

Rational and Irrational Numbers Explained

Grade 8 math · Test Answer Key · Standards: 8.NS.A.1, 8.NS.A.2

Use this answer key to score each question. Partial credit is listed in the scoring line under every solution. Award points for correct reasoning, such as testing squares, even when the arithmetic slips at the end.

Standards: 8.NS.A.1, 8.NS.A.2 · **Level:** Grade 8

Question 1 Sort the numbers (3 points)

- a. $-5.25 = -\frac{21}{4}$: rational.
- b. $\sqrt{72}$ is between 8 and 9 and not a perfect square: irrational.
- c. $\sqrt{169} = 13$: rational.
- d. Repeating block: rational.
- e. 2π : irrational.
- f. $\sqrt[9]{16} = \frac{3}{4}$: rational.

Irrational: $\sqrt{72}$ and 2π . **Rational:** the other four.

Scoring: $\frac{1}{2}$ point per correct label.

Question 2 Decimals and fractions (3 points)

- a. $0.6125 = \frac{6,125}{10,000} = \frac{49}{80}$.
- b. Let $x = 0.135135\dots$; $1,000x = 135.135\dots$; $999x = 135$; $x = \frac{135}{999} = \frac{5}{37}$.

(a) $\frac{49}{80}$ **(b)** $\frac{5}{37}$

Scoring: (a) 1 point. (b) 1 point for the equation $999x = 135$, 1 point for the simplified fraction.

Question 3 Estimating a root (2 points)

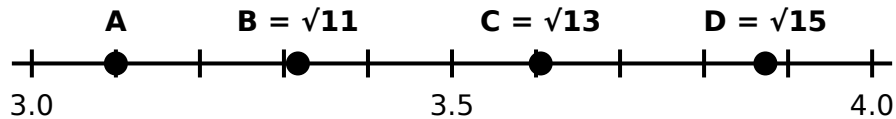
$7^2 = 49$ and $8^2 = 64$, so $7 < \sqrt{61} < 8$. Next, $7.8^2 = 60.84$ and $7.9^2 = 62.41$. Since 61 is much closer to 60.84, the estimate is 7.8.

Between 7 and 8; $\sqrt{61} \approx 7.8$

Scoring: 1 point for the integers, 1 point for 7.8 with a supporting square.

Question 4 Points on a number line (3 points)

$3.3^2 = 10.89$ and $3.4^2 = 11.56$, so $\sqrt{11} \approx 3.32$: point B. $3.6^2 = 12.96$ and $3.7^2 = 13.69$, so $\sqrt{13} \approx 3.61$: point C. $3.8^2 = 14.44$ and $3.9^2 = 15.21$, so $\sqrt{15} \approx 3.87$: point D. Point A is 3.1, which is not one of the three roots.



Matched points.

B = $\sqrt{11}$, C = $\sqrt{13}$, D = $\sqrt{15}$

Scoring: 1 point per correct match, with its square check.

Question 5 Order the numbers (2 points)

$4\frac{7}{9} = 4.777\ldots$. $4.79^2 = 22.9441$, less than 23, so $4.79 < \sqrt{23}$. $4.8^2 = 23.04$, more than 23, so $\sqrt{23} < 4.8$. Order: $4.777\ldots < 4.79 < \sqrt{23} < 4.8$.

$4\frac{7}{9}$, 4.79, $\sqrt{23}$, 4.8

Scoring: 1 point for the correct order, 1 point for squaring to justify $\sqrt{23}$.

Question 6 The mural (3 points)

- a. $9^2 = 81$ and $10^2 = 100$, so the side is between 9 and 10 feet.
- b. $9.4^2 = 88.36$ and $9.5^2 = 90.25$. Since 90 is closer to 90.25, the side is about 9.5.
- c. No. $9.5^2 = 90.25$, not 90, so 9.5 is only an approximation of $\sqrt{90}$, which is irrational.

(a) 9 and 10 (b) 9.5 ft (c) No, $9.5^2 = 90.25$

Scoring: 1 point per part.

Question 7 Always irrational? (2 points)

Take $\sqrt{2}$ and $\sqrt{8}$, both irrational. $\sqrt{2} \cdot \sqrt{8} = \sqrt{16} = 4$, and 4 is rational. Another example is $\sqrt{3} \cdot \sqrt{3} = 3$.

Claim false: $\sqrt{2} \cdot \sqrt{8} = 4$.

Scoring: 1 point for two irrational factors, 1 point for the rational product.

Question 8 A late-starting repeat (2 points)

Let $x = 0.2777\dots$. Then $10x = 2.777\dots$ and $100x = 27.777\dots$. Subtract: $90x = 25$, so $x = \frac{25}{90} = \frac{5}{18}$.

$$\frac{5}{18}$$

Scoring: 1 point for $90x = 25$, 1 point for the simplified fraction.