6th Grade Mini-Unit: Graphing in the Coordinate Plane

Graphing 6th Grade Topics

- Cartesian Plane
- Graphing Ordered Pairs
- Polygons in the Coordinate Plane
- Cartesian Plane Applications
- Glossary & Standards

Cartesian Plane
The development of the Coordinate or Cartesian plane is often credited to the French philosopher and mathematician, Rene Descartes.

It is said that Descartes first came up with the idea for the plane as he lay in bed watching several flies crawl across his tiled ceiling; as he observed their movement he realized that he could use the intersecting lines formed by the tiles to describe a fly’s location.

"Cogito, ergo sum"

Rene Descartes
1596 - 1650

Although historical evidence suggests that a contemporary of Descartes, Pierre de Fermat, did more to develop the coordinate system, Rene Descartes’ work certainly revolutionized mathematics by describing the properties of the plane and using it as the first systematic link between Euclidean geometry and algebra.

The coordinate plane is divided into four sections called quadrants. Each quadrant is numbered using the Roman numerals I through IV, in a counter-clockwise direction.
The Coordinate plane is also called the Cartesian plane.

One way to remember how the quadrants are numbered is to write a big "C" on top of the plane. The "C" will begin in quadrant I and end in quadrant IV.

The quadrants are formed by two intersecting number lines called axes. The horizontal line is the x-axis. The vertical line is the y-axis.

The point at which the x and y axes intersect is called the origin. The coordinates of the origin are (0, 0).
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Ordered Pairs

Points can be plotted on the plane using one coordinate from each of the axes. These sets are called **ordered pairs**. The x coordinate always appears first in these pairs. The y coordinate appears second.

(x, y)

10

Coordinate Plane

Each of the quadrants can be identified by the properties of the numbers that fall within their plane. Remember the ordered pairs are always of the form (x, y)

(-,+)
(+,+)
(-,-)
(+,-)

11

1 What points are in quadrant II?

A
B
C
D
E
F

12
2 What points are in quadrant I?

A
B
C
D
E
F

3 What points are in quadrant IV?

A
B
C
D
E
F

4 What points are in quadrant III?

A
B
C
D
E
F
5. What point is closest to the origin?

A  B  C  D  E  F

Answer: F

Graphing Ordered Pairs

To graph an ordered pair, such as (3, 2):
- start at the origin (0, 0)
- move left or right on the x-axis depending on the first number
- then move up or down from there depending on the second number
- plot the point
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**Ordered Pairs**

To graph \((-3, 4)\):
Start at the origin and then move
3 left, up 4

![Graph of (-3, 4)](image)

**Ordered Pairs**

To graph \((-3\frac{1}{2}, -2)\):
Start at the origin and then move
3 and a half left, down 2

![Graph of (-3 1/2, -2)](image)

**Ordered Pairs**

To graph \((5, -3.25)\):
Start at the origin and then move
5 right, down 3.25

![Graph of (5, -3.25)](image)
Ordered Pairs Practice

Place the star on (2.5, 8) in quadrant I
Place the triangle on (-4, 4) in quadrant II
Place the square on (-7, -3) in quadrant III
Place the circle on (1, -4) in quadrant IV

Place the star on (4, 9)
Place the triangle on (-6.25, 2)
Place the square on (3, -9)

In which quadrant is the circle?

What do you notice about the location of the points in relation to each other? What patterns do you see in the coordinates of the points?
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Ordered Pairs Practice

The points (4, 3) and (-4, 3) show a reflection across the y-axis.

What generalization can you make about the coordinates of a point when it is reflected across the y-axis?

Ordered Pairs Practice

The points (4, 3) and (4, -3) show a reflection across the x-axis.

What generalization can you make about the coordinates of a point when it is reflected across the x-axis?

Ordered Pairs Practice

The points (4, 3) and (-4, -3) show a reflection across both the x-axis and y-axis.

What generalization can you make about the coordinates of a point when it is reflected across the x-axis and y-axis?
Ordered Pairs Practice
Move the letter to match it to the correct coordinate point. Then move the circle to check your answer.

- (-9, -4.5)
- (2, -2)
- (9.5, 0)
- (0, 6)
- (5.25, 7.5)
- (-3, 2)

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6. The point (-5, 4) is located in quadrant_____.

