Graphing on the Coordinate Plane
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These activities are appropriate for students with the following IEP goals:
(5.G.1) Graph 3 out of 4 points on the coordinate plane.
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Gross Motor Introduction Activities

Teaching The Cartesian Graphing System

Teach the coordinate system to the class through gross motor kinesthetic activities. Many of these activities can be adapted to younger and older students (Quadrant I vs. all Quadrants). These activities should help resolve reference frame issues - they will place the student within the reference frame. The student’s starting point should be the origin (0, 0).

The beginning sets of activities are outdoor activities that are mostly done on large cartesian plane made from knotted rope. Knots should be spaced 2 feet apart. **IMPORTANT NOTE: Emphasize to the students that whenever they are moving on the Cartesian Plane, they must first step on the Origin, face forward, then slide sideways before moving up or down. Even if the student is moving down the y-axis (negative), he/she should remain facing forward - it is critical to keep the correct reference frame.**

Use consistent specific vocabulary for all activities, even if it is initially confusing (e.g., origin, x axis, y axis, coordinate/ordered pair). Provide warm-ups before having the student perform independently.

**Initial Activities:** These activities get students plotting points, while emphasizing that x-coordinates are moved first, then the y-coordinates.

- **Plotting Coordinates using the Ropes/Pulleys in the Archway**
  Use the large Cartesian plane (in the archway) to have students graph points that will eventually form a line. Have a student find the origin, then stand directly in front of it.
  Write the coordinate that you want the student to graph: e.g., (2,3)
  The student must first move laterally (∆x) to get the correct rope, then raise that flag to the correct height (∆Y). After each new point has been graphed, have the student explain how they got their flag to it’s destination: “I walked right 2, then raised it up 3 marks.”
  This provides integration of the gross motor, kinesthetic, visual processing w/ verbal expression.

- **Football Quarterback**
  Student #1: the “receiver” goes to the point on the Cartesian Plane and stands there.
  Student #2: the Quarterback starts at the origin. Teacher says, “hike.” QB moves sideways until lined-up with receiver- then verbalizes X coordinate, then throws a nerf football forward (+) or backward (-) to the receiver- then verbalizes the Y coordinate.

**Later Large-Plane Activities:**

- **Bricks on a grid**
  Place bricks (or other items) that are labeled A, B, C, etc onto a large Cartesian Plane.
  Have the students plot the points on their worksheet, and label the points with the correct coordinates.

  **Variation 1:**
  Give students cards with A(0,1), B(1,2), C(2,3) etc. Have these be collinear (so the teacher can easily see if a student has made an error). Have them find their places on the Plane, then plot their points on the worksheet and label the pairs.
Variation 2:
Give students a worksheet that already has coordinate pairs filled in. Have them place their bricks on the corresponding point of the large grid.

• **Red Herring Game** - Students make a line - with one exception.
Give each student an index card with an ordered pair written on it.
One at a time... have each student start at the origin, then step to the coordinates written on their card. Students need to determine if their location is on the line.

Possible coordinates: The line is \( y = 2x + 1 \)

\[
\begin{align*}
(1,3) \\
(2,5) \\
(3,7) \\
(-1, -1) \\
(0, 1) \\
(-2, -3) \\
(-2, 3) \text{ (the Red Herring)} \\
(-3, -5) \\
(-4, -7)
\end{align*}
\]

Possible coordinates: The line is \( y = 3x - 2 \)

\[
\begin{align*}
(-1, -5) \\
(-2, -8) \\
(0, -2) \\
(1, 1) \\
(2, 3) \text{ (the Red Herring)} \\
(2, 4) \\
(3, 7) \\
(4, 10)
\end{align*}
\]

Possible coordinates: The line is \( y = -2x + 2 \)

\[
\begin{align*}
(-3, 8) \\
(-1, 4) \\
(-2, 6) \\
(0, 2) \\
(1, 1) \text{ (the Red Herring)} \\
(2, -2) \\
(3, -4) \\
(4, -6)
\end{align*}
\]

**Extensions for Older students:**
This is the line, \( y = 2x + 1 \)  Find where the Y-Intercept is - where does the line cross the y axis?  (0,1)

For older students who are studying slope, the line can be used to model slope in a gross motor way. Put a pipe on the ground at their feet. Have each student walk up -or down then sideways to get to the position of their neighbor. This set of actions will determine the slope. E.g., for a line with slope=2, have everyone step up(+) and right (+1): the entire line will shift. Have the students with larger integers go first to avoid collisions. Record their change in y / change in x on a dry erase board to model slope.

