

Mathematics for Computing

Irrational Numbers

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Irrational Numbers

Given x is the irrational positive number $\sqrt{2}$:

- (i) Express x^8 in binary notation.
- (ii) Is x^8 a rational number?
- (iii) Write $\left(\frac{1}{x}\right)^3$ in the form 2^y where $y \in \mathbb{Q}$.

Irrational Numbers

Part (i) Express x^8 in binary notation

- ▶ $(\sqrt{2})^8 = 2^4 = 16$
- ▶ The binary equivalent of 16 is 1000.

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Part (ii) Is x^8 a rational number?

$$x^8 = 16$$

Yes 16 is an integer and therefore also a rational number.

$$x^8 \in \mathbb{Q}$$

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Part (iii) Write $\left(\frac{1}{x}\right)^3$ in the form 2^y where $y \in \mathbb{Q}$.

$$\left(\frac{1}{x}\right)^3 = \left(\frac{1}{\sqrt{2}}\right)^3$$

$$\left(\frac{1}{\sqrt{2}}\right)^3 = \left(2^{-1/2}\right)^3$$

$$\left(2^{-1/2}\right)^3 = 2^{-3/2}$$

$$y = \frac{-3}{2}$$