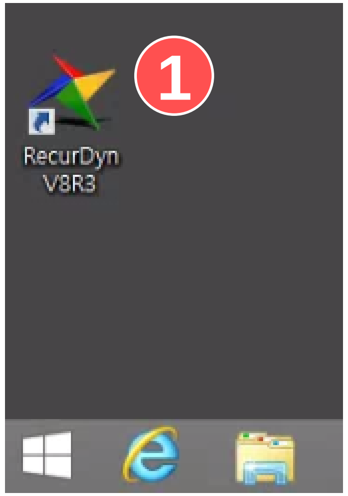
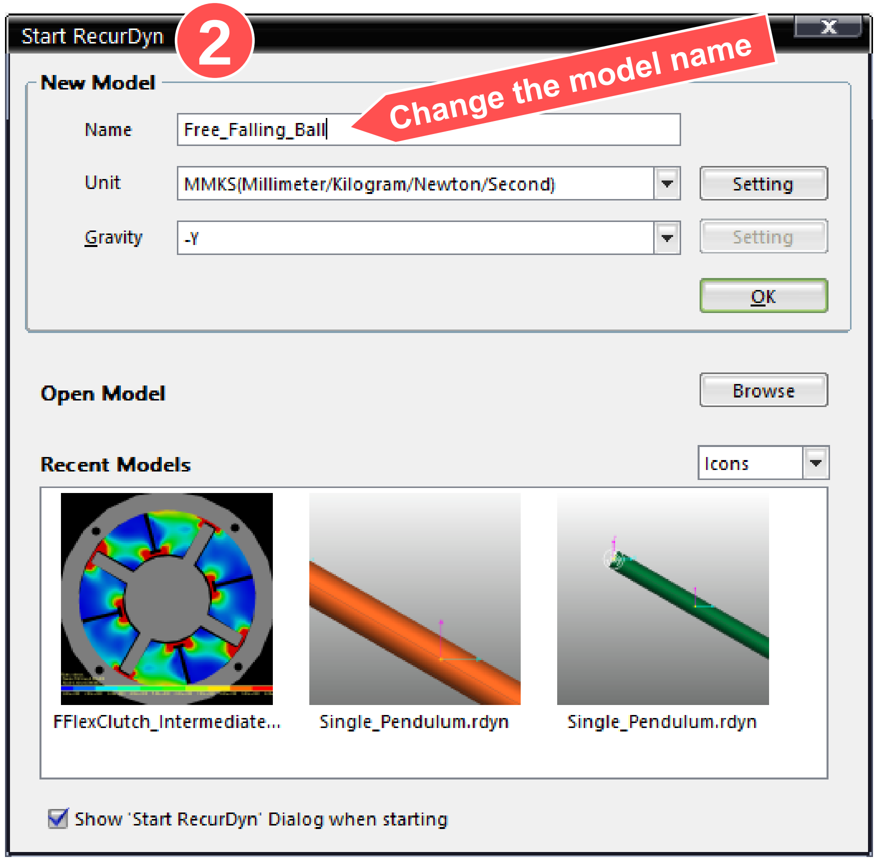
1. Running RecurDyn and Creating a New Model

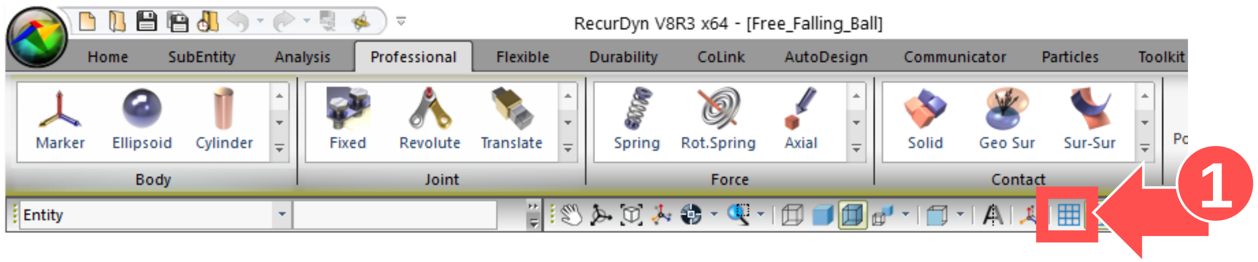
1. Double-click the RecurDyn icon on the Desktop to run RecurDyn.
2. Enter "Free_Falling_Ball" in the Name box and click **OK** to create a new model.

