

## Introduction to LON-CAPA (Session Overview)

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By the end of this session, you should be able to explore and discuss potential instructional uses, including:

- Navigate the LON-CAPA interface
- Build problem sets by using existing content shared within and among institutions in the LON-CAPA network
- Randomized homework assignments (every student receives a unique set of problems)
- Multiple opportunities for practice and feedback
- Automatic grading of assignments
- Embedded opportunities for student discussion around individual problems
- Access to rich data providing detailed overviews of student performance.

### Key Questions

- How might the use of LON-CAPA enhance learning in my course?
- What are the benefits of formative assessment for subject mastery?
- How can shared authoring facilitate the rapid adoption of LON-CAPA for my course

### Session Overview

LON-CAPA ([Learning Online Network – Computer-Assisted Personalized Approach](#)) functions as a distributed network system which permits the sharing of assessment items and learning objects both within and among participating institutions. LON-CAPA is used by faculty members and students in the sciences and mathematics because of its ability to author sophisticated problem types.

In reality, LON-CAPA can be a stand-alone course management system. It has the following features:

- Content sharing and content reusability, including:
  - Network of shared resources from [over 70 participating institutions](#)
  - [Shared repository of circa 150,000 resources](#) including assessment questions and multimedia content
  - Easy semester transition
  - A large set of resources in physics/astronomy, chemistry, biology, mathematics/statistics, and geology
  - Ability to add new resources to the existing content pool
- Creation and grading of randomized homework, quizzes or exams, including the ability to:
  - create [sophisticated question types](#) such as: click-on image, random label, random plot, or formula response

- reduce blind copying of answers by giving a different version of the problems to each student
- print randomized bubblesheet exams and quizzes
- configure the reporting of grades and feedback with a wide variety of options
- contextualize threaded homework discussions
- A development group base that sustains a twice-yearly LON-CAPA release cycle to insure rapid incorporation of instructor-requested enhancements.
- An open-source freeware system

LON-CAPA now serves approximately 40,000 course enrollments system-wide, ranging from middle school to graduate level courses. Disciplines include astronomy, biology, business, chemistry, civil engineering, computer science, family and child ecology, geology, human food and nutrition, human medicine, mathematics, medical technology, physics, and psychology.

With LON-CAPA, an instructor can create and/or assemble individualized assignments, quizzes, and examinations with a large variety of conceptual questions and quantitative problems. "Individualized" means that each student sees a slightly different computer-generated problem. This encourages collaboration between students on a conceptual level, but prevents blind copying of answers.

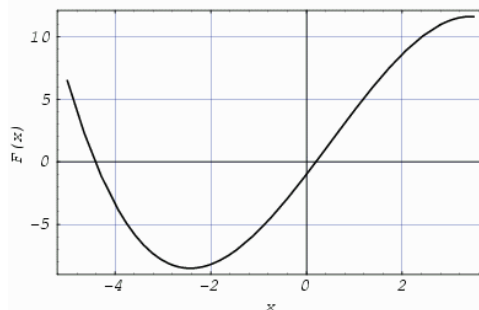
Problems can include pictures, animations, graphics, tables, links, etc.. The writing and development is done through a web-based editor, and facilitated by templates.

Students are given instant feedback and relevant hints via the internet and may correct errors without penalty prior to an assignment's due date.

As with all other LON-CAPA documents, problems are one-source-multiple-target. Depending on external parameters, problems can render themselves in online mode (shown below), print mode, online exam mode, and bubble-sheet mode, as well as edit mode for online problem creation.

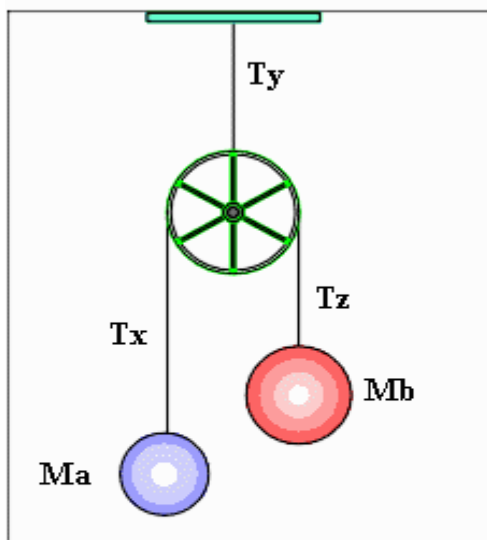
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Using graphical methods, determine at 2.0 the value of the derivative of function  $F(x)$  plotted in the graph below.



