Adding and Subtracting Rational Numbers

Spot mistakes, reason, and work backward

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Add numbers with the same sign by adding magnitudes and keeping the sign. With opposite signs, subtract magnitudes and keep the sign of the larger magnitude. $-8+5=-3$. For fractions, first use a common denominator: $-3/10+1/2=1/5$.

Worked example

Evaluate $(-\frac{3}{2})+(\frac{1}{2})$. Show an exact fraction or integer.

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

Practice Problems

Show your thinking.

1. Morgan claims $(-\frac{7}{2})+(1)=\frac{5}{2}$. Locate the sign error and give the correct value.

2. For $(\frac{5}{3})-(-\frac{9}{4})$, Jules drops the negative sign on the second number and gets $-\frac{7}{12}$. Correct the rewrite and the result.

3. Reconstruct x from $x+(-1)=-\frac{5}{2}$. Check by substitution.

4. Test whether $((4)-(-\frac{4}{3}))+(-\frac{16}{3})=0$. Show the numerical cancellation.

5. Find $(-1)+(\frac{7}{4})$. Is the result strictly between -1 and 1?

6. In $[(1)-(-3)]-(1)$, a student skips the brackets and reports 4. Finish the missing subtraction.

7. Find x if $-x=(-4)+(\frac{5}{3})$. Explain why the final sign must change.

8. Compare $2[(3)-(-\frac{3}{4})]$ with $(3)-(-\frac{3}{4})$. Find both and state their difference.

9. In $[(-\frac{17}{5})+(\frac{11}{6})]-(-\frac{17}{5})$, a student skips the brackets and reports $-\frac{47}{30}$. Finish the missing subtraction.

10. Find x if $-x=(\frac{19}{8})-(-\frac{7}{12})$. Explain why the final sign must change.

Answer Key

1. $-\frac{5}{2}$, not $\frac{5}{2}$.
2. $(\frac{5}{3}) + (\frac{9}{4}) = \frac{47}{12}$.
3. $x = -\frac{3}{2}$.
4. Yes; the sum is 0.
5. $\frac{3}{4}$; yes.
6. 3.
7. $x = \frac{7}{3}$.
8. $\frac{15}{2}$ and $\frac{15}{4}$; first minus second $\frac{15}{4}$.
9. $\frac{11}{6}$.
10. $x = -\frac{71}{24}$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Use denominator 2: $-\frac{7}{2} = -7/2$ and $1 = 2/2$.
2. Combine the signed numerators: $-7 + (2) = -5$.
3. The value is $-5/2 = -\frac{5}{2}$.
4. The claim $\frac{5}{2}$ differs from the computed value $-\frac{5}{2}$, so its sign is not correct.

Problem 2

1. Dropping the sign gives $(\frac{5}{3}) - (\frac{9}{4}) = -\frac{7}{12}$, a different problem.
2. Subtracting $-\frac{9}{4}$ adds its opposite: $(\frac{5}{3}) - (-\frac{9}{4}) = (\frac{5}{3}) + (\frac{9}{4})$.
3. Use denominator 12: $\frac{5}{3} = 20/12$ and $\frac{9}{4} = 27/12$. Combine the signed numerators: $20 + (27) = 47$. The value is $47/12 = \frac{47}{12}$.

Problem 3

1. Subtract the known addend from the sum.
2. Use denominator 2: $-\frac{5}{2} = -5/2$ and $-1 = -2/2$.
3. $x = (-\frac{5}{2}) - (-1) = -\frac{3}{2}$.
4. Check in the original: $(-\frac{3}{2}) + (-1) = -\frac{5}{2}$.

Problem 4

1. Use denominator 3: $4 = 12/3$ and $-\frac{4}{3} = -4/3$.
2. Combine the signed numerators: $12 - (-4) = 16$.
3. The value is $16/3 = \frac{16}{3}$.
4. $\frac{16}{3} + (-\frac{16}{3}) = 0$.

Problem 5

1. Use denominator 4: $-1 = -4/4$ and $\frac{7}{4} = 7/4$.
2. Combine the signed numerators: $-4 + (7) = 3$.
3. The value is $3/4 = \frac{3}{4}$.
4. Its magnitude is $\frac{3}{4} < 1$, so $-1 < \frac{3}{4} < 1$.

Problem 6

1. Use denominator 1: $1 = 1/1$ and $-3 = -3/1$.
2. Combine the signed numerators: $1 - (-3) = 4$.
3. The value is $4/1 = 4$.
4. The omitted step is $4 - (1) = 3$.

Problem 7

1. Use denominator 3: $-4 = -12/3$ and $\frac{5}{3} = 5/3$.
2. Combine the signed numerators: $-12 + (5) = -7$.
3. The value is $-7/3 = -\frac{7}{3}$.
4. $-x = -\frac{7}{3}$ gives $x = \frac{7}{3}$; check $-(\frac{7}{3}) = -\frac{7}{3}$.

Problem 8

1. Use denominator 4: $3 = 12/4$ and $-\frac{3}{4} = -3/4$.
2. Combine the signed numerators: $12 - (-3) = 15$.
3. The value is $15/4 = \frac{15}{4}$.
4. Double is $2(\frac{15}{4}) = \frac{15}{2}$; difference $\frac{15}{2} - (\frac{15}{4}) = \frac{15}{4}$.

Problem 9

1. Use denominator 30: $-\frac{17}{5} = -102/30$ and $\frac{11}{6} = 55/30$.
2. Combine the signed numerators: $-102 + (55) = -47$.
3. The value is $-47/30 = -\frac{47}{30}$.
4. The omitted step is $-\frac{47}{30} - (-\frac{17}{5}) = \frac{11}{6}$.

Problem 10

1. Use denominator 24: $\frac{19}{8} = 57/24$ and $-\frac{7}{12} = -14/24$.
2. Combine the signed numerators: $57 - (-14) = 71$.
3. The value is $71/24 = \frac{71}{24}$.
4. $-x = \frac{71}{24}$ gives $x = -\frac{71}{24}$; check $-(-\frac{71}{24}) = \frac{71}{24}$.

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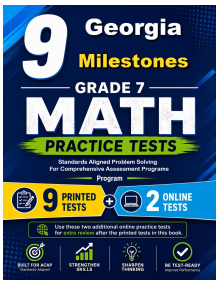

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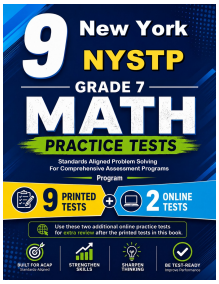

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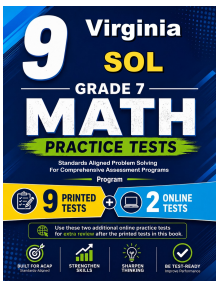

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