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 Subtracting Integers—Summarizing What We Know

 3.6b-3

 Group members’ names:

Each group will be given a few subtraction problems. Try to figure out the answers. Please show work that explains your thinking. When your group presents its work, you’ll be asked to explain a few things:

* How you got your answers, and
* How you’d change your method to solve different subtraction problems.

Small-group inquiry:

Please copy down the problems your group was asked to work on:

 A)

 B)

 C)

**Problem A**

1). Without actually drawing the picture for this problem, please describe in words what the picture would look like.

2). How many chips will be left at the end, and will they be Pos or Neg? Please show work to explain how you figured it out.

**Problem B.** Please write the problem again here: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

3). Without actually drawing the picture for this problem, please describe in words what the picture would look like.

4). How many chips will be left at the end, and will they be Pos or Neg? Please show work to explain how you figured it out.

**Problem C.** Please write the problem again here: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

5). Without actually drawing the picture for this problem, please describe in words what the picture would look like.

6). How many chips will be left at the end, and will they be Pos or Neg? Please show work to explain how you figured it out.

7). Our goal today is to summarize what we know about subtracting integers.

In general, when you’re subtracting integers without a picture, what’s the first thing you do?

 What are the next things you do? Please list the rest of the steps your group takes.

**Bellwork**

Blackline Master

**Can you explain the steps you’d take to subtract integers without drawing a picture?**

**Small Group Assignments**

**Please try these problems in your small groups:**

|  |  |  |
| --- | --- | --- |
| **Group 1:**A) 45 – **‑**23 B) **-**59 – 98 C) 287 – 76  | **Group 2:**A) 67 – 153 B) **-**23 – 57 C) **-**87 – **‑**24  | **Group 3:**A) 67 – **‑**153 B) 23 – 57 C) **-**87 – 24   |
| **Group 4:**A) 500 – 167 B) 36 – 68 C) **-**65 – **‑**210  | **Group 5:**A) **-**360 – 167 B) 36 – **-**68 C) 65 + **‑**210   | **Group 6:**A) 81 – 210 B) **-**36 – 68 C) 97 – **‑**210  |
| **Group 7:**A) 85 – 867 B) **-**78 – 99 C) **-**23 – **‑**84  | **Group 8:**A) 817 – 147 B) 76 – 65 C) **-**85 – **‑**290  |  |

**Teacher Notes**

**Objectives:**

Students will:

* Discover, explain, and apply the procedure for subtracting integers: keep the first number the same, change the subtraction sign to addition, and then flip the second number to its opposite.
* Understand and explain the difference between subtracting and adding integers: when adding integers, we don’t change any signs in the problem. We just do the problem, paying attention to whether the chips add up or cancel out.

**Procedure:**

1. Begin by displaying the bellwork reflection activity on blackline master. If students’ responses are incomplete or inaccurate, don’t correct them. The bellwork just gets them to recognize their current beliefs about how to subtract integers.
2. Group students into small groups and hand out 1 copy of the student handout to each group.
3. Tell students each group will be asked to solve 3 addition/subtraction problems without drawing a picture, just by describing what the picture would look like.
4. Display the assigned problems for each small group from the blackline master (the 3 problems each group is supposed to work on).
5. Let student groups work while you facilitate group discussions.
6. Finally, begin group presentations and class discussion. My process for the presentation and discussions is below.
7. Finally, after the class collectively “discovers” and agrees upon the correct procedure, refine their skills with the drill worksheets (included on the Curriki page for this lesson).

**My notes for leading the discussion:**

* For each group, just pick 1 question for that group to present.
* As they present, use questioning to check for understanding and to move the class toward articulating the general rule for subtracting integers. The discussion morphs as students present. At first, the teacher asks questions that relate to the specific question they solved. Later, the teacher asks questions that prompt students to explain the general procedure for subtracting integers, and to compare that procedure to the one for adding integers. The discussion moves from concrete to abstract.

**My “script” for leading the discussion:**

Question prompts for group presentations:

1. **FIRST HALF:** Discussion prompts for the first half of groups presenting. As an example, the following prompts are written as if the group were presenting the problem 23 – -58.
	1. “**What was your problem?”**
	2. **“Please explain how you solved it.”**
		1. Note: focus on the first half of their explanation—where they describe what the picture will look like. It’s less important how they did the scratch-work computation to get the final answer.
		2. Sample good response: “You just do Pos 23 and Pos 58”
	3. **“If you got a similar problem, like -42 – -85 , can you explain in one short sentence how somebody should solve that?”**
		1. Sample good response: “You just do Neg 42 and Pos 85.”
		2. We don’t really need to hear about the picture or about the “X” in the picture that shows you’re trying to take away 5 Negatives.
		3. We just need to hear the two amounts that are being combined. It’s not important yet that they use explicit vocabulary for addition such as “Pos 23 plus Pos 58” or “We would add Pos 23 and Pos 58”. That will come out very soon—after a few groups have presented.
	4. **“How would you do the problem differently if it looked different, like 23 – 58?”**
		1. (Follow-up if necessary): what’s the quickest way you’d do that? (We’re looking for a brief answer like, “We would just have Pos 23 and Neg 58.”
2. **LAST HALF:** Discussion prompts for the last half of groups presenting. As an example, the following prompts are written as if the group were presenting the problem -97 – 26.
	1. **“What was your problem?”**
	2. **“Please explain how you solved it.”**
	3. **“Can you summarize the general rule or pattern to follow when doing these subtraction problems?”**
		1. Sample good response: “You take the opposite of the second number, leave the first number the same, and add the two together”.
		2. Now explicit vocabulary related to addition is important.
	4. **“Can you make up an example and show how the rule you just gave applies to it?”**
	5. **“How would you do the problem differently if it said -97 + 26?”**
		1. (The point here is to see if students know NOT to change this addition to subtraction.
3. **FURTHER** whole-class discussion:
	1. **“Let’s do a problem together, and I want to ask some questions about it. Let’s do 10 – 89. What do we do?”**
		1. (Class suggests steps: do 10 + -89. To do that, find 89 – 10 = 79, and make the answer negative. Final answer: -79).
	2. **We’ve said we always change subtraction problems to adding the opposite. In this problem, though, we ended up doing 89 – 10. If we always change subtracting to adding, why do we sometimes end up subtracting?”**
		1. Sample good response: “After we change it to adding the opposite, sometimes we see the two amounts cancel out, and sometimes they add up. If they cancel out, we have to subtract the amounts, but we’re still doing an addition problem”.
	3. **“Let’s do 2 questions side-by-side and compare how to do them: -21 – 33 and -21 + 33.”**
		1. (The point to bring out in discussion is that you change subtraction problems to addition, but you DON’T change addition problems to subtraction).
4. Further discrimination practice: a drill worksheet with mixed adding/subtracting integers problems. A worksheet has been provided.