Rational Number Operations in Extended Contexts

Explore ideas and representations

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 and changes by $-\frac{3}{4}$ L per hour for 3 hours. Find the final reading. Finally subtract a separate $\frac{1}{2}$ L correction. Report the reading after this final correction too.

2. Account balance: model 3 withdrawals of 1 dollars from $\frac{13}{2}$ dollars. Find the signed total change and balance. Finally subtract a separate 1 dollars correction. Report the reading after this final correction too.

3. Temperature drops $\frac{5}{4}$ degrees C each hour from 7 for 3 hours. Write and evaluate one expression. Finally subtract a separate $\frac{3}{2}$ degrees C correction. Report the reading after this final correction too.

4. Trail elevation: split a total change of $-\frac{9}{2}$ m into 3 equal stages; then apply it to $\frac{15}{2}$ m. Finally subtract a separate 2 m correction. Report the reading after this final correction too.

5. Stock mass: 3 packages each lose $\frac{7}{4}$ kg. Find total loss and mass left from 8 kg. Finally subtract a separate $\frac{1}{2}$ kg correction. Report the reading after this final correction too.

6. Depth reading: compute the final position after 3 changes of -2 m from $\frac{17}{2}$, then its distance from zero. Finally subtract a separate 3 m correction. Report the reading after this final correction too.

7. Freezer temperature starts at $\frac{17}{2}$ degrees C and changes $-\frac{3}{5}$ each stage for 5 stages. Find the final reading. Finally add a separate correction of $\frac{1}{4}$ degrees C; report the corrected reading too.

8. Storage balance starts at $\frac{23}{2}$ kg and changes $-\frac{7}{8}$ each stage for 4 stages. Find the final reading. Finally add a separate correction of $\frac{3}{4}$ kg; report the corrected reading too.

Answer Key

1. Total change $-\frac{9}{4}$ L; final $\frac{15}{4}$ L. Corrected $\frac{13}{4}$ L.
2. Total change -3 dollars; final $\frac{7}{2}$ dollars. Corrected $\frac{5}{2}$ dollars.
3. $7+3(-\frac{5}{4})=\frac{13}{4}$ degrees C. Corrected $\frac{7}{4}$ degrees C.
4. Change per stage: $-\frac{3}{2}$ m; final elevation 3 m. Corrected 1 m.
5. Total change $-\frac{21}{4}$ kg; final $\frac{11}{4}$ kg. Corrected $\frac{9}{4}$ kg.
6. Final $\frac{5}{2}$ m; distance from zero $\frac{5}{2}$ m. Corrected $-\frac{1}{2}$ m.
7. $\frac{11}{2}$ degrees C. Corrected $\frac{23}{4}$ degrees C.
8. 8 kg. Corrected $\frac{35}{4}$ kg.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Total signed change: $(-\frac{3}{4})(3)=-\frac{9}{4}$ L.
2. Final reading: $6+(-\frac{9}{4})=\frac{15}{4}$ L.
3. Check backward: $\frac{15}{4}-(-\frac{9}{4})=6$ L.
4. Final corrected reading: $\frac{15}{4}-(\frac{1}{2})=\frac{13}{4}$ L.

Problem 2

1. Total signed change: $(-1)(3)=-3$ dollars.
2. Final reading: $\frac{13}{2}+(-3)=\frac{7}{2}$ dollars.
3. Check backward: $\frac{7}{2}-(-3)=\frac{13}{2}$ dollars.
4. Final corrected reading: $\frac{7}{2}-(1)=\frac{5}{2}$ dollars.

Problem 3

1. Write the entire change as $7+3(-\frac{5}{4})$; a drop has a negative sign.
2. Multiply first: $3(-\frac{5}{4})=-\frac{15}{4}$.
3. Add to the starting temperature: $7+(-\frac{15}{4})=\frac{13}{4}$ degrees C.
4. Final corrected reading: $\frac{13}{4}-(\frac{3}{2})=\frac{7}{4}$ degrees C.

Problem 4

1. Split the given total into equal stages: $(-\frac{9}{2})\div 3=-\frac{3}{2}$ m per stage.
2. The stages combine to $3(-\frac{3}{2})=-\frac{9}{2}$ m.
3. Apply that change: $\frac{15}{2}+(-\frac{9}{2})=3$ m.
4. Final corrected reading: $3-(2)=1$ m.

Problem 5

1. Total signed change: $(-\frac{7}{4})(3)=-\frac{21}{4}$ kg.
2. Final reading: $8+(-\frac{21}{4})=\frac{11}{4}$ kg.
3. Check backward: $\frac{11}{4}-(-\frac{21}{4})=8$ kg.
4. Final corrected reading: $\frac{11}{4}-(\frac{1}{2})=\frac{9}{4}$ kg.

Problem 6

1. Total signed change: $(-2)(3)=-6$ m.
2. Final reading: $\frac{17}{2}+(-6)=\frac{5}{2}$ m.
3. Distance from zero is $|\frac{5}{2}|=\frac{5}{2}$ m, regardless of the sign of the position.
4. Final corrected reading: $\frac{5}{2}-(3)=-\frac{1}{2}$ 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. Check change per stage: $(\frac{11}{2}-\frac{17}{2})/5=-\frac{3}{5}$ degrees C.
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. Check change per stage: $(8-\frac{23}{2})/4=-\frac{7}{8}$ kg.
4. Correction gives $8+\frac{3}{4}=\frac{35}{4}$ kg.

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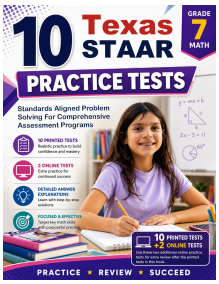

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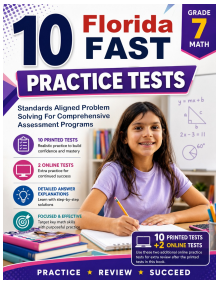

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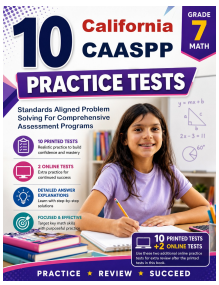

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