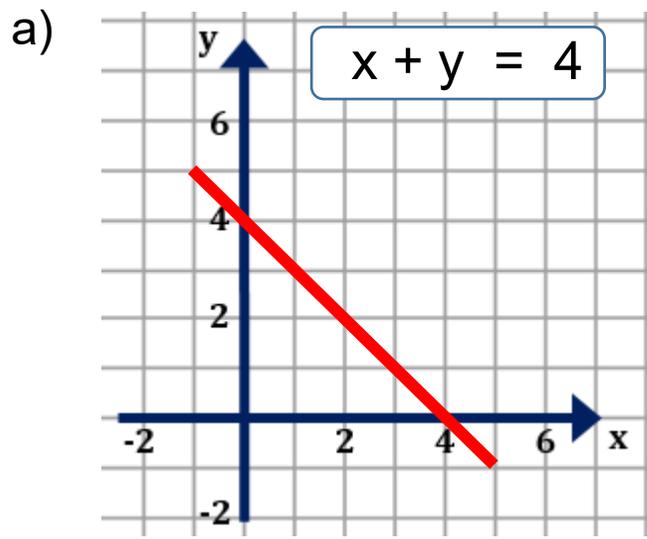
x	-3	-2	-1	0	1	2	3
y	-4	-6	-12	-	12	6	4

e)  $\frac{y}{x} = 3$

x	-3	-2	-1	0	1	2	3
y	-9	-6	-3	0	3	6	9

f)  $y - 2x = 3$

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



# Example

Find an equation that links these co-ordinate points.

$$(-4, -2), (0, 2), (2, 4), (4, 6)$$

# Solution

Find an equation that links these co-ordinate points.

$$(-4, -2), (0, 2), (2, 4), (4, 6)$$

In each coordinate pair, the y-value is two more than the x-value.

Hence,  $y = x + 2$

(Could we have written this as  $x = y + 2$  ?)

# Exercise

Find an equation that links each set of co-ordinate points.

a)  $(-1, -2)$  ,  $(0, -1)$  ,  $(1, 0)$  ,  $(2, 1)$  ,  $(3, 2)$

b)  $(-2, -6)$  ,  $(-1, -3)$  ,  $(0, 0)$  ,  $(1, 3)$  ,  $(2, 6)$

c)  $(-2, 12)$  ,  $(0, 10)$  ,  $(2, 8)$  ,  $(4, 6)$  ,  $(6, 4)$

d)  $(-2, 1)$  ,  $(0, 5)$  ,  $(2, 9)$  ,  $(4, 13)$  ,  $(6, 17)$

e)  $(-1, 1)$  ,  $(0, 0)$  ,  $(1, 1)$  ,  $(2, 4)$  ,  $(3, 9)$

## Challenge

Can you find the equations of two different straight lines that pass through the point  $(3, 5)$ ?

# Solutions

Find an equation that links each set of co-ordinate points.

a)  $(-1, -2)$  ,  $(0, -1)$  ,  $(1, 0)$  ,  $(2, 1)$  ,  $(3, 2)$

$y = x - 1$

b)  $(-2, -6)$  ,  $(-1, -3)$  ,  $(0, 0)$  ,  $(1, 3)$  ,  $(2, 6)$

$y = 3x$

c)  $(-2, 12)$  ,  $(0, 10)$  ,  $(2, 8)$  ,  $(4, 6)$  ,  $(6, 4)$

$x + y = 10$

d)  $(-2, 1)$  ,  $(0, 5)$  ,  $(2, 8)$  ,  $(4, 6)$  ,  $(6, 4)$

$y = 2x + 5$

e)  $(-1, 1)$  ,  $(0, 0)$  ,  $(1, 1)$  ,  $(2, 4)$  ,  $(3, 9)$

$y = x^2$  non linear

## Challenge

Can you find the equations of two different straight lines that pass through the point  $(3, 5)$ ?

for example:

$y = x + 2$  and

$x + y = 8$

1. The following points lie on the line  $y = 3x - 2$ .  
Fill in the missing numbers.

(3 , \_\_\_)    (0 , \_\_\_)    (\_\_\_ , 7)