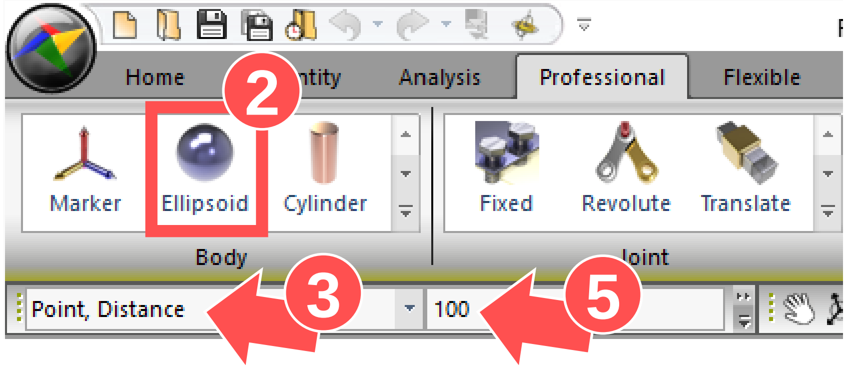


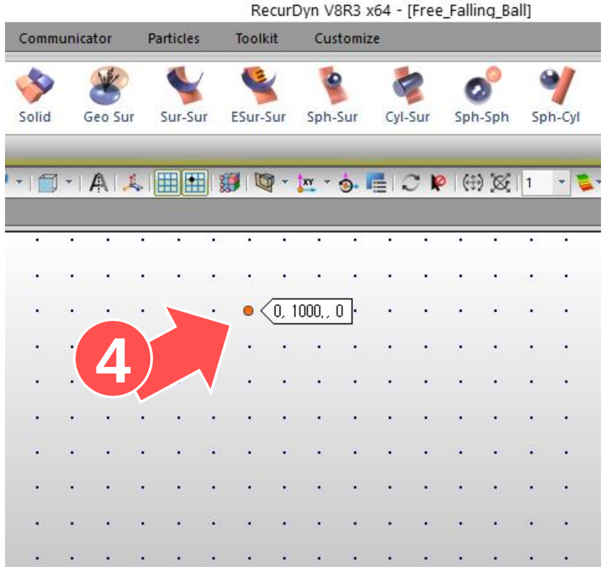


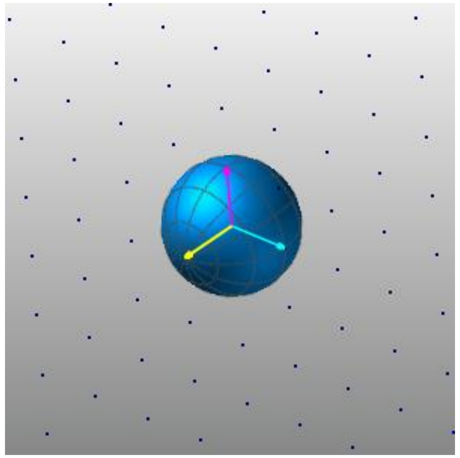
2. Configuring the Modeling Environment and Creating a Ball

1. On the toolbar, click the Grid button to display the grid.
2. On the Professional tab, in the Body group, click **Ellipsoid**.
3. Click to select **Point, Distance** for the modeling option.
4. Click the point **(0, 1000, 0)** on the work pane utilizing the displayed grid.
5. Enter "100" for the distance of an ellipsoid.



