

July 7, 2015

$0.\overline{318}$ (From Yesterday)

Let $x = 0.31818\dots$

$100x = 100(0.\overline{31818\dots})$

$100x = 31.81818\dots$

$-x = 0.31818\dots$

$99x = 31.5$ *Note: Still a decimal!

$\frac{99x}{99} = \frac{31.5}{99}$

$x = \frac{315}{990} = \frac{63}{198} = \frac{7}{22}$

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6.3

#74 $0.\overline{384615}$

Let $x = 0.\overline{384615}$,
More Six Places

$1,000,000x = 1,000,000(0.\overline{384615})$

$1000000x = 384615.\overline{384615}$

$-x = 0.\overline{384615}$

$999999x = \frac{384615}{999999}$

$x = \frac{42,735}{111,111} = \frac{14245}{37037}$

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Real Numbers

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    graph TD
      Real[Real] --> Rational[Rational]
      Real --> Irrational[Irrational]
      Irrational --> Pi["π, e, √2, √3, √5, ..."]
      Irrational --> Radicals[Radicals]
  
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Irrational Numbers

- numbers which are not Rational

Pythagorean Theorem

$c^2 = a^2 + b^2$ * Solves Right-Angle Triangles

side c Hypotenuse (longest side)
side a
side b

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Example

Triples: 3, 4, 5

①

$c^2 = a^2 + b^2$

$c^2 = (3)^2 + (4)^2$

$c^2 = 9 + 16$

$\sqrt{c^2} = \sqrt{25}$

$c = 5$

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Nile River

Land

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Example

②

$c^2 = (1)^2 + (1)^2$

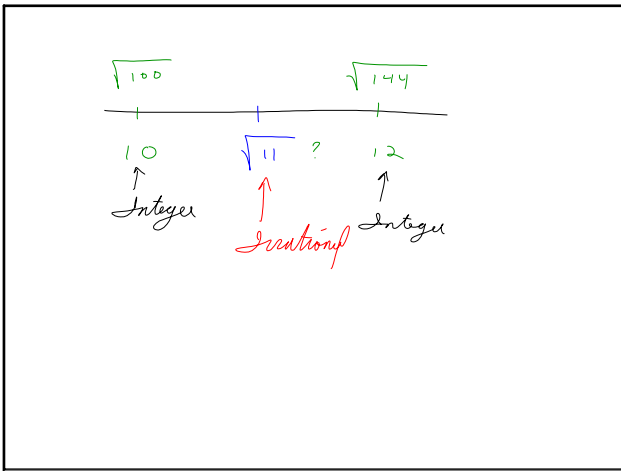
$= 1 + 1$

$\sqrt{c^2} = \sqrt{2}$

$c = \sqrt{2}$?? *not a Rational Number!

Irrational

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Radicaf ← Radical symbol

Index of the Radical when $n \geq 2$

$\sqrt[n]{A}$ ↑ Radicand

Examples

assume to be a "2"

$\sqrt{4}$ Square root of 4 = 2
Because $2^2 = 4$

$\sqrt{9} = 3$

$\sqrt{16} = 4$

$\sqrt{25} = 5$

$\sqrt[3]{125} = 5$; $5^3 = 5 \cdot 5 \cdot 5 = 125$

$\sqrt[3]{8} = 2$; $2^3 = 2 \cdot 2 \cdot 2 = 8$

$\sqrt[3]{9} = \text{Irrational}$

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Product Rule for Radicals

$\sqrt{a} \cdot \sqrt{b} = \sqrt{a \cdot b}$

$\sqrt{3} \cdot \sqrt{5} = \sqrt{3 \cdot 5} = \sqrt{15}$

$\sqrt{12} = \sqrt{3 \cdot 4} = \sqrt{3} \cdot \sqrt{4}$
 $= \sqrt{3} \cdot 2$
 $= 2\sqrt{3}$
 $\approx 3.4641\dots$

3 $2\sqrt{3}$ 4

write $2\sqrt{3}$ not $\sqrt{3} \cdot 2$

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Quotient Rule for Radicals

$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\frac{\sqrt{50}}{\sqrt{5}} = \sqrt{\frac{50}{5}} = \sqrt{10}$ ↑ Irrational

$\sqrt{10} = \sqrt{2 \cdot 5} = \sqrt{2} \cdot \sqrt{5}$ Not perfect roots

$\sqrt{12} = \sqrt{2 \cdot 6} = \sqrt{2} \cdot \sqrt{6}$
 \downarrow
 $\sqrt{3} \cdot \sqrt{4}$
 $2\sqrt{3}$

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Product Rule

$\sqrt{15} \cdot \sqrt{5} = \sqrt{15 \cdot 5}$

$\sqrt{3 \cdot 5} \cdot \sqrt{5} = \sqrt{75}$

$\sqrt{3} \cdot \sqrt{5} \cdot \sqrt{5} = \sqrt{3 \cdot 25}$

$\sqrt{3} \cdot \sqrt{25} = \sqrt{3} \cdot 5$

$5\sqrt{3}$

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Simplify

$\sqrt{\frac{54}{12}} = \sqrt{\frac{18}{4}} = \frac{\sqrt{18}}{\sqrt{4}}$

$\frac{\sqrt{6 \cdot 3}}{\sqrt{3 \cdot 4}} = \frac{\sqrt{9 \cdot 2}}{2}$

$\frac{\sqrt{6} \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{4}} = \frac{3\sqrt{2}}{2 \cdot 2}$

$\frac{\sqrt{6} \cdot 3}{\sqrt{3} \cdot 2} = \frac{3\sqrt{2}}{2}$

$\sqrt{\frac{6}{3}} = \sqrt{2}$

$\sqrt{2} \cdot \frac{3}{2} = \frac{3}{2}\sqrt{2}$

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