QUICK START TUTORIAL

CREATING A PROJECT STEP-BY-STEP

Welcome! We assume that you have successfully installed Pintar ***V*irtuaLab**$_{TM}$ Mechanics on your computer. You are now ready to create your very first virtual mechanics experiment using the powerful Pintar VirtuaLab Mechanics.

Creating a virtual experiment with Pintar ***V*irtuaLab**$_{TM}$ Mechanics is very similar to doing it in a real laboratory – setting up a relationship of masses and constraints, and viewing the resultant effects on each other. But, doing it in a virtual laboratory is even more fun because you can simulate the experiment on the Moon! Let's see you do that in your school lab. So, let's get going…

In this tutorial, the goal is to put together a simple experiment that would verify Hooke's Law. For a novice user, the quickest way to become familiar with Pintar ***V*irtuaLab**$_{TM}$ Mechanics is to follow this step-by-step tutorial. Throughout this tutorial, you will find quick references to the detail description, as indicated by the ? symbol. This tutorial assumes that you possess a fundamental working knowledge of Windows 9x, NT, ME, 2000 or XP.

Launching Pintar VirtuaLab$_{TM}$ Mechanics

In the Mechanics folder, double-click on MECH.EXE. The Pintar ***V*irtuaLab**$_{TM}$ Mechanics information panel appears, click on the information panel and it will go away leaving a new untitled.

EXPERIMENT

OBJECTIVE:

To discover the relationship between applied force and extension of an elastic material.

COMPONENTS USED:

For this experiment, you would need just two components : a spring and a circular mass object.

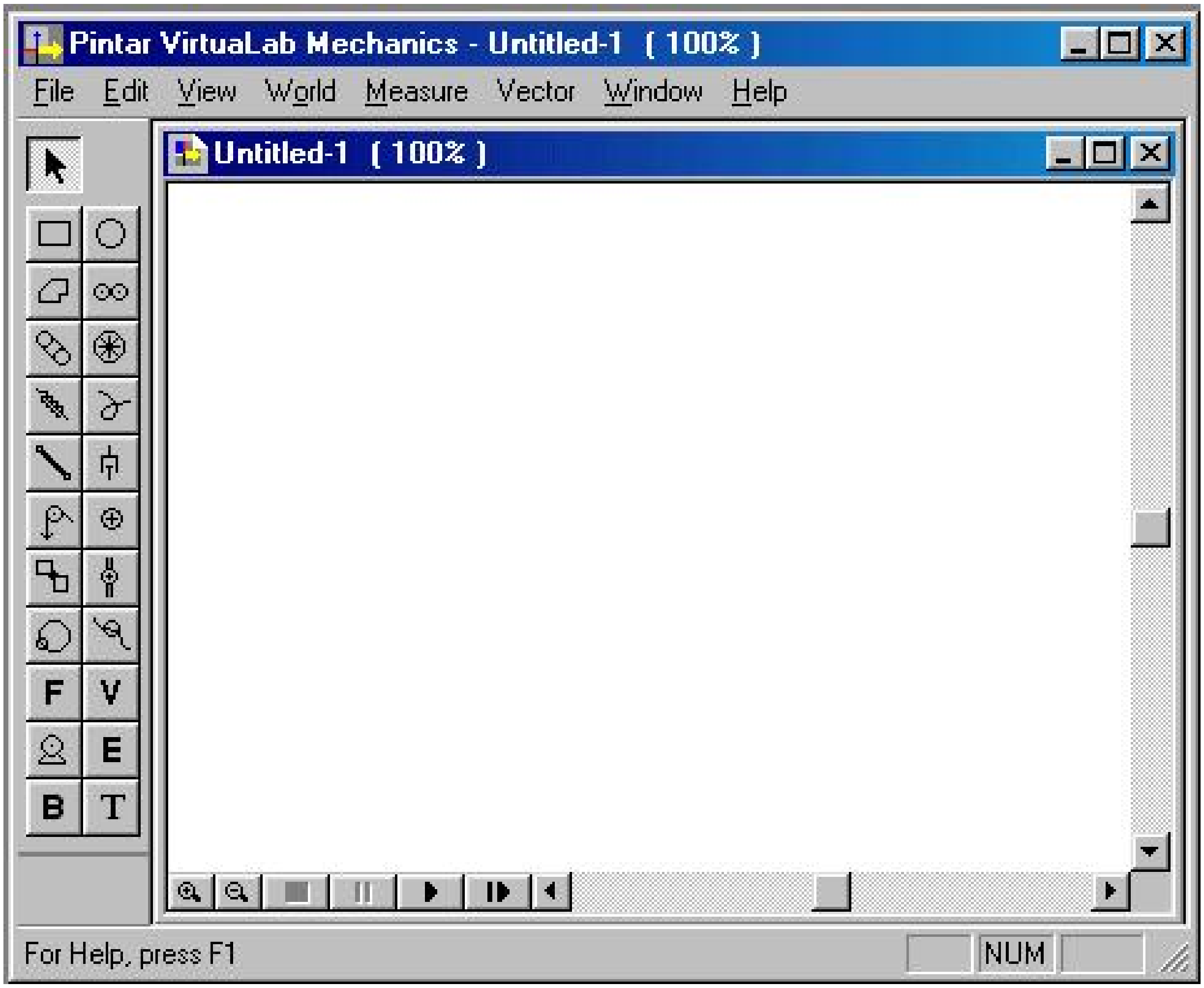
METHOD:

1. Starting a new project

Begin a new experiment by setting up a clean Workbench, on which objects for your experiment can be placed.

a. Select 'New…' from the File menu. A blank Workbench labelled 'Untitled-1' would be created.

? • **Starting a new experiment**

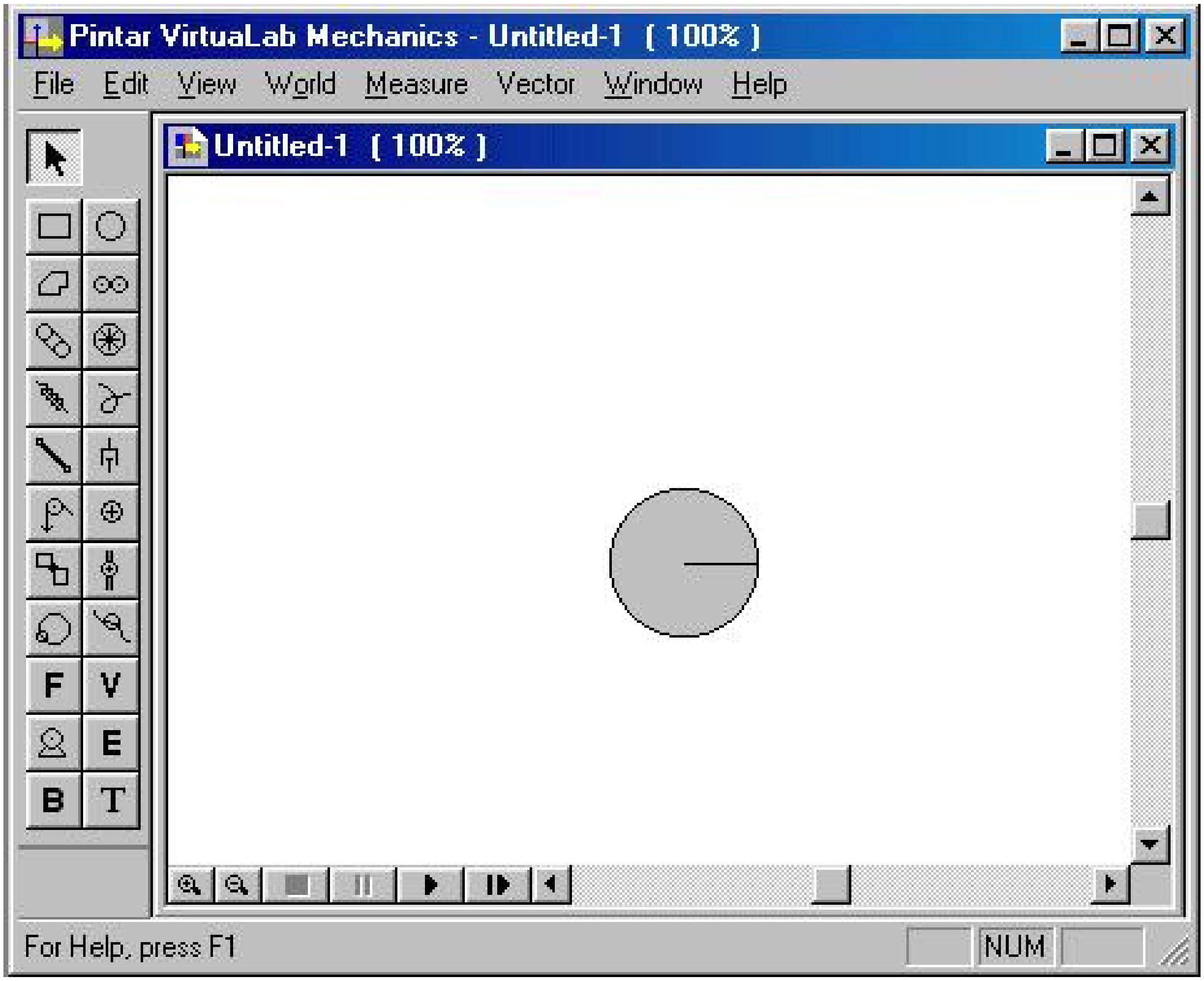


2. Drawing (placing) a mass object on the VirtuaLab

The Object Bar holds the tools for drawing and manipulating objects. You need to draw (place) the objects on the Workbench by using these tools.

a. Select the circle tool in the Toolbox.