• **Connect 4** - two teams (red and blue)
This is a bean bag toss from the origin. Bean bags can be made by filling ziploc bags with two different types of items (e.g., sand, pebbles). Student on the first team states a coordinate target, “I’m aiming for (-2, 3). Student points, teacher corrects. Student tosses bean bag at imagined target. Student describes actual coordinates: “I hit (- 3, 2). Class determines difference in x and y (missed left by -1x and low by -1y). Student from Team 2 takes a turn, follows same process. Winning team gets 4 in a row.

**Other Initial Activities**: These are other practice activities, but these can be done indoors, and do not require the large Cartesian Plane.

• **Simon Says**
Teacher says, “Move ( -1, 2) steps”.
Students point to the estimated coordinate (left one step, up two steps), teacher checks that students are pointing to the right place, then students move there... x, then y directions (left 1 step, then forward 2). Again, remember that is the y coordinate is negative, students still need to face forward when moving backwards!

• **Battleship Game** - For this game each player needs a Fleet game board and a Torpedo Sheet. This is a two player game. Each player draws 3 ships on the Cartesian plane labeled “My Fleet”. One is a 4 point ship, one ship has 3 points, the other has 2. Similar to regular battleship, ships must be vertical or horizontal, not diagonal. After each opponent has placed their ships on their fleet, they will have a chance to try to torpedo their op-
ponent. Player one calls a Torpedo point, and writes it down on their Torpedo Sheet. This is important, because at the end of the game, the winner must verify that he/she called all points that hit the enemy ships. Player two marks the called point on his own “My Fleet” cartesian plane, and declares “Hit” or “Miss”. Player Two may look at Player One’s Torpedo Sheet if he/she finds it difficult to hold the coordinates in auditory memory. Based on Player Two’s response, Player One should mark this point as a hit (x) or miss (•) on his “Enemy Fleet” Cartesian plane. Player One should also circle any Torpedo that hits the enemy ship. Eventually one player will “destroy” the entire ship of the opponent (hit all points). The opponent must declare that the ship is destroyed. The Player to first destroy all 3 enemy ships is the winner. In order to officially win however, the winning player must read all of the Torpedos that were “hits”, and with the opponent verify that these did, indeed, hit the enemy ships.
My Fleet

Battleship: 4 colinear points = ( , ) ( , ) ( , ) ( , )

Cruiser: 3 colinear points = ( , ) ( , ) ( , )

Patrol Boat: 2 colinear points = ( , ) ( , )

Cartesian Battleship:

My Fleet

Battleship: 4 colinear points = ( , ) ( , ) ( , ) ( , )

Cruiser: 3 colinear points = ( , ) ( , ) ( , )

Patrol Boat: 2 colinear points = ( , ) ( , )

Enemy Fleet

Battleship: 4 colinear points = ( , ) ( , ) ( , ) ( , )

Cruiser: 3 colinear points = ( , ) ( , ) ( , )

Patrol Boat: 2 colinear points = ( , ) ( , )
Torpedos!

(x, y)

Captain ____________
Quadrant I Activities -

These activities are appropriate for students with the following IEP goals:

(5.G.1) Graph 3 out of 4 points on the coordinate plane.

(6.NS.6c) Plot and label points on the number line and all quadrants of the Cartesian plane.

(8.EE.6) Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane.
Accuracy: Find the slope of a line from two sets of coordinate pairs, 3 out 4 correct.

(8.F.1) Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
Accuracy: Given 4 graphs, classify each as a function or relation.