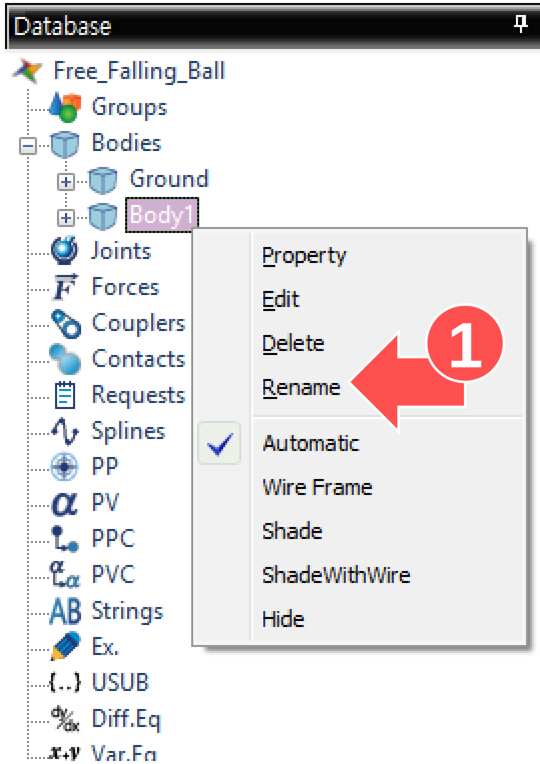


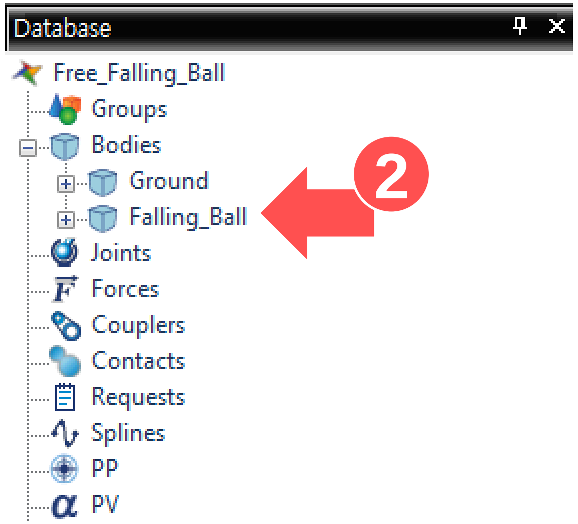




3. Checking the Entity You Created and Changing the Name

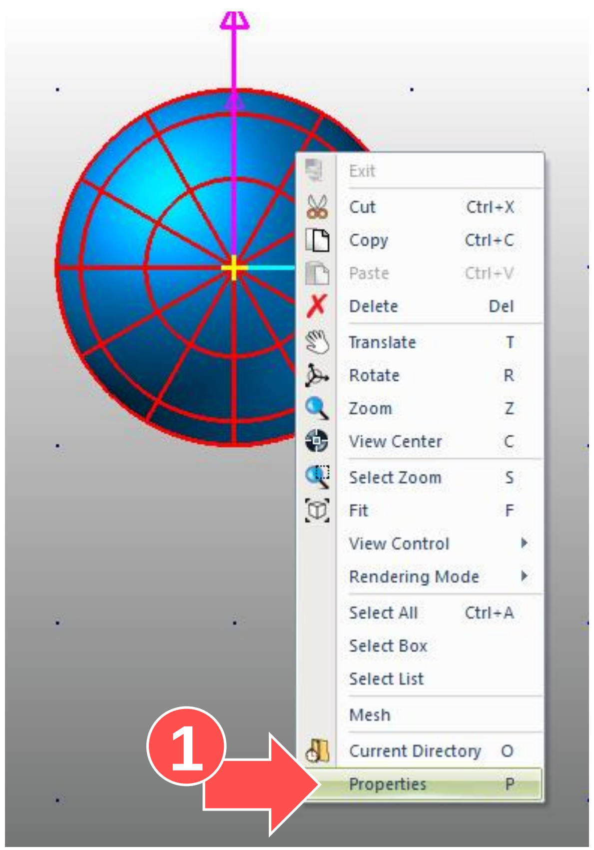
1. On the database pane to the right, right-click the **Ellipsoid Body** that you created, and then click **Rename**.
2. Change the name to **Falling_Ball**.

