Turning Repeating Decimals into Fractions

Name: _____ Date: _____ Score: _____ / 24

Quick Review

Every **repeating decimal** is secretly a fraction, and there is a neat trick to find it. Let x equal the decimal. Then multiply x by a power of 10 that shifts *one full repeating block* past the decimal point — by 10 if one digit repeats, by 100 if two digits repeat, and so on. **Subtract** the original x from this new number: the endless repeating tails line up and cancel, leaving a clean equation. Solve for x as a fraction and *simplify*. The number of 9s in the denominator matches the number of repeating digits.

◇ **Example:** Write $0.\overline{36}$ as a fraction in lowest terms.

⇒ Let $x = 0.363636\ldots$. Two digits repeat, so multiply both sides by 100: $100x = 36.363636\ldots$. Now here is the magic — subtract the first equation from the second so the endless tails cancel: $100x - x = 36.3636\ldots - 0.3636\ldots$, which gives $99x = 36$. Divide to get $x = \frac{36}{99}$, and both numbers share a factor of 9, so simplify to $\frac{4}{11}$.

Answer: $\frac{4}{11}$

PRACTICE

Write each repeating decimal as a fraction in lowest terms.

1. $0.\overline{1}$ _____
2. $0.\overline{4}$ _____
3. $0.\overline{7}$ _____
4. $0.\overline{9}$ _____
5. $0.\overline{2}$ _____
6. $0.\overline{12}$ _____
7. $0.\overline{27}$ _____
8. $0.\overline{45}$ _____
9. $0.\overline{6}$ _____
10. $0.\overline{81}$ _____
11. $0.\overline{063}$ _____
12. $1.\overline{3}$ _____
13. $2.\overline{6}$ _____
14. $0.\overline{5}$ _____
15. $0.\overline{18}$ _____
16. $0.\overline{72}$ _____
17. $0.\overline{8}$ _____
18. $0.\overline{216}$ _____
19. $0.\overline{15}$ _____
20. $3.\overline{1}$ _____

Word Problems

21. A recipe says each serving uses $0.\overline{3}$ of a cup of flour. Write this amount as a simple fraction. _____
22. A runner's lap time is $0.\overline{6}$ of a minute. Express this time as a fraction of a minute in lowest terms. _____
23. A measuring tool repeats the reading $0.\overline{27}$ meters. Convert it to a fraction in simplest form. _____
24. Liam's calculator shows $0.\overline{1}$ of a dollar left on a gift card. What fraction of a dollar is that? _____

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Answer Keys

1. $\frac{1}{9}$
2. $\frac{4}{9}$
3. $\frac{7}{9}$
4. 1
5. $\frac{2}{9}$
6. $\frac{4}{33}$
7. $\frac{3}{11}$
8. $\frac{5}{11}$
9. $\frac{2}{3}$
10. $\frac{9}{11}$
11. $\frac{7}{111}$
12. $\frac{4}{3}$
13. $\frac{8}{3}$
14. $\frac{5}{9}$
15. $\frac{2}{11}$
16. $\frac{8}{11}$
17. $\frac{8}{9}$
18. $\frac{8}{37}$
19. $\frac{5}{33}$
20. $\frac{28}{9}$
21. $\frac{1}{3}$ cup
22. $\frac{2}{3}$ minute
23. $\frac{3}{11}$ meter
24. $\frac{1}{9}$ dollar

Step-by-Step Explanations

1. One digit repeats, so $x = \frac{1}{9}$ — the denominator is a single 9.
2. With one repeating digit, $0.\overline{4} = \frac{4}{9}$.
3. One repeating digit gives a denominator of 9: $\frac{7}{9}$.
4. Surprisingly, $0.\overline{9} = \frac{9}{9} = 1$. The trick works perfectly even here!
5. One repeating digit: $0.\overline{2} = \frac{2}{9}$.
6. Two digits repeat, so $x = \frac{12}{99}$; dividing top and bottom by 3 gives $\frac{4}{33}$.
7. Here $x = \frac{27}{99}$, and both share a factor of 9, so it simplifies to $\frac{3}{11}$.
8. $x = \frac{45}{99}$; dividing by 9 gives $\frac{5}{11}$.
9. $x = \frac{6}{9}$, and dividing by 3 gives $\frac{2}{3}$.
10. $x = \frac{81}{99}$; both share a factor of 9, leaving $\frac{9}{11}$.
11. Three digits repeat, so $x = \frac{63}{999}$; dividing by 9 gives $\frac{7}{111}$.
12. The repeating part $0.\overline{3} = \frac{1}{3}$, so $1 + \frac{1}{3} = \frac{4}{3}$.
13. Since $0.\overline{6} = \frac{2}{3}$, we have $2 + \frac{2}{3} = \frac{8}{3}$.
14. One repeating digit: $0.\overline{5} = \frac{5}{9}$.
15. $x = \frac{18}{99}$; dividing by 9 gives $\frac{2}{11}$.
16. $x = \frac{72}{99}$; both share a factor of 9, leaving $\frac{8}{11}$.
17. One repeating digit gives $0.\overline{8} = \frac{8}{9}$.
18. Three digits repeat, so $x = \frac{216}{999}$; dividing by 27 gives $\frac{8}{37}$.
19. $x = \frac{15}{99}$; dividing top and bottom by 3 gives $\frac{5}{33}$.
20. The repeating tail $0.\overline{1} = \frac{1}{9}$, so $3 + \frac{1}{9} = \frac{27}{9} + \frac{1}{9} = \frac{28}{9}$.
21. Let $x = 0.\overline{3}$. Then $10x = 3.\overline{3}$, so $10x - x = 3$ and $9x = 3$, giving $x = \frac{3}{9} = \frac{1}{3}$ cup.
22. Let $x = 0.\overline{6}$, so $10x = 6.\overline{6}$ and $9x = 6$. Then $x = \frac{6}{9} = \frac{2}{3}$ of a minute.
23. Two digits repeat, so let $x = 0.\overline{27}$ and $100x = 27.\overline{27}$. Then $99x = 27$, so $x = \frac{27}{99} = \frac{3}{11}$ meter.
24. Let $x = 0.\overline{1}$. Then $10x = 1.\overline{1}$, so $9x = 1$ and $x = \frac{1}{9}$ of a dollar.

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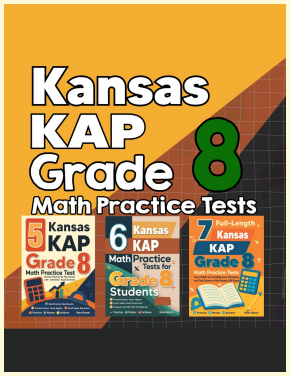

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