(A-REI.6) Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Accuracy: 3 out of 4
Plot these points on the big Cartesian plane and the grid above.
The coordinates of each point are listed below:

A ( 3, 4 )  B ( 1, 7 )  C ( 8, 4 )  D ( 5, 6 )  
E ( 0, 7 )  F ( 7, 0 )  G ( 2, 6 )  L ( 4, 3 )
Find the points on the big Cartesian plane, then plot them on this grid. Write the coordinate of each point below:

A ( , )  B ( , )  C ( , )  D ( , )  
E ( , )  F ( , )  G ( , )  L ( , )
Cartesian Plane Mapping Activity

Find the objects on the big Cartesian plane, then plot them on this grid.
Write the coordinate of each object below:

Pencil ( , )
Marker ( , )
Ball ( , )

Pen ( , )
_____________( , )
_____________( , )
_____________( , )
_____________( , )

_____________( , )
_____________( , )
Find the objects on the big Cartesian plane, then plot them on this grid. Label coordinates below:

___________________(      ,      )      _________________ (      ,      )
___________________(      ,      )      _________________ (      ,      )
___________________(      ,      )      _________________ (      ,      )
___________________(      ,      )      _________________ (      ,      )
___________________(      ,      )      _________________ (      ,      )

Cartesian Plane Mapping Activity
Teacher hands each student a placard. The placards have these pictures on one side and an empty ( , ) on the other. Have each student write the following coordinates on the ( , ) side of the dry erase placards. The teacher directs each (as necessary) to plot their placards at the following locations. Prompts to plot students: “Start at the origin, sidestep the x coordinate, step up to the Y.”
Teacher hands each student a placard.
The placards have these pictures on one side and an empty ( , ) on the other.
Have each student write the following coordinates on the ( , ) side of the dry erase placards.
The teacher directs each (as necessary) to plot their placards at the following locations.
Prompts to plot students: “Start at the origin, sidestep the x coordinate, step up to the Y.”

\[ y = x + 2 \]
\[ (0, 2) \quad \text{皇冠} \]
\[ (1, 3) \quad \text{菱形} \]
\[ (2, 4) \quad \text{锁} \]
\[ (3, 5) \quad \text{月亮} \]
\[ (4, 6) \quad \text{星星} \]

\[ y = -x + 6 \]
\[ (0, 6) \quad \text{爱心} \]
\[ (1, 5) \quad \text{宝箱} \]
\[ (2, 4) \quad \text{钥匙} \]
\[ (3, 3) \quad \text{手} \]
\[ (4, 2) \quad \text{骰子} \]
Teacher places the placards on the Cartesian plane. Students write the coordinates of each picture on this worksheet. The teacher has students take turns stepping the coordinates to each picture to validate. Each student must start at the origin, then...

- Sidestep until the picture is directly above to check the x coordinate.
- Walk forward to reach the object to check the y coordinate.

(   ,   )
(   ,   )
(   ,   )
(   ,   )
(   ,   )
(   ,   )
(   ,   )
(   ,   )
(   ,   )
(   ,   )
Large Shapes for Placards
Whole-Body Tactile Kinesthetic Adventures on the Cartesian Plane

**Activity #1 - Introduction**
Students trace the dot-to-dot constellations to build-up a knowledge base about the constellations to be formed.

**Activity #2 - Instruction:** Using gross motor, kinesthetic processing.
Graphing points within the primary reference frame on Quadrant I.
Students receive the (ordered pair) coordinates of their “star.”
They are guided to side step on a knotted rope that represents the X axis, then move forward (in the positive y direction) the appropriate number of steps to reach their star position. They remain there until all “stars” are plotted. When the teacher connects all the students by having them join hands, or connects them with forestry tape or yarn, the groups of stars will form a constellation.

**Activity #3** (Transfer the graphing task to a fine motor production task.)
Students graph the same constellations with pencil and paper.
Activity #1
Connect the stars in alphabetical order to make constellations.

Draco the Dragon

Cassiopeia

The Little Dipper
Ursa Minor- The Little Bear

Polaris: The North Star

The Big Dipper
Ursa Major- The Big Bear
Laminate 2 copies of these numbers. Use them to label the x axis and y axis. Staple them to two intersecting ropes, or tape them to the floor.
As an alternative to rope.... If you have a floor- tiled with 1 foot square tiles, use tape to define each axis, then tape the numbers to the floor along each axis. Make sure to space the numbers equally on both axes.

