

Algebra 1
Mixed Operations with Rational Numbers

Mixed Operations with Rational Numbers | A1-U01-P05

96 problems · Four activity formats

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Topic focus
Across 96 tasks this topic asks for efficient exact representation and value, exact rational value, first invalid step and repaired exact result, missing stage and forward verification, mixed expression and exact quantity with units and supported or not supported with decisive bound.
8 PDFs and a README; 58 buyer pages.

Algebra 1

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Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

Use the fully labeled operation diagram. A2-arrow operation machine starts with an unknown value, multiplies by $(-\frac{1}{2})$, then adds $\frac{3}{4}$, and ends at $-\frac{23}{28}$. Recover the starting value by undoing the arrows in reverse order, then verify it forward.

_____	Multiply by $-\frac{1}{2} \rightarrow$	_____	Add $\frac{3}{4} \rightarrow$	$-\frac{23}{28}$
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Bank label: _____

Evaluate $\frac{6}{5}(-3) - \frac{8}{3}$ exactly. Complete the multiplication or division before the addition or subtraction, and show the common-denominator step if one is needed.

Bank label: _____

Use the fully labeled operation diagram. A2-arrow operation machine starts with an unknown value, multiplies by $(-\frac{3}{4})$, then adds $(-\frac{3}{4})$, and ends at $-\frac{33}{28}$. Recover the starting value by undoing the arrows in reverse order, then verify it forward.

_____	Multiply by $-\frac{3}{4} \rightarrow$	_____	Add $-\frac{3}{4} \rightarrow$	$-\frac{33}{28}$
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Bank label: _____

Evaluate $\frac{5}{4} - \frac{10}{3} \div \frac{5}{2}$ exactly. Complete the multiplication or division before the addition or subtraction, and show the common-denominator step if one is needed.

Bank label: _____

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Name: _____ Date: _____ Class: _____

Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

Start at $\frac{6}{5}$ and follow the fixed order: divide by 5, then add one negative rational number. Construct the adjustment that reaches $-\frac{14}{25}$, and verify that the final result is noninteger. 	Evaluate $\frac{5}{6} - (-0.5) \cdot 1$ exactly. Choose fraction or terminating-decimal form to reduce the work, state why your choice avoids rounding, and give the exact value. 												
Use the quantities in the table. A position changes at a constant signed rate of 6 meters per hour for 2 hours, then has an additional signed change of $\frac{5}{2}$ meters. Write the mixed expression and find the net change in meters. <table border="1"> <thead> <tr> <th>Quantity</th> <th>Value</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>signed rate</td> <td>6</td> <td>meters per hour</td> </tr> <tr> <td>time</td> <td>2</td> <td>hours</td> </tr> <tr> <td>later adjustment</td> <td>$\frac{5}{2}$</td> <td>meters</td> </tr> </tbody> </table> 	Quantity	Value	Unit	signed rate	6	meters per hour	time	2	hours	later adjustment	$\frac{5}{2}$	meters	Evaluate $1.25 \div (-\frac{7}{10}) - 2$ exactly. Choose fraction or terminating-decimal form to reduce the work, state why your choice avoids rounding, and give the exact value.
Quantity	Value	Unit											
signed rate	6	meters per hour											
time	2	hours											
later adjustment	$\frac{5}{2}$	meters											
Evaluate $0.25 + \frac{4}{9} \cdot 3$ exactly. Choose fraction or terminating-decimal form to reduce the work, state why your choice avoids rounding, and give the exact value. 	Evaluate $1.2 + \frac{2}{7} \cdot \frac{1}{2}$ exactly. Choose fraction or terminating-decimal form to reduce the work, state why your choice avoids rounding, and give the exact value. 												

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Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

