Rational Number Operations in Extended Contexts

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

Choose signed values before calculating. Multiply repeated changes first, then combine with the start; use units throughout. Starting at 5.5 m with three changes of -0.5 m gives $5.5 + 3(-0.5) = 4$ m. Recover a start by subtracting the total signed change from the finish.

Worked example

Evaluate $(\frac{11}{2}) + (-\frac{3}{2})$. Show an exact fraction or integer.

1. Use denominator 2: $\frac{11}{2} = 11/2$ and $-\frac{3}{2} = -3/2$.
2. Combine the signed numerators: $11 + (-3) = 8$.
3. The value is $8/2 = 4$.
Answer: 4.

Practice Problems

Show your thinking.

1. Tank level starts at 6 L. Plan A changes by $-\frac{3}{4}$ L per hour for 5 hours; plan B ends at $\frac{5}{4}$ L. Which ends higher, and by how much? After comparing the plans, subtract $\frac{1}{2}$ L from Plan A only. Give its corrected ending reading.

2. Account balance: starting $\frac{13}{2}$ dollars, reserve 5 equal payments of 1 each. Is the remaining balance positive? Calculate it. Finally subtract a separate 1 dollars correction. Report the reading after this final correction too.

3. Temperature must remain above $-\frac{1}{4}$ degrees C. Starting at 7 with hourly change $-\frac{5}{4}$, test the reading after 5 hours. Finally subtract a separate $\frac{3}{2}$ degrees C correction. Report the reading after this final correction too.

4. Trail elevation: start at $\frac{15}{2}$ m, descend $\frac{3}{2}$ each stage for 5 stages. How far above -2 m do you finish? Finally subtract a separate 2 m correction. Report the reading after this final correction too.

5. Stock mass: available $\frac{23}{2}$ kg; allocate 5 portions of $\frac{7}{4}$ kg. Find the leftover and whether one more portion fits. Finally subtract a separate $\frac{1}{2}$ kg correction. Report the reading after this final correction too.

6. Depth reading: target $-\frac{1}{2}$ m; actual is $\frac{17}{2} + (-2)(5)$. Find the actual reading and the correction needed. In a separate scenario, do not make the target correction. Subtract 3 m from the original actual reading. Give that new reading.

7. Freezer temperature begins at $\frac{17}{2}$ degrees C. After 5 changes of $-\frac{3}{5}$, compare the reading with a required minimum 6 degrees C; find the gap. Finally add a separate correction of $\frac{1}{4}$ degrees C; report the corrected reading too.

8. Storage balance begins at $\frac{23}{2}$ kg. After 4 changes of $-\frac{7}{8}$, compare the reading with a required minimum $\frac{17}{2}$ kg; find the gap. Finally add a separate correction of $\frac{3}{4}$ kg; report the corrected reading too.

Answer Key

1. Plan A by 1 L. Corrected $\frac{7}{4}$ L.
2. $\frac{3}{2}$ dollars; positive. Corrected $\frac{1}{2}$ dollars.
3. $\frac{3}{4}$ degrees C; above the minimum by 1 degree. Corrected $-\frac{3}{4}$ degrees C.
4. Finish 0 m; 2 m above the reference. Corrected -2 m.
5. Left $\frac{11}{4}$ kg; one more portion fits. Corrected $\frac{9}{4}$ kg.
6. Actual $-\frac{3}{2}$ m; add 1 m. Corrected $-\frac{9}{2}$ m.
7. $\frac{11}{2}$ degrees C. Below the minimum by $1/2$ degrees C. Corrected $\frac{23}{4}$ degrees C.
8. 8 kg. Below the minimum by $1/2$ kg. Corrected $\frac{35}{4}$ kg.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Total signed change: $(-\frac{3}{4})(5) = -\frac{15}{4}$ L.
2. Final reading: $6 + (-\frac{15}{4}) = \frac{9}{4}$ L.
3. Check backward: $\frac{9}{4} - (-\frac{15}{4}) = 6$ L.
4. $\frac{9}{4} - (\frac{5}{4}) = 1$ L.
5. Correct Plan A only: $\frac{9}{4} - (\frac{1}{2}) = \frac{7}{4}$ L.

