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Gravitation Formulas

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List of 21 Gravitation Formulas

Gravitation

1) Gravitational Field Intensity

Open Calculator

fx $$E = \frac{F}{m}$$

ex $$0.075758N/Kg = \frac{2.5N}{33kg}$$

2) Gravitational Field Intensity due to Point Mass

Open Calculator

fx $$E = \frac{[G.] \cdot m \cdot m_o}{r}$$

ex $$1.8E\hat{}\text{-}10N/Kg = \frac{[G.] \cdot 33kg \cdot 0.5kg}{6m}$$

3) Gravitational Potential Energy

Open Calculator

fx $$U = -\frac{[G.] \cdot m_1 \cdot m_2}{r_c}$$

ex $$-1.5E\hat{}\text{-}10J = -\frac{[G.] \cdot 14kg \cdot 16kg}{102m}$$

4) Time Period of Satellite

Open Calculator

fx $$T = \left(\frac{2 \cdot \pi}{[\text{Earth-R}]} \right) \cdot \sqrt{\frac{([\text{Earth-R}] + h)^3}{g}}$$

ex $$1.407245\text{h} = \left(\frac{2 \cdot \pi}{[\text{Earth-R}]} \right) \cdot \sqrt{\frac{([\text{Earth-R}] + 13\text{m})^3}{9.8\text{m/s}^2}}$$

5) Universal Law of Gravitation

Open Calculator

fx $$F = \frac{[\text{G.}] \cdot m_1 \cdot m_2}{r_c^2}$$

ex $$1.4\text{E}\hat{}\text{-}12\text{N} = \frac{[\text{G.}] \cdot 14\text{kg} \cdot 16\text{kg}}{(102\text{m})^2}$$

Gravitational Field

6) Gravitational Field of Ring

Open Calculator

fx $$I = -\frac{[\text{G.}] \cdot m \cdot a}{\left(r_{ring}^2 + a^2\right)^{\frac{3}{2}}}$$

ex $$-3.4\text{E}\hat{}\text{-}15\text{N/Kg} = -\frac{[\text{G.}] \cdot 33\text{kg} \cdot (4\text{m})}{\left((5\text{m})^2 + (4\text{m})^2\right)^{\frac{3}{2}}}$$

7) Gravitational Field of Ring given Angle at any Point Outside Ring

Open Calculator

fx $$I = -\frac{[G.] \cdot m \cdot \cos(\theta)}{\left(a^2 + r_{ring}^2\right)^2}$$

ex $$\text{-1.1E^-12N/Kg} = -\frac{[G.] \cdot 33\text{kg} \cdot \cos(30^\circ)}{\left((4\text{m})^2 + (5\text{m})^2\right)^2}$$

8) Gravitational Field of Thin Circular Disc

Open Calculator

fx $$I = -\frac{2 \cdot [G.] \cdot m \cdot (1 - \cos(\theta))}{r_c^2}$$

ex $$\text{-5.7E^-14N/Kg} = -\frac{2 \cdot [G.] \cdot 33\text{kg} \cdot (1 - \cos(30^\circ))}{(102\text{m})^2}$$

9) Gravitational Field when Point is Inside of Non Conducting Solid Sphere

Open Calculator

fx $$I = -\frac{[G.] \cdot m \cdot a}{R^3}$$

ex $$\text{-4.5E^-9N/Kg} = -\frac{[G.] \cdot 33\text{kg} \cdot 4\text{m}}{(1.25\text{m})^3}$$

10) Gravitational Field when Point is Outside of Conducting Solid Sphere

Open Calculator

fx $$I = -\frac{[G.] \cdot m}{a^2}$$

ex $$\text{-1.4E^-10N/Kg} = -\frac{[G.] \cdot 33\text{kg}}{(4\text{m})^2}$$

11) Gravitational Field when Point is Outside of Non Conducting Solid Sphere

Open Calculator

fx $$I = -\frac{[G.] \cdot m}{a^2}$$

ex $$\text{-1.4E^-10N/Kg} = -\frac{[G.] \cdot 33\text{kg}}{(4\text{m})^2}$$

Gravitational Potential

12) Gravitational Potential

Open Calculator

fx $$V = -\frac{[G.] \cdot m}{s_{body}}$$

ex $$\text{-5.9E^-12J/kg} = -\frac{[G.] \cdot 33\text{kg}}{375\text{m}}$$

13) Gravitational Potential of Ring

Open Calculator

fx $$V = -\frac{[G.] \cdot m}{\sqrt{r_{ring}^2 + a^2}}$$

ex $$\text{-3.4E^-12J/kg} = -\frac{[G.] \cdot 33\text{kg}}{\sqrt{(5\text{m})^2 + (4\text{m})^2}}$$