The colored numbers that follow are the coordinates of stars that form constellations. Each star is labeled with a letter and a set of (x,y) coordinates. Stars that form a constellation are color coded. For instance, the green letters/ coordinates will form the “W- shaped” Cassiopeia when plotted and connected.

Cut out all five of the green letters with their associated coordinates and paste them on a star.

For Cassiopeia, select five students. Give each of them one of the stars. Plot each star-carrying student... one by one on the big cartesian plane made of the rope (described above). To “plot” a student, call the student’s name and have the student stand on the origin- there the vertical (Y) and horizontal (X) ropes are joined with a knot. To plot “Person A” (see above star) have them stand on the origin, facing the numbers on the Y axis. Have them side-step right- in this case (2, 6): 2 steps.
Once they arrive at the 2 on the X axis, have them take 6 steps forward- maintaining the y-axis number spacing. The student should remain in this location. Next, plot the next star-student.

After they are all plotted, have them form the constellation by joining hands in alphabetical order. Ask the students who are not plotted to look at their dot- to dot constellation sheets to determine the name of the constellation, in this case Cassiopeia.
• Paste or write these colored letters and \((x,y)\) coordinates on star-shaped cut-outs.
• Students are given a star, at the \((0,0)\) origin, then side-step (right) along the \(x\) axis \((x,\ )\) spaces.
• Then ask them to walk (forward) \((\ ,y)\) steps.

Big Dipper

\[
\begin{align*}
A & : (0, 2) \\
B & : (2, 3) \\
C & : (4, 2) \\
D & : (1, 0) \\
E & : (7, 0) \\
F & : (9, 1) \\
G & : (9, 3) \quad \text{* Note that the ray formed with F & G points to Polaris, the North Star!}
\end{align*}
\]
Plot Cassiopeia’s ordered pairs:
A (2, 6)
B (3, 1)
C (5, 4)
D (7, 0)
E (9, 3)

Little Dipper
P (9, 7) - Polaris, The North Star!
Polaris
Q (8, 7)
R (7, 7)
S (6, 6)
T (5, 7)
U (4, 6)
V (5, 5)
Draco the Dragon

Use this sheet as a guide when “plotting the kids.”

A  (10, 7)  I  (4, 6)
B  (9, 6)  J  (3, 7)
C  (9, 5)  K  (2, 6)
D  (8, 2)  L  (1, 3)
E  (7, 2)  M  (0, 1)
F  (6, 3)  N  (1, 0)
G  (5, 4)  O  (3, 1)
H  (5, 5)  Q  (2, 2)

E  (7, 2)  K  (2, 6)
F  (6, 3)  L  (1, 3)
G  (5, 4)  M  (0, 1)
H  (5, 5)  N  (1, 0)
I  (4, 6)  O  (3, 1)
J  (3, 7)  Q  (2, 2)
Plotting Stars Activity

Constellation: ____________________________________

Cassiopeia
Write the ordered pairs.

A (    ,    )
B (    ,    )
C (    ,    )
D (    ,    )
E (    ,    )

Plot the ordered pairs:

Cassiopeia

A (2, 6)
B (3, 1)
C (5, 4)
D (7, 0)
E (9, 3)
**Plotting Stars Activity**

Constellation: **Cassiopeia**

Plot Cassiopeia’s ordered pairs:

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>A</td>
<td>(2, 6)</td>
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<tr>
<td>B</td>
<td>(3, 1)</td>
</tr>
<tr>
<td>C</td>
<td>(5, 4)</td>
</tr>
<tr>
<td>D</td>
<td>(7, 0)</td>
</tr>
<tr>
<td>E</td>
<td>(9, 3)</td>
</tr>
</tbody>
</table>

Constellation: **Big Dipper and Little Dipper**

Plot the ordered pairs:

**Little Dipper**

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>P</td>
<td>(9, 7)</td>
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<tr>
<td>Q</td>
<td>(8, 7)</td>
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<tr>
<td>R</td>
<td>(7, 7)</td>
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<td>S</td>
<td>(6, 6)</td>
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<td>T</td>
<td>(5, 7)</td>
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<tr>
<td>U</td>
<td>(4, 6)</td>
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<tr>
<td>V</td>
<td>(5, 5)</td>
</tr>
</tbody>
</table>

