Name _____

Class _____

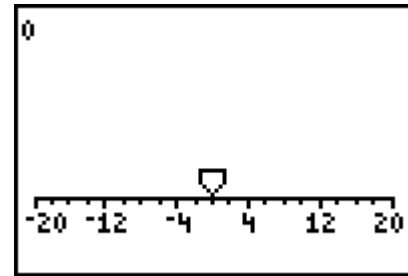### Problem 1 – Adding positive integers

1. Press APPS and arrow down to NUMLINE. Press ENTER
    to select it and press ENTER again to enter the
    application. Then select **1:Number Line**.

    Note: Your window should look like the one at the right.
    If not, press WINDOW and set **Min = –20**, **Max = 20**,
   **Scale = 2**, and **Start = 0** and turn the Labels **On**. Then
    press GRAPH.

2. To find the sum 13 + 8, type in **13** + **8** and press ENTER.

3. The arrows continue off the screen. Press WINDOW and
    change the **Max** value to 24. Press GRAPH.

    Explain how the "number rays" or vectors represent the
    operation of addition.
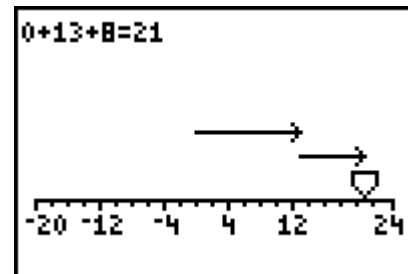
4. If you add 15 to the sum from Question 3, you know that
    the sum would appear off of the screen. Before finding
    the sum, press WINDOW and enter a new value for **Max**.

    Now, add 15 to the sum by pressing + **15** ENTER. Draw
   a sketch of your Number Line window on the blank
    screen at the right.
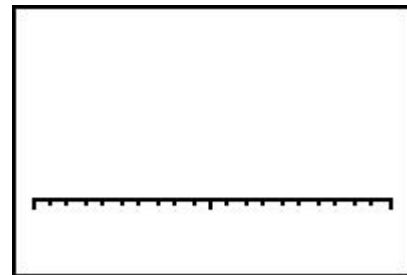
Problem 2 – Adding negative integers

5. Press CLEAR 1 to clear the window. Press WINDOW to
    change the **Max** value to **20**. Press GRAPH.

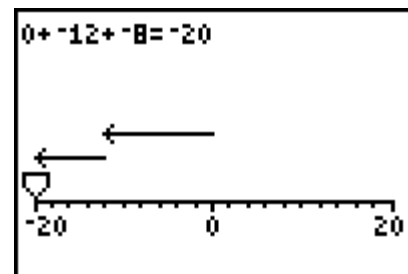   How will the application show adding **0 + –12**? Draw a
    sketch of your prediction on the screen at the right.

    Press + (-) **12**,then ENTER. Does your previous sketch
   match the current Number Line view?
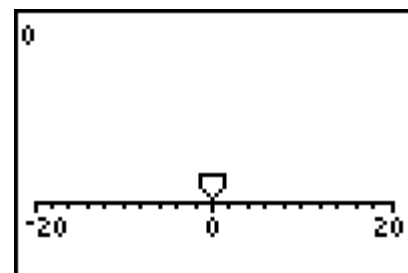
6. Now, add –8 to the current sum of –12. Press + (-) **8**,
    and then ENTER.

    How do the vectors show addition of negative integers
    when using a number line?

7. Add –5 to the sum. The vectors will go off the screen so press WINDOW and change the **Min** value appropriately. Press GRAPH.

a. If you continue adding negative integers, how would the vectors would look in the viewing window?

b. Would a vector ever be pointed in a positive direction if you continued adding negative integers? Explain.

c. How is adding positive integers similar to adding negative integers? How is it different?
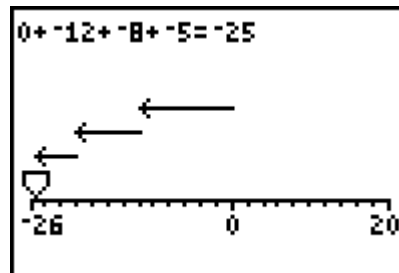
Problem 3 – Adding negative and positive integers

8. Now try adding positive and negative integers. What do you predict the sum of 15 + –9 will be?

Draw a sketch of the Number Line representation of the sum on the screen at the right, including labels.
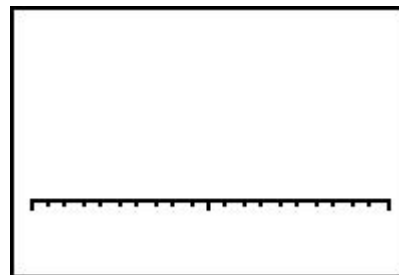
9. Press CLEAR 1 ZOOM 2 to clear and reset the window.