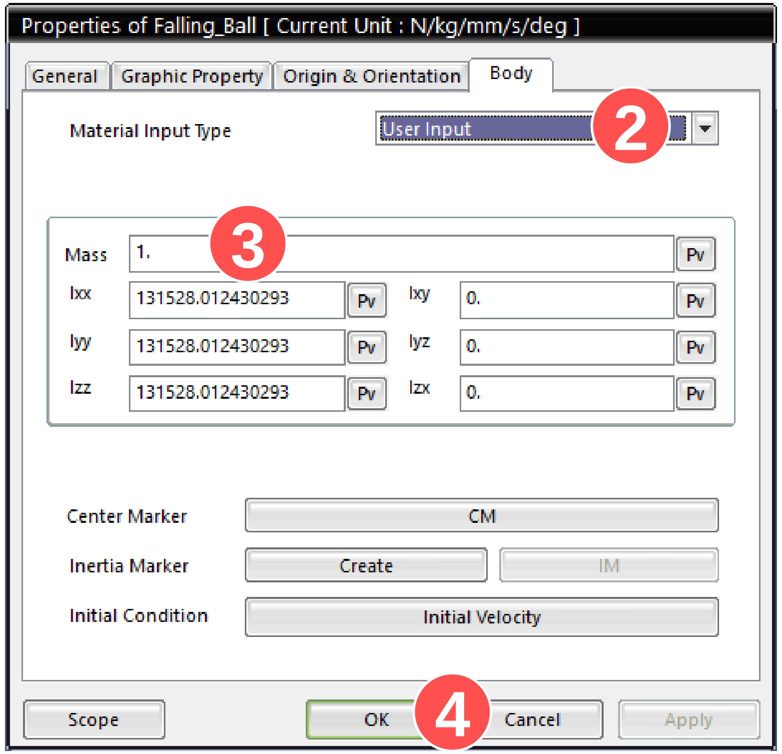




4. Changing the Mass of a Ball

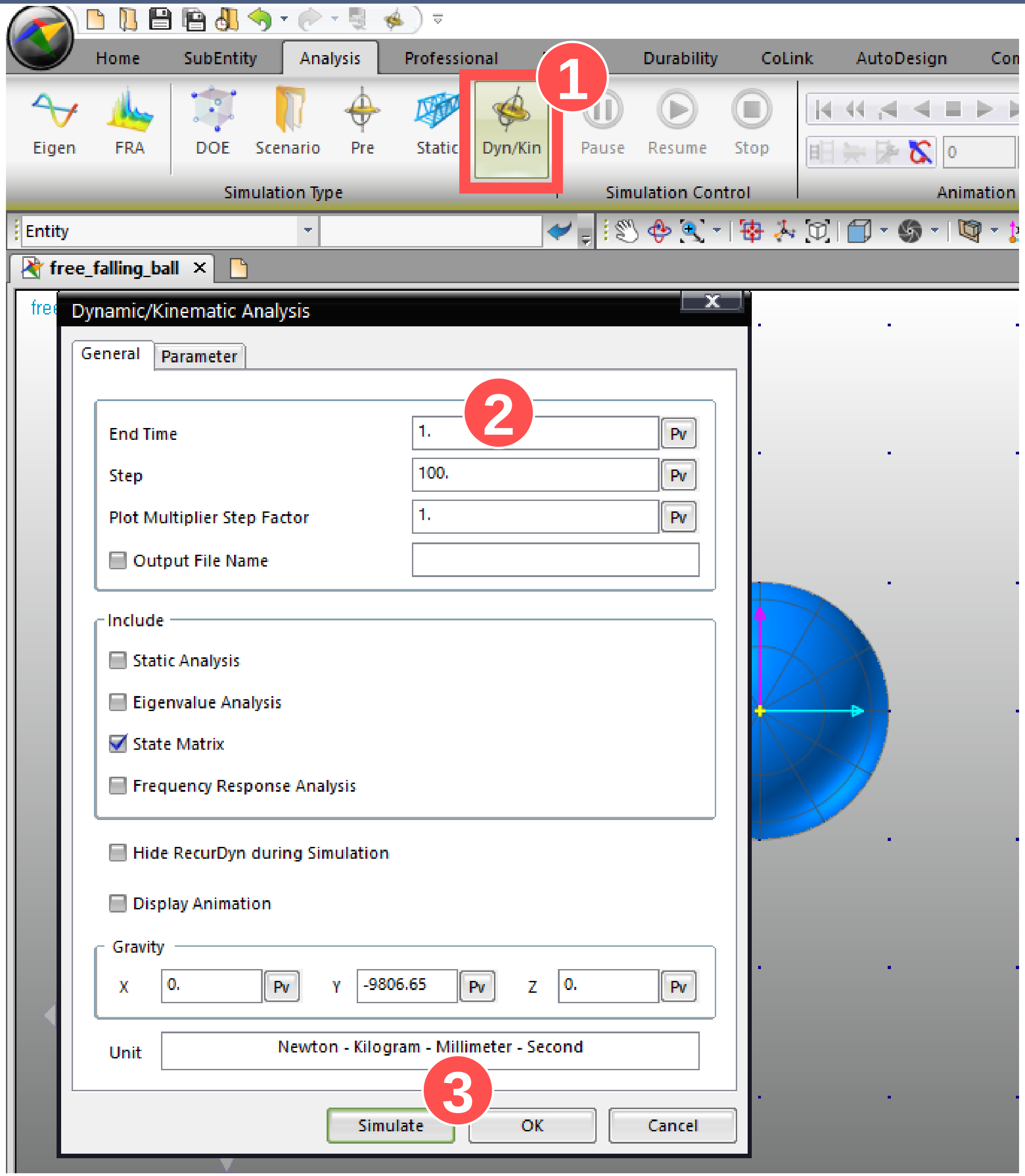
1. Right-click the ball that you created, and then click Properties.
2. In the Properties of Falling_Ball dialog box, click the Body tab, and click to select User Input for the Material Input Type.
3. Enter "1" for the Mass.
4. Click **OK** to apply the changes and close the dialog box.





