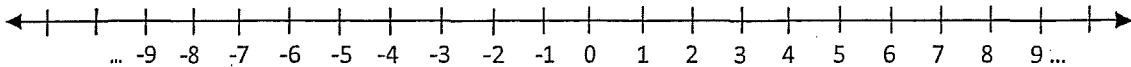# 5.1 – The Coordinate Plane

A **Coordinate Plane** is also known as a **Cartesian Plane**, named after French mathematician, Rene Descartes. It is a system for graphing any point (ordered pairs) on a grid by using two numbers that form a **coordinate** (x, y). He came up with the idea while trying to describe the position of a spider crawling across the ceiling.

In Unit 1, we worked with an integer number line.

... -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 ...

When a **vertical number line** and a **horizontal number line** intersect at **right angles** and at the point **zero** on each line, they form axes on a *coordinate plane.*

QUADRANT 2   QUADRANT 1

QUADRANT 3   QUADRANT 4
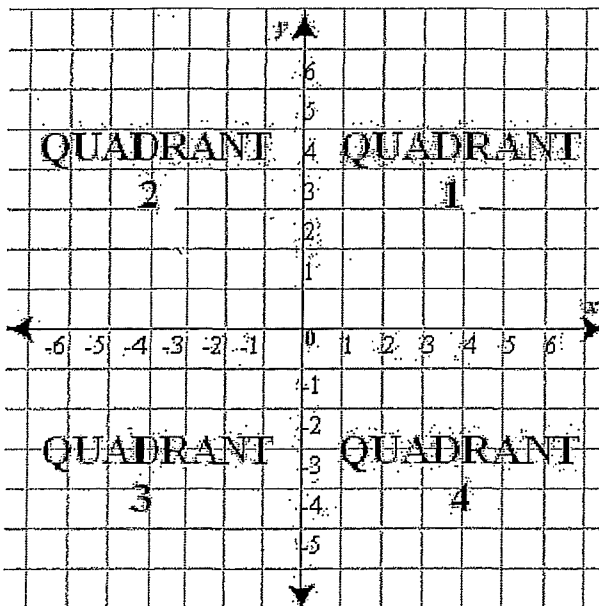
➤ The number lines intersect at the _____, which is labelled (0, 0).

➤ The _____ axis is labelled x.

➤ The _____ axis is labelled y.

➤ The axes divide the plane into four _____.

➤ The numbers on the axes are called the _____.

Coordinates / Ordered Pairs

Any point on the plane can be described by its *coordinates*. Coordinates are also known as _____ _____ and written in the form _____.

The $x - value$ of a coordinate represents the placement along the $x - axis$, and it is always written _____.

The $y - value$ of a coordinate represents the placement along the $y - axis$, and it is always written _____.

To plot a point (x, y):
  ✓ Always start at the origin (0, 0)

  ✓ Read along the $x - axis$ to identify the $x - coordiante$ (the first coordinate)
      A **positive** $x - value$ means move to the **right**.
      A **negative** $x - value$ means move to the **left**.

  ✓ Read along the $y - axis$ to identify the $y - coordiante$ (the first coordinate)
      A **positive** $y - value$ means move to the **upwards**.
      A **negative** $y - value$ means move to the **downwards**.

Ex. 1: Graph the following points on the given grid.   State which quadrant each point is in.

A (3 , 4)   B (- 1, 4)

C (4, - 2)   D (- 5, - 4)

E (2, 5)   F (- 3, - 1)

G (- 3, 7)   H (0, 0)

I (- 2 , 0)   J (0 , - 4)
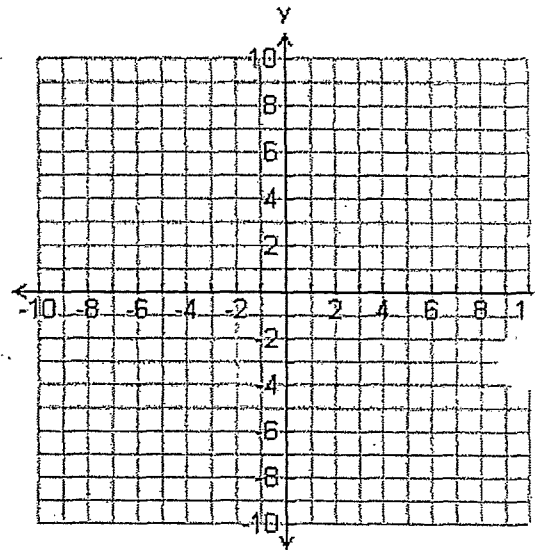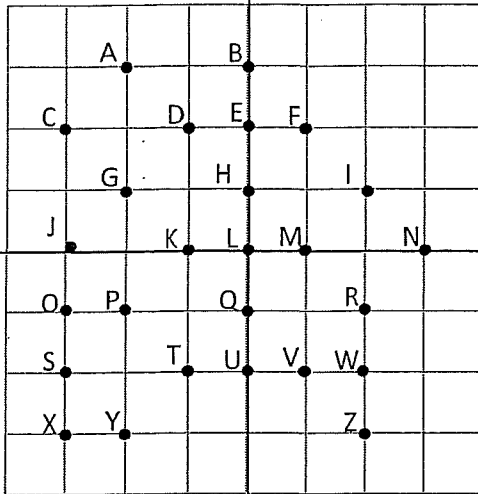
Ex. 2: Using the coordinate plane given, write the ordered pairs for each point.
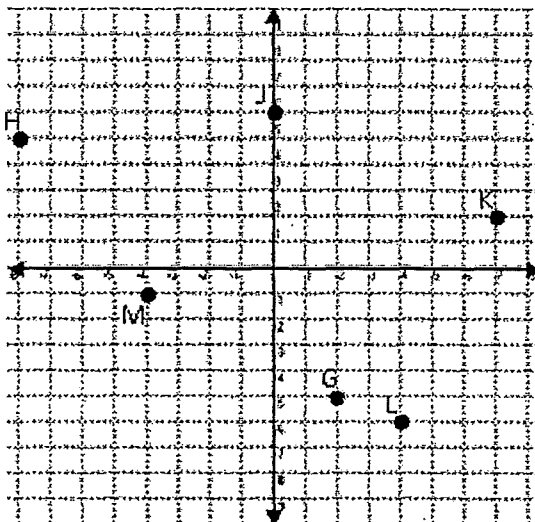
G (,)   H (,)

