DATA ANALYSIS

Introduction

A common way to display data is by organizing it into rows and columns to create a **table**. Tables can be a useful way to display data by making it easier to look up specific information. In this lesson, we'll use information in data tables to find the **mean**, **median**, and **mode**.

DATA ANALYSIS

The following table organizes test grades for students in a class.

Student	Test Grade
Alberto	98
Amir	82
Candace	78
Gregory	88
Jared	79
Lee	62
Melodie	65
Olivia	78
Valda	90

Often we want to summarize or describe data using single values. Three common descriptive measures are **mean**, **median** and **mode**.

Mean (Average)
The sum of the values in a set of data divided by the total number of values.

EXAMPLE A

Calculate the mean test grade for the class based on the table above.

Add all the test grade values:

$$98 + 82 + 78 + 88 + 79 + 62 + 65 + 78 + 90 = 720$$

$720 \div 9 = 80$ There are 9 test grades, so divide the sum by 9.

The mean (or average) test grade for this class is a score of 80.

DATA ANALYSIS

Median
The middle number when the values in a set of data are placed in order (if there is an even number of values, find the average of the two middle values).

EXAMPLE B

Find the median test grade for the data given in this table.

62, 65, 78, 78, 79, 82, 88, 90, 98 Put the grades in order from least to greatest.

For each number crossed off the beginning of the list, cross out one number from the end of the list. There is only one number remaining. This middle number is the median.

~~62~~, ~~65~~, ~~78~~, ~~78~~, 79, ~~82~~, ~~88~~, ~~90~~, ~~98~~

The median is 79 .

EXAMPLE C

Find the median of this list of numbers: 10, 15, 3, 11, 4, 6.

3, 4, 6, 10, 11, 15 Put the list in order from least to greatest.

For each number crossed off the beginning of the list, cross out one number from the end of the list. There are two numbers remaining: 6 and 10. Find the average of the two remaining numbers. The average is the median of this data set.

~~3~~, ~~4~~, 6, 10, ~~11~~, ~~15~~

$$6 + 10 = 16 \rightarrow 16 \div 2 = 8$$

The median is 8 .

DATA ANALYSIS

Mode
The value in a set of data that occurs most often. Note that it is possible for there to be more than one mode, or even no mode.

EXAMPLE D

Find the mode for the data given in this table.

62, 65, 78, 78, 79, 82, 88, 90, 98 List the numbers from least to greatest.

The mode is 78. The number 78 appears twice in the list—more often than any other number.

EXAMPLE C

Find the mode of this list of numbers: 5, 14, 9, 5, 14, 7, 9, 5, 9, 3.

3, 5, 5, 5, 7, 9, 9, 9, 14, 14 List the numbers from least to greatest.

The modes are 5 and 9. 5 and 9 appear three times in the list. Both values are modes.

DATA ANALYSIS

The table below applies to all of the following Extended Examples.

Student	Hours Worked per Week
Carly	7
Chet	30
Dominic	11
Drew	0
Ito	22
Patricia	25
Sahna	10

Extended Example 1a

The table above lists the hours worked per week by 7 students. Find the mean number of hours worked.

END OF LESSON

Find the mean of the list of numbers. Round answers to the tenths place.

4, 10, 5, 11, 6, 15

Find the median of the list of numbers. Round answers to the tenths place.

25, 22, 10, 45, 46, 35, 8, 28

Find the mode of the list of numbers.

5, 1, 7, 3, 2, 9, 4, 7, 2, 6, 0, 7, 5, 8, 9, 2, 5

The table below lists the length, in minutes, of five movies.

Find the a) mean, b) median, and c) mode of the data set. Round answers to the tenths place.

Movie	Length
1	152
2	161
3	142
4	157
5	138

The table below lists the number of classes seven students are enrolled in.
Find the a) mean, b) median, and c) mode of the data set. Round answers to the tenths place.

Student	# of Classes
Alejandro	4
Hudson	4
Dakota	6
Elijah	2
Ivan	5
Camille	7
Myles	5

DISPLAYING DATA

Introduction

There are many types of **graphs** that can be used to illustrate data. In this section, you will learn about **pictographs**, **circle graphs**, **bar graphs**, and **line graphs**. The benefit of displaying data in a graph is that you can make comparisons and spot trends and relationships between two variables much easier than with a table.

1 of 6

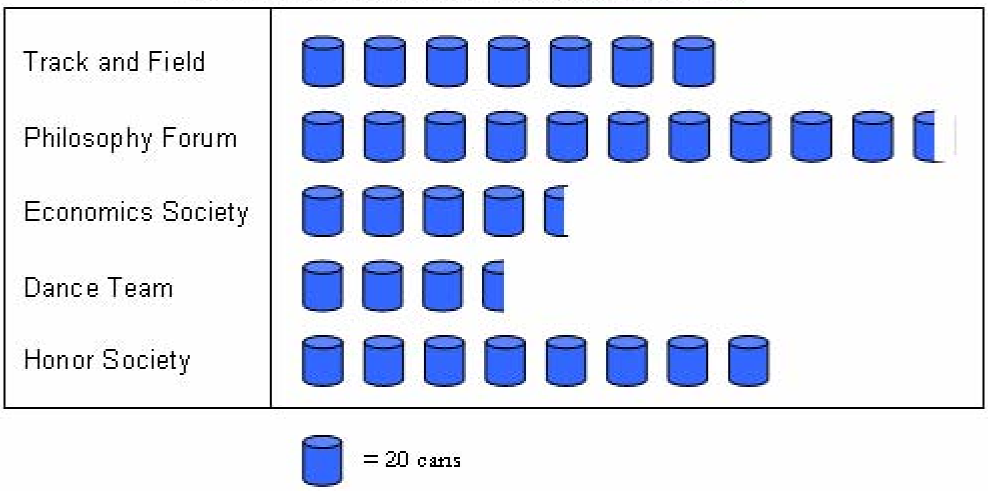
DISPLAYING DATA

Pictographs

Pictographs use symbols or pictures that represent amounts of data.