b. Move the cursor to the Workbench, click and drag in a downward diagonal direction. Draw a circular mass object of about half an inch (approx. 1.25 cm) in diameter.

? • **Drawing (creating) a new object on the Workbench**



3. Move in object

Move the circle object to the left side of the Workbench making room on the right for other things to come.

a. In one continuous action, click on the object and drag it towards the left side of the Workbench.

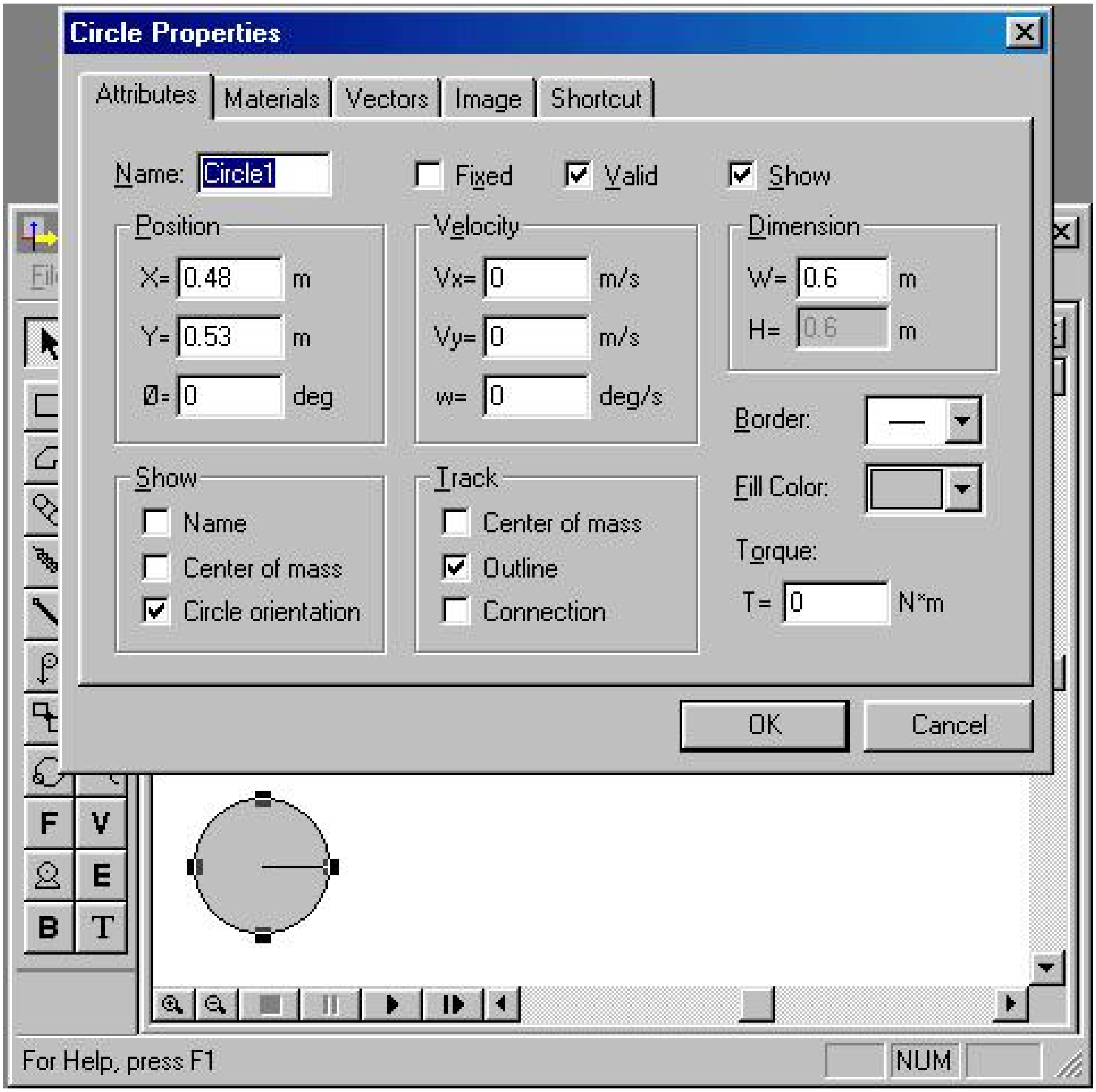
? • [**Moving an object accross the Workbench**]

