Name: Date:

**Student Exploration:** **Adding and Subtracting
Integers with Chips**

**Vocabulary:** difference, integer, sum, zero pair

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

One winter night, the temperature at 8:00 p.m. is 0°C. By 4:00 a.m., it has gotten 15° colder.

1. What is the temperature at 4:00 a.m.?
2. The next afternoon, it warms up by 25°C. What is the temperature then?
3. By midnight, it will be 18°C colder. What will the temperature be then?

**Gizmo Warm-up**

Physical models such as apples and oranges are useful for modeling addition and subtraction with positive numbers, but different models must be used when the numbers are negative.

The *Adding and Subtracting Integers with Chips* Gizmo allows you to use chips to find **sums** and **differences** of positive and negative **integers**, which are numbers with no fractional part.

1. To begin, select **Explore**. Drag four of the yellow **1-chips** and three of the **–1-chips** into the yellow **Modeling Area**. What is the sum that you have modeled?
2. Drag a **zero pair** (a 1-chip and a –1-chip) into the area. Does this change the total value of chips in the area? Explain.

1. Remove all the zero pairs you can by dragging 1-chips over –1-chips. (You can also remove zero pairs by selecting a whole region of zero pairs and then clicking inside the region.)

Does removing zero pairs change the sum?

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| **Activity A:** **Adding integers** | Get the Gizmo ready: * Select **Addition** from the choices at top right.
 | 599SE2 |

1. Check that under **Evaluate** the problem is 5 + (–2). (If not, refresh your browser to restart the Gizmo.) Follow the ***Instructions*** to model 5 and –2 in the modeling area.
2. How many 1-chips did you use?
3. How many –1-chips did you use?
4. Click **Continue**. Recall that adding and removing zero pairs does not change the sum. Remove all the zero pairs you can by dragging 1-chips over –1-chips.
5. How many zero pairs did you remove?
6. What remains after all the zero pairs have been removed?
7. Click **Continue**. Type the sum in the space above the modeling area and click **Enter**. What is 5 + (–2)?
8. Click **New**. The problem should now be (–7) + 3. Model this sum using chips.
9. How many 1-chips did you use? How many –1-chips?
10. Click **Continue** and remove the zero pairs. How many did you remove?
11. Click **Continue** and enter the sum. What is the sum of –7 and 3?
12. Practice additional problems using the Gizmo. Then, in the space at right, use drawings of chips to model the sum 4 + (–3). Cross out the zero pairs and write the sum. Check your answer in the Gizmo. (Use the **Explore** mode.)

4 + (–3) =

1. Use what you have learned to solve the problems below. Check your answers with the Gizmo when possible. (You will need to use the **Explore** mode of the Gizmo.)
2. –6 + (–5)
3. 7 + (–12)
4. –22 + 23

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| **Activity B:** **Subtracting integers** | Get the Gizmo ready: * Select **Subtraction**.
 | 599SE3 |

1. Check that under **Evaluate:** the problem is (–4) – (–3). Follow the ***Instructions*** to model –4 in the modeling area.
2. How many –1-chips did you use to model –4?
3. Click **Continue**. To model subtraction, drag three of the –1-chips into the **Subtraction Bin** to the right. (You can also remove the chips by clicking on them.)

How many –1-chips remain in the yellow modeling area?

1. Click **Continue** and enter the answer. What is (–4) – (–3) equal to?
2. Click **New**. The problem should now be 6 – (–2). Model 6 using chips and click **Continue**.
3. Is it possible to remove two –1-chips from the modeling area now?
4. Add two **zero pairs** to the modeling area. Does this change the total value of the chips in the modeling area?
5. Is it possible to remove two –1-chips from the modeling area now?
6. Remove the –1-chips and click **Continue**. Enter the answer. What is 6 – (–2)?
7. What addition expression is equivalent to 6 – (–2)?
8. In general, what is equivalent to subtracting a negative?
9. Practice additional problems using the Gizmo. Then, in the space at right, use drawings of chips to model the difference –4 – (–6). Be sure to add zero pairs if necessary, then cross out the chips that are removed.

–4 – (–6) =

1. Use what you have learned to solve the problems below. If possible, check your answers using the **Explore** mode of the Gizmo.
2. –3 – (–5)
3. 8 – (–12)
4. –22 – 1