Year 9 Indices and Surds – Challenge

ANSWER KEY HappyKids.fit

Answers and worked solutions · 8 questions

A. Think like a mathematician

1. **No. Counter-example: √2 × √2 = 2, which is rational.**
   Test some examples
   Counter-example: √2 × √2 = 2, which is rational.
   Decide whether it is always true

2. **No. Counter-example: √9 = 3, which is rational.**
   Test some examples
   Counter-example: √9 = 3, which is rational.
   Decide whether it is always true

3. **Yes. If √3 + r were rational, then √3 would be a rational number minus r, which is rational, but √3 is irrational.**
   Test some examples
   If √3 + r were rational, then √3 would be a rational number minus r, which is rational, but √3 is irrational.
   Decide whether it is always true

4. **Subtract the indices: 3 − (−1) = 4, so the answer is 10^4.**
   Error: subtracting a negative index adds it
   $3 - (-1) = 3 + 1 = 4$
   $= 10^4$

5. **$(3/4)^{-1}$ is the reciprocal: 4/3.**
   Error: a power of −1 does not make a number negative
   A power of −1 means the reciprocal
   $(3/4)^{-1} = 4/3$

6. **8, 4, 2, 1; $2^{-1} = 1/2$, $2^{-2} = 1/4$: each time the index goes down by 1, divide by 2**
   $2^3 = 8$, $2^2 = 4$, $2^1 = 2$, $2^0 = 1$
   Each step divides by 2
   So $2^{-1} = 1/2$ and $2^{-2} = 1/4$

7. **between 10 and 11 cm; irrational, because 115 is not a square number**
   Side = √115; $10^2 = 100$ and $11^2 = 121$
   115 is not a square number, so √115 is irrational

8. **10.5**
   $10.5^2 = 110.25$ and $10.6^2 = 112.36$, so √111 is between 10.5 and 10.6
   $10.55^2 = 111.3025$, which is more than 111, so $\sqrt{111} \approx 10.5$