4. Setting the parameters of the circle mass object

We need the mass object to have certain know properties before the experiment can be a success.

a. Double-click on the circle mass. A properties dialog panel for the circle will appear. You should be in the 'Attributes' group of parameters as indicated by the tab above the parameter settings.
b. For the Position parameters, set 'X' to 1, and 'Y' to 3.
c. Click on the 'Materials' tab. Set the 'Mass' to 1 kg.
d. Click on the 'Vectors' tab. In the scrolling list, select 'Gravitational Force' and click the 'Show vector' checkbox.
e. When done, click on 'OK'.

? • **Setting/changing the properties of an object**



5. Connecting a spring to the circle mass

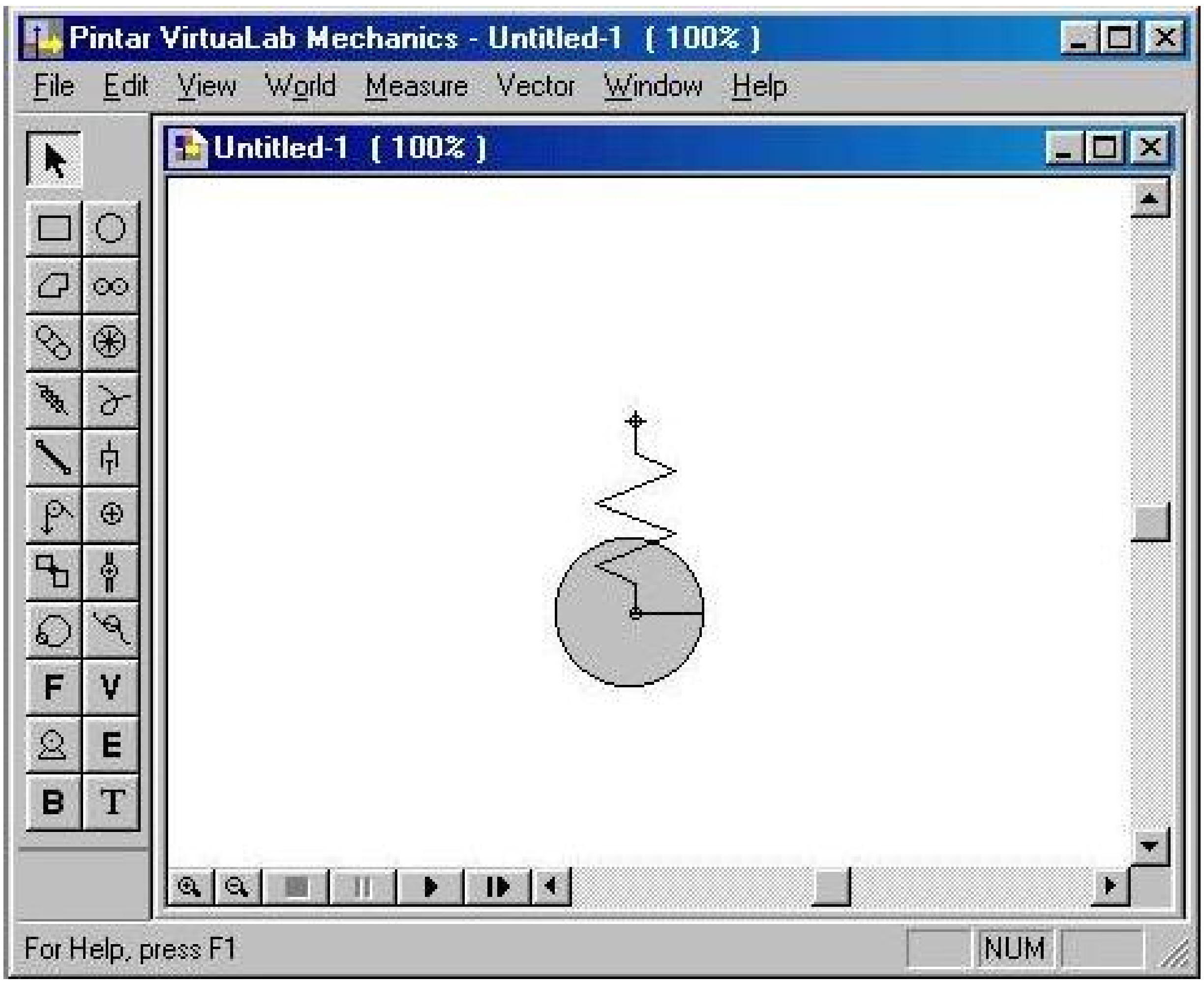
The next step is to take a spring, connect one endpoint to the circle mass and fix the other endpoint to the Workbench. You do not have to explicitly 'fix' an endpoint of a constraint to the Workbench. Any endpoint that is on the Workbench is considered fixed to it.

Alternatively, you can attach the free end to another mass object, and fix the mass object to the Workbench. However, unless for aesthetic reason, this is unnecessary.

a. Select the spring tool in the Toolbox.
b. Click on the circle mass and drag upwards to the Workbench such that the spring looks about two inches (five centimeters) long.

Adjust the endpoints of the spring so that they are aligned in a vertical straight line with the center of the circle mass.