**Big Dipper**

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<tbody>
<tr>
<td>A</td>
<td>(0, 2)</td>
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<tr>
<td>B</td>
<td>(2, 3)</td>
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<tr>
<td>C</td>
<td>(4, 2)</td>
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<tr>
<td>D</td>
<td>(6, 1)</td>
</tr>
<tr>
<td>E</td>
<td>(7, 0)</td>
</tr>
<tr>
<td>F</td>
<td>(9, 1)</td>
</tr>
<tr>
<td>G</td>
<td>(9, 3)</td>
</tr>
</tbody>
</table>

*Note that the ray formed with F & G points to Polaris, the North Star!*
Plotting Stars Activity

Constellations: **Draco the Dragon**

Write the ordered pairs:

- A ( , )
- B ( , )
- C ( , )
- D ( , )
- E ( , )
- F ( , )
- G ( , )
- H ( , )
- I ( , )
- J ( , )
- K ( , )
- L ( , )
- M ( , )
- N ( , )
- O ( , )
- Q ( , )
Plotting Stars Activity

Constellation: ____________________________________

Little Dipper - 7 stars.
Write the ordered pairs, then connect the points in the order listed:

Polaris (    ,    )
Q         (    ,    )
R         (    ,    )
S         (    ,    )
T         (    ,    )
U          (     ,    )
V         (    ,    )

Big Dipper - 7 stars
Write the ordered pairs, then connect the points in the order listed:

A       (     ,     )
B       (     ,     )
C       (     ,     )
D       (     ,     )
E       (     ,     )
F       (     ,     )
G       (     ,     )

Big and Little Dippers
Plotting Stars Activity

Big Dipper
Constellation: ____________________________________

Plot the ordered pairs:
Big Dipper

A ( 0, 2)
B ( 2, 3)
C ( 4, 2)
D ( 1, 0)
E ( 7, 0)
F ( 9, 1)
G ( 9, 3) * Note that the ray formed with F & G points to Polaris, the North Star!

Draco the Dragon
Constellation: ____________________________________

Plot the ordered pairs:
Draco the Dragon

A (10, 7)
B ( 9, 6)
C ( 9, 5)
D ( 8, 2)
E ( 7, 2)
F ( 6, 3)
G ( 5, 4)
H ( 5, 5)
I ( 4, 6)
J ( 3, 7)
K ( 2, 6)
L ( 1, 3)
M ( 0, 1)
N ( 1, 0)
O ( 3, 1)
Q ( 2, 2)
## Cartesian Plane Vocabulary A to Z