J (,)   K (,)

L (,)   M (,)

The Coordinate Plane - Practice

Use the following grid to code and decode messages.

1. Write the coordinate positions for the letters in these words:

DRIVE _____

PARTY _____

GAME . _____

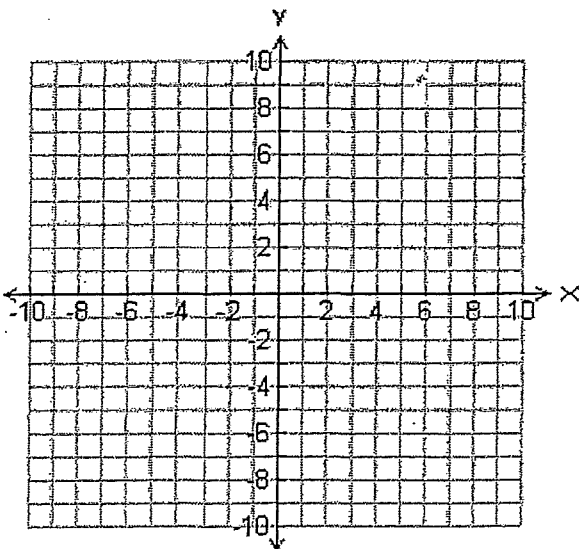2. Decode this message, using the coordinate plane on the left.

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

_____

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

_____

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

_____

3. On the grid below, plot and
   label each point.

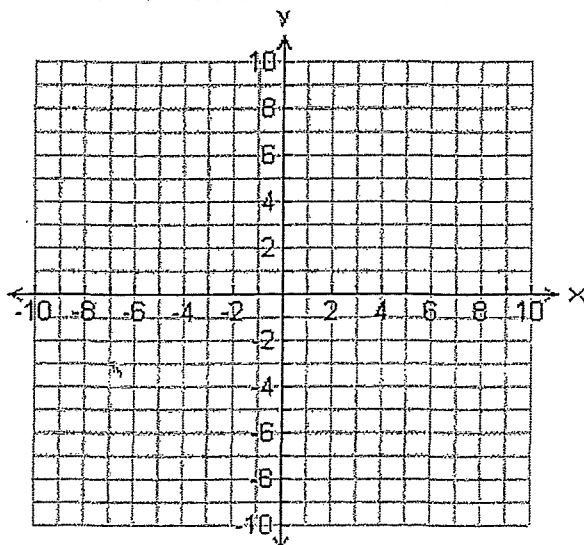|		
N(2, 3)	P(2, -3)	Q(1, -3)
R(0, 3)	S(3, 0)	T(-2, 0)
U(0, -1)	V(-1, 2)	W(-3, 1)
X(-1, 3)	Y(-3, -1)	Z(-3, -2)

4. For each set of points, plot and join the points in order to
   form a closed figure.

(a) A(2, 1) B(5, 1) C(5, 3) D(2, 3)

(b) E(-2, 3) F(-5, 3) G(-5, 1)

(c) H(-3, 1) I(-1, 1) J(-1, -1) K(-3, -1)

(d) L(2, 1) M(5, 1) N(4, -3) P(1, -3)

5. Match the words in the box with the most appropriate expression below.

coordinates	origin	scale
y-coordinate	horizontal axis	ordered pair
x-coordinate	vertical axis	coordinate plane

(a) A grid with two perpendicular lines _____

(b) tells how far the point is along the x-axis _____

(c) the numbers on the axes _____

(d) tells how far the point is along the y-axis _____

(e) also known as the x-axis _____

(f) the point where the axes cross _____

(g) a point in a plane represented by an ordered pair of numbers _____

(h) two numbers, written in order within a set of brackets and separated by a comma

_____

(i) also known as the y-axis _____

6. Exactly where in coordinate plane are the following ordered pairs located?
   (e.g. Quadrant 1, 2, 3, or 4; origin; $x-$axis; $y-$axis)

1)	(27, -89)	2)	(0, -19)	3)	(14, 34)
4)	(0, 0)	5)	(-66, -23)	6)	(-1,103)
7)	(126, -12)	8)	(-18, 0)	9)	(352, -353)

What Happened After a Burglar Broke Into a Tuba Factory ?