LON-CAPA has dynamic plotting support - in this problem, both the plotted function and the x-value are different from student to student. The student has to graphically determine the slope.

A [frictionless, massless](#) pulley is attached to the ceiling, in a gravity field  $g = 9.81 \text{ m/s}^2$ . Mass  $M_b$  is greater than mass  $M_a$ . The tensions  $T_x$ ,  $T_y$ ,  $T_z$ , and the constant  $g$  are magnitudes. (For each statement select 'True', 'False', 'Greater than', 'Less than', 'Equal to'.) [Motion of Masses on a Pulley.](#)

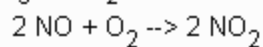
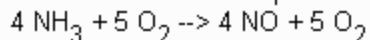


- $T_y$  is ....  $T_z + T_x$ .  
  $T_z$  is ...  $(M_b)g$ .  
 The center-of-mass accelerates.  
  $(M_a)g + (M_b)g$  is ....  $T_y$ .  
 The magnitude of the acceleration of  $M_a$  is ... the magnitude of the acceleration of  $M_b$ .  
  $T_x$  is ....  $T_z$ .

Submit All Answers

The labels on the above image are different from student to student, so are the options and the order of the options. Labels on the image and in the options automatically correspond.

An important use of  $\text{NH}_3$  is in the production of nitric acid, a top-15 industrial chemical (7 billion kg produced in 1991). Nitric acid is produced by a three-step synthesis called the *Ostwald process*:



Starting with 695 kg of ammonia, how many kg of nitric acid can be produced if each step is 91.6% efficient?

Submit All Answers

LON-CAPA has full LaTeX-support from both online and print. In the example, the ammonia mass and the efficiency are randomized.

**Example:**

$$\frac{d}{dt} \begin{pmatrix} 3at \\ 2t^2 \\ 5 \end{pmatrix} = \begin{pmatrix} 3a \\ 4t \\ 0 \end{pmatrix}$$

**Exercise:** What is the derivative of the vector

$$\begin{pmatrix} c \sin(at) \\ c \exp(kt) \\ bt^3 \end{pmatrix}$$

with respect to  $t$ ? Enter the components separated by commas, with exponents denoted by  $\wedge$  and explicit multiplication using  $*$ , e.g.,  $7*b*t^2+a$ ,  $5a$ ,  $a+b*t$ .

Submit Answer

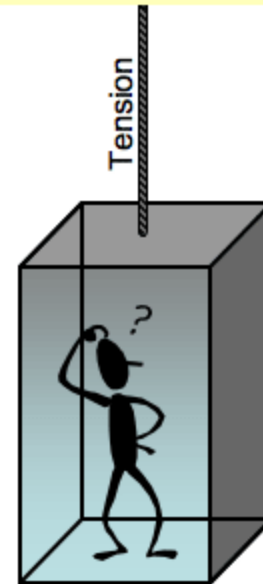
Tries 0/99

LON-CAPA can accept and grade multi-dimensional symbolic answers, including mathematical equivalence. In this example, the functions in the vector are randomized.

## Elevator Problem

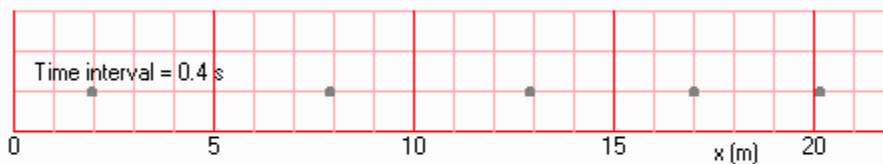
Due never

An elevator (cabin mass 500 kg) is designed for a maximum load of 2600 kg, and to reach a velocity of 3 m/s in 5 s. For this scenario, what is the tension the elevator rope has to withstand?

 Tries 0/99


LON-CAPA has full support for physical units, understands all SI-units and their relationships, as well as all prefixes.

You were driving along the highway when you spotted a police officer. You brake to slow down at a constant rate. Your position at a time interval of 0.40 s is plotted along  $x$ . (a) Find the initial velocity before you apply the brakes. (b) Find your acceleration.




(a)

(b)

In this example, the student can see the plot build up over time. The parameters for this plotting applet are randomized. There are multiple answer fields, which require physical units in the answer.

A fisherman and his young nephew are in a boat on a small pond. Both are wearing life jackets. The nephew is holding a large floating helium filled balloon by a string. Consider each action below independently, and indicate whether the level of the water in the pond, Rises, Falls, or is Unchanged.