<table>
<thead>
<tr>
<th>Word or Term</th>
<th># Syllables</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>congruent</td>
<td>3</td>
<td>Exactly the same size and shape</td>
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<tr>
<td>coordinate</td>
<td>4</td>
<td>The two numbers (x,y) that describe the location of a point</td>
</tr>
<tr>
<td>image</td>
<td>2</td>
<td>The new copy of a figure after a transformation is performed</td>
</tr>
<tr>
<td>ordered pair</td>
<td>2, 1</td>
<td>Synonym for “coordinate” - the two numbers (x,y) that describe the location of a point</td>
</tr>
<tr>
<td>origin</td>
<td>3</td>
<td>The place where the x axis and y axis meet</td>
</tr>
<tr>
<td>quadrant</td>
<td>2</td>
<td>one quarter of the Cartesian Plane</td>
</tr>
<tr>
<td>reflect</td>
<td>2</td>
<td>flip the image</td>
</tr>
<tr>
<td>rotate</td>
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<td>spin the image</td>
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<tr>
<td>translate</td>
<td>2</td>
<td>slide the image</td>
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**CW 2010**
<table>
<thead>
<tr>
<th>Word or Term</th>
<th># Syllables</th>
<th>Definition</th>
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<tbody>
<tr>
<td>vertex (vertices)</td>
<td>2(3)</td>
<td>The point where edges of a solid shape meet.</td>
</tr>
<tr>
<td>x axis</td>
<td>1,2</td>
<td>The horizontal axis</td>
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<td>y axis</td>
<td>1,2</td>
<td>The vertical axis</td>
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<td>Definition</td>
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<th>Word or Term</th>
<th># Syllables</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>copy</td>
<td>3</td>
<td>Exactly the same size and shape</td>
</tr>
<tr>
<td>copy</td>
<td>4</td>
<td>The two numbers ((x,y)) that describe the location of a point</td>
</tr>
<tr>
<td>copy</td>
<td>2</td>
<td>The new copy of a figure after a transformation is performed</td>
</tr>
<tr>
<td>copy</td>
<td>2, 1</td>
<td>Synonym for “coordinate” - the two numbers ((x,y)) that describe the location of a point</td>
</tr>
<tr>
<td>copy</td>
<td>3</td>
<td>The place where the x axis and y axis meet</td>
</tr>
<tr>
<td>copy</td>
<td>2</td>
<td>one quarter of the Cartesian Plane</td>
</tr>
<tr>
<td>copy</td>
<td>2</td>
<td>flip the image</td>
</tr>
<tr>
<td>copy</td>
<td>2</td>
<td>spin the image</td>
</tr>
<tr>
<td>copy</td>
<td>2</td>
<td>slide the image</td>
</tr>
<tr>
<td>Word or Term</td>
<td># Syllables</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>The horizontal axis</td>
<td>1,2</td>
<td>The point where edges of a solid shape meet.</td>
</tr>
<tr>
<td>The vertical axis</td>
<td>1,2</td>
<td></td>
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<tr>
<td>Word or Term</td>
<td># Syllables</td>
<td>Definition</td>
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<tr>
<td>congruent</td>
<td>3</td>
<td>copy entire word or term below:</td>
</tr>
<tr>
<td>coordinate</td>
<td>4</td>
<td>copy</td>
</tr>
<tr>
<td>image</td>
<td>2</td>
<td>copy</td>
</tr>
<tr>
<td>ordered pair</td>
<td>2, 1</td>
<td>copy</td>
</tr>
<tr>
<td>origin</td>
<td>3</td>
<td>copy</td>
</tr>
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<td>quadrant</td>
<td>2</td>
<td>copy</td>
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<tr>
<td>reflect</td>
<td>2</td>
<td>copy</td>
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<tr>
<td>rotate</td>
<td>2</td>
<td>copy</td>
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<tr>
<td>translate</td>
<td>2</td>
<td>copy</td>
</tr>
<tr>
<td>Word or Term</td>
<td># Syllables</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------</td>
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<td>------------</td>
</tr>
<tr>
<td>vertex (vertices)</td>
<td>2(3)</td>
<td></td>
</tr>
<tr>
<td>x axis</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>y axis</td>
<td>1,2</td>
<td></td>
</tr>
</tbody>
</table>

copy entire word or term below:

copy

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Transformations

Types of transformations

• Translating means shifting the object (in the same orientation) right, left, up, or down.

• Reflecting involves flipping the object in the direction of the reflection, then repositioning the object on the opposite side of the axis of reflection. Each vertex of the object should be positioned the same distance from this axis as its corresponding vertex from the original figure. Think of your reflection in a mirror. The mirror is the axis of reflection.

• Less frequently occurring transformations include dilation- the process of expanding or contracting, and rotation- spinning the object while maintaining its size and the serial order of the vertices. These transformations are beyond the scope of this initial worksheet series.

Letter Block Transformations

Students will cut out letters and transform them on the Cartesian Plane.

To make it clear that each point of the letter is being translated or reflected, have the students mark one corner of the cut-out letter with a large colored point. They should then mark the corresponding point of the shape that is already drawn on the Cartesian plane. As they “transform” using their cut-out letter, they should be moving the colored point the appropriate amount of units (see example).

Extension for older students:
• Have students label one point on the original figure, and label the corresponding point on the image.

Discuss which coordinates have changed, and by how much. Help students discover that one coordinate stays the same, while the other changes (and discover how it changes).
Draw the figures after they have been transformed.

Translate the red-dot corner right 5 units -->
(-2, 5)  (3, 5)

Translate left 4 units

Translate up 3 units

Translate down 2 units

Cut these out. Glue stick them to grids.

To quantify the change described by the translation in a mathematical way, write the coordinates of the two points on the board and find the difference between them by subtracting them.
Transformations
Letter Blocks

Draw the figures after they have been transformed.