---

2. Does the graph of  $y = 2x + 1$  pass through the origin?
- 

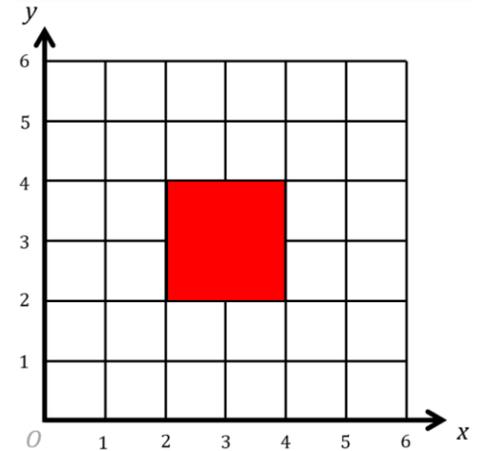
3. Do the points  $(2, 7)$  ,  $(5, 19)$  lie on a straight line? If so, find its equation.
- 

4. Do the points  $(1, 1)$  ,  $(3, 5)$  and  $(4, 9)$  lie on a straight line? If so, find its equation.
- 

5. Which graph is steeper,  $y = x$  or  $y = 2x$  ?

6. Can you write the equation of a graph that is parallel to  $y = x + 1$ ?
- 

7. Here is a square drawn on a coordinate grid.



- a) Write down the equations of the four sides of the square.
- b) Can you find the equations of the diagonals of the square?

1. The following points lie on the line  $y = 3x - 2$ .  
Fill in the missing numbers.

(3 , **7**)    (0 , **-2**)    (**3**, 7)

---

2. Does the graph of  $y = 2x + 1$  pass through the origin?    **No**
- 

3. Do the points (2, 7) , (5 , 19) lie on a straight line? If so, find its equation.  
**Yes ,  $y = 4x - 1$**
- 

4. Do the points (1 , 1) , (3 , 5) and (4 , 9) lie on a straight line? If so, find its equation.  
**No**
- 

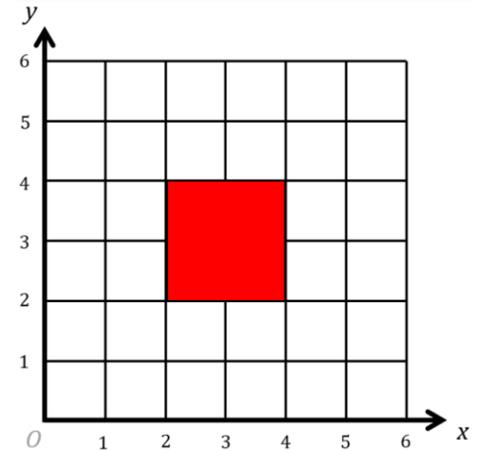
5. Which graph is steeper,  $y = x$  or  $y = 2x$  ?  
 **$y = 2x$**

6. Can you write the equation of a graph that is parallel to  $y = x + 1$ ?

**Any equation of the form  $y = x \pm a$**

---

7. Here is a square drawn on a coordinate grid.



- a) Write down the equations of the four sides of the square.  
 **$y = 2$  ,  $y = 4$  ,  $x = 2$  ,  $x = 4$**
- b) Can you find the equations of the diagonals of the square?  
 **$y = 6 - x$  and  $y = x$**

# Extension

The lines  $y = x$  and  $x + y = 10$  cross each other once.

Where do they cross?

Repeat for  $y = x$  and  $y = x + 1$

# Solution

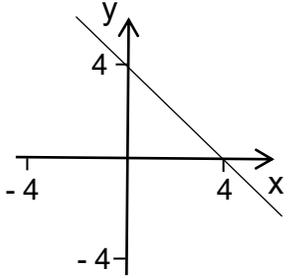
The lines  $y = x$  and  $x + y = 10$  cross each other once.

