



Lesson 7: Distance on the Coordinate Plane

Student Outcomes

- Students use absolute value to determine distance between integers on the coordinate plane in order to find side lengths of polygons.

Lesson Notes

Students build on their work in Module 3. More specifically, they will build on their work with absolute value from Lessons 11 and 12 as well as on their work with coordinate planes from Lessons 17–19.

Also note that each square unit on the coordinate planes represents 1 unit.

Fluency Exercise (5 minutes)

Addition of Decimals Sprint

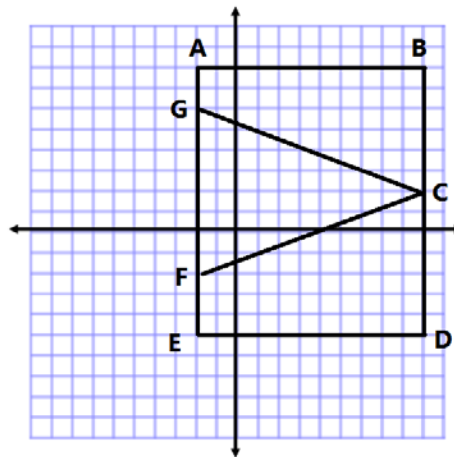
Classwork

Example 1 (15 minutes)

Example 1

Determine the lengths of the given line segments by determining the distance between the two endpoints.

Line Segment	Point	Point	Distance	Proof
\overline{AB}	$(-2, 8)$	$(9, 8)$	11	
\overline{BC}	$(9, 8)$	$(9, 2)$	6	
\overline{CD}	$(9, 2)$	$(9, -5)$	7	
\overline{BD}	$(9, 8)$	$(9, -5)$	13	
\overline{DE}	$(9, -5)$	$(-2, -5)$	11	
\overline{EF}	$(-2, -5)$	$(-2, -2)$	3	
\overline{FG}	$(-2, -2)$	$(-2, 6)$	8	
\overline{EG}	$(-2, -5)$	$(-2, 6)$	11	
\overline{GA}	$(-2, 6)$	$(-2, 8)$	2	
\overline{FA}	$(-2, -2)$	$(-2, 8)$	10	
\overline{EA}	$(-2, -5)$	$(-2, 8)$	13	



MP.8

MP.8

- What do you notice about each pair of points?
 - *In each pair, either the x-coordinates are the same or the y-coordinates are the same.*
- How could you calculate the lengths of the segments using only the coordinate of their endpoints? (Please note, it is possible that ELLs may not understand this question and may need modeling to understand. In addition, students may need to be reminded that distances or lengths are positive.)
 - *Either the x-values will be the same or the y-values will be the same. We will ignore these and focus on the coordinates that are different. We can subtract the absolute values of the endpoints if both points have the same sign. If the signs are different, we will add the absolute values.*
- Why are the steps different? For example, why are the steps for \overline{AE} different than the steps for \overline{AG} ? (Note that it may be helpful for students to go back to the image and walk through the steps visually when trying to describe the steps and the difference between the two.)
 - *When we determine the distance from A to E, we are really adding together the distance from A to the x-axis and the distance from E to the x-axis. We add them together because they are on opposite sides of the x-axis. When determining the distance from A to G, we are taking the distance from A to the x-axis and G to the x-axis and finding the difference because they are on the same side of the x-axis.*
- Add a fourth column to the table to show proof of your distances.

