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Kinematics and Dynamics Formulas

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List of 12 Kinematics and Dynamics Formulas

Kinematics and Dynamics

Circular Motion

1) Angular Displacement

Open Calculator

fx $$\theta = \frac{s_{cir}}{R_{curvature}}$$

ex $$37.60799^\circ = \frac{10\text{m}}{15.235\text{m}}$$

2) Angular Speed

Open Calculator

fx $$\omega = \frac{\theta}{t_{total}}$$

ex $$0.005139\text{rev/s} = \frac{37^\circ}{20\text{s}}$$

3) Centripetal Force

Open Calculator

fx $$F_C = \frac{M \cdot v^2}{r}$$

ex $$21984.91\text{N} = \frac{35.45\text{kg} \cdot (61\text{m/s})^2}{6\text{m}}$$

4) Speed of Object in Circular Motion

Open Calculator

fx $$V = 2 \cdot \pi \cdot r \cdot f$$

ex $$3392.92\text{m/s} = 2 \cdot \pi \cdot 6\text{m} \cdot 90\text{Hz}$$

Motion in 1D

5) Acceleration

Open Calculator

fx $$a = \frac{\Delta v}{t_{total}}$$

ex $$12.55\text{m/s}^2 = \frac{251\text{m/s}}{20\text{s}}$$

6) Average Speed

Open Calculator

fx $$v_{avg} = \frac{D}{t_{total}}$$

ex $$3\text{m/s} = \frac{60\text{m}}{20\text{s}}$$

7) Distance Traveled

Open Calculator

fx $$s = u \cdot t + \frac{a \cdot t^2}{2}$$

ex $$331.875\text{m} = 35\text{m/s} \cdot 5\text{s} + \frac{12.55\text{m/s}^2 \cdot (5\text{s})^2}{2}$$

Rotational Mechanics

8) Angular Momentum

Open Calculator

fx $$L = I \cdot \omega$$

ex $$0.035343\text{kg*m}^2/\text{s} = 1.125\text{kg}\cdot\text{m}^2 \cdot 0.005\text{rev/s}$$

9) Torque

Open Calculator

fx $$\tau = F \cdot l_{dis} \cdot \sin(\theta_{FD})$$

ex $$1.5\text{N*m} = 2.5\text{N} \cdot 1.2\text{m} \cdot \sin(30^\circ)$$

Work and Energy

10) Kinetic Energy

Open Calculator

fx $$KE = \frac{M \cdot v^2}{2}$$

ex $$65954.73\text{J} = \frac{35.45\text{kg} \cdot (61\text{m/s})^2}{2}$$

11) Potential Energy

Open Calculator

fx $$PE = M \cdot g \cdot h$$

ex $$4168.92\text{J} = 35.45\text{kg} \cdot 9.8\text{m/s}^2 \cdot 12\text{m}$$

12) Work

Open Calculator

fx $W = F \cdot d \cdot \cos(\theta_{FD})$

ex $216.5064\text{J} = 2.5\text{N} \cdot 100\text{m} \cdot \cos(30^\circ)$

Variables Used

- **a** Acceleration *(Meter per Square Second)*
- **d** Displacement *(Meter)*
- **D** Total Distance Traveled *(Meter)*
- **f** Frequency *(Hertz)*
- **F** Force *(Newton)*
- F_C Centripetal Force *(Newton)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **h** Height *(Meter)*
- **I** Moment of Inertia *(Kilogram Square Meter)*
- **KE** Kinetic Energy *(Joule)*
- **L** Angular Momentum *(Kilogram Square Meter per Second)*
- l_{dis} Length of Displacement Vector *(Meter)*
- **M** Mass *(Kilogram)*
- **PE** Potential Energy *(Joule)*
- **r** Radius *(Meter)*
- $R_{curvature}$ Radius of Curvature *(Meter)*
- **s** Distance Traveled *(Meter)*
- s_{cir} Distance Covered on the Circular Path *(Meter)*
- **t** Time Taken to Travel *(Second)*
- t_{total} Total Time Taken *(Second)*
- **u** Initial Velocity *(Meter per Second)*
- **v** Velocity *(Meter per Second)*
- **V** Speed of object moving in Circle *(Meter per Second)*

- v_{avg} Average Velocity *(Meter per Second)*
- W Work *(Joule)*
- Δv Change in Velocity *(Meter per Second)*
- θ Angular Displacement *(Degree)*
- θ_{FD} Angle between Force and Displacement Vector *(Degree)*
- τ Torque Exerted on Wheel *(Newton Meter)*
- ω Angular Speed *(Revolution per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- 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.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed 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: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion

- Measurement: **Angular Velocity** in Revolution per Second (rev/s)
  Angular Velocity Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion
- Measurement: **Moment of Inertia** in Kilogram Square Meter (kg·m²)
  Moment of Inertia Unit Conversion
- Measurement: **Angular Momentum** in Kilogram Square Meter per Second (kg*m²/s)
  Angular Momentum Unit Conversion

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- **Elasticity Formulas**
- **Gravitation Formulas**
- **Kinematics and Dynamics Formulas**

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