

# Engineering Mechanics Dynamics Formula Sheet

Engineering Mechanics Dynamics Formula Sheet Conquer Dynamics Your Ultimate Engineering Mechanics Dynamics Formula Sheet Guide So youre tackling engineering mechanics dynamics Its a challenging but rewarding subject full of fascinating concepts like motion forces and energy But lets be honest keeping all those formulas straight can feel like trying to herd cats Thats why weve created this comprehensive guide complete with a handy formula sheet practical examples and troubleshooting tips to help you master dynamics This isnt just another dry textbook regurgitation Were aiming for clarity and practical application Think of this as your trusty sidekick for tackling those tough dynamics problems The Essential Engineering Mechanics Dynamics Formula Sheet This sheet focuses on core concepts Remember context is key Always consider the specific problem and choose the appropriate formula

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**Concept Formula Description Units SI**

**Newton's Second Law**  $F = ma$  The sum of forces acting on a body equals its mass times acceleration N Newtons kg kilograms ms meters per second squared

**Kinematic Equations**

**Constant Acceleration**  $v = u + at$   $s = ut + \frac{1}{2}at^2$   $v^2 = u^2 + 2as$  Relate initial velocity  $u$  final velocity  $v$  acceleration  $a$  displacement  $s$  and time  $t$  ms ms m s

**Work/Energy Theorem**  $W = \Delta KE = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$  Work done on a body equals the change in its kinetic energy J Joules kg ms

**Potential Energy**

**Gravitational PE**  $PE = mgh$  Potential energy due to gravity J kg ms m

**Conservation of Energy**  $KE + PE + W_{nc} = \text{Total energy}$  Total energy remains constant considering nonconservative work  $W_{nc}$  J

**Impulse/Momentum Theorem**  $Ft = \Delta p = mv - mu$  Impulse  $Ft$  equals the change in momentum p Ns Newtonseconds kg ms

**Angular Velocity**  $\omega = \frac{d\theta}{dt}$  Rate of change of angular displacement rads radians per second

**Angular Acceleration**  $\alpha = \frac{d\omega}{dt}$  Rate of change of angular velocity rads

**Moment of Inertia I** Varies depending on shape see below Resistance to angular acceleration kg m

**Kinetic Energy Rotation**  $KE = \frac{1}{2}I\omega^2$  Kinetic energy due to rotation J

**Moments of Inertia for Common Shapes**

Thin Rod about center  $I = \frac{1}{12}ml^2$  Thin Rod about end  $I = \frac{1}{3}ml^2$  Solid Cylinder/Disk  $I = \frac{1}{2}mr^2$  Solid Sphere  $I = \frac{2}{5}mr^2$  Hollow Cylinder/Disk  $I = \frac{1}{2}m(R^2 + r^2)$   $R$  outer radius  $r$  inner radius

**Howto Solving Dynamics Problems** Follow these steps for a systematic approach

- 1 Draw a Free Body Diagram FBD This crucial step visually represents all forces acting on the body Clearly label forces and angles
- 2 Establish a Coordinate System Choose a convenient xy coordinate system
- 3 Apply Newton's Second Law Resolve forces into x and y components and apply  $F = ma$  in each direction
- 4 Kinematic Equations if applicable Use the appropriate kinematic equations to relate velocity acceleration displacement and time
- 5 Energy Methods if applicable If energy is conserved or partially conserved apply the workenergy theorem or conservation of energy
- 6 Solve for the unknowns Use algebra to solve for the required variables
- 7 Check your units and answer Ensure your units are consistent and your answer





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