Translate the red-dot corner right 5 units→

<---- Translate left 4 units

Translate up 3 units

Translate down 2 units

Cut these out.
Glue stick them to grids
Transformations
Draw the figures after they have been transformed.

Translate right ___ units.-->  

Translate left ___ units.  

Translate up ___ units.  

Translate down ___ units.

Cut these out.
Glue stick them to grids.
Transformations
Draw the figures after they have been transformed.

Reflect over the X axis.

Reflect over the Y axis --->.

Flip these, then trace the reflected letters on the reverse sides.
Transformations
Draw the figures after they have been transformed.

Rotation
Turn!

Rotate 90 degrees around the origin.

Rotate 90 degrees around the origin.

Rotate 90 degrees around the origin.

Cut these out.
Glue stick them to grids
Paper Triangle Series

1) Use scissors to cut the bottom right corner off the paper on the dotted line.

2) Place this paper triangle over triangle abc. Use this paper triangle to perform the translation (slide) or reflection (flip).

3) After the teacher has confirmed that the student has accurately performed the transformation, have the student mark and label the vertices. The coordinates should then be documented in the parentheses provided at the top of the page.

4) Compare the coordinates of the original shape to the new coordinates. Have the students explain how the changes are applied consistently to all of the coordinates.
Coordinates of triangle abc: a: ( , ), b: ( , ), c: ( , )
Translated 5 units down: d: ( , ), e: ( , ), f: ( , )
Translated 5 units right: g: ( , ), h: ( , ), i: ( , )
Coordinates of triangle abc:  a: ( , ), b: ( , ), c: ( , )
Translated 5 units up:  d: ( , ), e: ( , ), f: ( , )
Translated 5 units right:  g: ( , ), h: ( , ), i: ( , )
Coordinates of triangle abc:  a: ( , ),  b: ( , ),  c: ( , )
\( \Delta \) abc reflected over the y axis:  d: ( , ),  e: ( , ),  f: ( , )
\( \Delta \) abc reflected over the x axis:  g: ( , ),  h: ( , ),  i: ( , )
Coordinates of triangle ABC: a: ( , ), b: ( , ), c: ( , )

△ ABC reflected over the y axis: d: ( , ), e: ( , ), f: ( , )

△ ABC reflected over the x axis: g: ( , ), h: ( , ), i: ( , )
Reflect and Translate Series

Draw the figures and their transformations.
Label the new coordinates of the vertices

Reflect triangle abc: a ( , ) b ( , ) c ( , ) across the Y axis.
Label vertices of the image: e ( , ) f ( , ) g ( , )

Translate triangle abc: a ( , ) b ( , ) c ( , ) 4 units down.
Label vertices of the image: h ( , ) i ( , ) j ( , )
Draw the figures and their transformations.
Label the new coordinates of the vertices

Reflect triangle abc:  a ( , ) b ( , ) c ( , ) across the Y axis.
Label vertices of the image: e( , ) f ( , ) g ( , )

Translate triangle abc:  a ( , ) b ( , ) c ( , ) 4 units up.
Label vertices of the image: h( , ) i ( , ) j ( , )
Draw the figures and their transformations.
Label the new coordinates of the vertices

Reflect triangle abc: \( a ( \ , \ ) \ b ( \ , \ ) \ c ( \ , \ ) \) across the y axis.
Label vertices of the image: \( e ( \ , \ ) \ f ( \ , \ ) \ g ( \ , \ ) \)

Translate triangle abc: \( a ( \ , \ ) \ b ( \ , \ ) \ c ( \ , \ ) \) 4 units left.
Label vertices of the image: \( h ( \ , \ ) \ i ( \ , \ ) \ j ( \ , \ ) \)
Draw the figures and their transformations.
Label the new coordinates of the vertices

Reflect triangle abc: \( a ( \quad , \quad ) \quad b ( \quad , \quad ) \quad c ( \quad , \quad ) \) across the x-axis.
Label vertices of the image: \( a' ( \quad , \quad ) \quad b' ( \quad , \quad ) \quad c' ( \quad , \quad ) \)