   A. I
   B. II
   C. III
   D. IV

7. The point (7, -2) is located in quadrant_____.

   A. I
   B. II
   C. III
   D. IV
8. The point (4, 5.75) is located in quadrant ____.

A. I  
B. II  
C. III  
D. IV

9. The quadrant where the x & y coordinates are both negative is quadrant ____.

A. I  
B. II  
C. III  
D. IV

10. When plotting points in the Cartesian Plane, you always start at ____.

A. the x-axis  
B. the origin  
C. the y-axis  
D. the Coordinate Plane  
E. (0,0)
11 Point A is plotted on the coordinate plane. Point A is reflected across the y-axis. What are the coordinates of the reflection of point A?

A (4, 6)  
B (-4, 6)  
C (4, -6)  
D (-4, -6)

Answer: B (-4, 6)

12 Point A is plotted on the coordinate plane. Point A is reflected across the x-axis. What are the coordinates of the reflection of point A?

A (4, 6)  
B (-4, 6)  
C (4, -6)  
D (-4, -6)

Answer: C (4, -6)

13 Point B is plotted on the coordinate plane. Point B is reflected across the x-axis. What are the coordinates of the reflection of point B?

A (5, 2)  
B (-5, 2)  
C (5, -2)  
D (-5, -2)

Answer: D (-5, -2)
14 Point B is plotted on the coordinate plane.

Point B is reflected across the y-axis. What are the coordinates of the reflection of point B?

A (5, 2)
B (-5, 2)
C (5, -2)
D (-5, -2)

Answer: B (-5, 2)

15 Point C is plotted on the coordinate plane.

Point C is reflected across the x-axis and y-axis. After both reflections, what are the coordinates of point C?

A (2, 9)
B (-2, 9)
C (2, -9)
D (-2, -9)

Answer: A (2, 9)

16 Point D is plotted on the coordinate plane.

Point D is reflected across the x-axis and y-axis. After both reflections, what are the coordinates of point D?

A (3, 5)
B (-3, 5)
C (3, -5)
D (-3, -5)

Answer: B (-3, 5)
17 Point Q is plotted on the coordinate plane.

Point Q is reflected across the x-axis.

What are the coordinates of the reflection of point Q?

(___,___)

From PARCC EOY sample test non-calculator #11

Ordered Pairs Practice

List the coordinates of each point

A
B
C
D
E
F

Ordered Pairs Practice

List the coordinates of each point

A
B
C
D
E
F
18. If the x-coordinate is positive, the point to be plotted will be in quadrant _____.
   A) I
   B) I & II
   C) I & IV
   D) II

19. If the y-coordinate is positive, the point to be plotted will be in quadrant _____.
   A) I
   B) I & II
   C) I & IV
   D) II
20 If the x-coordinate is negative and the y-coordinate is positive, the point to be plotted will be in quadrant _____.
   A I
   B I & II
   C I & IV
   D II
   Answer: B

21 If the x-coordinate is positive and the y-coordinate is negative, the point to be plotted will be in quadrant _____.
   A I
   B II
   C III
   D IV
   Answer: C

22 Point A is located at (-3, 2)
   True
   False
   Answer: False
23 Point A is located at (-5, 1)

True

False

24 Point A is located at (-2.5, 3)

True

False

Polygons in the Coordinate Plane
We can use coordinates as vertices, and connect the dots to draw polygons on a coordinate plane.

### Polygons

Point A and point B have been plotted.

- A (2, 1)
- B (2, 4)

List 4 possible coordinates for point C that would form a right triangle.

Plot point C to check.

### Polygons

Plot and label the following points:
- H (4, 3)
- I (0, 3)
- J (4, 0)

What 4th point would form rectangle HIJK?
25 Which point will create a square?
A (3, 2)  
B (5, 1)  
C (2, 1)  
D (1, 2)

26 Which point will create a right triangle?
A (1, 4)  
B (4, 1)  
C (3, 4)  
D (2, 1)

27 Which point will create a parallelogram?
A (4, 8)  
B (8, 4)  
C (9, 5)  
D (7, 4)
28. Which point will create a trapezoid?
A (1, 3)  
B (1, 1)  
C (3, 3)  
D (3, 1)  

29. Three vertices of rectangle PORS are P(3, 2), Q(3, -3), and R(0, -3). What are the coordinates of vertex S.
A (2, 0)  
B (-2, 0)  
C (0, 2)  
D (-3, 0)  

Coordinate Grid Geoboards Activity
- Work in partners.
- One partner creates a polygon on the geoboard and writes down the vertices.
- Other partner plots the points, and connects them with line segments.
- Compare the polygons, then switch roles.