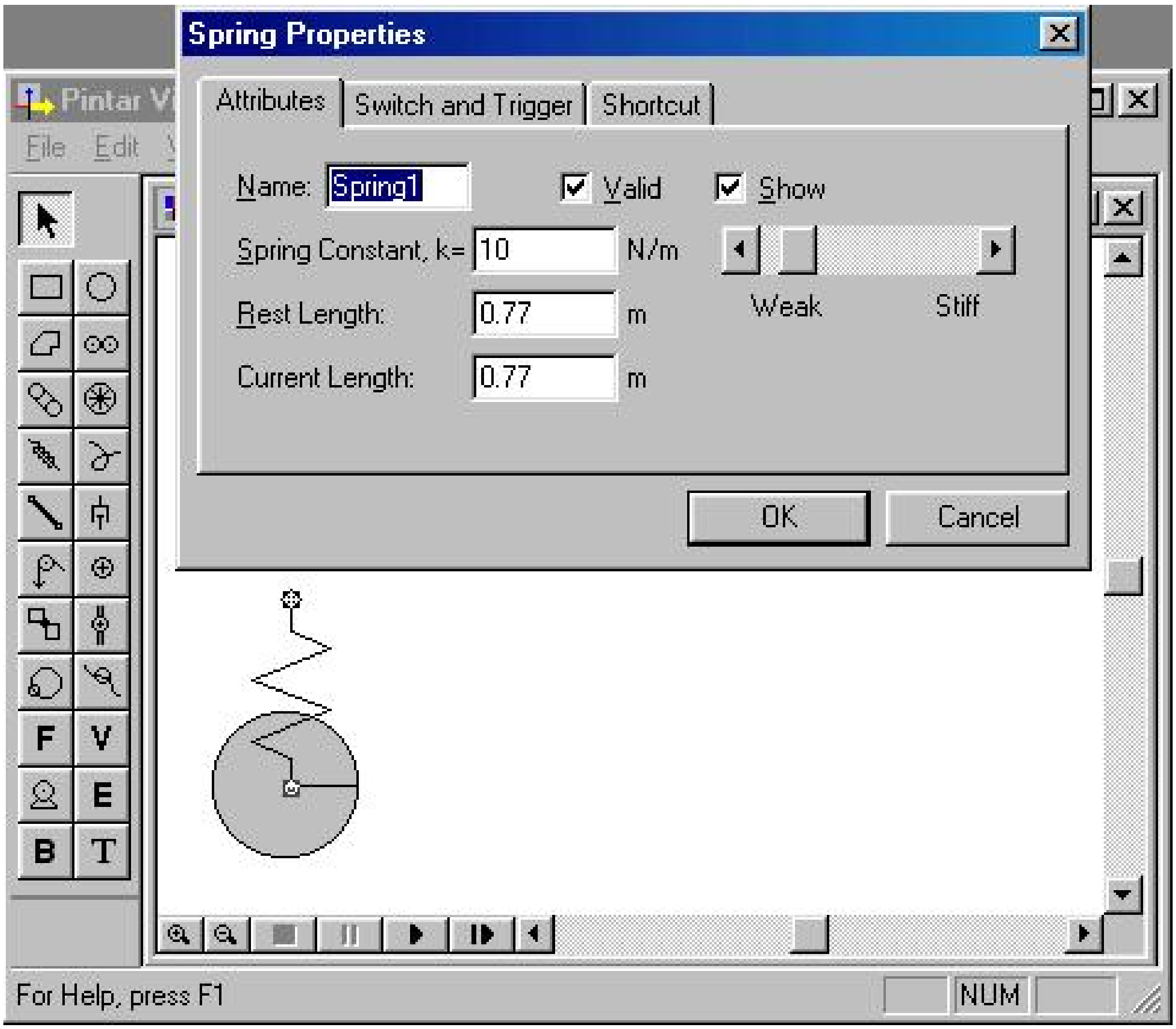
a. Click and drag on the endpoints to align them.



6. Setting appropriate parameters for the spring

Just as we have set the properties of the mass object to know quantities, we do the same for the spring.

a. Double-click on the spring to open its properties dialog panel.
b. Set the spring constant to 10 N/m.
c. Check that the rest length and current length have the same values. If the values are different, the spring is in either compression or extension.



7. Annotating your experiment

It is always a good practice to annotate or label your experiment.

a. Select the Text tool in the Toolbox.
b. Move the cursor to the Workbench and click at the location where you wish to place the next text. A text object with the default word "Text" appears at the position where you clicked.
c. Next, double-click on the text object, and the text properties dialog panel appears.
d. In the scrolling field, type "Hookes Law".
e. Choosing from the options available, set alignment and font.
f. When satisfied with the setting, click 'OK'.

? • **The text tool**

8. Measuring the parameters during the experiment

When we run the experiment, we hope to receive feedback regarding the position of mass object, thereby obtaining the extension of the spring. Pintar ***V*irtuaLab**$_{TM}$ Mechanics provides a graphical display with numerical readouts on any of several parameters of a mass object.

a. Select the circle mass.
b. Then, select 'Position' from the Measure menu. A display panel opens titled "Position of Circle 1".
c. Move the display to the right side of the Workbench. Hence, you now appreciate the foresight in moving the objects to the left of the Workbench earlier.