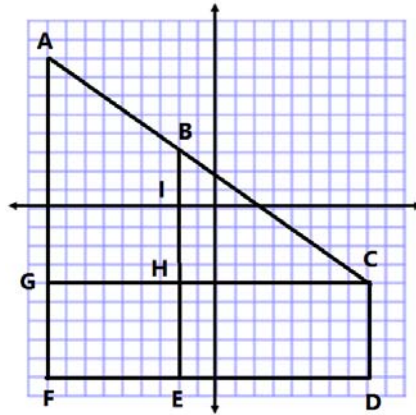
Line Segment	Point	Point	Distance	Proof
\overline{AB}	(-2, 8)	(9, 8)	11	$ 9 + -2 = 11$
\overline{BC}	(9, 8)	(9, 2)	6	$ 8 - 2 = 6$
\overline{CD}	(9, 2)	(9, -5)	7	$ 2 + -5 = 7$
\overline{BD}	(9, 8)	(9, -5)	13	$ 8 + -5 = 13$
\overline{DE}	(9, -5)	(-2, -5)	11	$ 9 + -2 = 11$
\overline{EF}	(-2, -5)	(-2, -2)	3	$ -5 - -2 = 3$
\overline{FG}	(-2, -2)	(-2, 6)	8	$ -2 + 6 = 8$
\overline{EG}	(-2, -5)	(-2, 6)	11	$ -5 + 6 = 11$
\overline{GA}	(-2, 6)	(-2, 8)	2	$ 8 - 6 = 2$
\overline{FA}	(-2, -2)	(-2, 8)	10	$ -2 + 8 = 10$
\overline{EA}	(-2, -5)	(-2, 8)	13	$ -5 + 8 = 13$

- How would the distances from one point to another change if each square unit on the plane were 2 units in length? Or 3 units in length?
 - *The distance would double if each square unit were worth 2 units. The distance would triple if each square unit is actually equal to 3 units in length.*

Exercises (15 minutes)

Exercises

Complete the table using the diagram on the coordinate plane.



Line Segment	Point	Point	Distance	Proof
\overline{BI}	$(-2, 3)$	$(-2, 0)$	3	$ 3 + 0 = 3$
\overline{BH}	$(-2, 3)$	$(-2, -4)$	7	$ 3 + -4 = 7$
\overline{BE}	$(-2, 3)$	$(-2, -9)$	12	$ 3 + -9 = 12$
\overline{GH}	$(-9, -4)$	$(-2, -4)$	7	$ -9 - -2 = 7$
\overline{HC}	$(-2, -4)$	$(8, -4)$	10	$ -2 + 8 = 10$
\overline{GC}	$(-9, -4)$	$(8, -4)$	17	$ -9 + 8 = 17$
\overline{CD}	$(8, -4)$	$(8, -9)$	5	$ -9 - -4 = 5$
\overline{FG}	$(-9, -9)$	$(-9, -4)$	5	$ -9 - -4 = 5$
\overline{GA}	$(-9, -4)$	$(-9, 8)$	12	$ -4 + 8 = 12$
\overline{AF}	$(-9, 8)$	$(-9, -9)$	17	$ 8 + -9 = 17$

Extension (3 minutes)

Extension

For each problem below, write the coordinates of two points that are 5 units apart with the segment connecting these points having the following characteristic:

- a. The segment is vertical.

Answers may vary. (2, 1) and (2, 6)

- b. The segment intersects the x -axis.

Answers may vary. (3, -4) and (3, 1)

- c. The segment intersects the y -axis.
Answers may vary. $(-4, 3)$ and $(1, 3)$
- d. The segment is vertical and lies above the x -axis.
Answers may vary. $(-3, 5)$ and $(-3, 10)$

Closing (2 minutes)

- What did all of the segments used in the lesson have in common?
 - *They were all either vertical or horizontal.*
- How could you determine whether the segments were vertical or horizontal given the coordinates of their endpoints?
 - *If the x -coordinates were the same for both points, then the segment was vertical. If the y -coordinates were the same, then the segment was horizontal.*
- How did you calculate the length of the segments given the coordinates of the endpoints?
 - *If the coordinates that were not the same had the same sign, we subtracted the absolute values.*
 - *If the coordinates that were not the same had different signs, we added the absolute values.*

Exit Ticket (5 minutes)