For example, the pictograph below illustrates the number of cans collected by student organizations for a campus-wide food drive. At the bottom of the graph is a **key** that tells you what each symbol represents—in this case, 20 cans. A fraction of a can symbol is used to represent a fraction of 20 cans.

Cans Collected for the Canned Food Drive



DISPLAYING DATA

The examples below refer to this pictograph.

EXAMPLE A

Approximately how many cans were collected by the Economics Society?

There are $4\frac{1}{2}$ can symbols for the Economics Society, and each can symbol represents 20 cans.

$$4\frac{1}{2}\cdot 20 = \frac{9}{\cancel{2}^{1}}\cdot\frac{\cancel{20}^{10}}{1}$$

Use multiplication to estimate the number of cans collected.

$$= 9\cdot 10$$

$$= 90$$

The Economics Society collected approximately 90 cans.

EXAMPLE B

Approximately how many more cans were collected by the Philosophy Forum than the Honor Society?

There are $2\frac{1}{2}$ more can symbols for the Philosophy Forum than the Honor Society. Each can symbol represents 20 cans.

$$2\frac{1}{2}\cdot 20 = \frac{5}{\cancel{2}^{1}}\cdot\frac{\cancel{20}^{10}}{1}$$

Use multiplication to estimate the number of cans.

$$= 5\cdot 10$$

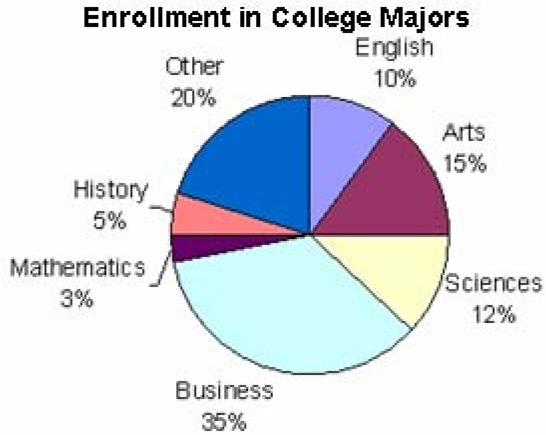
$$= 50$$

The Philosophy Forum collected approximately 50 more cans than the Honor Society.

DISPLAYING DATA

Circle Graphs

Circle graphs use a circle divided into sections that represent parts of a total amount. It's common for the data in a circle graph to be shown as percents. The graph below shows the percent of college students enrolled in different majors.



The total enrollment is 10,000 students (which is 100% of enrollment). Each section of the circle represents the percentage of students enrolled in each major.

EXAMPLE C

How many students are science majors?

$$\text{Percent} \cdot \text{Base} = \text{Amount}$$

$$12\% \cdot 10,000 = ?$$

$$0.12 \cdot 10,000 = 1,200$$

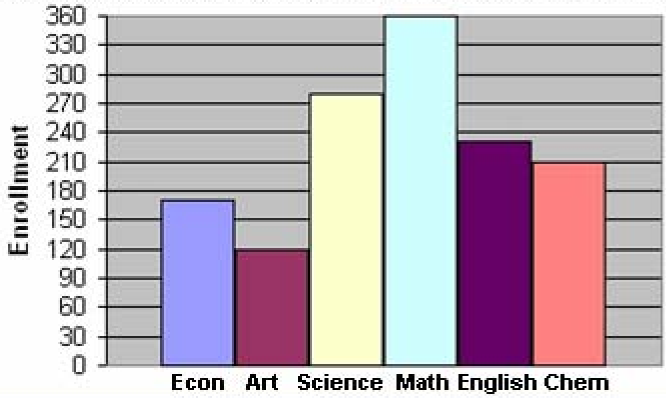
The percent for science is 12% and the total is 10,000 students. Use the percent formula learned earlier. Don't forget to change the percent to a decimal.

There are 1,200 science majors.

DISPLAYING DATA

Bar Graphs

Bar Graphs are another way to illustrate data. To draw a bar graph, draw a horizontal line (horizontal axis) and a vertical line (vertical axis). Each of these two axes represents one of the variables in a table. The following bar graph demonstrates the number of enrollments in each college course for one semester.



EXAMPLE D

How many students are enrolled in an Economics course?

Economics (Econ) is the first bar on the left. The top of the bar approximately lines up with 170 on the vertical axis. So, there are 170 students enrolled in an Economics course.

EXAMPLE E

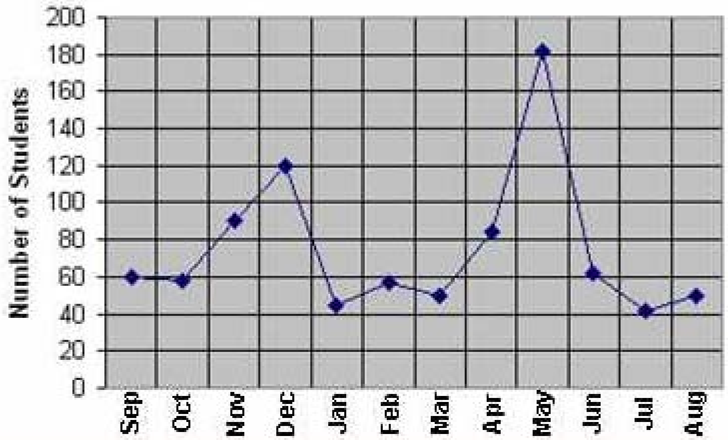
How many students are enrolled in a Mathematics course?

