## Lesson 10: On or Off the Line?

Let’s interpret the meaning of points in a coordinate plane.

### 10.1: Which One Doesn’t Belong: Lines in the Plane

Which one doesn’t belong? Explain your reasoning.



### 10.2: Pocket Full of Change

Jada told Noah that she has $2 worth of quarters and dimes in her pocket and 17 coins all together. She asked him to guess how many of each type of coin she has.

1. Here is a table that shows some combinations of quarters and dimes that are worth $2. Complete the table.

| * number of quarters
 | * number of dimes
 |
| --- | --- |
| * 0
 | * 20
 |
| * 4
 | *
 |
| *
 | * 0
 |
| *
 | * 5
 |
| *
 | *
 |

1. Here is a graph of the relationship between the number of quarters and the number of dimes when there are a total of 17 coins.
	1. What does Point $A$ represent?
	2. How much money, in dollars, is the combination represented by Point $A$ worth?
	* 
2. Is it possible for Jada to have 4 quarters and 13 dimes in her pocket? Explain how you know.
3. How many quarters and dimes must Jada have? Explain your reasoning.

### 10.3: Making Signs

Clare and Andre are making signs for all the lockers as part of the decorations for the upcoming spirit week. Yesterday, Andre made 15 signs and Clare made 5 signs. Today, they need to make more signs. Each person's progress today is shown in the coordinate plane.



Based on the lines, mark the statements as true or false for each person.

| point | what it says | Clare | Andre |
| --- | --- | --- | --- |
| $A$ | At 40 minutes, I have 25 signs completed. |  |  |
| $B$ | At 75 minutes, I have 42 and a half signs completed. |  |  |
| $C$ | At 0 minutes, I have 15 signs completed. |  |  |
| $D$ | At 100 minutes, I have 60 signs completed. |  |  |

#### Are you ready for more?

* 4 toothpicks make 1 square
* 7 toothpicks make 2 squares
* 10 toothpicks make 3 squares



Do you see a pattern? If so, how many toothpicks would you need to make 10 squares according to your pattern? Can you represent your pattern with an expression?

### Lesson 10 Summary

We studied linear relationships in an earlier unit. We learned that values of $x$ and $y$ that make an equation true correspond to points $\left(x,y\right)$ on the graph. For example, if we have $x$ pounds of flour that costs $0.80 per pound and $y$ pounds of sugar that costs $0.50 per pound, and the total cost is $9.00, then we can write an equation like this to represent the relationship between $x$ and $y:$

$0.8x+0.5y=9$

Since 5 pounds of flour costs $4.00 and 10 pounds of sugar costs $5.00, we know that $x=5$, $y=10$ is a solution to the equation, and the point $\left(5,10\right)$ is a point on the graph. The line shown is the graph of the equation:



Notice that there are two points shown that are not on the line. What do they mean in the context? The point $\left(1,14\right)$ means that there is 1 pound of flour and 14 pounds of sugar. The total cost for this is $0.8⋅1+0.5⋅14$ or $7.80. Since the cost is not $9.00, this point is not on the graph. Likewise, 9 pounds of flour and 16 pounds of sugar costs $0.8⋅9+0.5⋅16$ or $15.20, so the other point is not on the graph either.

Suppose we also know that the flour and sugar together weigh 15 pounds. That means that

$x+y=15$

If we draw the graph of this equation on the same coordinate plane, we see it passes through two of the three labeled points:



The point $\left(1,14\right)$ is on the graph of $x+y=15$ because $1+14=15$. Similarly, $5+10=15$. But $9+16\ne 15$, so $\left(9,16\right)$ is *not* on the graph of $x+y=15$. In general, if we have two lines in the coordinate plane,

* The coordinates of a point that is on both lines makes both equations true.
* The coordinates of a point on only one line makes only one equation true.
* The coordinates of a point on neither line make both equations false.



© CC BY Open Up Resources. Adaptations CC BY IM.