The fisherman knocks the tackle box overboard and it sinks to the bottom.

The nephew pops the balloon.

The fisherman lowers the anchor and it hangs vertically, one foot above the bottom of the pond.

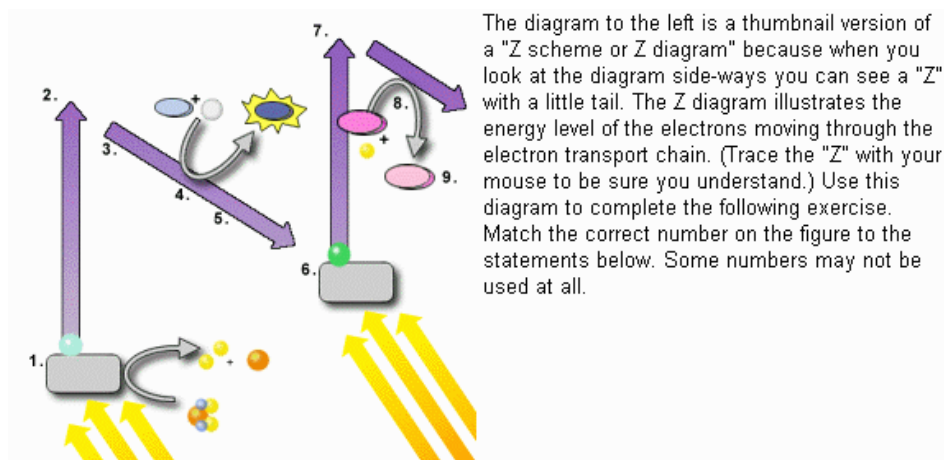
The nephew finds a cup and bails some water out of the bottom of the boat

The nephew gets in the water, loses his grip on the string, letting the balloon escape upwards.

The fisherman lowers himself in the water and floats on his back.

Submit All Answers

In this example, the options and the order of the options are randomized.



- Where do electrons first get energized, corresponding to excitement of PS II by light energy?
- Where do electrons get energized by sunlight a second time, corresponding to PS I?
- Where is ATP made? Look carefully - this is one of the energy rich products of the light reactions!
- Which number corresponds to plastocyanin, which is reduced by the cytochrome complex and shuttles electrons to PSI?

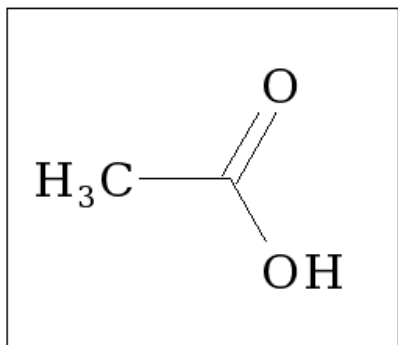
Submit All Answers

In this example, the options are randomized.

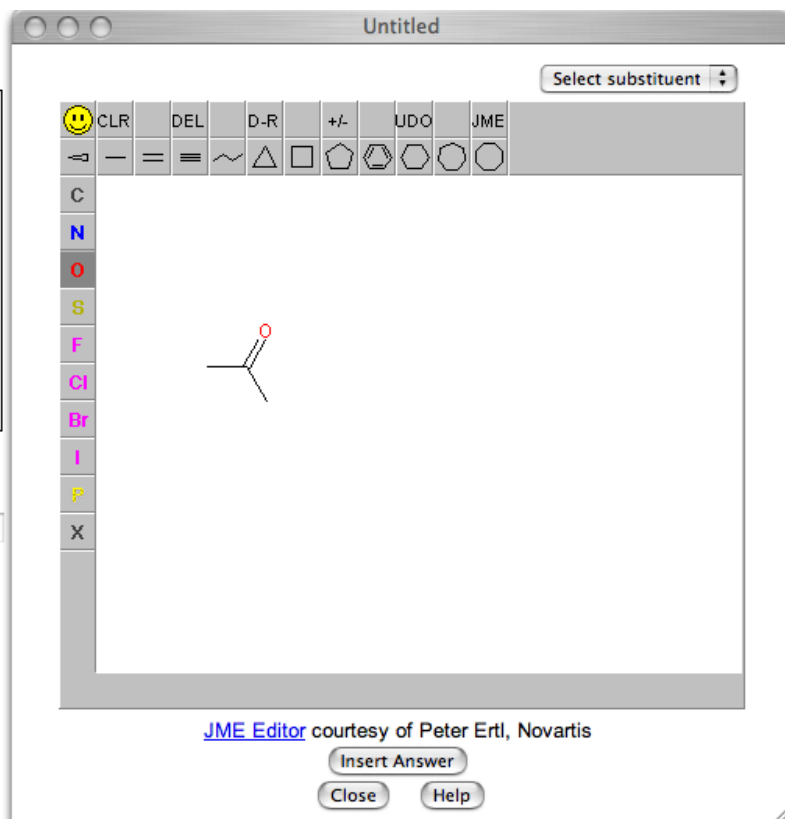
You are handed a 8.0 cm stack of new one-dollar bills. Assume the thickness of a dollar bill is 1.5 times thicker than your textbook paper (textbook paper = 69  $\mu\text{m}$ ). Estimate the number of dollars in your stack.