Mathematics (Math) is the fourth bar from the left. The top of the bar approximately lines up with 360 on the vertical axis. So, there are 360 students enrolled in a Math course.

DISPLAYING DATA

Line Graphs

Line graphs can be used when you want to illustrate a trend in data. They are commonly used to show trends over a particular amount of time. The line graph below shows the average daily library attendance for each month. Each point on the line indicates the average number of students attending the library in that month.



EXAMPLE F

What was the average daily attendance for the library in November?

The point above November lines up approximately with 90 on the vertical axis. The average daily attendance for the library in November is approximately 90 students.

EXAMPLE G

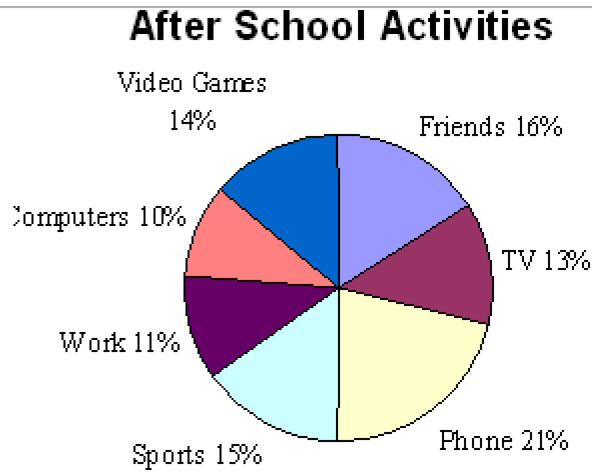
What month had the highest average daily attendance?

The highest point on the graph is above May. The highest average daily attendance occurred in May.

END OF LESSON

The circle graph shows the percentage of 800 students who prefer each after school activity. Use the circle graph to answer problems 8–13.

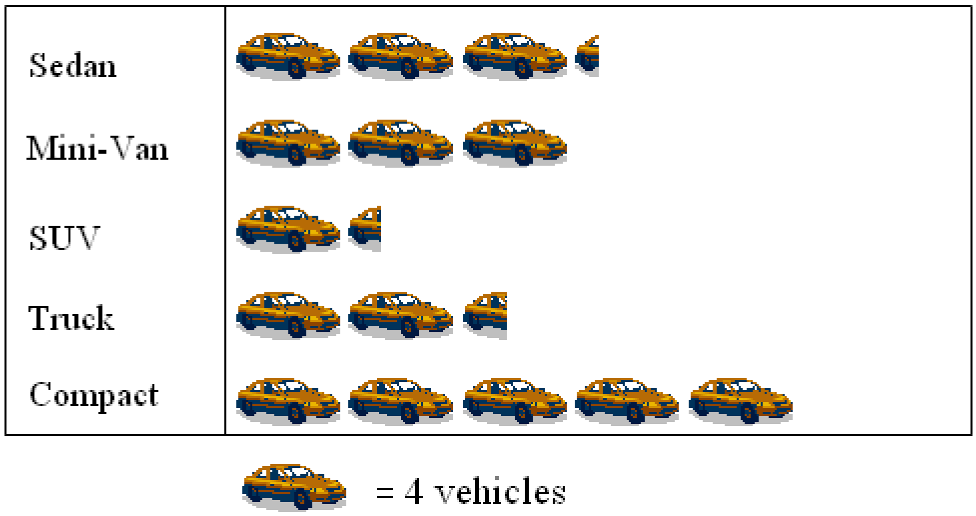
How many more students prefer the phone over sports?



The pictograph shows the number of different types of vehicles sold this month by a dealership.

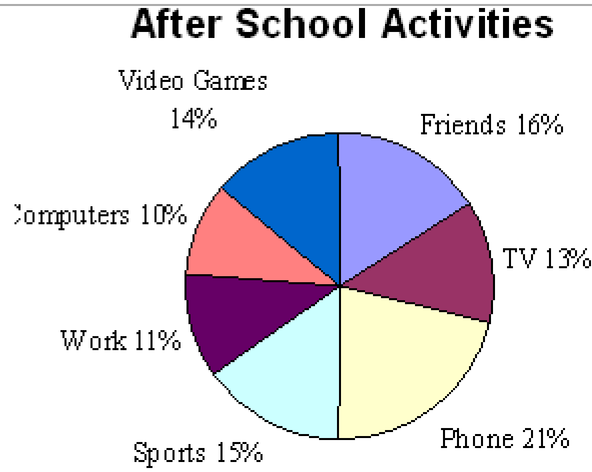
How many more Compacts were sold than SUVs and Trucks combined?