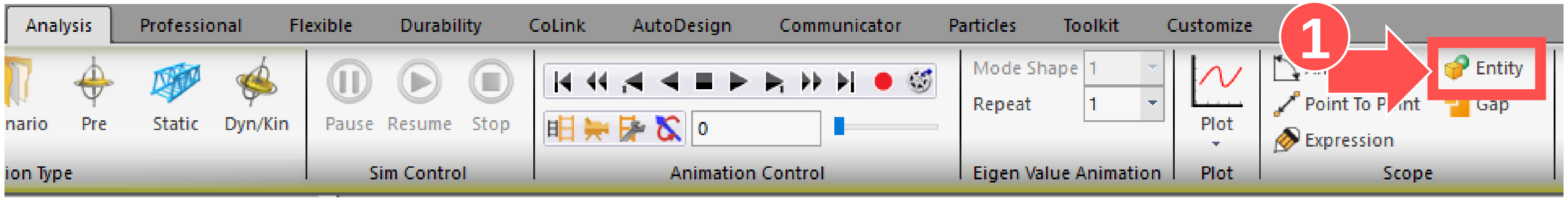
5. Performing Dynamic Analysis

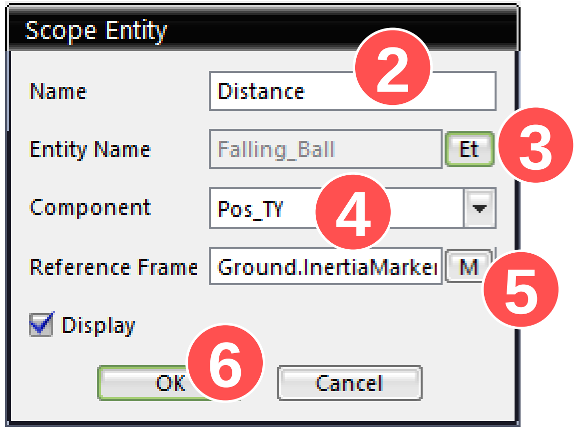
1. On the Analysis tab, in the Simulation Type group, click Dyn/Kin (Dynamic/Kinematic Analysis).
2. In the dialog box, click the General tab, and enter “1" for the End Time.
3. Click **Simulate**.