Each ordered pair at the bottom of the page represents a point on the coordinates below. Above each ordered pair, write the letter that appears at that point.
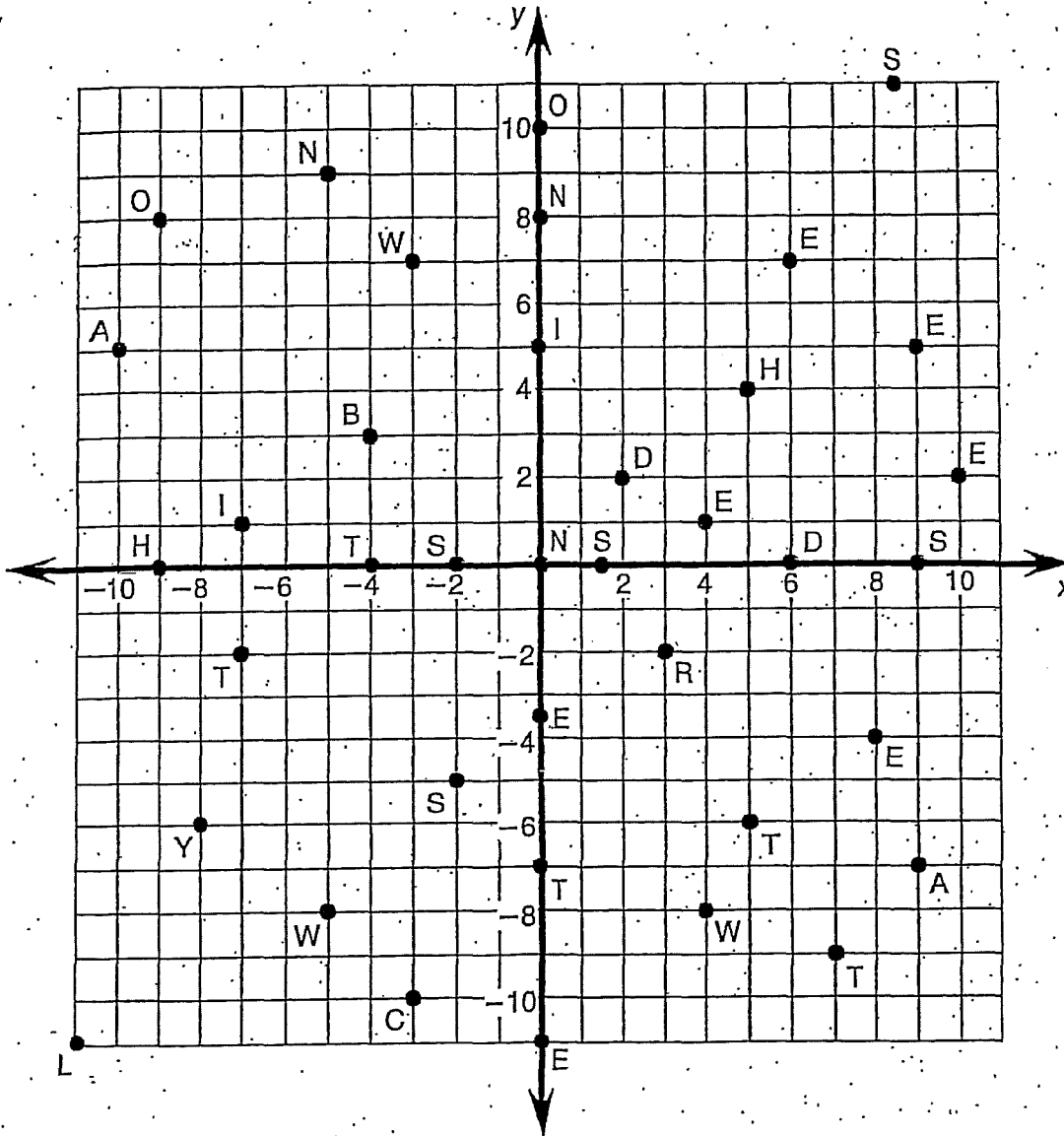
$(5, 4)$ $(10, 2)$ $(-3, 7)$ $(-10, 5)$ $(-2, -5)$ $(-3, -10)$ $(3, -2)$ $(8, -4)$ $(6, 0)$ $(0, 5)$ $(-4, 0)$ $(0, -11)$ $(2, 2)$

$(-5, -8)$ $(-7, 1)$ $(7, -9)$ $(-9, 0)$ $(-7, -2)$ $(4, -8)$ $(6, 7)$ $(-5, 9)$ $(0, -7)$ $(-8, -6)$ $(0, 10)$ $(0, 0)$ $(9, 5)$

$(9, 0)$ $(5, -6)$ $(-9, 8)$ $(-11, -11)$ $(4, 1)$ $(0, 8)$ $(-4, 3)$ $(9, -7)$ $(-2, 0)$ $(8.5, 11)$ $(0, -3.5)$ $(1.5, 0)$

OBJECTIVE 5–a: To locate a point in a coordinate plane given its coordinates.