Vehicles Sold



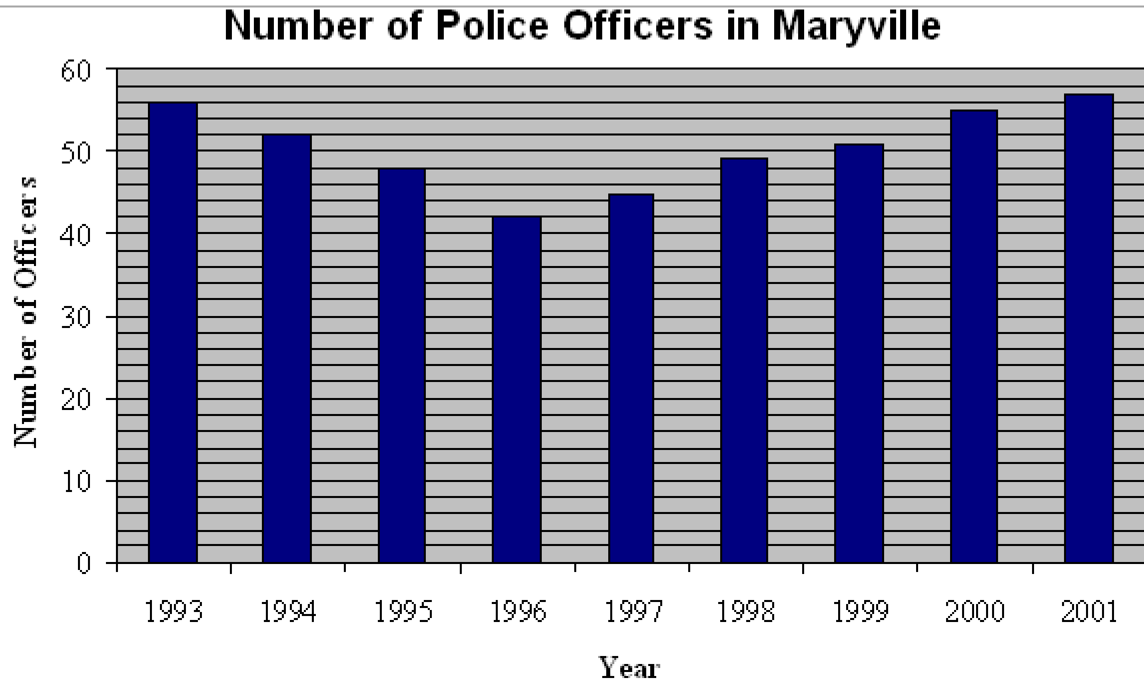
The circle graph shows the percentage of 800 students who prefer each after school activity.

What activity do 168 students prefer?



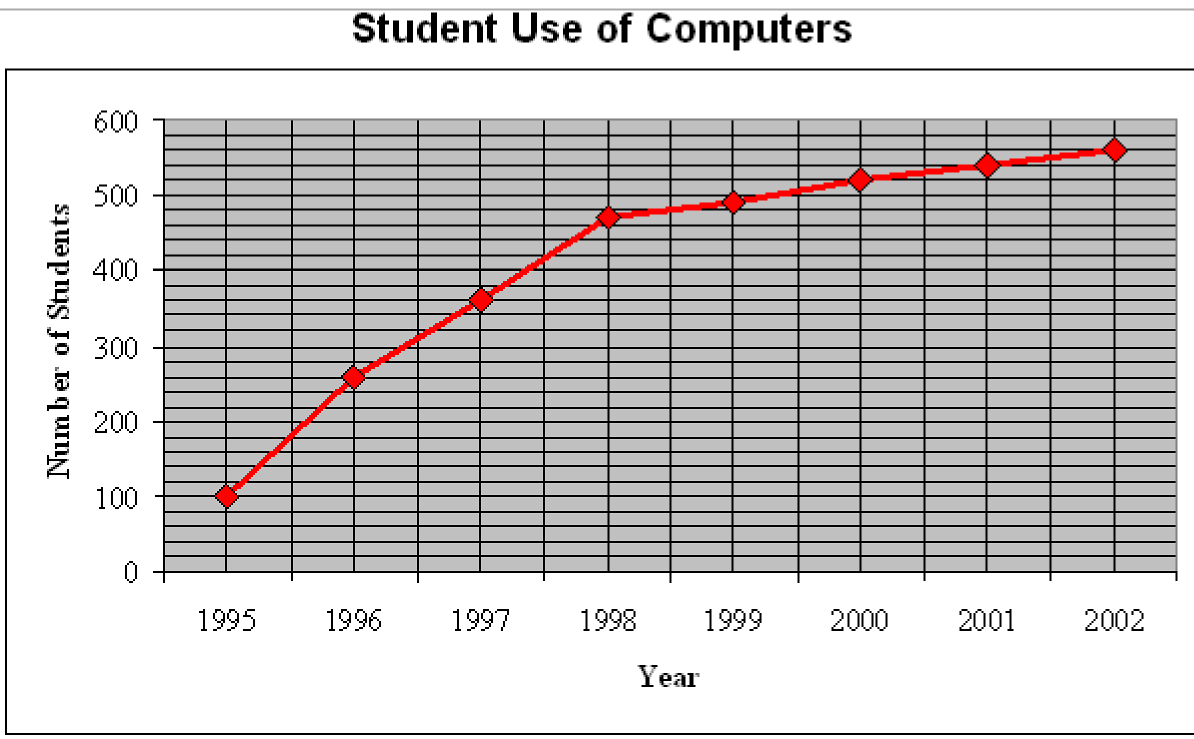
The following bar graph shows the number of police officers in Maryville between 1993 and 2001.

How many more police officers were there in 1993 than in 1997?



The following line graph shows the use of a computer by the number of student from 1995 to 2002 in a community college.

How many students used computers in 2000?