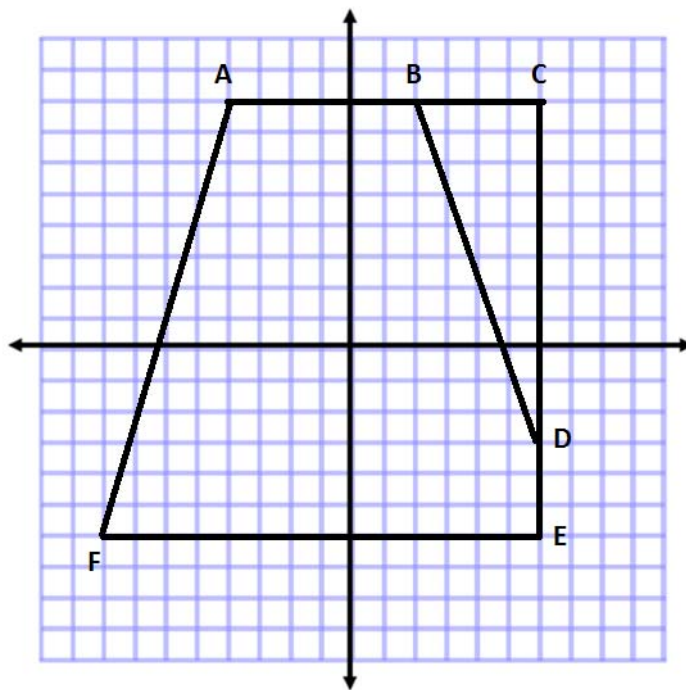
Name _____

Date _____

Lesson 7: Distance on the Coordinate Plane

Exit Ticket

Use absolute value to show the lengths of \overline{AB} , \overline{BC} , \overline{CD} , \overline{DE} , and \overline{EF} .



Line Segment	Point	Point	Distance	Proof
\overline{AB}				
\overline{BC}				
\overline{CD}				
\overline{DE}				
\overline{EF}				

Exit Ticket Sample Solutions

Use absolute value to show the lengths of \overline{AB} , \overline{BC} , \overline{CD} , \overline{DE} , and \overline{EF} .

Line Segment	Point	Point	Distance	Proof
\overline{AB}	$(-4, 8)$	$(2, 8)$	6	$ -4 + 2 $
\overline{BC}	$(2, 8)$	$(6, 8)$	4	$ 6 - 2 $
\overline{CD}	$(6, 8)$	$(6, -3)$	11	$ 8 + -3 $
\overline{DE}	$(6, -3)$	$(6, -6)$	3	$ -6 - -3 $
\overline{EF}	$(6, -6)$	$(-8, -6)$	14	$ 6 + -8 $

Problem Set Sample Solutions

1. Given the pairs of points, determine whether the segment that joins them will be horizontal, vertical, or neither.

a. $X(3, 5)$ and $Y(-2, 5)$ Horizontal

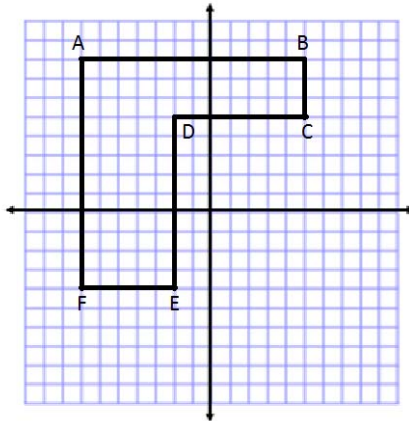
b. $M(-4, 9)$ and $N(4, -9)$ Neither

c. $E(-7, 1)$ and $F(-7, 4)$ Vertical

2. Complete the table using absolute value to determine the lengths of the line segments.

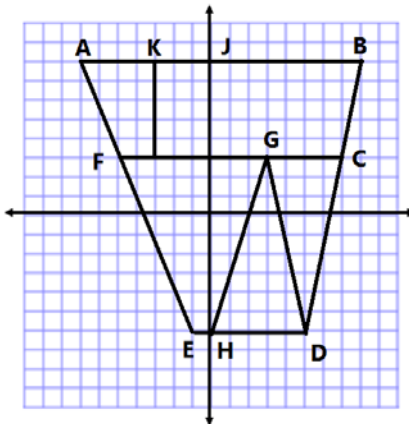
Line Segment	Point	Point	Distance	Proof
\overline{AB}	$(-3, 5)$	$(7, 5)$	10	$ -3 + 7 $
\overline{CD}	$(1, -3)$	$(-6, -3)$	7	$ 1 + -6 $
\overline{EF}	$(2, -9)$	$(2, -3)$	6	$ -9 - -3 $
\overline{GH}	$(6, 1)$	$(6, 16)$	15	$ 16 - 1 $
\overline{JK}	$(-3, 0)$	$(-3, 12)$	12	$ 12 + 0 $