Tolerances for numerical answers can be set symmetric and asymmetric, absolute and relative. In addition, ranges for number of significant digits can be specified.

The image below is  $\text{C}_2\text{H}_4\text{O}_2$



Draw acetic acid.

 Tries 0/99

The screenshot shows the JME Editor interface. The window title is "Untitled". The toolbar includes buttons for CLR, DEL, D-R, +/-, LDO, and JME. Below the toolbar is a vertical list of elements: C, N, O, S, F, Cl, Br, I, P, and X. The main drawing area shows a partial chemical structure of acetic acid. At the bottom of the editor, there is a link to "JME Editor courtesy of Peter Ertl, Novartis" and buttons for "Insert Answer", "Close", and "Help".

LON-CAPA supports input and grading of chemical structures.

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You can contact the VCU Help Desk to set up a LON-CAPA course for you. Once created, you can log in to your course at <http://loncapa.vcu.edu/adm/roles>. Your roles screen should appear after logging in.

- You can always go back to this screen by clicking the Roles link on the Inline Menu which appears at the top of every page or by going to the Main Menu.

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- Click the [Select] button next to the Course Coordinator role for the course you wish to work in.
- This course will now be displayed.

### Edit Course

- The Course Editor is where you can upload, import, and create documents for your course.
- If you are not already at the Course Editor, click the Edit Course link from the Inline Menu or Main Menu.
- You can use folders to organize your course in terms of Homework Sets, Chapters, and Units. After creating a folder (Ex: Unit 1), click on the folder icon to enter the folder and create a sub-folder (Ex: Chapter 1).

NOTE: You cannot drag and drop resources. If you add a resource to the wrong folder, use the Cut link before the resource name. Navigate to the folder you wish to paste the resource and click the [Paste] button.

### Special Documents

- By clicking on the corresponding button, you can add a new folder, syllabus, simple page, navigate contents page, simple problem, document drop-box, and more.
- Click the [New Folder] button to add folders in your course. For example, you can create a folder called "Homework Set 1" and import homework problems to that folder.
- Clicking the [Navigate Contents] button will add a Navigate Course Contents resource page to your course. This is a good first resource for your course because it displays all of your course contents, such as your syllabus and problems sets.

### Importing Published Documents

- Go to the folder you want to add material to.
- Click the [Import] button on the Edit Course screen.
- Browse published documents from the LON-CAPA resource pool.
- Select the documents you wish to use.
- Click the [Import] button to add documents to your course folder.
- Finalize the order if more than one document was selected and then click the [Finish Import] button.
- Click the [re-initializing Course] button to make changes appear.

### Search for Published Documents

- Click the [Search] button to search the LON-CAPA Catalog and upload documents.
- Uploading Documents from Your Computer
- Go to the folder you want to add material to. Click the [Browse] button to search for documents saved to your computer.

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- Select a file, choose a title, and click the [Upload Document] button to import to your course. Re-initialize course when finished.

### Set/Modify Course Parameter Settings

- Use the Course Parameter Settings to set parameters such as open date, due date, and number of tries.
- Select the Clock Icon to Modify parameter settings from the Main Menu. This will take you to the Set/Modify Course Parameters screen.

### Parameter Helper

- The Course Assessment Parameter Helper Mode is the easiest way to set your parameters, as it will guide you through the process step-by-step. Using the Helper, you will be able to set the following parameters: open date (when problems open to students), due date (when problems are due; students cannot view problems after this date unless answer date is set), answer date (when answers are viewable to students), tries, and weight.

NOTE: Changes may take up to 10 minutes to be active for all students in your course.

### Contact Information

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