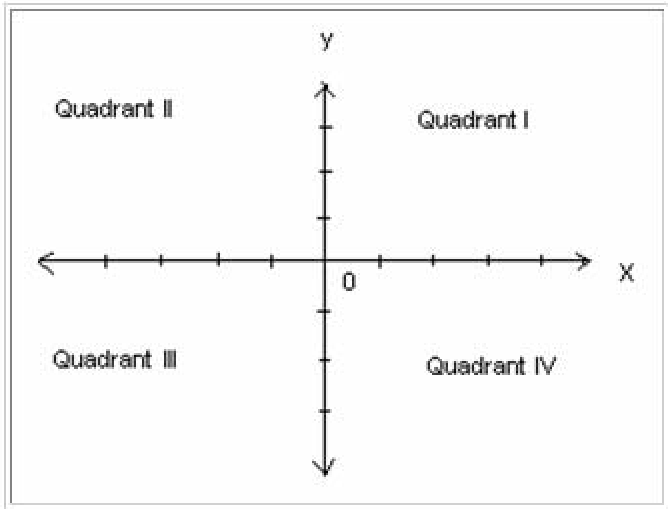
Introduction

This lesson introduces the rectangular coordinate system and its basic features.

THE RECTANGULAR COORDINATE SYSTEM

The **rectangular coordinate system** is composed of an indefinitely large plane that stretches out from each side forever. This plane is divided into four equal parts by two lines—one a vertical line and the other a horizontal line.

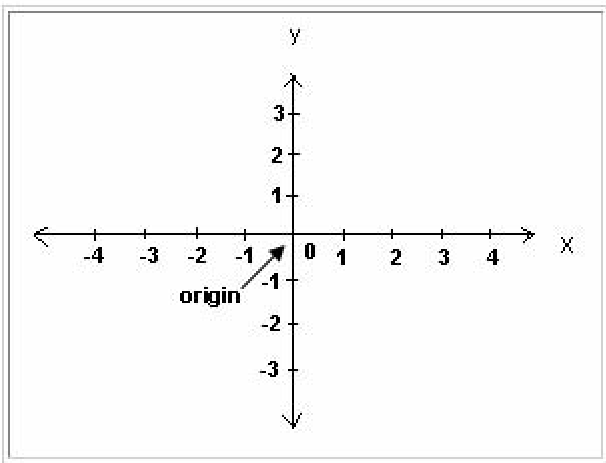
Each of the four equal parts is called a **quadrant.** The quadrants are named with Roman numerals one through four in a specific order. See the image below.



THE RECTANGULAR COORDINATE SYSTEM

The horizontal line is the x **-axis**, and the vertical line is the y **-axis.** The x- and y-axes are perpendicular to each other. The point where these two lines intersect is called the **origin**.

Similar to a number line, both the x- and y-axes are divided into equal intervals of units. On the x-axis, all numbers to the right of the origin are positive numbers and all numbers to the left of the origin are negative numbers. On the y-axis, all numbers above the origin are positive and all numbers below the origin are negative.

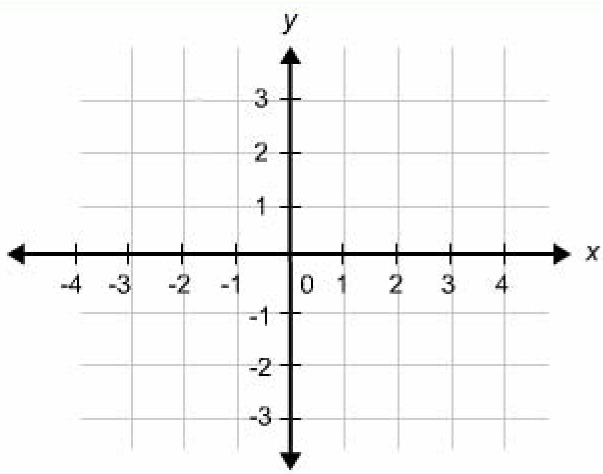


THE RECTANGULAR COORDINATE SYSTEM

The rectangular plane contains an infinite number of points. Each point on the plane has an x-coordinate and a y-coordinate.

The set of x- and y-coordinates of a point is known as an **ordered pair**. We write the ordered pair as (x, y), where x represents a horizontal unit distance from the origin, and y represents a vertical unit distance from the origin. The coordinates for the origin are $(0, 0)$.

The coordinates of a point allow us to plot (or "graph") a specific point on the rectangular coordinate system. For example, to plot point **A** with the coordinates $(2, 3)$, start at the origin and move 2 units to the right. From there, move 3 units up. View the animation below to see this process.



THE RECTANGULAR COORDINATE SYSTEM

Notice that points in Quadrant I have a positive value for both the x- and y-coordinates, and points in Quadrant II have a negative x-coordinate and a positive y-coordinate. Similarly, points in Quadrant III have a negative value for both the x- and y-coordinates, and points in Quadrant IV have a positive x-coordinate and a negative y-coordinate. This information can help you find where to plot a point faster.

EXAMPLE A

In what quadrant is the point $M(-4,-3)$ located? Plot this point.

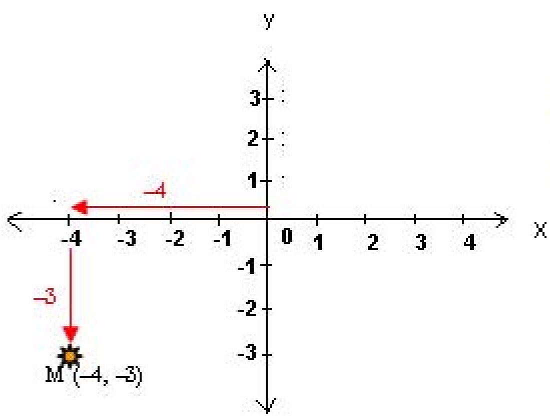
$M\ (-4,-3)$

x-coordinate $= -4$

y-coordinate $= -3$

Look at the sign of each coordinate.