14) Gravitational Potential of Thin Circular Disc

Open Calculator

fx $$V = -\frac{2 \cdot [G.] \cdot m \cdot \left(\sqrt{a^2 + R^2} - a\right)}{R^2}$$

ex $$\text{-5.4E^-10J/kg} = -\frac{2 \cdot [G.] \cdot 33\text{kg} \cdot \left(\sqrt{(4\text{m})^2 + (1.25\text{m})^2} - (4\text{m})\right)}{(1.25\text{m})^2}$$

15) Gravitational Potential when Point is Inside of Conducting Solid Sphere

Open Calculator

fx $$V = -\frac{[G.] \cdot m}{R}$$

ex $$\text{-1.8E^-9J/kg} = -\frac{[G.] \cdot 33\text{kg}}{1.25\text{m}}$$

16) Gravitational Potential when Point is Inside of Non Conducting Solid Sphere

Open Calculator

fx $$V = -\frac{[G.] \cdot m \cdot \left(3 \cdot r_c^2 - a^2\right)}{2 \cdot R^3}$$

ex $$\text{-1.8E^-5J/kg} = -\frac{[G.] \cdot 33\text{kg} \cdot \left(3 \cdot (102\text{m})^2 - (4\text{m})^2\right)}{2 \cdot (1.25\text{m})^3}$$

17) Gravitational Potential when Point is Outside of Conducting Solid Sphere

Open Calculator

fx $$V = -\frac{[G.] \cdot m}{a}$$

ex $$\text{-5.5E^-10J/kg} = -\frac{[G.] \cdot 33\text{kg}}{4\text{m}}$$

18) Gravitational Potential when Point is Outside of Non Conducting Solid Sphere

Open Calculator

fx $$V = -\frac{[G.] \cdot m}{a}$$

ex $$\text{-5.5E^-10J/kg} = -\frac{[G.] \cdot 33\text{kg}}{4\text{m}}$$

Variation of Acceleration due to Gravity

19) Variation of Acceleration due to Gravity on Altitude

Open Calculator

fx $$g_v = g \cdot \left(1 - \frac{2 \cdot h}{[\text{Earth-R}]}\right)$$

ex $$9.79996\text{m/s}^2 = 9.8\text{m/s}^2 \cdot \left(1 - \frac{2 \cdot 13\text{m}}{[\text{Earth-R}]}\right)$$

20) Variation of Acceleration due to Gravity on Depth

Open Calculator

fx $$g_v = g \cdot \left(1 - \frac{D}{[\text{Earth-R}]}\right)$$

ex $$9.799995\text{m/s}^2 = 9.8\text{m/s}^2 \cdot \left(1 - \frac{3\text{m}}{[\text{Earth-R}]}\right)$$

21) Variation of Acceleration on Surface of Earth due to Gravity Effect

Open Calculator

fx $$g_v = g \cdot \left(1 - \frac{[\text{Earth-R}] \cdot \omega}{g}\right)$$

ex $$-12742007.8\text{m/s}^2 = 9.8\text{m/s}^2 \cdot \left(1 - \frac{[\text{Earth-R}] \cdot 2\text{rad/s}}{9.8\text{m/s}^2}\right)$$

Variables Used

- **a** Distance from Center to Point *(Meter)*
- **D** Depth *(Meter)*
- **E** Gravitational Field Intensity *(Newton per Kilogram)*
- **F** Force *(Newton)*
- **g** Acceleration Due To Gravity *(Meter per Square Second)*
- g_v Variation of Acceleration due to Gravity *(Meter per Square Second)*
- **h** Altitude *(Meter)*
- **I** Gravitational Field *(Newton per Kilogram)*
- **m** Mass *(Kilogram)*
- m_1 Mass 1 *(Kilogram)*
- m_2 Mass 2 *(Kilogram)*
- m_o Test Mass *(Kilogram)*
- **r** Distance between Two Bodies *(Meter)*
- **R** Radius *(Meter)*
- r_c Distance between Centers *(Meter)*
- r_{ring} Radius of Ring *(Meter)*
- s_{body} Displacement of Body *(Meter)*
- **T** Time period of Satellite *(Hour)*
- **U** Gravitational Potential Energy *(Joule)*
- **V** Gravitational Potential *(Joule per Kilogram)*
- **θ** Theta *(Degree)*
- **ω** Angular Velocity *(Radian per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[Earth-R]**, 6371.0088 Kilometer
  Earth mean radius
- Constant: **[G.]**, 6.67408E-11 * Meter³/Kiogram Second²
  Gravitational constant
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Time** in Hour (h)
  Time Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Energy** in Joule (J)
  Energy Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Angular Velocity** in Radian per Second (rad/s)
  Angular Velocity Unit Conversion

- Measurement: **Gravitational Potential** in Joule per Kilogram (J/kg)
  Gravitational Potential Unit Conversion
- Measurement: **Gravitational Field Intensity** in Newton per Kilogram (N/Kg)
  Gravitational Field Intensity Unit Conversion

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