6.NS Above and below sea level

Alignments to Content Standards: 6.NS.C.7

Task

The table below shows the lowest elevation above sea level in three American cities.

<table>
<thead>
<tr>
<th>City</th>
<th>State</th>
<th>Elevation above sea level</th>
<th>Elevation below sea level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>Colorado</td>
<td>5130</td>
<td></td>
</tr>
<tr>
<td>New Orleans</td>
<td>Louisiana</td>
<td>-8</td>
<td></td>
</tr>
<tr>
<td>Seattle</td>
<td>Washington</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Finish filling in the table as you think about the following statements. Decide whether each of the following statements is true or false. Explain your answer for each one.

a. New Orleans is $|−8|$ feet below sea level.

b. New Orleans is $−8$ feet below sea level.

c. New Orleans is 8 feet below sea level.

d. Seattle is 0 feet above sea level.

e. Seattle is $|0|$ feet below sea level.

f. Denver is $−5130$ feet below sea level.

g. Denver is $|−5130|$ feet below sea level.

h. Denver is $−|5130|$ feet below sea level.
IM Commentary

The purpose of this task is to help students interpret signed numbers in a context as a magnitude and a direction and to make sense of the absolute value of a signed number as its magnitude. The questions about the elevation of New Orleans are fairly natural: it is a standard convention to use positive numbers to represent elevations above sea level and negative numbers below sea level. However, it is possible to represent them the other way around. The questions about Denver, while they may seem unnatural, are there to see if students understand that in this kind of context, positive numbers are chosen to represent distances in an arbitrary direction relative to an arbitrary elevation, and that once the reference elevation and positive direction are chosen, the negative values can also be interpreted in the context.

Edit this solution

Solution

a. True. New Orleans is \(|-8| = 8\) feet below sea level. We measure positive distances above sea level, so a point that is a negative "distance" above sea level is actually below sea level.

b. False. \(-8\) feet below sea level is 8 feet above sea level....

c. True. New Orleans is 8 feet below sea level (see part (a)).

d. True. Seattle is 0 feet above sea level because 0 feet above or below sea level is the same as being at sea level.

e. True. Seattle is \(|0| = 0\) feet below sea level (see part (d)).

f. True. Denver is \(-5130\) feet below sea level because if we were to measure positive distances below sea level, then negative distances (or, more accurately, a negative displacement) would be above sea level.

g. False. Denver is \(|-5130| = 5130\) feet above sea level.

h. True. Denver is \(-|5130| = -5130\) feet below sea level (see part (f)).
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