The x-coordinate is negative so the point is to the left of the origin. The y-coordinate is negative so the point is below the origin. The point lies in Quadrant III.



Starting at the origin move 4 units to the left and 3 units down. Check to make sure your point lies in Quadrant III.

THE RECTANGULAR COORDINATE SYSTEM

Extended Example 1a

Which quadrant is point $(-4, 3)$ in? Graph this point.

6 of 7

THE RECTANGULAR COORDINATE SYSTEM

EXAMPLE B

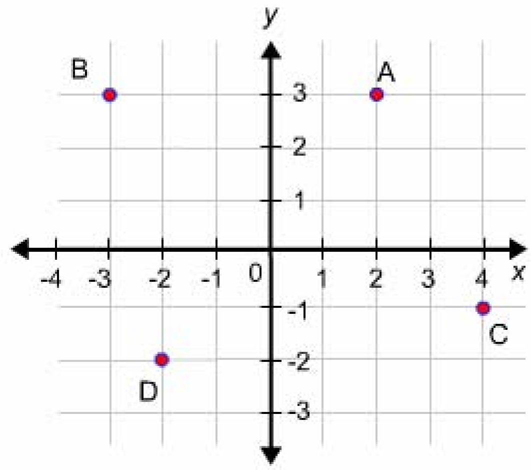
State the coordinates of each point plotted in the graph shown below.

A:

B:

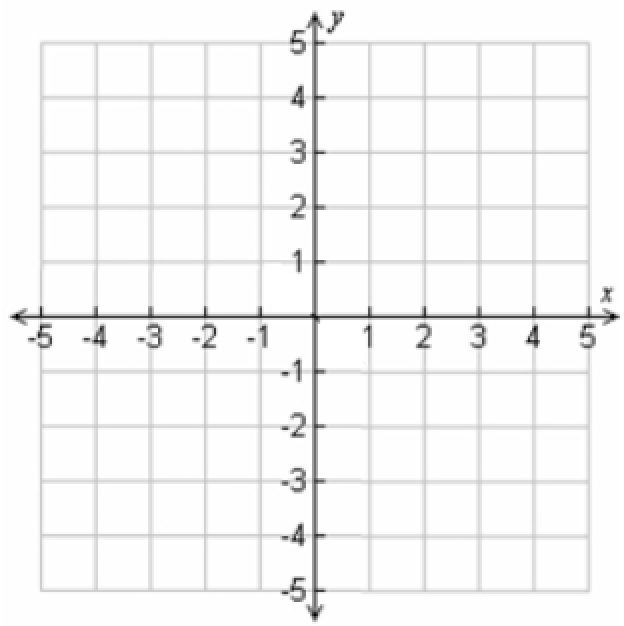
C:

D:

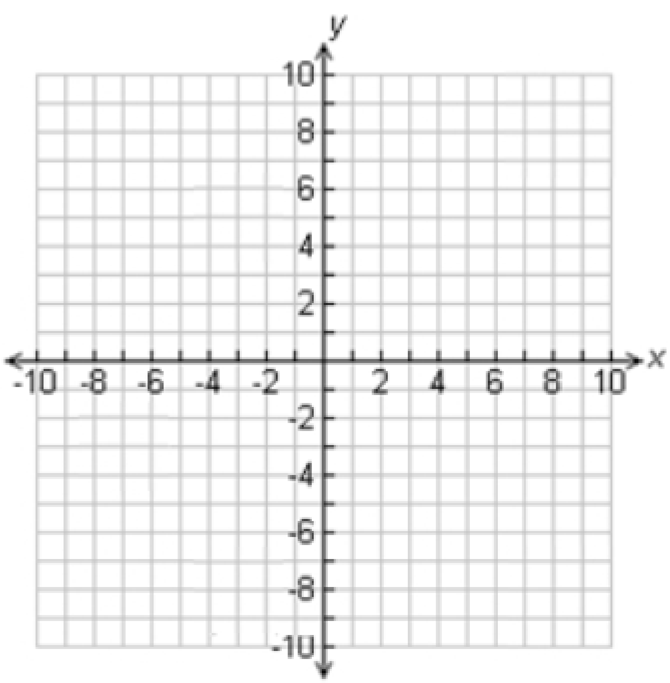


END OF LESSON

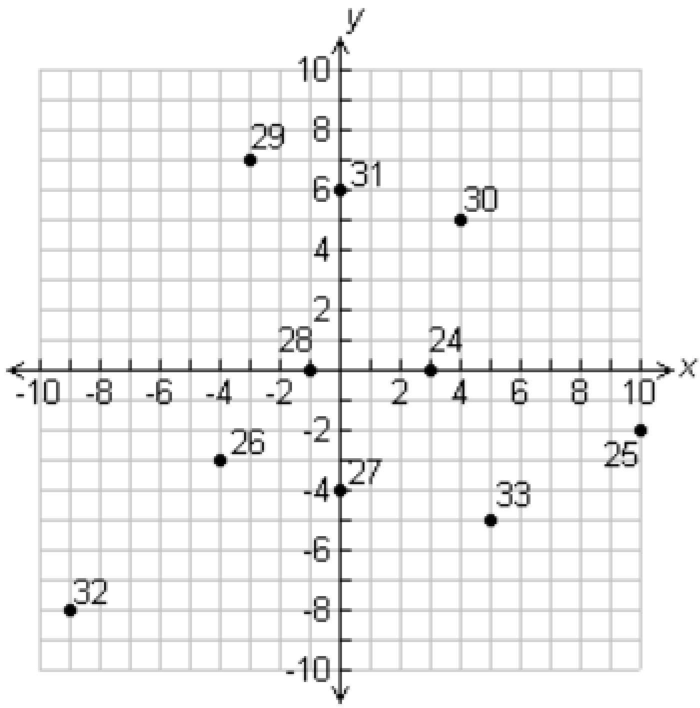
Use the coordinate plane below to plot and label the point (0, 5).



