# MASSPROP command

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The **MASSPROP** command is used to calculate the mass properties of regions or 3D solids.

**Command Access:**

**Toolbar** : Home > Utilities > Measure > Region
**Menu** : Tools > Inquiry > Region/Mass Properties
**Command** : MASSPROP

**Command Prompts:**

Select objects:

**Function Description:**

If selected more than one region, it only accepts the first region and regions coplanar with the first region. The mass property will be displayed in the text box and users should choose whether to write analysis to a file (.mpr). The mass properties that displayed are determined by the types of selected objects, 3D solids, or regions (whether the selected regions are coplanar with XY plane of the current UCS).

Relative Glossary:

**Properties of region:**

**Area:**
The superficial area or closed area of region.
**Perimeter:**
The total length of inner and external ring; the perimeter of solid is not calculated.
**Bounding box:**
Using two coordinates to define the bounding box. According to the region that coplanar with XY plane in current UCS, the bounding box is determined by rectangle corner points and the region enclosed by the rectangle; according to the region that not coplanar with XY plane in current UCS, the bounding box is determined by 3D wireframe corner points, the region is enclosed by the wireframe.
**Centroid:**
Represent 2D or 3D coordinates of region center. According to the region that coplanar with XY plane in current UCS, the centroid is a 2D point; according to the region that not coplanar with XY plane, the centroid is a **3D point.**

According to the region that coplanar with the XY plane of current UCS, the following additional information will be displayed:

**Moments of inertia:**

It is used to calculate distributed load (for example, fluid pressure of a board) or inner stress of a curved beam. The expression is:
Area_moments_of_inertia= area_of_interest*radius2 The unit of moments of inertia is fourth power of distance.

**Products of inertia:**

The force makes objects move, the Products of inertia is used to calculate the force. In general, users select two orthogonal planes to calculate products of inertia of YZ plane and XZ plane, the expression is:
Product_of_inertiayz,xz = mass*distcentroid_to_yz*distcentroid_to_xz The XY value is expressed by mass multiple by square of distance.

**Radii of gyration:**

It is another way to express 3D solids moments of inertia. The expression is:
Gyration_radii= (moments_of_inertia/body_mass)1/2 The radius of gyration is expressed by distance.

**Principal moments and X-Y directions about centroid:**

It is calculated by the products of inertia and they have the same unit.
The axis across the centroid has the maximum moment of inertia. The axis along the normal direction has the minimum moment of inertia and it also across the centroid. The third moment of inertia is between the maximum and minimum one.

**3D solids:**

**Mass:**

It is used to measure inertia of 3D solids. Specify the density to 1, the value of mass is the same as the volume.

**Volume:**

The total space enclosed in 3D space. Bounding box: The 3D wireframe corner points that enclosed by 3D solids.

**Centroid:**

A 3D point represents mass center of solid, if the solid has the uniform density.

**Moments of inertia:**

The object will be rotated by force, the moment of inertia is used to calculate the force (for example, the wheel rotates around axis), the expression is:
Mass_moments_of_inertia= object_mass*radiusaxis2 Its unit is expressed by mass multiple by square of distance.

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The axis across the centroid has the maximum moments of inertia. The axis along the normal direction has the minimum moment of inertia and it also across the centroid. The third moment of inertia is between the maximum and minimum one.