

Fix it 1 Write it out

Recurring decimals · ANSWERS

One dot: that digit recurs. Dots on two digits: the block from the first dot to the second recurs. Digits before the first dot are written once. Then write $x =$ the decimal, at least six places.

EXAMPLE

Write $0.\dot{3}7$ out as $x = \dots$

1. Dots on the 3 and the 7: the block 37 recurs.
2. Write the block again and again.
3. $x = 0.373737\dots$

YOUR TURN

- 1 Write $0.5\dot{8}$ out as $x = \dots$, to at least six decimal places.

$x =$ 0.585858...

- 2 Write $0.2\dot{4}7$ out as $x = \dots$, to at least six decimal places.

$x =$ 0.247247...

- 3 Write $0.6\dot{1}$ out as $x = \dots$, to at least six decimal places.

$x =$ 0.611111...

Check: Read your digits back: after the digits written once, the same block again and again.

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Fix it 2 Count the recurring digits

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Count the digits in the block that recurs. One digit: multiply by 10. Two: by 100. Three: by 1000. That moves every digit one whole block, so the tails still match.

EXAMPLE

$x = 0.613613\dots$ Multiply by 10, 100 or 1000?

1. The block 613 recurs: three digits.
2. Three digits: multiply by 1000.
3. $\times 1000$ moves every digit three places, one whole block, so the tails still match.

YOUR TURN

- 1 $x = 0.282828\dots$ Multiply by 10, 100 or 1000?

100

- 2 $x = 0.509509\dots$ Multiply by 10, 100 or 1000?

1000

- 3 $x = 0.040404\dots$ Multiply by 10, 100 or 1000?

100

Check: Write both lines out. The digits after the points match, one under the other.

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Fix it 3 Which two lines?

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Recurring straight after the point: x and $10x$, $100x$ or $1000x$. Digits before it: first multiply by 10 for each one, so the recurring starts straight after the point. Then multiply that by the number from card 2.

EXAMPLE

$x = 0.6141414...$ Which two lines do you write?

1. The 6 does not recur: $\times 10$ moves it in front of the point.
2. $10x = 6.141414...$
3. Two digits recur: $\times 100$ more.
4. Write $10x$ and $1000x$.

YOUR TURN

- 1 $x = 0.733333...$ Which two multiples of x do you write?

$10x$ and $100x$

- 2 $x = 0.2858585...$ Which two multiples of x do you write?

$10x$ and $1000x$

- 3 $x = 0.094444...$ Which two multiples of x do you write?

$100x$ and $1000x$

Check: In both lines, everything after the point recurs.

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Fix it 4 Multiply and line up

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$\times 10$ moves every digit one place, $\times 100$ two places, $\times 1000$ three. Write the new line above the old one with the points in a column, so the recurring tails sit one under the other.

EXAMPLE

$x = 0.929292...$ Write $100x$ above it.

1. $\times 100$ moves every digit two places.
2. $100x = 92.929292...$
 $x = 0.929292...$
3. The points line up. So do the tails.

YOUR TURN

- 1 $x = 0.464646...$ Write $100x$.

$100x = 46.464646...$

- 2 $x = 0.381381...$ Write $1000x$.

$1000x = 381.381381...$

- 3 $10x = 1.575757...$ Write $1000x$.

$1000x = 157.575757...$

Check: Divide your new line by the 10, 100 or 1000 in your head. You get the old line back.

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Fix it 5 Subtract

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Take the lower line from the upper one: the x 's first ($100x - 10x = 90x$), then the numbers. The tails cancel, so the number is whole.

EXAMPLE

Take x away from $100x$.

$$1. 100x = 92.929292\dots$$

$$x = 0.929292\dots$$

$$99x = 92$$

$$2. 100x - x = 99x. \text{ The tails cancel.}$$

YOUR TURN

$$1 \quad 1000x = 245.245245\dots$$

$$x = 0.245245\dots$$

Take x away from $1000x$.

$$999x = 245$$

$$2 \quad 100x = 37.777777\dots$$

$$10x = 3.777777\dots$$

Take $10x$ away from $100x$.

$$90x = 34$$

$$3 \quad 1000x = 862.626262\dots$$

$$10x = 8.626262\dots$$

Take $10x$ away from $1000x$.

$$990x = 854$$

Check: Your number has nothing after the point. If it has, the tails were not lined up.

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Fix it 6 Solve for x

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Divide both sides by the number in front of x . The number on the right is the numerator and the number in front of x is the denominator.

EXAMPLE

$99x = 92$. Write x as a fraction.

1. Divide both sides by 99.

$$2. x = \frac{92}{99}$$

YOUR TURN

$$1 \quad 999x = 410. \text{ Write } x \text{ as a fraction.}$$

$$x = \frac{410}{999}$$

$$2 \quad 90x = 53. \text{ Write } x \text{ as a fraction.}$$

$$x = \frac{53}{90}$$

$$3 \quad 990x = 707. \text{ Write } x \text{ as a fraction.}$$

$$x = \frac{707}{990}$$

Check: Multiply your fraction by the number in front of x . You get the number on the right back.

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Find a number that divides the numerator and the denominator. Divide both by it, and keep going until nothing does. The denominator is 9s and 0s, so try 2, 3, 5, 9 and 11.

EXAMPLE

Write $\frac{144}{990}$ in its simplest form.

1. Both are even: $\frac{72}{495}$
2. Both divide by 9: $\frac{8}{55}$
3. Nothing else divides 8 and 55.

YOUR TURN

- 1 Write $\frac{72}{99}$ in its simplest form.

$$\frac{8}{11}$$

- 2 Write $\frac{85}{90}$ in its simplest form.

$$\frac{17}{18}$$

- 3 Write $\frac{270}{999}$ in its simplest form.

$$\frac{10}{37}$$

Check: Multiply the numerator and denominator by what you divided by. You get the fraction you started with.

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