Slope

Name: _____   Per: __5__

Example 1

These diagrams represent two staircases:
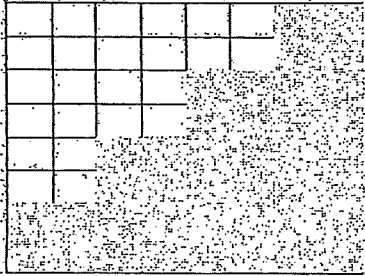
We move 2 blocks right.   The _____ is 2.

We move up 2 blocks.   The _____ is 2.

We move 1 block right and 1 block up.

The run is _____ and the rise is _____.

Suppose we lay a board on each staircase.
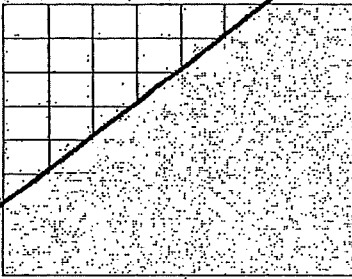
What do you notice about the steepness of each board?

Example 2

- On the following grid draw a staircase where each step has a rise of 6 and a run of 2.
- Without changing the steepness, draw additional blocks so that each horizontal step is only 1 block.
- On the new staircase, as we move 1 block right, we move _____ blocks up. This number is the slope.
- What is the slope of the staircase? _____
- Draw a board that will lie on your staircase.
- Explain why moving 2 units right and 6 units up has the same steepness as moving 1 unit right and 3 units up.

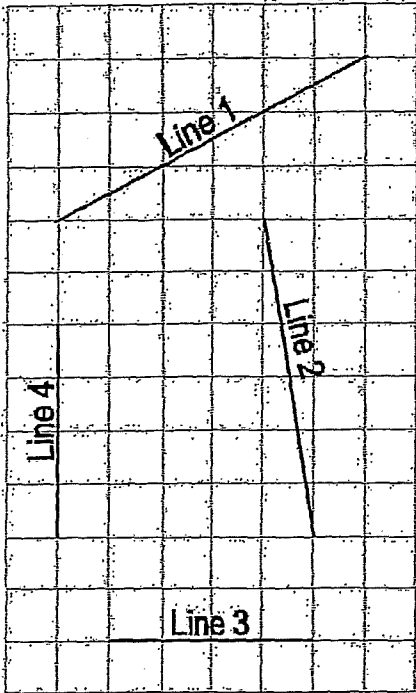- When the rise is 6 and the run is 2, what is the slope?
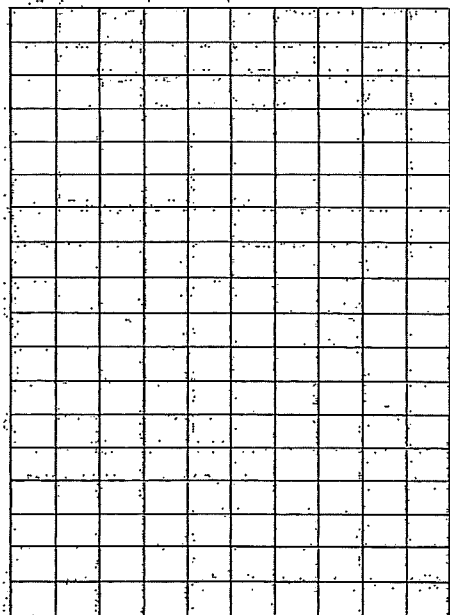
When calculating slope on a grid you need to be careful of positive and negative values.

➤ On a grid we always count the run from left to right (just like we read!) **So the run is always positive!!**

Example 6

Determine the slope of each line on the following grid.

Line 1 **rises** from left to right, so it has a _____

    Slope =

Line 2 **drops** from left to right, so it has a _____

    Slope =

Line 3 doesn't rise or fall from left to right so its rise is _____.

    Slope =

Line 4 has a rise of ____ and a run of _____. Therefore, the slope is _____.

Conclusions

Any line **rising** to the right has a _____ slope.

Any line **falling** to the right has a _____ slope.

Any **horizontal line** has a slope of _____.

Any **vertical line** has an _____ slope.

Slope is calculated using the formula $$\text{Slope} = \frac{\rule{2cm}{0.4pt}}{}$$

Slope measures how _____ a line is

A **higher** value for slope represents a _____ line.

A **lower** value for slope represents a _____ line.

What Might You Have If You Don't Feel Well ?

