

# DiscreteDelta

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## Notations

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### Traditional name

Discrete delta function

### Traditional notation

$\delta(n)$

### Mathematica StandardForm notation

DiscreteDelta[n]

## Primary definition

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04.18.02.0001.01

$$\delta(n) = 1 \ ; \ n = 0$$

04.18.02.0002.01

$$\delta(n) = 0 \ ; \ n \neq 0$$

The below formula accumulates the above definitions for different values  $n$  in one expression.

04.18.02.0003.01

$$\delta(n) = \begin{cases} 1 & n = 0 \\ 0 & \text{True} \end{cases}$$

## Specific values

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### Values at fixed points

04.18.03.0001.01

$$\delta(0) = 1$$

04.18.03.0002.01

$$\delta(1) = 0$$

04.18.03.0003.01

$$\delta(-1) = 0$$

04.18.03.0004.01

$$\delta(2) = 0$$

04.18.03.0007.01

$$\delta(i) = 0$$

## Values at infinities

04.18.03.0005.01

$$\delta(\infty) = 0$$

04.18.03.0006.01

$$\delta(-\infty) = 0$$

## General characteristics

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### Domain and analyticity

$\delta(n)$  is a nonanalytical function defined on  $\mathbb{C}$ . Its possible values are 0 and 1.

04.18.04.0001.01

$$n \rightarrow \delta(n) : \mathbb{R} \rightarrow \{0, 1\}$$

### Symmetries and periodicities

#### Parity

$\delta(n)$  is an even function.

04.18.04.0002.01

$$\delta(-n) = \delta(n)$$

#### Periodicity

No periodicity

## Integral representations

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### On the real axis

04.18.07.0001.01

$$\delta(n) = \frac{1}{2\pi} \int_0^{2\pi} e^{itn} dt$$

## Transformations

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### Transformations and argument simplifications

04.18.16.0001.01

$$\delta(-n) = \delta(n)$$

## Differentiation

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### Low-order differentiation

04.18.20.0001.01

$$\frac{\partial \delta(n)}{\partial n} = 0$$

## Fractional integro-differentiation

04.18.20.0002.01

$$\frac{\partial^\alpha \delta(n)}{\partial n^\alpha} = \frac{n^{-\alpha} \delta(n)}{\Gamma(1 - \alpha)}$$

## Integration

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### Indefinite integration

04.18.21.0001.01

$$\int \delta(z) dz = \delta(z) z$$

## Representations through equivalent functions

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04.18.27.0001.01

$$\delta(n) = \delta(n_1, n_2, \dots, n_m) /; n_1 = n \wedge m = 1$$

04.18.27.0002.01

$$\delta(n) = \delta_{n,0}$$

04.18.27.0003.01

$$\delta(n) = \delta_n$$

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