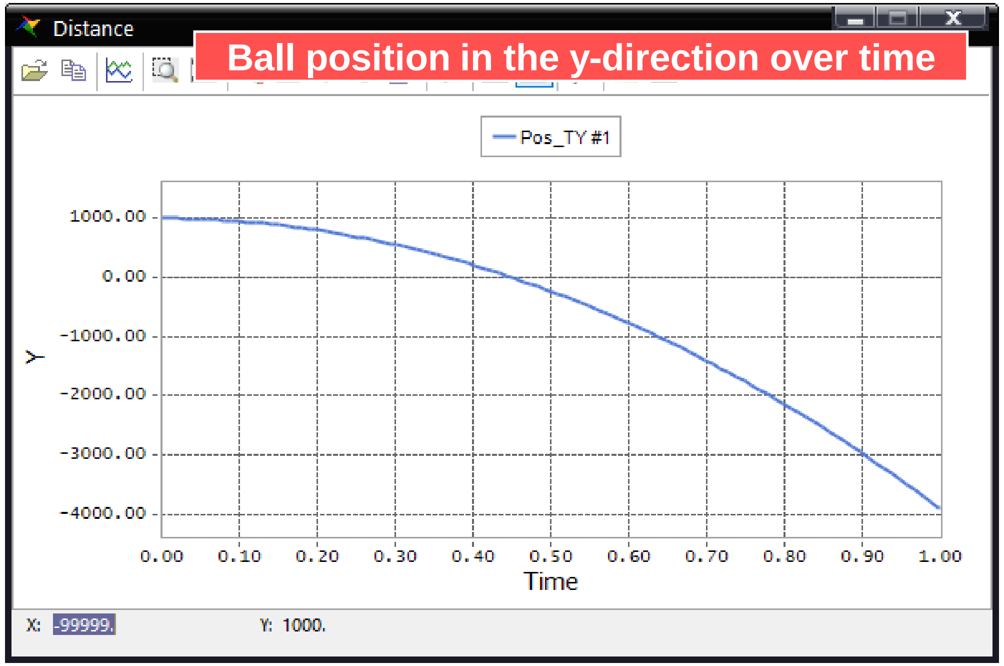


6. Creating a Scope and Checking the Results Graph on the Work Screen

1. On the Analysis tab, in the Scope group, click **Entity**.
2. In the Scope Entity dialog box, enter "Distance" in the Name box.
3. Click the **Et** button next to the Entity Name box to select the created ellipsoid.
4. Click to select Pos_TY for Component (the ball position in the y-direction).
5. Click to select Ground.InertiaMarker for Reference Frame.
6. Select the Display check box and click **OK** to apply the changes.