3. Complete the table using the diagram and absolute value to determine the lengths of the line segments.



Line Segment	Point	Point	Distance	Proof
\overline{AB}	$(-7, 8)$	$(5, 8)$	12	$ -7 + 5 $
\overline{BC}	$(5, 8)$	$(5, 5)$	3	$ 8 - 5 $
\overline{CD}	$(5, 5)$	$(-2, 5)$	7	$ 5 + -2 $
\overline{DE}	$(-2, 5)$	$(-2, -4)$	9	$ 5 + -4 $
\overline{EF}	$(-2, -4)$	$(-7, -4)$	5	$ -7 - -2 $
\overline{FA}	$(-7, -4)$	$(-7, 8)$	12	$ -4 + 8 $

4. Complete the table using the diagram and absolute value to determine the lengths of the line segments.



Line Segment	Point	Point	Distance	Proof
\overline{AB}	$(-7, 8)$	$(8, 8)$	15	$ -7 + 8 = 15$
\overline{CG}	$(7, 3)$	$(3, 3)$	4	$ 7 - 3 = 4$
\overline{CF}	$(7, 3)$	$(-5, 3)$	12	$ 7 + -5 = 12$
\overline{GF}	$(3, 3)$	$(-5, 3)$	8	$ 3 + -5 = 8$
\overline{DH}	$(5, -6)$	$(0, -6)$	5	$ 5 + 0 = 5$
\overline{DE}	$(5, -6)$	$(-1, -6)$	6	$ 5 + -1 = 6$
\overline{HJ}	$(0, -6)$	$(0, 8)$	14	$ -6 + 8 = 14$
\overline{KL}	$(-3, 8)$	$(-3, 3)$	5	$ 8 - 3 = 5$

5. Name two points in different quadrants that form a vertical line segment that is 8 units in length.

Answers will vary. Sample solution (2, 5) and (2, -3)

6. Name two points in the same quadrant that form a horizontal line segment that is 5 units in length.

Answers will vary. Sample solution (-4, -11) and (-9, -11)



Addition of Decimals – Round 1

Directions: *Determine the sum of the decimals.*

Number Correct: _____

1.	$4.2 + 3.5$	
2.	$9.2 + 2.8$	
3.	$23.4 + 45.5$	
4.	$45.2 + 53.7$	
5.	$6.8 + 7.5$	
6.	$5.62 + 3.17$	
7.	$23.85 + 21.1$	
8.	$32.45 + 24.77$	
9.	$112.07 + 54.25$	
10.	$64.82 + 42.7$	
11.	$87.5 + 45.21$	
12.	$16.87 + 17.3$	
13.	$27.84 + 34.21$	
14.	$114.8 + 83.71$	
15.	$235.6 + 78.26$	
16.	$78.04 + 8.29$	
17.	$176.23 + 74.7$	

18.	$89.12 + 45.5$	
19.	$416.78 + 46.5$	
20.	$247.12 + 356.78$	
21.	$9 + 8.47$	
22.	$254.78 + 9$	
23.	$85.12 + 78.99$	
24.	$74.54 + 0.97$	
25.	$108 + 1.75$	
26.	$457.23 + 106$	
27.	$841.99 + 178.01$	
28.	$154 + 85.3$	
29.	$246.34 + 525.66$	
30.	$356 + 0.874$	
31.	$243.84 + 75.3$	
32.	$438.21 + 195.7$	
33.	$85.7 + 17.63$	
34.	$0.648 + 3.08$	

Addition of Decimals – Round 1 [KEY]Directions: *Determine the sum of the decimals.*

1.	$4.2 + 3.5$	7.7
2.	$9.2 + 2.8$	12
3.	$23.4 + 45.5$	68.9
4.	$45.2 + 53.7$	98.9
5.	$6.8 + 7.5$	14.3
6.	$5.62 + 3.17$	8.79
7.	$23.85 + 21.1$	44.95
8.	$32.45 + 24.77$	57.22
9.	$112.07 + 54.25$	166.32
10.	$64.82 + 42.7$	107.52
11.	$87.5 + 45.21$	132.71
12.	$16.87 + 17.3$	34.17
13.	$27.84 + 34.21$	62.05
14.	$114.8 + 83.71$	198.51
15.	$235.6 + 78.26$	313.86
16.	$78.04 + 8.29$	86.33
17.	$176.23 + 74.7$	250.93

