



[calculatoratoz.com](http://calculatoratoz.com)



[unitsconverters.com](http://unitsconverters.com)

# Group Velocity, Beats, Energy Transport Formulas

Calculators!

Examples!

Conversions!

Bookmark [calculatoratoz.com](http://calculatoratoz.com), [unitsconverters.com](http://unitsconverters.com)

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**  
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**  
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

*[Please leave your feedback here...](#)*



# List of 9 Group Velocity, Beats, Energy Transport Formulas

## Group Velocity, Beats, Energy Transport

### 1) Group Velocity given Wave Power per unit Crest Width

$$fx \quad V_g = \frac{P}{E}$$

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

$$ex \quad 28.70813\text{m/s} = \frac{120\text{W}}{4.18\text{J}}$$

### 2) Group Velocity of Waves

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

$$V_g = 0.5 \cdot v \cdot \left( 1 + \left( \frac{k \cdot d}{\sinh(k \cdot d) \cdot \cosh(k \cdot d)} \right) \right)$$

 $ex$ 

$$28.66436\text{m/s} = 0.5 \cdot 50\text{m/s} \cdot \left( 1 + \left( \frac{0.2 \cdot 10\text{m}}{\sinh(0.2 \cdot 10\text{m}) \cdot \cosh(0.2 \cdot 10\text{m})} \right) \right)$$

### 3) Radian Frequency given Wave Propagation

$$fx \quad \omega = k \cdot x$$

[Open Calculator !\[\]\(235bfe13ebf007ce2eea9e689707fac7\_img.jpg\)](#)

$$ex \quad 6.2\text{rad/s} = 0.2 \cdot 31$$



4) Surface Elevation 

$$fx \quad \eta = \left( \frac{H_w}{2} \right) \cdot \cos((k \cdot x) - (\omega \cdot t))$$

Open Calculator 


$$ex \quad 0.476143m = \left( \frac{3m}{2} \right) \cdot \cos((0.2 \cdot 31) - (6.2rad/s \cdot 16s))$$

5) Total Energy per unit Area given Wave Power per unit Crest Width 

$$fx \quad E = \frac{P}{V_g}$$

Open Calculator 

$$ex \quad 4.18702J = \frac{120W}{28.66m/s}$$

6) Wave Power per unit Crest Width 

$$fx \quad P = E \cdot V_g$$

Open Calculator 

$$ex \quad 119.7988W = 4.18J \cdot 28.66m/s$$


7) Wave Speed 

$$fx \quad v = \frac{\omega}{k}$$

Open Calculator 

$$ex \quad 50m/s = \frac{6.2rad/s}{0.124}$$




8) Wave Speed given Group Velocity 

$$fx \quad v = \frac{V_g}{0.5 \cdot \left( 1 + \left( \frac{k \cdot d}{\sinh(k \cdot d) \cdot \cosh(k \cdot d)} \right) \right)}$$

Open Calculator 

$$ex \quad 49.9924 \text{m/s} = \frac{28.66 \text{m/s}}{0.5 \cdot \left( 1 + \left( \frac{0.2 \cdot 10 \text{m}}{\sinh(0.2 \cdot 10 \text{m}) \cdot \cosh(0.2 \cdot 10 \text{m})} \right) \right)}$$

9) Wavenumber given Wave Speed 

$$fx \quad k'' = \frac{\omega}{v}$$

Open Calculator 

$$ex \quad 0.124 = \frac{6.2 \text{rad/s}}{50 \text{m/s}}$$









## Variables Used

- **d** Coastal Mean Depth (*Meter*)
- **E** Total Energy Per Unit Area (*Joule*)
- **H<sub>w</sub>** Wave Height for Surface Gravity Waves (*Meter*)
- **k** Wave Number for Water Wave
- **k''** Wave Number
- **P** Wave Power Per Unit Crest Width (*Watt*)
- **t** Time (*Second*)
- **v** Wave Speed (*Meter per Second*)
- **V<sub>g</sub>** Group Velocity of Waves (*Meter per Second*)
- **x** Propagation of Wave in One Direction
- **η** Surface Elevation (*Meter*)
- **ω** Wave Angular Frequency (*Radian per Second*)



## Constants, Functions, Measurements used

- **Function: cos**,  $\cos(\text{Angle})$   
*Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- **Function: cosh**,  $\cosh(\text{Number})$   
*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: sinh**,  $\sinh(\text{Number})$   
*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: Time** in Second (s)  
*Time Unit Conversion* 
- **Measurement: Speed** in Meter per Second (m/s)  
*Speed Unit Conversion* 
- **Measurement: Energy** in Joule (J)  
*Energy Unit Conversion* 
- **Measurement: Power** in Watt (W)  
*Power Unit Conversion* 
- **Measurement: Angular Frequency** in Radian per Second (rad/s)  
*Angular Frequency Unit Conversion* 



## Check other formula lists

- [Group Velocity, Beats, Energy Transport Formulas](#) 
- [Linear Dispersion Relation of Linear Wave Formulas](#) 
- [Non-Linear Wave Theory Formulas](#) 
- [Shoaling, Refraction and Breaking Formulas](#) 

Feel free to SHARE this document with your friends!

### PDF Available in

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

5/17/2024 | 5:19:25 AM UTC

[Please leave your feedback here...](#)