For each exercise, draw a line through the two given points. Determine the *slope* of this line. Find your answer at the bottom of the page and write the letter of that exercise above it.
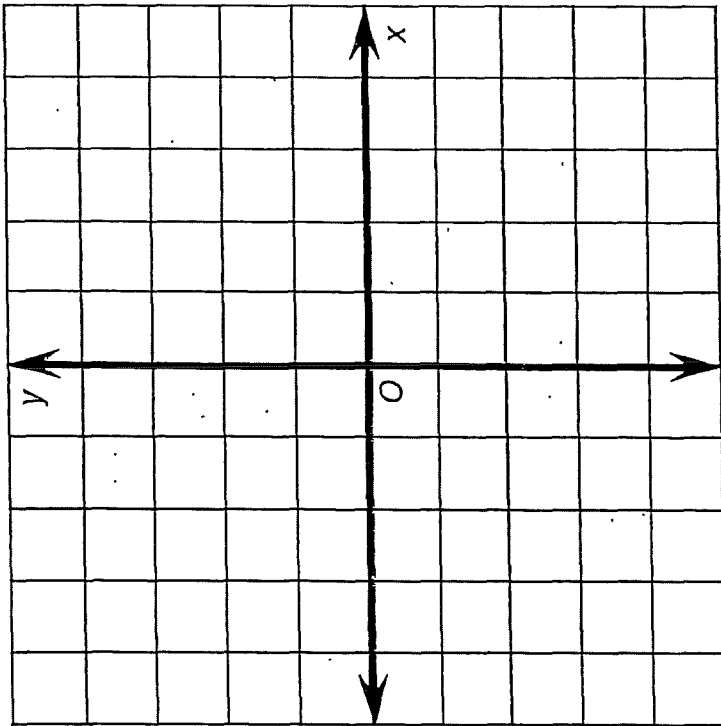
Ⓔ (1, 2) and (4, 4)

Ⓞ (3, −3) and (4, 1)

Ⓖ (−4, −2) and (2, −5)

Ⓢ (−2, 4) and (0, −2)
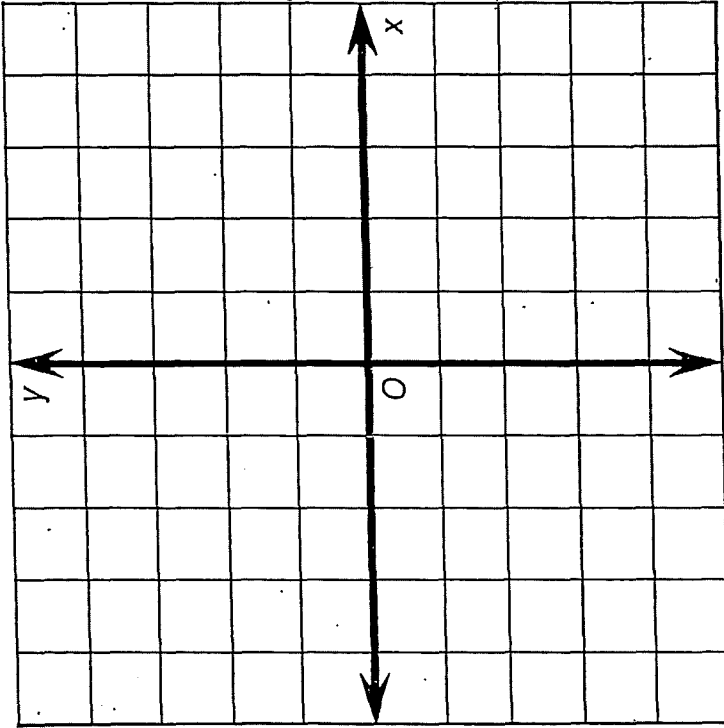
Ⓞ (0, −1) and (4, 3)

Ⓝ (−5, 2) and (−3, −3)

Ⓥ (−1, 0) and (−3, 4)

Ⓛ (5, −1) and (−2, −4)

$-\frac{4}{3}$	$-\frac{1}{2}$	$\frac{3}{7}$	1	-2	$\frac{2}{3}$	-3	$\frac{7}{3}$	4	$-\frac{5}{2}$	0

© 1989 Creative Publications

OBJECTIVE 5–g: To find the slope of a line given

Grid Lines: *The vertical and* _____ *lines which form the grid on graph paper.*

Grid Point: *Any point of* _____ *of two* _____ _____ *on graph paper.*

Slope: *A number which represents the* _____ *or* _____ *of a line.*

AMOUNT OF SLOPE:

Moderate Slope: ....makes an angle of _____ with the horizontal.

Gentle Slope: ....makes an angle between _____ and _____ with the horizontal.

Steep Slope: ....makes an angle between _____ and _____ with the horizontal.

Zero slope: ....makes an angle of _____ with the horizontal.

DIRECTION OF SLOPE: Lines many be *vertical, horizontal, uphill* or *downhill* in direction.

