

Turning Repeating Decimals into Fractions

Name: _____ Date: _____ Score: _____ / 24

Q 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 $x = 0.363636\dots$. Two digits repeat, so multiply both sides by 100: $100x = 36.363636\dots$. Now here is the magic — subtract the first equation from the second so the endless tails cancel: $100x - x = 36.3636\dots - 0.3636\dots$, 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.

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

◆ Word Problems

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



Answer Keys

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

Step-by-Step Explanations

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