

Rational and Irrational Numbers

Name: _____

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Q 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 π , $\sqrt{2}$, 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. π | _____ | 15. $\sqrt{64}$ | _____ |
| 6. -8 | _____ | 16. $\sqrt{2} + 1$ | _____ |
| 7. $0.\overline{6}$ | _____ | 17. $\frac{22}{7}$ | _____ |
| 8. $\sqrt{16}$ | _____ | 18. 0.1010010001 ... | _____ |
| 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 8π . Is that exact circumference rational or irrational?



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Answer Keys

- | | |
|---------------|---------------------|
| 1. rational | 13. irrational |
| 2. rational | 14. rational |
| 3. irrational | 15. rational |
| 4. rational | 16. irrational |
| 5. irrational | 17. rational |
| 6. rational | 18. irrational |
| 7. rational | 19. rational |
| 8. rational | 20. irrational |
| 9. irrational | 21. rational, 6 ft |
| 10. rational | 22. irrational |
| 11. rational | 23. 0.5 is rational |
| 12. 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 π , 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. 8π is a rational (8) times an irrational (π), giving irrational.



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