18.	$89.12 + 45.5$	134.62
19.	$416.78 + 46.5$	463.28
20.	$247.12 + 356.78$	603.9
21.	$9 + 8.47$	17.47
22.	$254.78 + 9$	263.78
23.	$85.12 + 78.99$	164.11
24.	$74.54 + 0.97$	75.51
25.	$108 + 1.75$	109.75
26.	$457.23 + 106$	563.23
27.	$841.99 + 178.01$	1020
28.	$154 + 85.3$	239.3
29.	$246.34 + 525.66$	772
30.	$356 + 0.874$	356.874
31.	$243.84 + 75.3$	319.14
32.	$438.21 + 195.7$	633.91
33.	$85.7 + 17.63$	103.33
34.	$0.648 + 3.08$	3.728



Addition of Decimals – Round 2

Number Correct: _____

Improvement: _____

Directions: *Determine the sum of the decimals.*

1.	$2.5 + 3.1$	
2.	$7.4 + 2.5$	
3.	$7.5 + 9.4$	
4.	$23.5 + 31.2$	
5.	$43.4 + 36.2$	
6.	$23.08 + 75.21$	
7.	$41.41 + 27.27$	
8.	$102.4 + 247.3$	
9.	$67.08 + 22.51$	
10.	$32.27 + 45.31$	
11.	$23.9 + 34.6$	
12.	$31.7 + 54.7$	
13.	$62.5 + 23.9$	
14.	$73.8 + 32.6$	
15.	$114.6 + 241.7$	
16.	$327.4 + 238.9$	
17.	$381.6 + 472.5$	

18.	$24.06 + 31.97$	
19.	$36.92 + 22.19$	
20.	$58.67 + 31.28$	
21.	$43.26 + 32.87$	
22.	$428.74 + 343.58$	
23.	$624.85 + 283.61$	
24.	$568.25 + 257.36$	
25.	$841.66 + 382.62$	
26.	$526 + 85.47$	
27.	$654.19 + 346$	
28.	$654.28 + 547.3$	
29.	$475.84 + 89.3$	
30.	$685.42 + 736.5$	
31.	$635.54 + 582$	
32.	$835.7 + 109.54$	
33.	$627 + 225.7$	
34.	$357.23 + 436.77$	

Addition of Decimals – Round 2 [KEY]Directions: *Determine the sum of the decimals.*

1.	$2.5 + 3.1$	5.6
2.	$7.4 + 2.5$	9.9
3.	$7.5 + 9.4$	16.9
4.	$23.5 + 31.2$	54.7
5.	$43.4 + 36.2$	79.6
6.	$23.08 + 75.21$	98.29
7.	$41.41 + 27.27$	68.68
8.	$102.4 + 247.3$	349.7
9.	$67.08 + 22.51$	89.59
10.	$32.27 + 45.31$	77.58
11.	$23.9 + 34.6$	58.5
12.	$31.7 + 54.7$	86.4
13.	$62.5 + 23.9$	86.4
14.	$73.8 + 32.6$	106.4
15.	$114.6 + 241.7$	356.3
16.	$327.4 + 238.9$	566.3
17.	$381.6 + 472.5$	854.1

18.	$24.06 + 31.97$	56.03
19.	$36.92 + 22.19$	59.11
20.	$58.67 + 31.28$	89.95
21.	$43.26 + 32.87$	76.13
22.	$428.74 + 343.58$	772.32
23.	$624.85 + 283.61$	908.46
24.	$568.25 + 257.36$	825.61
25.	$841.66 + 382.62$	1,224.28
26.	$526 + 85.47$	611.47
27.	$654.19 + 346$	1,000.19
28.	$654.28 + 547.3$	1,201.58
29.	$475.84 + 89.3$	565.14
30.	$685.42 + 736.5$	1,421.92
31.	$635.54 + 582$	1,217.54
32.	$835.7 + 109.54$	945.24
33.	$627 + 225.7$	852.7
34.	$357.23 + 436.77$	794