Use the coordinate plane below to plot and label the point (8, –7).



Find the coordinates of the point labeled 29.



GRAPHING LINES

Introduction

In the previous section, you learned how to graph points. In this lesson we'll see how to graph the equation of a line. A line is made up of an infinite number of points. Plotting a few points that are on a line and connecting these points will result in the graph of the line.

The standard equation of a straight line is of the form $ax + by = c$, where a, b, and c are real numbers, and x and y are coordinates of any point on the line. We will learn how to graph the equation of a line using two different methods. The first method uses a table to find the coordinates of points on the line. The second method uses two special points on a line.

GRAPHING LINES

Using a Table

One method for graphing the equation of a line is by creating a table of coordinates. First, select three different values for x. These values can be anything, so it is best to choose small, simple numbers such as -1, 0, or 1. Then, substitute each value into the equation for x and solve for the value of y. Study the following examples.

EXAMPLE A

Graph the line with the equation: $y = x + 1$.

To graph the line, find the coordinates of some points on the line.

To find these coordinates, select three values for x: 1, 0, and -1.

Then, substitute these values into the equation for x and solve for the values of y. The resulting (x, y) coordinates are the coordinates of points on the line.

x	$y = x + 1$	y	(x, y)
1	$y = 1 + 1 = 2$	2	$(1, 2)$
0	$y = 0 + 1 = 1$	1	$(0, 1)$
-1	$y = -1 + 1 = 0$	0	$(-1, 0)$

Plot the calculated points, $(1, 2)$, $(0, 1)$, and $(-1, 0)$ on the rectangular coordinate plane. Connect the points with a straight line. Recall that lines are drawn with an arrow at each end to indicate that they continue on forever.

GRAPHING LINES

EXAMPLE B

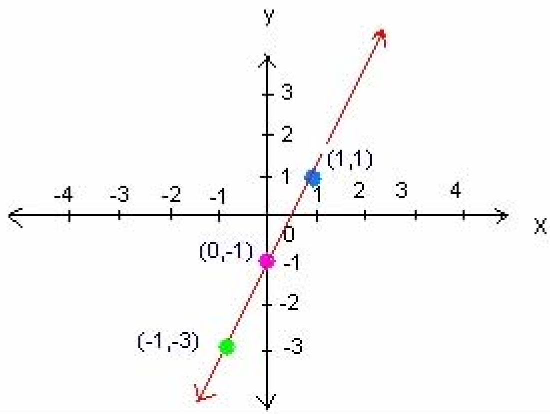
Graph the equation of the line $y = 2x - 1$.

Substitute 1, 0, and -1 for x and solve for y.

The resulting three sets of coordinates are the coordinates of three points on the line.

x	$y = 2x - 1$	y	(x, y)
1	$y = 2(1) - 1 = 1$	1	$(1,1)$
0	$y = 2(0) - 1 = -1$	-1	$(0,-1)$
-1	$y = 2(-1) - 1 = -3$	-3	$(-1,-3)$

Plot the ordered pairs, $(1,1)$, $(0,-1)$, and $(-1,-3)$ on the rectangular coordinate plane. Connect the points and graph the line.



3 of 9

Extended Example 1a

Graph the equation of the line $4x + 3y = 2$.

GRAPHING LINES

The x- and y-Intercepts

The intersection of two lines occurs at a point. The intersection point of the graph of a line ($ax+by=c$) and the x-axis is called the $\boldsymbol{x}$ **-intercept** of the line. Because the x-intercept of a line lies on the x-axis, its coordinates are always of the form $(x,0)$. This means that the value of the y-coordinate is always zero at the x-intercept. Similarly, the intersection point of the graph of a line and the y-axis is called the $\boldsymbol{y}$ **-intercept**. This point is on the y-axis and its coordinates are always of the form $(0,y)$. Meaning that the value of the x-coordinate, at the y-intercept, is always zero.

Finding the x -Intercept

We know that $y=0$ at the x-intercept but we don't know the value for x. To find the x-coordinate of the x-intercept, substitute 0 for y and solve for x.

EXAMPLE C

Find x-intercept of the line $4x+3y=12$.

$$\begin{aligned} 4x+3y &= 12 \\ 4x+3(0) &= 12 \\ 4x+0 &= 12 \\ 4x &= 12 \\ \frac{4x}{4} &= \frac{12}{4} \\ x &= 3 \end{aligned}$$

Substitute 0 for y in the equation of the line, and solve for x.

The x-intercept is $(3,0)$.

The x-coordinate of the x-intercept is 3. The y-coordinate is 0.

Finding the y -Intercept

At the y -intercept, we know that $x = 0$ but we do not know the value for y . To find the y -coordinate of the y -intercept, substitute 0 for x and solve for y .