Uphill: *Ascending,* _____ *or* _____ *to the right.*

Downhill: _____ , _____ *or* _____ *to the right.*

Steps For Finding A Numerical Value For Slope:

1. Find two **grid points** on the line and mark them with dots.
2. Start at the left grid point.
3. Use a ruler to draw a horizontal line to the right from this point until you are vertically above or below the second grid point. This horizontal line is the **run**.
4. Now draw a vertical line from the right end of the **run** either up or down to connect to the second grid point. This vertical line is the **rise**.
5. Count the graph squares to determine the length of the **run** and the **rise**.
6. The **run** is always positive.
7. The **rise** is positive if it is going upwards from the **run**, or is negative if the **rise** is going downwards from the **run**.
8. $$SLOPE = \frac{rise}{run}$$
9. Reduce the answer for slope to a fraction in lowest terms – avoid decimals or mixed numbers.

SUMMARY:

Uphill Slope: ....corresponds to slope values which are _____ .

Downhill Slope: ....corresponds to slope values which are _____ .

Moderate Slope: ....corresponds to a slope value of _____ or _____ .

Gentle Slope: ....corresponds to slope values which are _____ than _____ .

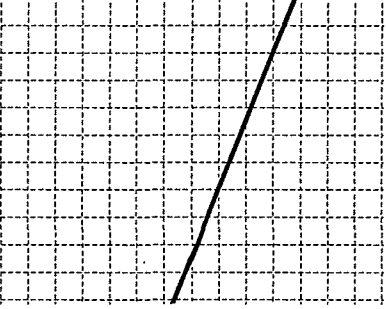*Steep Slope:* ....corresponds to slope values which are _____ than _____ .
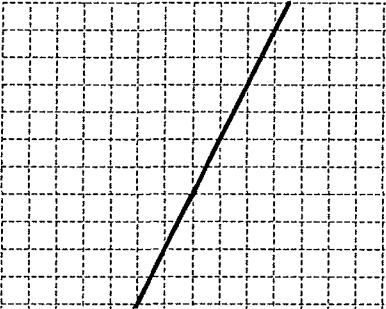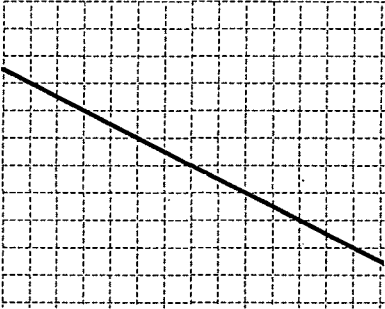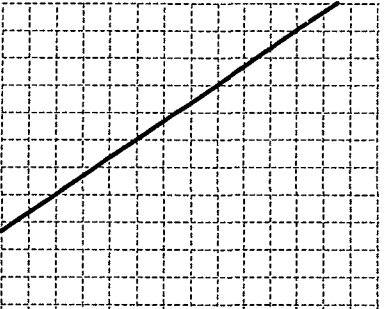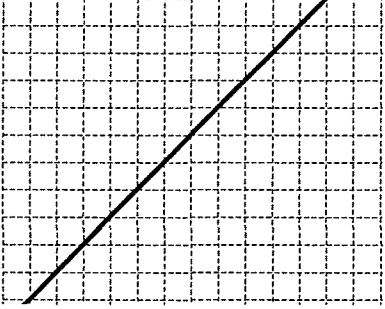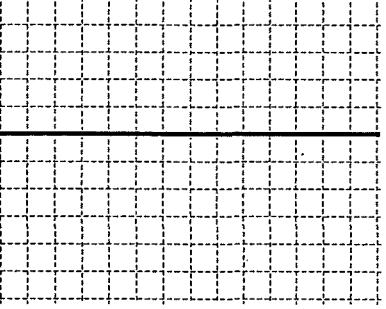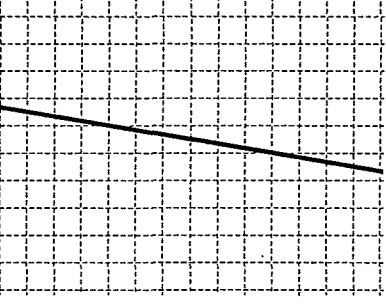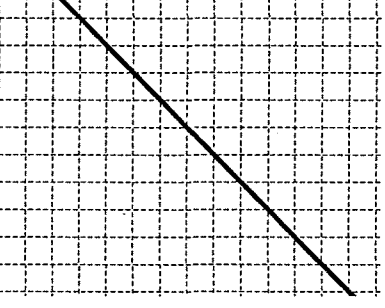
Zero slope: ....corresponds to a slope value of _____ .
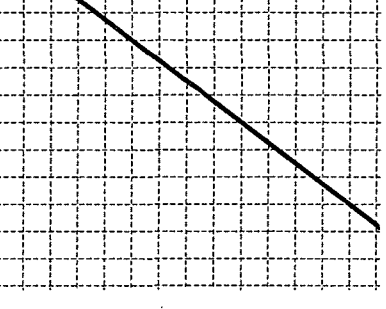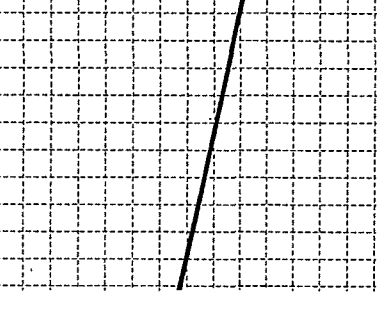
Graph # _____ has the **steepest slope** of all because its slope value is _____ .