Translate triangle abc: \( a ( \quad , \quad ) \quad b ( \quad , \quad ) \quad c ( \quad , \quad ) \) 4 units down.
Label vertices of the image: \( a' ( \quad , \quad ) \quad b' ( \quad , \quad ) \quad c' ( \quad , \quad ) \)
Draw the figures and their transformations.
Label the new coordinates of the vertices

**Reflect triangle abc:** \(a\left(\ , \right)\) \(b\left(\ , \right)\) \(c\left(\ , \right)\) across the x-axis.
Label vertices of the image: \(a'\left(\ , \right)\) \(b'\left(\ , \right)\) \(c'\left(\ , \right)\)

**Translate triangle abc:** \(a\left(\ , \right)\) \(b\left(\ , \right)\) \(c\left(\ , \right)\) 5 units right.
Label vertices of the image: \(a'\left(\ , \right)\) \(b'\left(\ , \right)\) \(c'\left(\ , \right)\)
Draw the figures and their transformations.
Label the new coordinates of the vertices

Reflect triangle abc: \[a (\ , \ ) \ b (\ , \ ) \ c (\ , \ )\] across line PQ.
Label vertices of the image: \[a’ (\ , \ ) \ b’ (\ , \ ) \ c’ (\ , \ )\]

Translate triangle abc: \[a (\ , \ ) \ b (\ , \ ) \ c (\ , \ )\] 5 units left.
Label vertices of the image: \[a’ (\ , \ ) \ b’ (\ , \ ) \ c’ (\ , \ )\]
Draw the figures and their transformations.
Label the new coordinates of the vertices

Reflect triangle abc: a( , ) b( , ) c( , ) across line PQ.
Label vertices of the image: a’( , ) b’( , ) c’( , )
Graphing Linear Equations

These are gross motor introductory activities for graphing lines. Do these activities prior to fine-motor graphing linear equations activities.

Rocket Launcher

Students will receive an X value and then use a given function to figure out their Y coordinate. This will be done on the large roped Cartesian Plane.

Give each student a positive x coordinate. It is most fun when the coordinate is written on a rocket ship (see next page).

Write a function on a wipe-off board and hold it up for all to see (e.g., $Y = 2x + 1$). Direct students to calculate their x value - each student should double their x value, then add 1 to find their Y value. Give students time to calculate their Y value.

Have the person with the first x value (e.g., $x=2$) go to the origin, then sidestep right to position 2 on the x axis. The student will “launch” himself after finding the Y coordinate, using the given function: $Y = 2x + 1$
The student standing at $x=2$ should double 2 to get 4 then add one to get a Y coordinate of 5. The student should then launch to the 5 position on the Y axis.

Continue with each student, all using the same function: $Y = 2x + 1$ (Each Y value will be found when you double your x position, then take 1 additional step.) Make sure that all students remember to start at the origin, side step to the x value, then “launch” and step up to the Y value. If done correctly, all students should make a line.

As described earlier, for older students who are studying slope, the line can be used to model slope in a gross motor way. Put a pipe on the ground at their feet. Have each student walk up -or down then sideways to get to the position of their neighbor. This set of actions will determine the slope. E.g., for a line with slope=2, have everyone step up (+2) and right (+1): the entire line will shift. Have the students with larger integers go first to avoid collisions. Record their change in y / change in x on a dry erase board to model slope.

To continue practicing, have students switch around their rockets. Then write an other function on the wipe-off board. Remember to give students time to calculate their Y values before asking them to launch!
Plotting Lines on Ropes/Pulleys in Archway

Use the large Cartesian plane in the archway to have students graph points that will eventually form a line.

“Cover”
Fill in the “m” and “b” elements of the y = mx + b, slope intercept equation using large paper numbers (see following pages).

Choose X coordinates, and put the numbers into the table.
Students figure out the Y coordinates, then plot the coordinates using the ropes.

To plot the coordinates, have them find the origin, then stand directly in front of it.
They must first move laterally (Δx) to get the correct rope, then raise that flag to the correct height (ΔY).
After each new point has been graphed, have the student explain how they got their flag to it’s destination: “I walked right 2, then raised it up 3 marks.” This provides integration of the gross motor, kinesthetic, visual processing w/ verbal expression.