9. Saving your experiment

At this point, it would be a good idea to save the experiment that you have created thus far.

Note: If you are using a free trial version of Pintar ***V*irtuaLab**$_{TM}$ Mechanics, you will not be able to save your experiment because this feature has been disabled. Continue with Step 11.

a. Select 'Save As...' from the File menu.
b. Name the project, "FirstMech". You may want to save your project in the Examples folder.

? • **Saving an experiment**

10. Running your experiment

You are now ready for an initial test run of your experiment to see how things would behave. Keep your fingers crossed.

a. Click on the ‘Play’ or ‘Run’ button in the Control Panel.

Observe the animated simulation for a while. As with most things in life, the first try is often less than satisfactory. You will discover that,

a. the circle mass oscillating up and down, stretching and compressing the spring as it does. After a while, you begin to wonder when the oscillations will stop, so that you can take the reading of the extension of the spring. It won’t!
b. the data in the Measure display panel changes so fast that it is quite impossible to read the fractional values.

11. Stopping your experiment

Stop the experiment and adjust.

Click on the ‘Stop’ or ‘Construct’ button in the Control Panel. From the observations made in step 11, it is obvious a little extra tinkering to the experiment would needed. Remedies to the situation include :-

a. Add air resistance. Since we have not set any air resistance, there is nothing to slow down the oscillation.
b. To note the starting position of the mass, do not click on the Run button. Instead, click on the Step button. This moves the mass object to the next animation point, which is almost the same as the starting position. Then, you may run the experiment.

12. Adding air resistance to dampen the oscillating

By adding air resistance to the experiment, we can bring the oscillations to a gradual stop.

a. Select ‘Air Resistance...’ from the World menu.
b. Set the air resistance to 2/s.

13. Running your experiment again

Click on the Step button, not the Run button. The mass object moves just slightly.

14. Taking readings for record

Quickly, note down the ‘y’ value. This is the initial position of the mass.

Click on the Run button and wait for the oscillating mass to stop. Records its ‘y’ value again. Subtract the first reading from the second reading, and the difference is the extension of the spring caused by the mass object.

15. Obtaining more readings

More than one reading will be needed to derive a relationship between extension and applied force on the spring.

a. Stop the experiment.
b. Change the mass of the circle object to 1.5kg.
c. Repeat steps 13 and 14.

Do this a few more times, each time increasing the mass of the circle object by 0.5kg. When you have collected about half a dozen readings for the extension of the spring, you may call it a day.

16. Using magnification

In the later part of the experiment, when the mass of the circle object was increased beyond 2kg, the object has extended past the bottom of the visible range of the VirtuaLab.

Click once on the magnify glass with a minus sign in the Control Panel. You’ll see that the Workbench has been scaled down. Scaling gives you more Workbench room to work with. It does not change the actual size of the Workbench.

17. Ending your work session

Although this experiment is coming to an end, your learning adventure with the Pintar ***VirtuaLab***$_{TM}$ Mechanics is just beginning. Let your imagination loose and dream up experiments that escape the confines of earthly limitations!

Select ‘Quit’ from the File menu.

OBSERVATION:

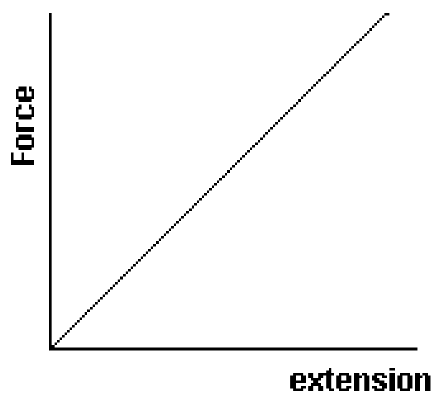
With the data collected, tabulate as shown below.

Force N	*y1* mm	*y2* mm	*Extension*, (y2 - y1) mm	*Force* N / *Extension* mm
0.0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				

Plot a graph of extension (x-axis) against force (y-axis). The diagram below shows what the graph may look like.

INFERENCE:

A 'straight line through the origin' graph demonstrates that the extension of the spring is directly proportional to the force applied on the spring, thus, verifying Hooke's Law.



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