Graph # _____ has the **gentlest slope** of all because its slope value is _____ .

1.	amount of slope:	direction of slope:	slope =

2.	amount of slope:	direction of slope:	slope =

3.	amount of slope:	direction of slope:	slope =

4.	amount of slope:	direction of slope:	slope =

5.	amount of slope:	direction of slope:	slope =

6.	amount of slope:	direction of slope:	slope =

7.	amount of slope:	direction of slope:	slope =

8.	amount of slope:	direction of slope:	slope =

9.	amount of slope:	direction of slope:	slope =

10.	amount of slope:	direction of slope:	slope =

11.	amount of slope:	direction of slope:	slope =
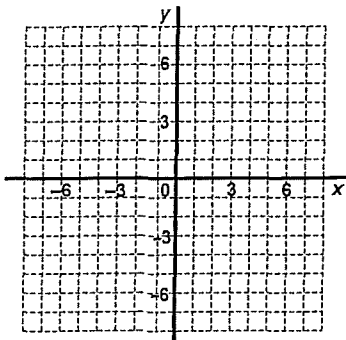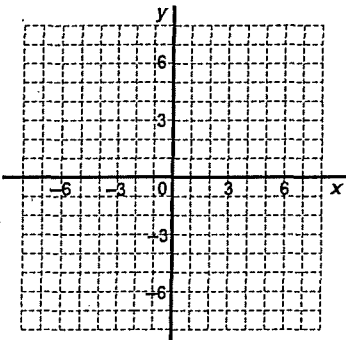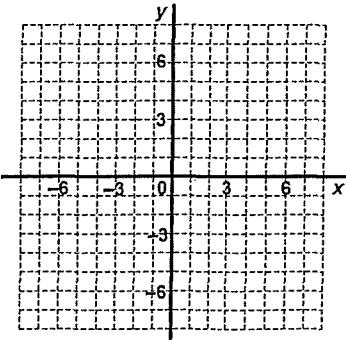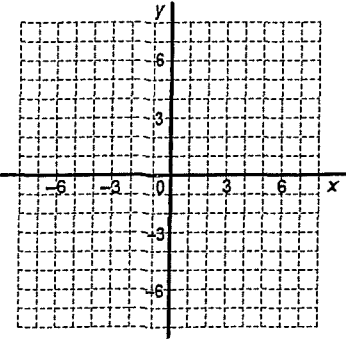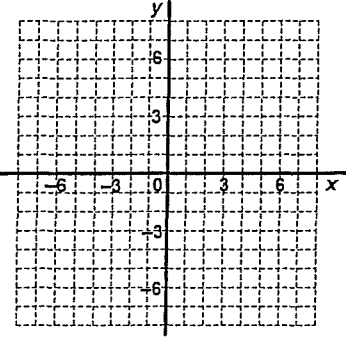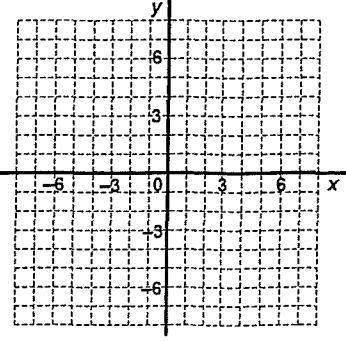
12.	amount of slope:	direction of slope:	slope =

① For each of the slopes given in the table below:
   a)   Complete the rows for *amount of slope* and *direction of slope* in words.
   b)   Give the *rise* and the *run* in the spaces provided.

