

# 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.

- |                       |       |                        |       |
|-----------------------|-------|------------------------|-------|
| 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.  $\frac{1}{9}$

2.  $\frac{4}{9}$

3.  $\frac{7}{9}$

4.  $\frac{1}{9}$

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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