38.

Addition and Subtraction of Integers

Addition of Integers

Level: Introductory Grade 8

Time: 1 class period (40–50 minutes)

Objective: To generate an understanding of the addition of integers using number lines (slide rule).

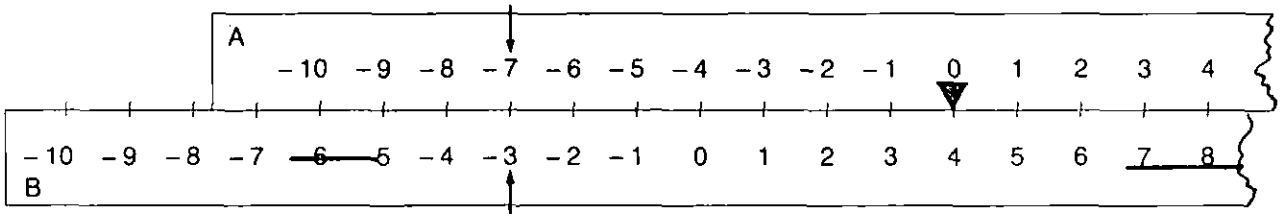
Prerequisite Skills: Placement of integers on number lines; directional meaning of positive and negative signs; identification of addends

Materials: 1 set of numbered scales for each pair of students, scissors, 1 set of numbered scales on transparency for teacher use

Procedure:

1. Cut scales A and B along lines indicated. Scale A represents trips taken (second addend). Scale B represents the starting point (first addend).

2. Taking scale A, line up the reference point (marked by the zero) directly above the first addend position on scale B (see illustration below). This signifies the starting point on your number line.



$4 + -7 = -3$

Place the zero of scale A above 4 on scale B.

3. Determine the distance and direction to move by looking at the second addend.

   For example: −7 means 7 spaces *left*.

   Follow this trip on scale A.

4. Read your answer directly below this number on scale B. In the example, the answer would be −3.

5. Use the slide rule illustrated to represent the following sums:

   4 + −1 = 4 + −2 =
   4 + −4 = 4 + 3 =
   4 + 2 = 4 + −3 =

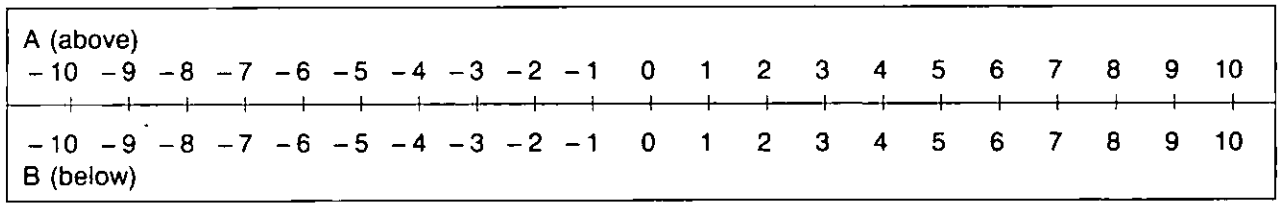
6. Have students try the following sums using the slide rule. Can any patterns or conclusions be drawn about the addition of integers using these examples?

   (a) 4 + 5 = (d) −3 + 7 = (g) −7 + −2 =
   (b) 5 + 4 = (e) −6 + 6 = (h) −4 + −5 =
   (c) 3 + 4 = (f) 6 + −6 =

7. Ask students to do these questions in reverse.

   For example: (c) rewrite as −4 + 3 =

   Does this rewriting change the result?



Exercises for Students

1. Using your addition slide rule, find the following sums:

   (a) −8 + 4 = (d) −6 + 7 = (g) −7 + −2 =
   (b) 3 + −5 = (e) 6 + 2 = (h) −6 + 6 =
   (c) 7 + −6 = (f) −3 + −5 =

   (i) Will you obtain a different result if you change the order of the numbers in questions (a) through (h)?

   (j) What is the same in answers (c) and (d)?
   What is different in answers (c) and (d)?

2. In your own words, state a rule to find the sum for:

   (a) 2 positive numbers (question e above).
   (b) 2 negative numbers (questions f and g above).
   (c) 1 positive and 1 negative number (questions a, b, c, d, and h above).

3. Without using your scales, find the following sums:

   (a) −8 + −9 = (e) −19 + −17 = (i) −34 + −52 =
   (b) 3 + −2 = (f) 30 + 40 = (j) 34 + 52 =
   (c) −7 + 4 = (g) −42 + −41 = (k) −60 + 60 =
   (d) 15 + −10 = (h) −60 + 65 = (l) 87 + −87 =

   Compare your answers to (i) and (j). What do you notice about these 2 questions?

   Compare your answers to (k) and (l). What do you notice about these 2 questions?

Subtraction of Integers

Level: Introductory Grade 8

Time: 1 class period (40–50 minutes)

Objective: To generate an understanding of the relationship between addition and subtraction of integers.

Prerequisite Skills: Directional meaning of positive and negative signs; experience with the addition slide rule

Procedure:

1. Using only *positive* numbers, have students do the following subtraction questions with the slide rule.

   (a) $4 - 2 =$ (c) $9 - 5 =$
   (b) $8 - 3 =$ (d) $7 - 2 =$

2. If the positive signs are understood for each number, what is the purpose of the subtraction sign in these questions?

   For example: $4 + -2 =$ $9 + -5 =$
   $8 + -3 =$ $7 + -2 =$

   What similarities are there between the addition and subtraction questions? What differences are there?

3. Have students try these questions:

   (a) $3 - 5 =$ (c) $2 - 7 =$
   (b) $5 - 7 =$ (d) $6 - 9 =$

4. Ask students to write a related addition question for each example in question 3.

5. If any subtraction question can be written as addition, do we need the operation of subtraction?

6. Have students write the related addition question for each of the following:

   (a) $5 - -2 =$ (c) $-9 - 5 =$
   (b) $11 - -13 =$ (d) $-7 - -6 =$

7. Generate a rule for writing a subtraction question as addition.

Alternative Method:

The subtraction sign actually tells you to move in the opposite direction indicated by the sign of the number.

For example: $8 - 5$ means $8 - +5$.

Hence, from starting point 8, move the opposite of 5 spaces right. Therefore, move 5 spaces left.

For example: $-2 - 5$ means $-2 - +5$. The starting point at $+5$ is *understood*. Move the opposite of 5 spaces right; therefore, move 5 spaces left.

For example: $-7 - -5$. From starting point -7, move the opposite of 5 spaces *left;* therefore, 5 spaces *right.*

Exercises for Students

1. Using your slide rule, complete the following subtraction problems:

   (a) $10 - 5 =$ (d) $0 - 7 =$ (g) $-2 - -4 =$
   (b) $2 - 4 =$ (e) $-5 - 5 =$ (h) $0 - -6 =$
   (c) $9 - 6 =$ (f) $-2 - 3 =$

2. Write the related addition question for each of the above questions and solve using your slide rule.

3. State a rule for subtracting 2 integers.

4. Solve the following problems without using the slide rule:

   (a) $-6 - 8 =$ (d) $-6 - -5 =$ (g) $-28 - -16 =$
   (b) $4 - 9 =$ (e) $5 - -7 =$ (h) $-19 - -19 =$
   (c) $0 - 7 =$ (f) $26 - 32 =$