Problem 2

1. Total signed change: $(-1)(5) = -5$ dollars.
2. Final reading: $\frac{13}{2} + (-5) = \frac{3}{2}$ dollars.
3. The remaining balance $\frac{3}{2} > 0$, so it is positive.
4. Final corrected reading: $\frac{3}{2} - (1) = \frac{1}{2}$ dollars.

Problem 3

1. Total signed change: $(-\frac{5}{4})(5) = -\frac{25}{4}$ degrees C.
2. Final reading: $7 + (-\frac{25}{4}) = \frac{3}{4}$ degrees C.
3. Even the lowest reading is $\frac{3}{4} - (-\frac{1}{4}) = 1$ degree above the minimum; earlier readings were warmer.
4. Final corrected reading: $\frac{3}{4} - (\frac{3}{2}) = -\frac{3}{4}$ degrees C.

Problem 4

1. Total signed change: $(-\frac{3}{2})(5) = -\frac{15}{2}$ m.
2. Final reading: $\frac{15}{2} + (-\frac{15}{2}) = 0$ m.
3. Subtract the reference elevation from the finish: $0 - (-2) = 2$ m.
4. Final corrected reading: $0 - (2) = -2$ m.

Problem 5

1. Total signed change: $(-\frac{7}{4})(5) = -\frac{35}{4}$ kg.
2. Final reading: $\frac{23}{2} + (-\frac{35}{4}) = \frac{11}{4}$ kg.
3. Check backward: $\frac{11}{4} - (-\frac{35}{4}) = \frac{23}{2}$ kg.
4. Compare leftover $\frac{11}{4}$ with portion $\frac{7}{4}$ kg.
5. Final corrected reading: $\frac{11}{4} - (\frac{1}{2}) = \frac{9}{4}$ kg.

Problem 6

1. Total signed change: $(-2)(5) = -10$ m.
2. Final reading: $\frac{17}{2} + (-10) = -\frac{3}{2}$ m.
3. Correction is target minus actual: $-\frac{1}{2} - (-\frac{3}{2}) = 1$ m.
4. Use the original actual reading, before any adjustment: $-\frac{3}{2} - (3) = -\frac{9}{2}$ m.

Problem 7

1. Total change $= 5(-\frac{3}{5}) = -3$ degrees C.
2. End $= \frac{17}{2} + (-3) = \frac{11}{2}$ degrees C.
3. Minimum minus actual is $6 - (\frac{11}{2}) = \frac{1}{2}$ degrees C, so the reading is below the minimum.
4. Correction gives $\frac{11}{2} + \frac{1}{4} = \frac{23}{4}$ degrees C.

Problem 8

1. Total change $= 4(-\frac{7}{8}) = -\frac{7}{2}$ kg.
2. End $= \frac{23}{2} + (-\frac{7}{2}) = 8$ kg.
3. Minimum minus actual is $\frac{17}{2} - (8) = \frac{1}{2}$ kg, so the reading is below the minimum.
4. Correction gives $8 + \frac{3}{4} = \frac{35}{4}$ kg.

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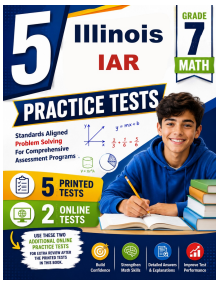

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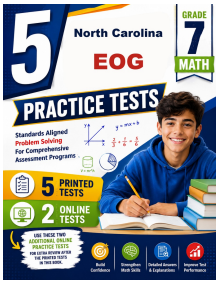

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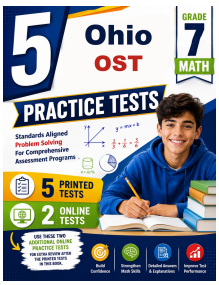

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