Incoming: add $(-\frac{1}{3})$: $\frac{8}{3} \rightarrow 4 \rightarrow \frac{11}{3}$ A2-arrow operation machine starts with an unknown value, divides by $\frac{3}{2}$, then subtracts $\frac{2}{3}$, and ends at $-\frac{20}{21}$. Recover the starting value by undoing the arrows in reverse order, then verify it forward. <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <tr> <td style="width: 20%; text-align: center;">_____</td> <td style="width: 20%; text-align: center;">Divide by $\frac{3}{2} \rightarrow$</td> <td style="width: 20%; text-align: center;">_____</td> <td style="width: 20%; text-align: center;">Subtract $\frac{2}{3} \rightarrow$</td> <td style="width: 20%; text-align: center;">$-\frac{20}{21}$</td> </tr> </table> Your response: _____	_____	Divide by $\frac{3}{2} \rightarrow$	_____	Subtract $\frac{2}{3} \rightarrow$	$-\frac{20}{21}$	Incoming: $-\frac{3}{7}$ Evaluate $\frac{7}{6} + \frac{1}{5} \cdot 2$ exactly. Complete the multiplication or division before the addition or subtraction, and show the common-denominator step if one is needed. Your response: _____
_____	Divide by $\frac{3}{2} \rightarrow$	_____	Subtract $\frac{2}{3} \rightarrow$	$-\frac{20}{21}$		
Incoming: $\frac{3}{10}$ Start at $\frac{8}{3}$ and follow the fixed order: divide by $\frac{2}{3}$, then add one negative rational number. Construct the adjustment that reaches $\frac{11}{3}$, and verify that the final result is noninteger. Your response: _____	Incoming: $\frac{9}{2}$ Evaluate $-\frac{7}{5} - \frac{5}{2} \div \frac{5}{2}$ exactly. Complete the multiplication or division before the addition or subtraction, and show the common-denominator step if one is needed. Your response: _____					
Incoming: $-\frac{493}{24}$ A2-arrow operation machine starts with an unknown value, adds $(-\frac{2}{3})$, then multiplies by 6, and ends at $\frac{38}{7}$. Recover the starting value by undoing the arrows in reverse order, then verify it forward. <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <tr> <td style="width: 20%; text-align: center;">_____</td> <td style="width: 20%; text-align: center;">Add $-\frac{2}{3} \rightarrow$</td> <td style="width: 20%; text-align: center;">_____</td> <td style="width: 20%; text-align: center;">Multiply by $6 \rightarrow$</td> <td style="width: 20%; text-align: center;">$\frac{38}{7}$</td> </tr> </table> Your response: _____	_____	Add $-\frac{2}{3} \rightarrow$	_____	Multiply by $6 \rightarrow$	$\frac{38}{7}$	Incoming: $\frac{71}{10}$ Evaluate $\frac{3}{4} - \frac{1}{2} \div 2$ exactly. Complete the multiplication or division before the addition or subtraction, and show the common-denominator step if one is needed. Your response: _____
_____	Add $-\frac{2}{3} \rightarrow$	_____	Multiply by $6 \rightarrow$	$\frac{38}{7}$		

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Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

Audit this worked calculation for $\frac{3}{4} + (\frac{2}{5})(\frac{5}{2})$. Step 1: Add $\frac{3}{4} + \frac{2}{5}$ first. Step 2: Multiply that result by $\frac{5}{2}$. Identify the first invalid step, preserve every valid prefix, and give the repaired exact result. If no step is invalid, say so.

Audit this worked calculation for $\frac{2}{5} + (\frac{1}{3})(\frac{3}{4})$. Step 1: Multiply $\frac{1}{3}$ by $\frac{3}{4}$ to get $\frac{1}{4}$. Step 2: Add $\frac{2}{5} + \frac{1}{4}$ as $\frac{3}{9} = \frac{1}{3}$. Identify the first invalid step, preserve every valid prefix, and give the repaired exact result. If no step is invalid, say so.

Audit this worked calculation for $\frac{3}{4} \div (\frac{5}{6}) - \frac{1}{10}$. Step 1: Rewrite as $\frac{3}{4}$ times $\frac{5}{6}$ minus $\frac{1}{10}$. Step 2: Report $\frac{21}{40}$. Identify the first invalid step, preserve every valid prefix, and give the repaired exact result. If no step is invalid, say so.

Audit this worked calculation for $(\frac{3}{4} + \frac{5}{6})(\frac{2}{3})$. Step 1: Cancel the 3 in $\frac{3}{4}$ with the outside factor $\frac{2}{3}$. Step 2: Multiply the remaining expression. Identify the first invalid step, preserve every valid prefix, and give the repaired exact result. If no step is invalid, say so.

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Full Worked Solutions - excerpt

Worked example

Problem. Start at $\frac{7}{3}$. Use each operation exactly once—add $\frac{8}{3}$ and multiply by $\frac{3}{4}$ —in an order that reaches $\frac{15}{4}$. The intermediate value must be positive. Construct and verify the chain.

Answer. $\frac{7}{3} \rightarrow$ add $\frac{8}{3} \rightarrow 5 \rightarrow$ multiply by $\frac{3}{4} \rightarrow \frac{15}{4}$

Explanation and check.

Adding first gives the required positive intermediate 5; multiplying it by $\frac{3}{4}$ reaches $\frac{15}{4}$.

Worked example

Problem. Start at $\frac{3}{2}$. Use each operation exactly once—add $\frac{4}{3}$ and multiply by $\frac{3}{2}$ —in an order that reaches $\frac{17}{4}$. The intermediate value must be positive. Construct and verify the chain.

Answer. $\frac{3}{2} \rightarrow$ add $\frac{4}{3} \rightarrow \frac{17}{6} \rightarrow$ multiply by $\frac{3}{2} \rightarrow \frac{17}{4}$

Explanation and check.

Adding first gives the required positive intermediate $\frac{17}{6}$; multiplying it by $\frac{3}{2}$ reaches $\frac{17}{4}$.