EXAMPLE D

Find the y -intercept of line with the equation $4x+3y=12$.

$$\begin{aligned} 4x+3y&=12\\ 4(0)+3y&=12\\ 0+3y&=12\\ 3y&=12\\ \frac{3y}{3}&=\frac{12}{3}\\ y&=4 \end{aligned}$$

Substitute 0 for x in the equation of the line, and solve for y .

The y -intercept is $(0,4)$.

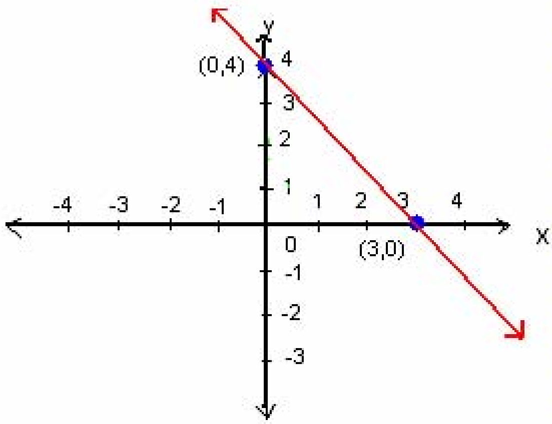
The y -coordinate of the y -intercept is 4. The x -coordinate is 0.

Graphing a Line Using the Intercepts

To graph the line, first plot both the x- and y-intercepts, and then connect the two points with a straight line.

EXAMPLE E

Graph the line $4x + 3y = 12$ using the x- and y-intercepts.



In Example C we found the x-intercept: $(3,0)$. Plot this point on the rectangular coordinate system.

In Example D we found the y-intercept: $(0,4)$. Plot this point on the same rectangular coordinate system.

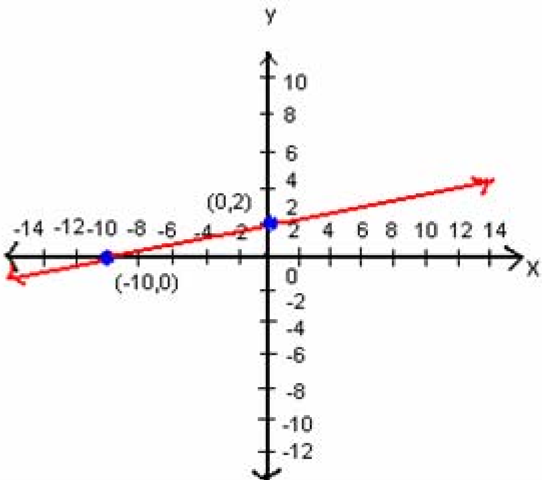
Connect the points with a straight line.

GRAPHING LINES

EXAMPLE F

Find the x- and y-intercepts of the line $x-5y=-10$. Graph the line.

x-intercept $(x,0)$:	y-intercept $(0,y)$:
$x-5y=-10$ $x-5(0)=-10$ $x-0=-10$ $x=-10$ The x-intercept is $(-10,0)$.	$x-5y=-10$ $(0)-5y=-10$ $0-5y=-10$ $-5y=-10$ $\frac{-5y}{-5}=\frac{-10}{-5}$ $y=2$ The y-intercept is $(0,2)$.



Plot the x-intercept: (–10,0).

Plot the y-intercept: (0, 2).

Connect the points with a straight line.

Extended Example 2a

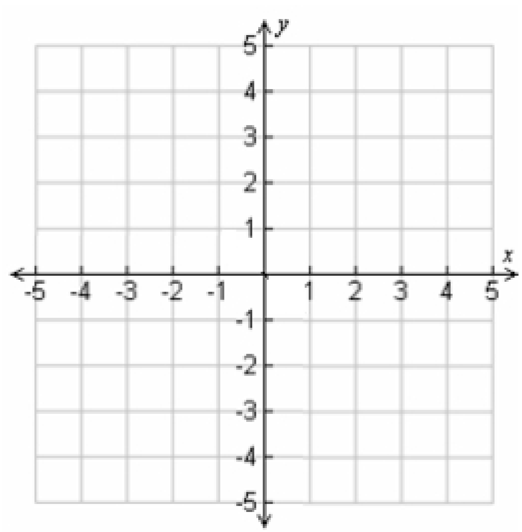
Find the x- and y-intercepts of the line $2x-3y=6$. Graph the line.

END OF LESSON

Complete the table for the equation.
$4x + y = 7$

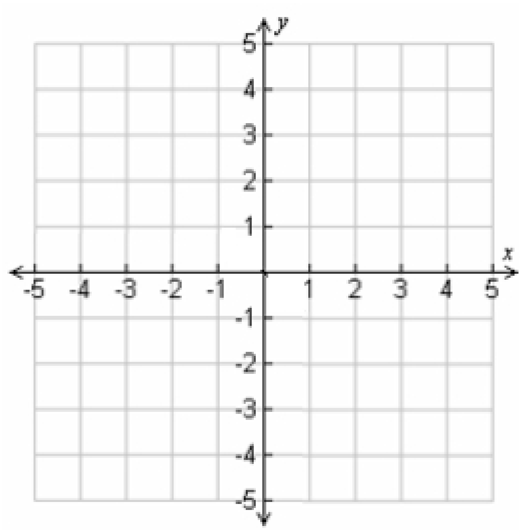
x	y
1	
0	
–1	

Graph the equation.
$y = -x + 4$



Graph the equation.

$2x - y = 1$



Find the a) x-intercept and b) y-intercept for the equation.

$-4x + 12y = -24$

Use the x- and y-intercepts to sketch a graph of the equation.

$$y = \frac{1}{2}x + 1$$