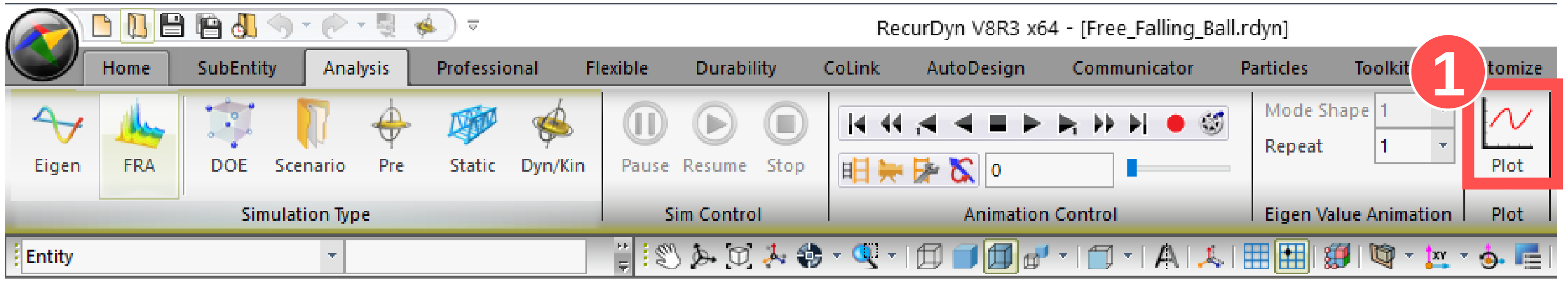


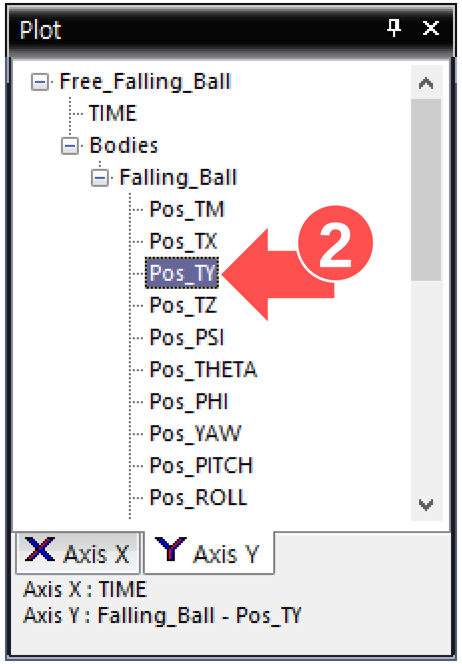


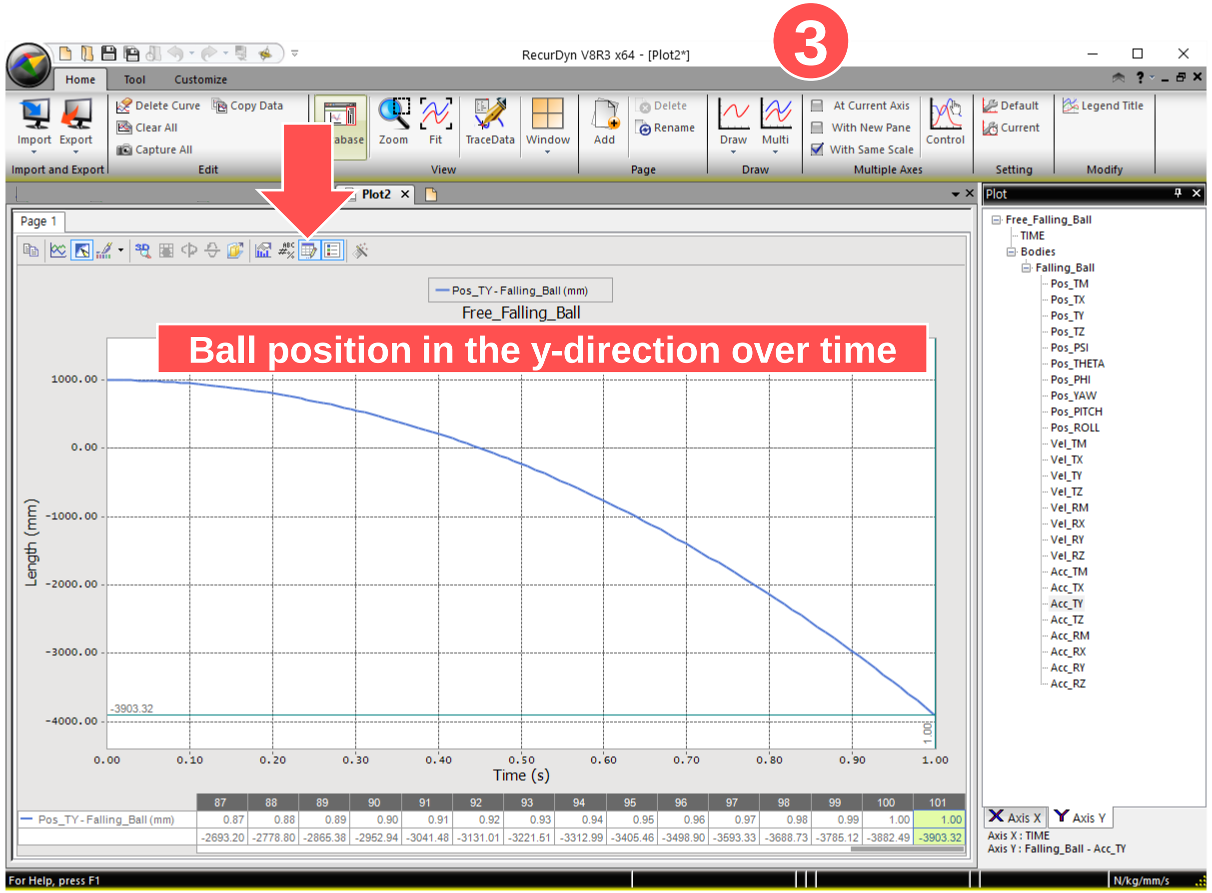


7. Checking the Results Graph in Plot - Position

1. On the Analysis tab, in the Plot group, click Plot.
2. On the Plot database pane to the right, click Bodies, click Falling_Ball, and then double-click Pos_TY.
3. Click the **Data Editor** button.
4. Scroll the data sheet that appears below to the right and check the ball position on the y-axis when time is 1 second.