Where do they cross? **They meet at (5 , 5)**

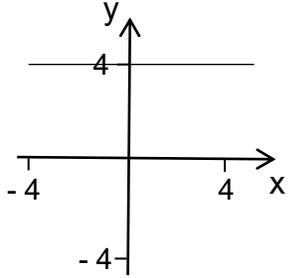
Repeat for  $y = x$  and  $y = x + 1$  **These lines never meet – they are parallel.**

# Exam Style Question

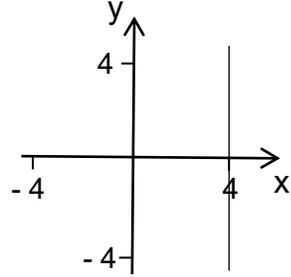
Here are some straight line graphs.



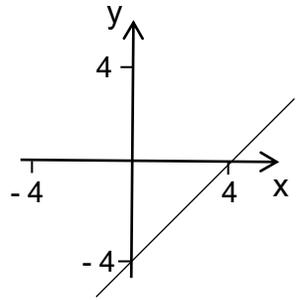
Graph A



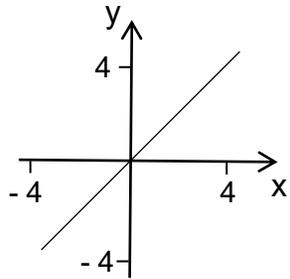
Graph B



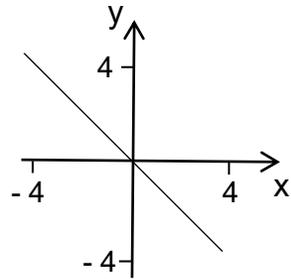
Graph C



Graph D



Graph E



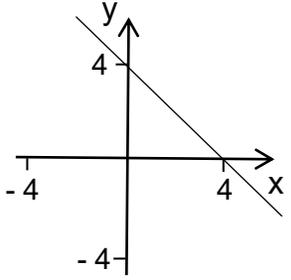
Graph F

Match each equation in the table to the correct graph.

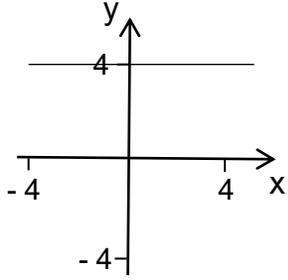
Equation	Graph
$y = x$	
$y = 4$	
$y = x - 4$	
$x + y = 4$	
$x = 4$	
$y = -x$	

# Solution

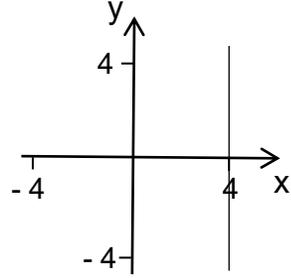
Here are some straight line graphs.



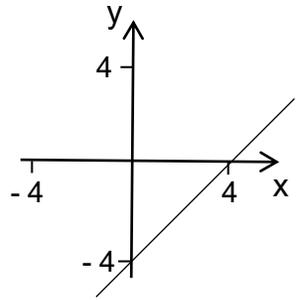
Graph A



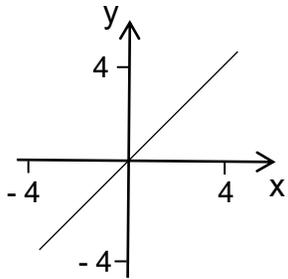
Graph B



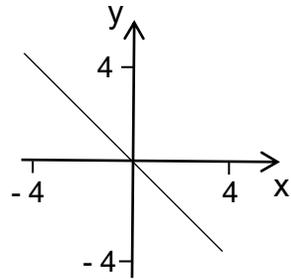
Graph C



Graph D



Graph E



Graph F

Match each equation in the table to the correct graph.

Equation	Graph
$y = x$	<i>E</i>
$y = 4$	<i>B</i>
$y = x - 4$	<i>D</i>
$x + y = 4$	<i>A</i>
$x = 4$	<i>C</i>
$y = -x$	<i>F</i>