Converting Rational Numbers to Decimals

Explore ideas and representations

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

QUICK REVIEW

Divide numerator by denominator. A repeated remainder makes a repeating block; a zero remainder ends the decimal. $1/5 = 0.2$ terminates. $1/9 = 0.\overline{1}$ repeats. A reduced denominator with only factors $2, 5$ terminates. A bar is not a rounding symbol.

Worked example

Convert $9/16$ to an exact decimal.

1. $16(625) = 10000$, so use ten-thousandths.
2. $9(625) = 5625$, so $9/16 = 5625/10000 = 0.5625$.
3. Only factors of 2 occur in $16 = 2^4$, so the decimal terminates.
Answer: 0.5625, terminating.

Practice Problems

Show your thinking.

1. Convert $\frac{3}{8}$ to a decimal. Mark a repeating block with a bar and classify it as terminating or repeating. Compare the exact reading with 0.4 and find their exact difference.

2. Convert $-\frac{7}{20}$ to a decimal. Mark a repeating block with a bar and classify it as terminating or repeating. Write the original value as a signed percent.

3. Convert $\frac{5}{6}$ to a decimal. Mark a repeating block with a bar and classify it as terminating or repeating. Add $1/6$ exactly; explain why using rounded hundredths can lose the exact sum.

4. Convert $\frac{2}{11}$ to a decimal. Mark a repeating block with a bar and classify it as terminating or repeating. Use $100d - d$ to verify the repeating decimal as an exact fraction.

5. Convert $-\frac{4}{9}$ to a decimal. Mark a repeating block with a bar and classify it as terminating or repeating. Find the positive distance between this value and $-1/2$.

6. Convert $\frac{7}{12}$ to a decimal. Mark a repeating block with a bar and classify it as terminating or repeating. Recover the missing fraction x in $x + 5/12 = 1$ and relate it to this reading.

7. Signal record: convert $\frac{7}{16}$ to an exact decimal; use a bar only for a repeating block.

8. Distance marker: convert $-\frac{9}{25}$ to an exact decimal; use a bar only for a repeating block.

9. Balance check: convert exact decimal $0.3\overline{6}$ to a fraction, showing its place-value or repeating-block calculation.

10. Reference scale: compare $0.\overline{63}$ with $1/2$ using exact fractions. Find the positive distance between them.

Answer Key

1. 0.375; terminating. It is $0.025 = 1/40$ less than 0.4.
2. -0.35; terminating. -35%.
3. $0.8\overline{3}$; repeating. Exact sum 1.
4. $0.\overline{18}$; repeating. $99d = 18$, so $d = 18/99 = 2/11$.
5. $-0.\overline{4}$; repeating. Distance $1/18$.
6. $0.58\overline{3}$; repeating. $x = 7/12$ is the reading.
7. $0.4375 = \frac{7}{16}$.
8. $-0.36 = -\frac{9}{25}$.
9. $0.3\overline{6} = \frac{11}{30}$.
10. $\frac{7}{11}$ is greater than $1/2$; distance $\frac{3}{22}$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Divide the magnitude, carrying the remainders: $30 = 8(3) + 6$, $60 = 8(7) + 4$, $40 = 8(5) + 0$.
2. The reduced denominator is 8; removing factors 2 and 5 leaves 1, so the decimal terminates.
3. The exact signed decimal is $0.375 = \frac{3}{8}$.
4. $0.4 - 0.375 = 0.025 = 1/40$.

Problem 2

1. Divide the magnitude, carrying the remainders: $70 = 20(3) + 10$, $100 = 20(5) + 0$.
2. The reduced denominator is 20; removing factors 2 and 5 leaves 1, so the decimal terminates.
3. The exact signed decimal is $-0.35 = -\frac{7}{20}$.
4. $-7/20 = -35/100 = -35\%$.

Problem 3

1. Divide the magnitude, carrying the remainders: $50 = 6(8) + 2$, $20 = 6(3) + 2$.
2. The reduced denominator is 6; removing factors 2 and 5 leaves 3, so the decimal repeats.
3. The exact signed decimal is $0.8\overline{3} = \frac{5}{6}$.
4. $5/6 + 1/6 = 6/6 = 1$, while $0.83 + 0.17$ happens to give 1 only because the rounding errors cancel.

Problem 4

1. Divide the magnitude, carrying the remainders: $20 = 11(1) + 9$, $90 = 11(8) + 2$.
2. The reduced denominator is 11; removing factors 2 and 5 leaves 11, so the decimal repeats.
3. The exact signed decimal is $0.\overline{18} = \frac{2}{11}$.
4. For $d = 0.\overline{18}$, subtract d from $100d$: $99d = 18$, giving $2/11$.

Problem 5

1. Divide the magnitude, carrying the remainders: $40 = 9(4) + 4$.
2. The reduced denominator is 9; removing factors 2 and 5 leaves 9, so the decimal repeats.
3. The exact signed decimal is $-0.\overline{4} = -\frac{4}{9}$.
4. $|-4/9 - (-1/2)| = |-8/18 + 9/18| = 1/18$.

Problem 6

1. Divide the magnitude, carrying the remainders: $70 = 12(5) + 10$, $100 = 12(8) + 4$, $40 = 12(3) + 4$.
2. The reduced denominator is 12; removing factors 2 and 5 leaves 3, so the decimal repeats.
3. The exact signed decimal is $0.58\overline{3} = \frac{7}{12}$.
4. $x = 1 - 5/12 = 7/12$, whose decimal is $0.58\overline{3}$.

Problem 7

1. Long division of the magnitude: $70 = 16(4) + 6$, $60 = 16(3) + 12$, $120 = 16(7) + 8$, $80 = 16(5) + 0$.
2. A zero remainder ends the decimal.
3. Therefore $\frac{7}{16} = 0.4375$ exactly.

Problem 8

1. Long division of the magnitude: $90 = 25(3) + 15$, $150 = 25(6) + 0$.
2. A zero remainder ends the decimal.
3. Therefore $-\frac{9}{25} = -0.36$ exactly.

Problem 9

1. Let $d = 0.3\overline{6}$ be the magnitude. Shift to line up the repeating digits: $100d = 36.\overline{6}$ and $10d = 3.\overline{6}$.
2. Subtract: $100d - 10d = 33$, so $90d = 33$.
3. Divide both sides: $d = \frac{33}{90} = \frac{11}{30}$.

Problem 10

1. Let $d = 0.\overline{63}$ be the magnitude. Shift to line up the repeating digits: $100d = 63.\overline{63}$ and $1d = 0.\overline{63}$.
2. Subtract: $100d - 1d = 63$, so $99d = 63$.
3. Divide both sides: $d = \frac{63}{99} = \frac{7}{11}$.
4. With denominator 22, subtract $\frac{14}{22} - \frac{11}{22} = \frac{3}{22}$. The reading is above $1/2$, at distance $\frac{3}{22}$.

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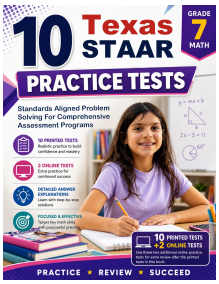

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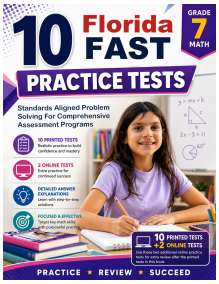

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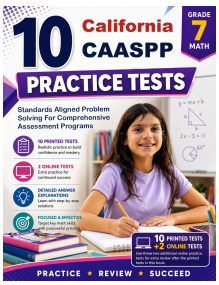

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