Subtracting Integers by Generalizing Patterns

The idea of subtraction can show up in different ways in real-world situations. We can think about subtraction using the "take away" model. If I have $47 and spend $19, then it is like taking away $19 from my $47. On the other hand, the problem situation could be that I have $47 and you have $19. How much more money do I have than you? We are making an additive comparison between these two quantities and to answer this question, one could subtract. In this activity, we will look at subtraction from a comparison point of view.

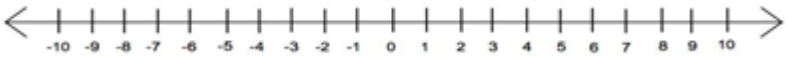
Part 1 – Using a Number Line

1. Place the number 5 and the number 3 on the number line.

2. We can think of the arithmetic situation 5 – 3 as an additive comparison between 5 and 3. That is, how far from 3 is 5 on the number line? Would you classify this distance as positive or negative?

Students may see that 5 is 2 units to the right of 3 on the number line thus 5 – 3 = 2.

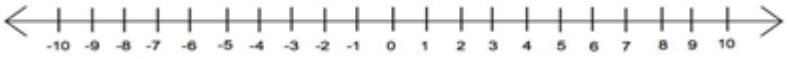
3. Place the number –5 and the number –3 on the number line.



4. Let's compare –5 and –3 by thinking of the arithmetic situation –5 – (–3). That is, how far from –3 is –5 on the number line? Would you classify this distance as positive or negative?

Students may see that –5 is 2 units to the left of –3 on the number line thus –5 –(–3) = –2.

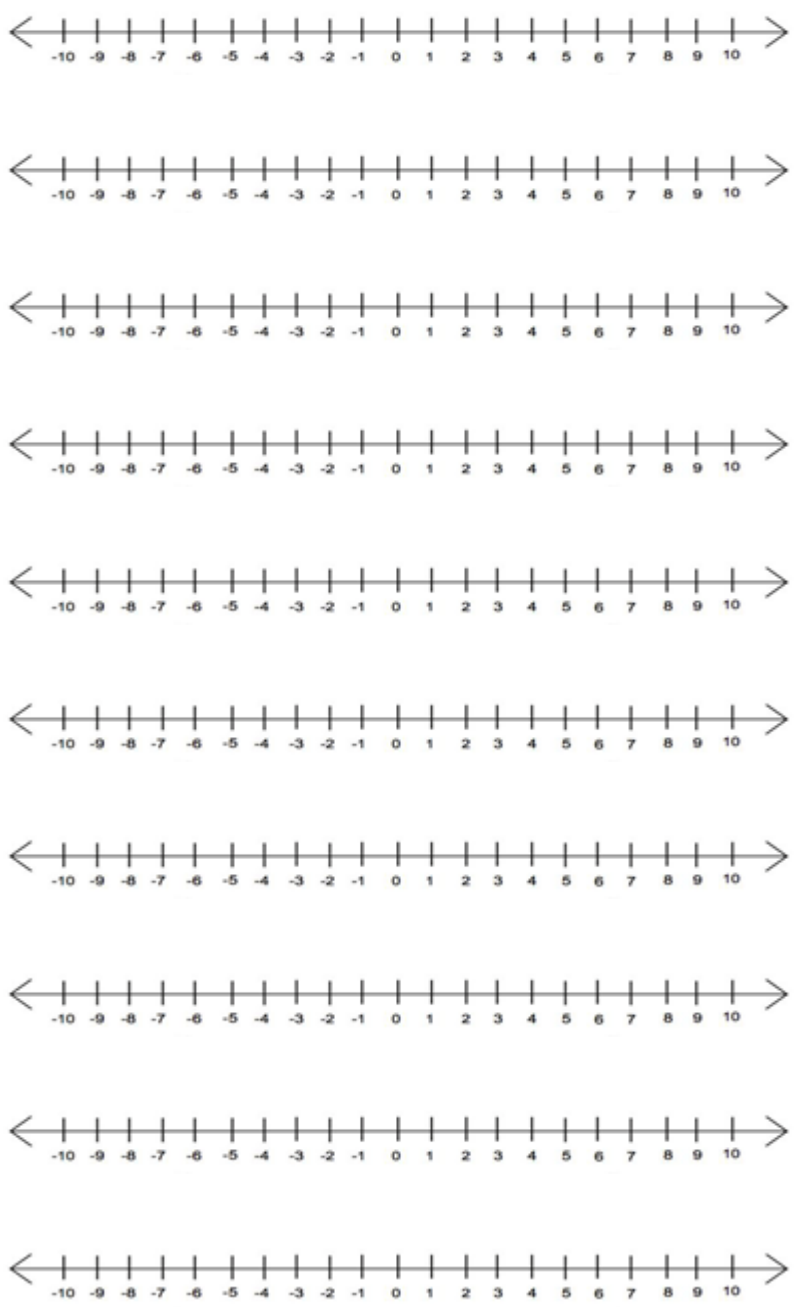
5. Place the number 5 and the number –3 on the number line.



6. Let's compare 5 and –3 by thinking of the arithmetic situation 5 – (–3). That is, how far from –3 is 5 on the number line? Would you classify this distance as positive or negative?

Students may see that 5 is 8 units to the right of –3 on the number line thus 5 – (–3) = 8.

7. Continue to explore by comparing other numbers of your choosing. Consider comparing, for example, 5 – 3 and 3 – 5. Record any observations you can make based on your explorations.



We are hoping for two results. First, students may see that subtraction is equivalent to adding the opposite. Second, students may see that subtraction is not commutative. In general, if a – b = c then b – a = –c.

Part 2 – Exploring Number Patterns

1. Complete the table by subtracting. Enter the answer in the right column.

5 – 3 =	2
5 – 2 =	3
5 – 1 =	4
5 – 0 =	5

2. Describe the pattern in the left column of the table.

The number being subtracted from five is one less than the number in the previous row.

3. Describe the pattern in the right column of the table.

The result in each row is one greater than the previous row.

4. Extend the pattern by completing the table.

5 – 3 =	2
5 – 2 =	3
5 – 1 =	4
5 – 0 =	5
5 – (–1) =	6
5 – (–2) =	7
5 – (–3) =	8

5. Complete the table by subtracting. Enter the answer in the right column.

8 – 6 =	2
8 – 4 =	4
8 – 2 =	6
8 – 0 =	8

6. Describe the pattern in the left column of the table.

The number being subtracted from 8 is decreased by 2 in each row.

7. Describe the pattern in the right column of the table.

The result is 2 greater than the result in the previous row.

8.Extend the pattern by completing the table.

8 – 6 =	2
8 – 4 =	4
8 – 2 =	6
8 – 0 =	8
8 – (–2) =	10
8 – (–4) =	12
8 – (–6) =	14

9. In general, what happens when you subtract a negative number?

It is the same as adding the opposite (positive).

Find each of the following. Be prepare to explain how you know your result is correct.

10. 5 – (–5) =10

11. 8 – (–10) =18

12. 2 – (–7) = 9

13. 9 – (–6) = 15