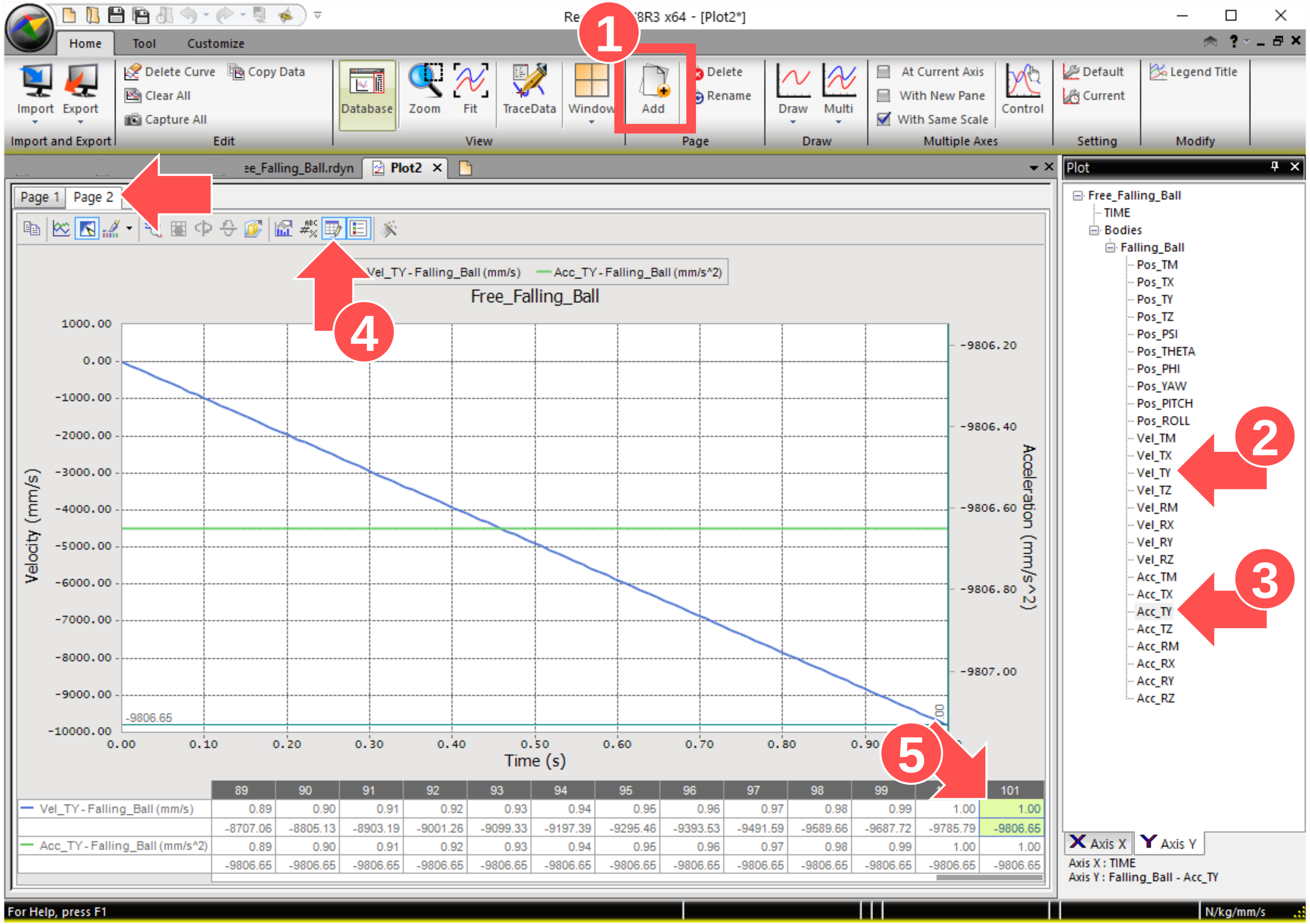






8. Checking the Results Graph in Plot - Velocity, Acceleration

1. Click Add.
2. For the added chart, on the Plot database pane to the right, click Bodies, click Falling_Ball, and then double-click Vel_TY.
3. Double-click Acc_TY as in step 2.
4. Click the **Data Editor** button.
5. Check the results on the data sheet below when time is 1 second.



9. Analytical Solution

- Refer to the analysis results of RecurDyn and calculate kinetic energy when time is 1 second.
  - s=Distance
  - a=Acceleration
  - t=Time
  - v=Velocity
  - m=mass

RecurDyn Results

Distance traveled after 1 second : $2903.32\ mm$

Velocity after 1 second : $-9806.6\ mm/s$

Acceleration after 1 second : $-9806.6\ mm/s^2$

Analytical Solution

$$s = \frac{1}{2}(at^2) = 2903.32$$

$$v = at = 9806.6\ mm/s$$

$$a = g = 9806.6\ mm/s^2$$

$$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 1kg \times (9806.6\ mm/s)^2 = 4.8085e7(kg \cdot mm^2/s^2)$$

Conversion to N: $1N = 1(kg \cdot m/s^2)$

$$KE = 4.8085e7 \times [\left(kg \cdot \frac{mm^2}{s^2}\right)(\frac{1\text{m}}{100\text{mm}})] \times mm = 48085.2\ N \cdot mm$$