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# Zero-Crossing Method Formulas

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# List of 12 Zero-Crossing Method Formulas

## Zero-Crossing Method

### 1) Number of Crests in Wave Record given Wave Crest Period

$$fx \quad N_c = \frac{T_r}{T_c}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$ex \quad 18.04124 = \frac{70s}{3.88s}$$

### 2) Number of Zero Up-Crossings given Zero-Crossing Period

$$fx \quad N_Z = \frac{T_r}{T_Z}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$ex \quad 10 = \frac{70s}{7s}$$

### 3) Probability that Wave Height is Greater than or Equal to Design Wave Height

$$fx \quad p = \frac{m}{4}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$ex \quad 0.5 = \frac{2}{4/m}$$



#### 4) Probability that Wave Height is Lesser than or Equal to Design Wave Height

$$fx \quad p = 1 - \left( \frac{m}{4} \right)$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

$$ex \quad 0.5 = 1 - \left( \frac{2}{4/m} \right)$$

#### 5) Record Length given Wave Crest Period

$$fx \quad T_r = T_c \cdot N_c$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

$$ex \quad 69.84s = 3.88s \cdot 18$$

#### 6) Record Length given Zero-Crossing Period

$$fx \quad T_r = T_z \cdot N_z$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

$$ex \quad 70s = 7s \cdot 10$$

#### 7) Root Mean Square Surface Elevation given Significant Wave Height

$$fx \quad \eta_{rms} = \frac{H_s}{4}$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754\_img.jpg\)](#)

$$ex \quad 16.25m = \frac{65m}{4}$$



## 8) Significant Wave Height given rms Surface Elevation

$$fx \quad H_s = 4 \cdot \eta_{rms}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

$$ex \quad 64m = 4 \cdot 16m$$

## 9) Significant Wave Height given Zero-th Moment

$$fx \quad H_s = 4 \cdot \sqrt{m_0}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$ex \quad 65.11528m = 4 \cdot \sqrt{265}$$

## 10) Wave Crest Period

$$fx \quad T_c = \frac{T_r}{N_c}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$ex \quad 3.888889s = \frac{70s}{18}$$

## 11) Zero-Crossing Period

$$fx \quad T_Z = \frac{T_r}{N_Z}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b\_img.jpg\)](#)

$$ex \quad 7s = \frac{70s}{10}$$



## 12) Zero-th Moment given Significant Wave Height

[Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff\_img.jpg\)](#)

$$\text{fx } m_0 = \left( \frac{H_s}{4} \right)^2$$

$$\text{ex } 264.0625 = \left( \frac{65\text{m}}{4} \right)^2$$






## Variables Used

- **4** Wave Number (1 per Meter)
- **H<sub>s</sub>** Significant Wave Height (Meter)
- **m** Number of Waves Higher than Design Wave Height
- **m<sub>0</sub>** Zero-th Moment of Wave Spectrum
- **N<sub>c</sub>** Number of Crests
- **N<sub>z</sub>** Number of Zero-Upcrossings
- **p** Probability
- **T<sub>c</sub>** Wave Crest Period (Second)
- **T<sub>r</sub>** Record Length (Second)
- **T<sub>z</sub>** Zero-Crossing Period (Second)
- **η<sub>rms</sub>** RMS Surface Elevation (Meter)



## Constants, Functions, Measurements used

- **Function:** **sqrt**, sqrt(Number)  
*A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- **Measurement:** **Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement:** **Time** in Second (s)  
*Time Unit Conversion* 
- **Measurement:** **Wave Number** in 1 per Meter (1/m)  
*Wave Number Unit Conversion* 



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