



## Horizontal and Vertical Semi-Axis of Ellipse Formulas

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### List of 13 Horizontal and Vertical Semi-Axis of **Ellipse Formulas**

## Horizontal and Vertical Semi-Axis of Ellipse &

1) Major Horizontal Semi Axis for Deep Water Condition 🖸



 $\left| \mathbf{A} = \left( rac{\mathbf{H}_{\mathrm{w}}}{2} 
ight) \cdot \exp \left( 2 \cdot \pi \cdot rac{\mathbf{Z}}{\mathbf{L}} 
ight) 
ight|$ 

Open Calculator

ex  $7.402077 = \left(\frac{14\text{m}}{2}\right) \cdot \exp\left(2 \cdot \pi \cdot \frac{0.8}{90\text{m}}\right)$ 

2) Major Horizontal Semi Axis for Shallow Water Condition

 $\mathbf{A} = \left(\frac{\mathbf{H}_{\mathrm{w}}}{2}\right) \cdot \left(\frac{\mathbf{L}}{2 \cdot \pi \cdot \mathbf{d}_{\mathrm{s}}}\right)$ 

Open Calculator

3) Minor Vertical Semi Axis for Shallow Water Condition

 $\left| \mathbf{E} \right| \mathbf{B} = \left( rac{\mathbf{H}_{\mathrm{w}}}{2} 
ight) \cdot \left( 1 + rac{\mathbf{Z}}{\mathbf{d}_{\mathrm{s}}} 
ight) \left| \mathbf{E} \right|$ 

Open Calculator 2

ex  $7.414815 = \left(\frac{14\text{m}}{2}\right) \cdot \left(1 + \frac{0.8}{13.5\text{m}}\right)$ 





#### 4) Minor Vertical Semi-Axis for Deep Water Condition

 $\mathbf{E} = \left( rac{H_{\mathrm{w}}}{2} 
ight) \cdot \exp \left( 2 \cdot \pi \cdot rac{Z}{L} 
ight)$ 

Open Calculator

Open Calculator

ex  $7.402077 = \left(\frac{14\text{m}}{2}\right) \cdot \exp\left(2 \cdot \pi \cdot \frac{0.8}{90\text{m}}\right)$ 

### 5) Phase Angle for Horizontal Fluid Particle Displacement 🖸

$$egin{aligned} \theta = a \mathrm{sin} \left( \left( \left( rac{\epsilon}{\mathrm{a}} 
ight) \cdot \left( rac{\mathrm{sinh} \left( 2 \cdot \pi \cdot rac{\mathrm{d}}{\lambda} 
ight)}{\mathrm{cosh} \left( 2 \cdot \pi \cdot rac{\mathrm{y}}{\lambda} 
ight)} 
ight) 
ight)^2 \end{aligned}$$

 $oxed{ex} 0.000103^\circ = a \mathrm{sin} \Bigg( \Bigg( igg( rac{0.4 \mathrm{m}}{1.56 \mathrm{m}} \Bigg) \cdot \Bigg( rac{\mathrm{sinh} ig( 2 \cdot \pi \cdot rac{1.05 \mathrm{m}}{26.8 \mathrm{m}} ig)}{\mathrm{cosh} ig( 2 \cdot \pi \cdot rac{4.92 \mathrm{m}}{23.2} ig)} \Bigg) \Bigg)^2 \Bigg)^2$ 

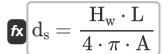
### 6) Sea Bed Given Minor Vertical Semi-Axis for Shallow Water Condition

 $\mathbf{E} \mathbf{Z} = \mathrm{d_s} \cdot \left( \left( rac{\mathrm{B}}{\mathrm{H_w}} 
ight) - 1 
ight)$ 

Open Calculator



## 7) Water Depth for Major Horizontal Semi-Axis for Shallow Water Condition



Open Calculator 🚰

ex 
$$13.54583$$
m =  $\frac{14$ m ·  $90$ m  $4 \cdot \pi \cdot 7.4021$ 

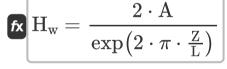
# 8) Water Depth Given Minor Vertical Semi-Axis for Shallow Water Condition

fx 
$$d_{
m s} = rac{
m Z}{\left(rac{
m B}{rac{
m H_W}{
m s}}
ight)-1}$$

Open Calculator

ex 
$$13.49398$$
m  $= \frac{0.8}{\left(\frac{7.415}{\frac{14m}{2}}\right) - 1}$ 

### 9) Wave Height for Major Horizontal Semi-Axis Deep Water Condition

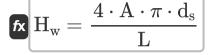


ex 
$$14.00004 \mathrm{m} = \frac{2 \cdot 7.4021}{\exp\left(2 \cdot \pi \cdot \frac{0.8}{90 \mathrm{m}}\right)}$$





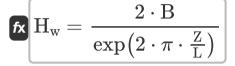
## 10) Wave Height for Major Horizontal Semi-Axis for Shallow Water Condition



Open Calculator 🚰

 $= 13.95263 \text{m} = \frac{4 \cdot 7.4021 \cdot \pi \cdot 13.5 \text{m}}{90 \text{m}}$ 

11) Wave Height for Minor Vertical Semi-Axis Deep Water Condition



Open Calculator

 $ext{ex} 14.02444 ext{m} = rac{2 \cdot 7.415}{\exp\left(2 \cdot \pi \cdot rac{0.8}{90 ext{m}}
ight)}$ 

12) Wave Height Given Minor Vertical Semi-Axis for Shallow Water Condition

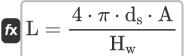
 $\mathbf{H}_{\mathrm{w}} = rac{2 \cdot \mathrm{B}}{1 + \left(rac{\mathrm{Z}}{\mathrm{d_{\mathrm{s}}}}
ight)}$ 

Open Calculator

ex  $14.00035 \mathrm{m} = rac{2 \cdot 7.415}{1 + \left(rac{0.8}{13.5 \mathrm{m}}
ight)}$ 



# 13) Wavelength for Major Horizontal Semi-Axis for Shallow Water Condition



Open Calculator 🗗



#### Variables Used

- a Wave Amplitude (Meter)
- A Horizontal Semi-axis of Water Particle
- B Vertical Semi-Axis
- **d** Water Depth (Meter)
- **d**<sub>s</sub> Water Depth for Semi-Axis of Ellipse (*Meter*)
- H<sub>w</sub> Height of the Wave (Meter)
- L Length of Water Wave (Meter)
- y Elevation above the Bottom (Meter)
- Z Sea Bed Elevation
- E Fluid Particle Displacement (Meter)
- θ Phase Angle (Degree)
- λ Wavelength of Coast (Meter)





#### Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
   Archimedes' constant
- Function: asin, asin(Number)

  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: cosh, cosh(Number)

  The hyperbolic cosine function is a mathematical function that is defined as the ratio of the sum of the exponential functions of x and negative x to 2.
- Function: exp, exp(Number)

  n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.
- Function: sin, sin(Angle)
   Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: sinh, sinh(Number)
   The hyperbolic sine function, also known as the sinh function, is a mathematical function that is defined as the hyperbolic analogue of the sine function.
- Measurement: Length in Meter (m)
   Length Unit Conversion
- Measurement: Angle in Degree (°)
   Angle Unit Conversion





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   Formulas
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