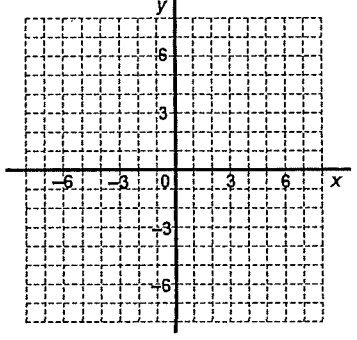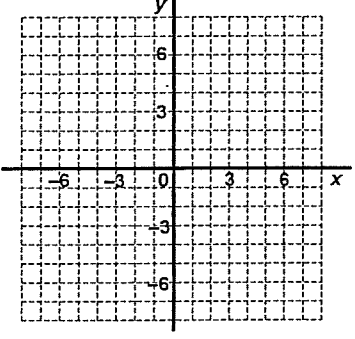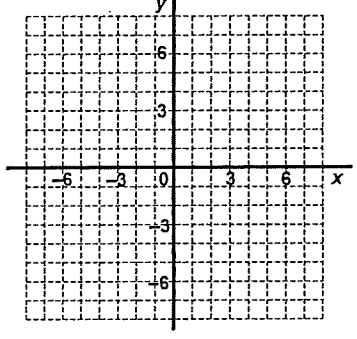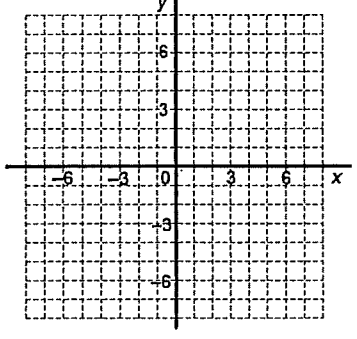| Graph #:	1	2	3	4	5	6
Slope	$\frac{4}{5}$	$\frac{5}{2}$	$-\frac{5}{3}$	$-\frac{1}{3}$	4	−3
Direction Of Slope						
Amount Of Slope						
Run (always positive)						
Rise (positive or negative)						
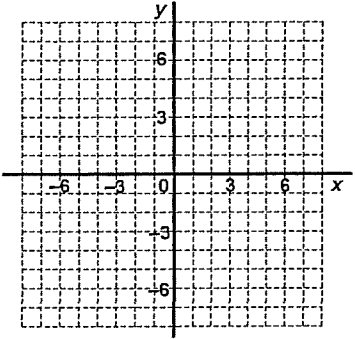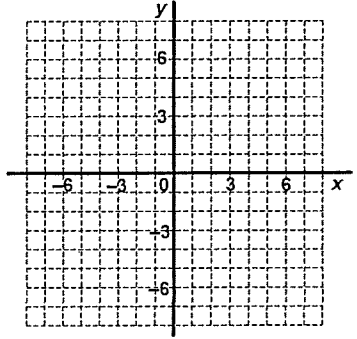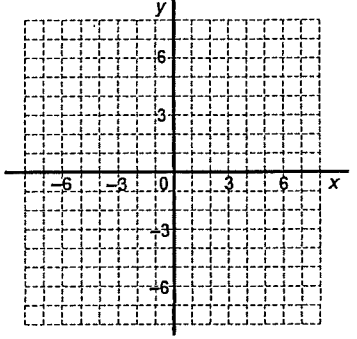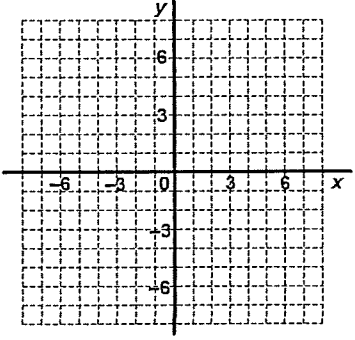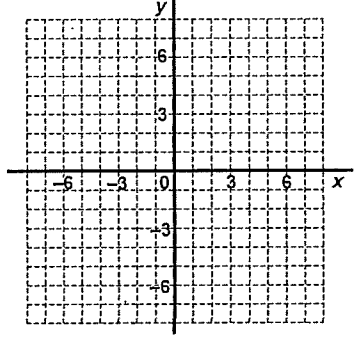
② On the 6 graphs below, plot lines which pass through the origin that have the given slopes.

Steps: i)   Place your pencil at the requested starting point.

ii)   Use a ruler draw the *run first*. Since this is always positive, it will always be drawn to the right from the starting point.

iii)   Now *draw the rise* from the end of the run. (*Up* if positive, *down* if negative.)

iv)   Draw a line through the ends of the rise and run and *extend the line to the edges of the grid.*

1.   slope $= \frac{4}{5}$; start at (0,0)

2.   slope $= \frac{5}{2}$; start at (0,0)

3.   slope $= -\frac{5}{3}$; start at (0,0)

4.   slope $= -\frac{1}{3}$; start at (0,0)

5.   slope $= 4$; start at (0,0)

6.   slope $= -3$; start at (0,0)

For the remaining graphs notice that the requested start point for the *run* is no longer at the origin.

7. slope $=\frac{2}{3}$; start at (1,1)	8. slope $=-\frac{11}{4}$; start at (2,6)	9. slope $=-\frac{1}{5}$; start at (−5,5)
10. slope $=\frac{5}{4}$; start at (−4,0)	11. slope $=-6$; start at (0,5)	12. slope $=5$; start at (0,−3)
13. slope $=\frac{3}{5}$; start at (−4,−7)	14. slope $=-\frac{1}{2}$; start at (−7,1)	15. slope $=\frac{5}{7}$; start at (−1,−3)

To Check Answers:

If drawn correctly, your line will also go through the point indicated below. *(A near miss probably means that you just need to be more careful when lining up your ruler to draw the line—try it!)*

1. (−5,−4)	2. (−2,−5)	3. (−3,5)	4. (−6,2)	5. (2,8)	6. (−1,3)
7. (7,5)	8. (6,−5)	9. (5,3)	10. (−8,−5)	11. (2,−7)	12. (−1,−8)
13. (6,−1)	14. (1,−3)	15. (−8,−8)			