# Rational and Irrational Numbers

| Name: _____ | Date: _____ | Score: _____ / 24 |
|---|---|---|

## Quick Review

A **rational number** can be written as a fraction $\frac{a}{b}$ of two integers (with $b \neq 0$). As decimals, rationals either terminate (like $0.75$) or repeat (like $0.\overline{3}$). **Irrational numbers** can't be written as such a fraction — their decimals go on forever without repeating, such as $\pi$, $\sqrt{2}$, and $\sqrt{10}$. **Closure rules**: rational $+$ rational $=$ rational; rational $\times$ rational $=$ rational. Irrational $+$ rational $=$ irrational (the irrational part can't be undone). Irrational $\times$ nonzero rational $=$ irrational. The trickiest rule: $\sqrt{n}$ is rational only when $n$ is a perfect square; otherwise irrational.

## PRACTICE

*Classify each number as rational or irrational.*

| | | | |
|---|---|---|---|
| **1.** $\frac{3}{5}$ | _____ | **11.** $2.\overline{18}$ | _____ |
| **2.** $\sqrt{49}$ | _____ | **12.** $\sqrt{100}$ | _____ |
| **3.** $\sqrt{7}$ | _____ | **13.** $-\sqrt{2}$ | _____ |
| **4.** $0.25$ | _____ | **14.** $3.5$ | _____ |
| **5.** $\pi$ | _____ | **15.** $\sqrt{64}$ | _____ |
| **6.** $-8$ | _____ | **16.** $\sqrt{2}+1$ | _____ |
| **7.** $0.\overline{6}$ | _____ | **17.** $\frac{22}{7}$ | _____ |
| **8.** $\sqrt{16}$ | _____ | **18.** $0.1010010001\ldots$ | _____ |
| **9.** $\sqrt{20}$ | _____ | **19.** $\sqrt{81}$ | _____ |
| **10.** $\frac{0}{9}$ | _____ | **20.** $\sqrt{50}$ | _____ |

### ♦ Word Problems

**21.** A square garden has area $36$ ft$^2$. Is the exact side length rational or irrational?

_____

**22.** A square tile has area $30$ in$^2$. Is its exact side length rational or irrational?

_____

**23.** Maria claims any number with a decimal point is irrational. Give a number that proves her claim false.

_____

**24.** A circle has radius $4$ cm, so its exact circumference is $8\pi$. Is that exact circumference rational or irrational?

_____

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# Answer Keys

1. rational
2. rational
3. irrational
4. rational
5. irrational
6. rational
7. rational
8. rational
9. irrational
10. rational
11. rational
12. rational
13. irrational
14. rational
15. rational
16. irrational
17. rational
18. irrational
19. rational
20. irrational
21. rational, $6$ ft
22. irrational
23. $0.5$ is rational
24. irrational

## Step-by-Step Tutor Notes

1. Take it one clear step at a time and keep the original question in mind. Already a fraction of integers. So the answer is rational.
2. Take it one clear step at a time and keep the original question in mind. $49 = 7^2$, so $\sqrt{49} = 7$. So the answer is rational.
3. Take it one clear step at a time and keep the original question in mind. $7$ is between $4$ and $9$ — not a perfect square. So the answer is irrational.
4. Take it one clear step at a time and keep the original question in mind. Terminates: $0.25 = \frac{1}{4}$. So the answer is rational.
5. This is a good place to slow down, check the notation, and simplify cleanly. Famously irrational. So the answer is irrational.
6. Use the clue in the question first, then let the arithmetic finish the job. Integer $= \frac{-8}{1}$. So the answer is rational.
7. Focus on the main idea of the problem, then simplify carefully. Repeating decimal $= \frac{2}{3}$. So the answer is rational.
8. Use the clue in the question first, then let the arithmetic finish the job. $16 = 4^2$, so $\sqrt{16} = 4$. So the answer is rational.
9. Use the clue in the question first, then let the arithmetic finish the job. $20$ isn't a perfect square ($16 < 20 < 25$). So the answer is irrational.
10. This is a good place to slow down, check the notation, and simplify cleanly. Equals $0$, an integer. So the answer is rational.
11. Start with the definition the problem is testing, then apply it directly. Repeating $=$ rational. So the answer is rational.
12. Use the clue in the question first, then let the arithmetic finish the job. $= 10$. So the answer is rational.
13. This is a good place to slow down, check the notation, and simplify cleanly. Negating irrational stays irrational. So the answer is irrational.
14. Take it one clear step at a time and keep the original question in mind. $= \frac{7}{2}$. So the answer is rational.
15. Focus on the main idea of the problem, then simplify carefully. $= 8$. So the answer is rational.
16. Work one inverse operation at a time and keep both sides balanced. Adding rational $1$ to irrational stays irrational. After simplifying, the answer is irrational.
17. This is a good place to slow down, check the notation, and simplify cleanly. Famous approximation of $\pi$, but it's still rational. So the answer is rational.
18. Start with the definition the problem is testing, then apply it directly. No repeating pattern. So the answer is irrational.
19. Use the clue in the question first, then let the arithmetic finish the job. $= 9$. So the answer is rational.
20. Focus on the main idea of the problem, then simplify carefully. $50$ is between $49$ and $64$. So the answer is irrational.
21. Use the given numbers to build the model, then finish the calculation. Side $= \sqrt{36} = 6$. Perfect square root $\rightarrow$ rational.
22. Use the given numbers to build the model, then finish the calculation. Side $= \sqrt{30}$, and $30$ isn't a perfect square.
23. Use the given numbers to build the model, then finish the calculation. $0.5 = \frac{1}{2}$. Terminating decimals are rational.
24. Use the given numbers to build the model, then finish the calculation. $8\pi$ is a rational $(8)$ times an irrational $(\pi)$, giving irrational.

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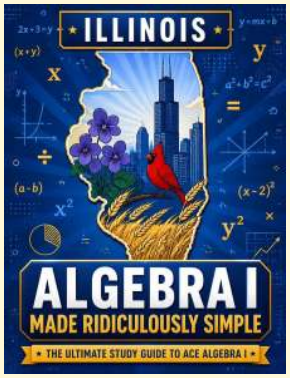


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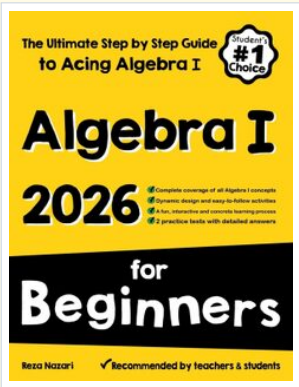


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