This example, the vertices are:
(1, 3)  
(4, 1)  
(4, 3)  

Click above to practice using the National Library of Virtual Manipulatives website.
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Length of Each Side
Plot the following points and connect them in the order given. Use the coordinates to find the length of each side.
A (4, 2) B (-2, 2) C (-2, -2) D (4, -2)

Length of Each Side
Plot the following points and connect them in the order given. Use the coordinates to find the length of side CD.
A (6, 8) B (-3, 8) C (-3, -1) D (6, -1)

30. Plot the following points and connect them in the order given. What is the length of AD?
A (-1, -2) B (-5, -2) C (-2, -4) D (-1, -4)
31 Plot and connect the following points: M(1,2), A(-1,2), T (1,4), H (-1,4). What is the length of MA?

32 Plot and connect the following points: A(-2, 2), B(6, 2), C (0, 4). What is the measure of AC?

Help Sarah make a map of her town by plotting the buildings correctly. Her house (point A) is 2 units West and one unit South of the school (point B). Town Hall (point C) is 3 units South of the school. The library (point D) forms parallelogram ABCD.
What can be said about the distance between the school and Sarah's house, and the distance between the library and Town Hall? Justify your answer.

33 $AB$ is one side of right triangle $ABC$. In the triangle, angle $A$ is the right angle, and the length of side $AC$ is 5 units. Choose all the possible coordinates for vertex $C$.

A $(-4, 7)$
B $(2, 7)$
C $(-4, -3)$
D $(2, -3)$
Four friends are touring on motorcycles. They come to an intersection of two roads; the road they are on continues straight, and the other is perpendicular to it. The sign at the intersection shows the distances to several towns. Label the roads on the map. Then, use the map answer the following questions.

What is the distance between Albertsville and Dewey Falls?

Albertsville is 8 miles to the left and Dewey Falls is 6 miles to the right. Since the towns are in opposite directions from the intersection, their distances must be combined. By addition, 8 + 6 = 14, so the distance between Albertsville and Dewey Falls is 14 miles.

Think, Pair, Share

What is the distance between Albertville and Dewey Falls?
What is the distance between Blossville and Cheyenne?

Blossville and Cheyenne are both straight ahead from the intersection in the direction that they are going. Since they are on the same side of the intersection, Blossville is on the way to Cheyenne so the distance to Cheyenne includes the 3 miles to Blossville.

To find the distance, we subtract 12 - 3 = 9. So the distance from Blossville to Cheyenne is 9 miles.

On the coordinate plane, what represents the intersection of the two roads?

The intersection is represented by the origin.

The points (-6, 2) and (3, 2) are plotted below. What is the distance between these two points?

The points (-6, 2) and (3, 2) are plotted below. What is the distance between these two points?
35 The points (-4.5, 4) and (0, 4) are plotted below. What is the distance between these two points?

36 The Canal St station is related to another station on the map. Its x-coordinate is the same as point mystery station's, but its y-coordinate is the opposite of the mystery station's. What are the coordinates of the mystery station?

A (0, 2)  
B (-2, 2)  
C (1, -3)  
D (2, -2)

Navigation Application
Find and plot the point at the following subway stops.
- Canal St (2, 2)
- Fulton St-Broadway (2, -2)
- World Trade Center (-1/2, -1)
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Navigation Solution

Click to reveal answer.

Navigation Application

If each unit equals .5 miles, calculate the distance between the Canal St. and the Fulton St. Broadway stop.

Click to reveal.

37 Each unit of the coordinate plane represents 1/4 mile. About how far is the intersection of Canal St and Church Street from the intersection of Canal St and Broadway?
Study the table below. What pattern do you see between the set of points and the distance between them?

Is there a way to find the distance between the two points without graphing them first on a coordinate plane?

<table>
<thead>
<tr>
<th>Points</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-6, 2)</td>
<td>9</td>
</tr>
<tr>
<td>(3, 2)</td>
<td></td>
</tr>
<tr>
<td>(-5, 4)</td>
<td>6</td>
</tr>
<tr>
<td>(1, 4)</td>
<td></td>
</tr>
<tr>
<td>(-2, 6)</td>
<td>10</td>
</tr>
<tr>
<td>(-2, -4)</td>
<td></td>
</tr>
<tr>
<td>(-5, 7)</td>
<td>4</td>
</tr>
<tr>
<td>(-5, 3)</td>
<td></td>
</tr>
<tr>
<td>(3, -3)</td>
<td>5</td>
</tr>
<tr>
<td>(8, -3)</td>
<td></td>
</tr>
</tbody>
</table>

If two points have either the same x- or y-coordinate, the distance between them can be as follows:

If the different coordinates are either both positive or both negative, subtract their absolute values.