Press + **15** ENTER. The line indicator moves to 15 on the number line. Now, press + (-) **9** ENTER. Adding –9 produced a new vector beginning at 15, 9 units long and pointed in the negative direction. The sum is at the end of this vector.

10. If you added –19 to the current sum, would the new sum still be in the current viewing window or would you have to change the window settings? Explain.

In which direction will the vector for adding –19 be pointed? Explain.

Test your prediction. Draw a sketch of the result of adding –19 to the previous expression 15 + –9. Notice that this is the same as adding –19 to 6.

11. To help understand the movement along the Number Line, press the TRACE key to move along the vectors. Notice a box at the top of the screen that appears around the last addend of –19. Flashing cursors appear on the end of the vector and on the number line.
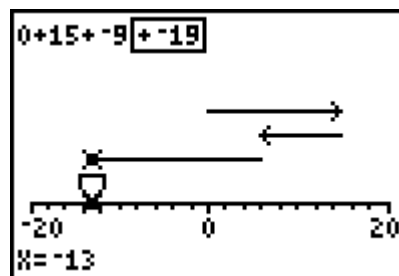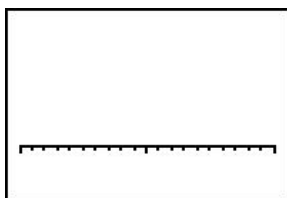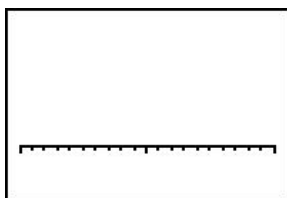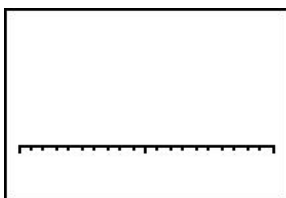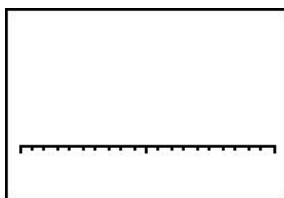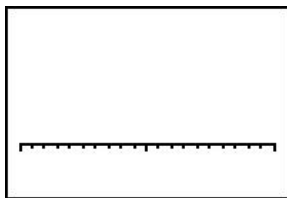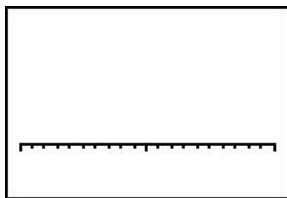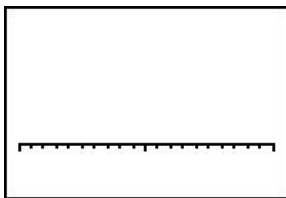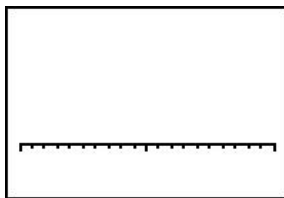
Press the ▶ and ◀ keys to "trace the path" of the vectors until you are at the original starting point of 0.

Imagine sitting on top of the cursor and taking "a ride" along the vectors (as you "move" through the expression **0 + 15 + –9 + –19**). Describe the "ride" of adding positive and negative integers.
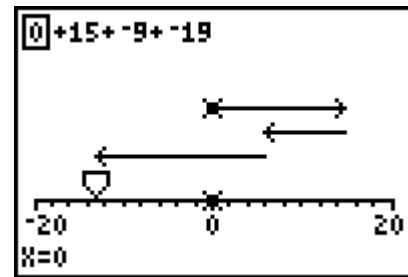
12. Try a few more additions of positive and negative integers. Record your sketches of final sums in the boxes below. For one of your examples, enter in the addends in the opposite order and see what happens. For example, if you have done 15 + –9; try –9 +15. These examples help in understanding the *commutative property for addition*.

Problem 4 – Opposites

13. Predict what will happen when you add 13 to –13.

   a. Test your prediction and record a sketch of the window. Press the TRACE key to move along the vectors.

   b. The numbers 13 and –13 are called **opposites**. How does the Number Line application help make sense of the term *opposite*?

   c. Test a few more opposites on the calculator. Do you always return to zero? (If you are trying very large numbers, remember to change the viewing window so you can see all of the vectors.)

Problem 5 – Wrap Up

14. a. Describe the general movement of the TRACE key when adding only positive integers? If you need to, enter a sum of positive integers to do the tracing.

   b. Describe the movement of the TRACE key when adding only negative integers.

   c. What is the biggest difference between adding just positive or just negative integers, and adding positive AND negative integers?

Additional Problems

15. Find the following sums by using mental arithmetic and visualizing the movement on the Number Line.

    a. 19 + 17

    b. 13 + −27

    c. −27 + −13

    d. 26 + −5

    e. 24 + 6

    f. 15 + 15