# Kinematics

A table with math equations

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## Kinematic Equations

For rotational acceleration

### Displacement

### Curvilinear Motion

### Velocity

|  |  |
| --- | --- |
| Translation |  |
| Rotation |  |
| Plane |  |

### Acceleration (Vectors)

A black and white math equation

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ICR Method: Given ICR C, you can find velocity at any point on object.

# Mass Properties

## Second Moment of Area.

### From Radius of Gyration

### Parallel Axis Theorem

### FBD, EFD

|  |  |  |
| --- | --- | --- |
|  |  |  |

Taking moment about non-G pt & equate:

FBD:

EFD:

A diagram of a mathematical equation

Description automatically generated

Combine multiple bodies, and consider their separate

Common sol: express in terms of and solve to get .

## General Procedure

Kinematics() Kinetic(), separate and combined bodies.

# Rolling

|  |  |
| --- | --- |
| Rolling no sliding\* |  |
| Rolling, sliding imp\*^ |  |
| Rotating & Sliding |  |

\*

\***WEP can be used! ^Max Friction Force**

If unknown, assume case 1. Solve for and a, check if . If yes, use 1. Else, use 3 and recalculate.

|  |  |
| --- | --- |
|  | :motion of disc rolling along curved path is related to of disc |

## Along Straight Path: Path Contact Point

|  |  |
| --- | --- |
|  |  |

# Work Energy Power

## Kinetic Energy

### Rotating body about fixed point A (ICR A)

|  |  |  |
| --- | --- | --- |
| Spring\* | GPE | Friction |
|  |  |  |

For solving vibration via forces: spring extension in equilibrium. and eliminate by static analysis.

# Approximations

|  |  |
| --- | --- |
|  |  |

# Free Vibration without damping

EOM: (is Freq in rad/s)

|  |  |
| --- | --- |
| Spring Mass |  |
| Pendulum |  |
| **Free oscillation about O** |  |

|  |  |
| --- | --- |
|  |  |

Note that and conditions at

# Damped vibration

Over:

Critical:

Under:

## Dashpot Damper:

## Damping Ratio(c is damping coeff)

|  |  |
| --- | --- |
|  | Over damped |
|  | Crict damped |
|  | Under damped |

Stiffness Coeff:



## Initial Conditions

## Exponential Decaying Coefficient

## A diagram of a mathematical equation Description automatically generated with medium confidenceDamped Oscillation Freq

## A diagram of a rectangular object Description automatically generatedLogarithmic Decrement

|  |  |
| --- | --- |
|  |  |

A diagram of a triangle

Description automatically generatedOrder:

# A screenshot of a math book Description automatically generatedCos Rule