If the different coordinates are opposite signs, add their absolute values.

Let’s look at the table again to see how this works:

<table>
<thead>
<tr>
<th>Points</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-6, 2)</td>
<td></td>
</tr>
<tr>
<td>(3, 2)</td>
<td></td>
</tr>
<tr>
<td>(-5, 4)</td>
<td></td>
</tr>
<tr>
<td>(1, 4)</td>
<td></td>
</tr>
<tr>
<td>(-2, 6)</td>
<td></td>
</tr>
<tr>
<td>(-2, -4)</td>
<td></td>
</tr>
<tr>
<td>(-5, 7)</td>
<td></td>
</tr>
<tr>
<td>(-5, 3)</td>
<td></td>
</tr>
<tr>
<td>(3, -3)</td>
<td></td>
</tr>
<tr>
<td>(8, -3)</td>
<td></td>
</tr>
</tbody>
</table>

Find the distance between (-8, 4) and (-8, 9).
39 Find the distance between (6, 9) and (-2, 9).

85

40 Find the distance between (5, -7) and (5, -2).

86

41 Given the points A(-3, -3), B(2, -3), C (-3, 0), D (2, 0), what is the distance of CD?
42 Given the points X (-3, -2), Y (0, 2), Z (3, -2), what is the distance of XZ?

Answer

88

43 Without plotting the points given, find the perimeter of the shape given its coordinates.

S (5, -5) T (1, -5) U (1, 3) V (5, 3)

Answer

89

44 Without plotting the points given, find the area of the shape given its coordinates.

L (-1, 1) M (-1, -5) N (4, -5) O (4, 1)

Answer

90
45 The graph shows the location of point P and point R. Point R is on the y-axis and has the same coordinate as point P.

Point Q is graphed at (n, -2). The distance from point P to point Q is equal to the distance from point P to point R.

**Part A** What is the distance from point P to point Q? Explain.

*From PARCC PBA sample test calculator #6*

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46 The graph shows the location of point P and point R. Point R is on the y-axis and has the same coordinate as point P.

Point Q is graphed at (n, -2). The distance from point P to point Q is equal to the distance from point P to point R.

**Part B** What is the value of n? Explain.

*From PARCC PBA sample test calculator #6*

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47 City planners are creating a neighborhood map on a coordinate grid. **Neighborhood Planning**

<table>
<thead>
<tr>
<th>Building</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>library</td>
<td>(-4, -6)</td>
</tr>
<tr>
<td>school</td>
<td>(5, -6)</td>
</tr>
</tbody>
</table>

The table shows the locations of the neighborhood library and school on a coordinate grid. In this coordinate grid, the distance between each gridline represents 1 mile. What is the distance, in miles, between the library and the school?

(You can use the coordinate grid on the next page to help you find the answer by plotting two points.)

*From PARCC EOY sample test non-calculator #21*
Glossary & Standards

Cartesian Plane

The two dimensional plane or flat surface that is created when the x-axis intersects with the y-axis.

Also known as a coordinate graph and a coordinate plane.

(0, 0)
Coordinates
A pair of values that show an exact position on a coordinate plane.

(\(x, y\))

(0, 0)

(2, 3)

Counter-clockwise
Turning in the opposite direction of the hands on a clock.

Ordered Pair
Coordinates on a coordinate graph can also be called an ordered pair.

(\(x, y\))

(3, 2)
Origin

The point where zero on the x-axis intersects zero on the y-axis. The coordinates of the origin are (0, 0).

Plane

A flat, two-dimensional surface, that extends in every direction.

Quadrant

Any of the four regions created when the x-axis intersects the y-axis. They are usually numbered with Roman numerals.
Vertex

A point where two or more straight lines meet.

- **Point A or vertex A**
- **The plural of vertex is “vertices”**

X-axis

Horizontal number line that extends indefinitely in both directions from zero. (Right- positive Left negative)

- **(x, y)**
- **X-axis**

Y-axis

Vertical number line that extends indefinitely in both directions from zero. (Up- positive Down- negative)

- **(x, y)**
- **Y-axis**