# OpenTA

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# OVERVIEW

OpenTA is primarily designed to allow teachers to present assignments and exercises to questions where answers are are given using mathematical formulas. It provides the opportunity for a student to supplement these answers with by uploading handwritten material which the teacher can then review to provide additional feedback and grade if assigning a grade is a goal.

OpenTA allows teachers to monitor student progress by seeing what tasks the students are actively working on and how well they have resolved outstanding tasks. The teacher can monitor both individual responses and overall statistics. They can also see recent response attempts, both correct and incorrect for a given question. It is possible for the teacher look in detail at a given student and see how they are faring in the course.

CHAPTER

ONE

# INTRODUCTION

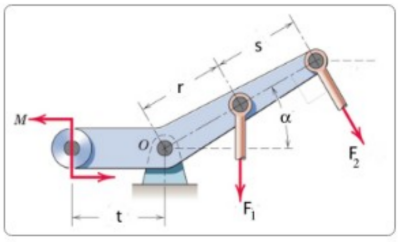
## 1.1 Goals

- E-learning system for questions with symbolic answers.
- Effective user interface for students and teachers on **computer**, **tablet** or **smartphone**.
- More effective feedback between teacher and student.

## 1.2 Exercises

In a physics class, exercises typically involve some practical problem to be solved. Often analytically. A typical question from the earliest part of the mechanics course as presented in OpenTA is given in the following figure.

Systemet givet av kraftparet $M$ samt krafterna $F_1$ och $F_2$ kan ersättas med en resulterande kraft med en given verkningslinje. (**Antag att** $F_1 > 0$, $F_2 > 0$). Beräkna vridmomentet $M$ samt storleken på resultanten av systemet givet att verkningslinjen för resultanten passerar genom $O$.




The difficulty in evaluating a student's answer to this is that there are many equivalent responses that are correct and acceptable. An auto correcting system must accept all correct answers.

The form of a correct answer may vary as follows:

$$\sqrt{(F1 + F2 \cdot \cos(\alpha))^2 + (F2 \cdot \sin(\alpha))^2} \tag{1.1}$$

$$\sqrt{F1^2 + F262 + 2 \cdot F1 \cdot F2 \cdot \cos(\alpha)} \tag{1.2}$$

$$\sqrt{(|F2| \sin(\alpha)^2 + (|F1| + |F2| \cos(\alpha))^2} \tag{1.3}$$

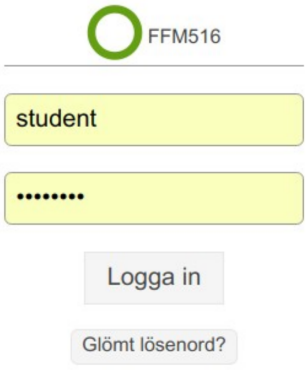
$$\sqrt{(F1)^2 + 2F1F2 \cos(\alpha) + (F2)^2} \tag{1.4}$$

This is the challenge which is surprisingly difficult to meet. The goal is therefore an exercise teaching platform that can properly evaluate mathematical content in questions, not only the usual numerical and multiple choice answers that are used as quizzes in many teaching platform.

The goal is to make the exercises fun and instructive for the students, and allow them to use the *tools* that they use every day. I.e. the platform should be adaptable: usable not only on laptops but should be usable on tablets and smartphones.

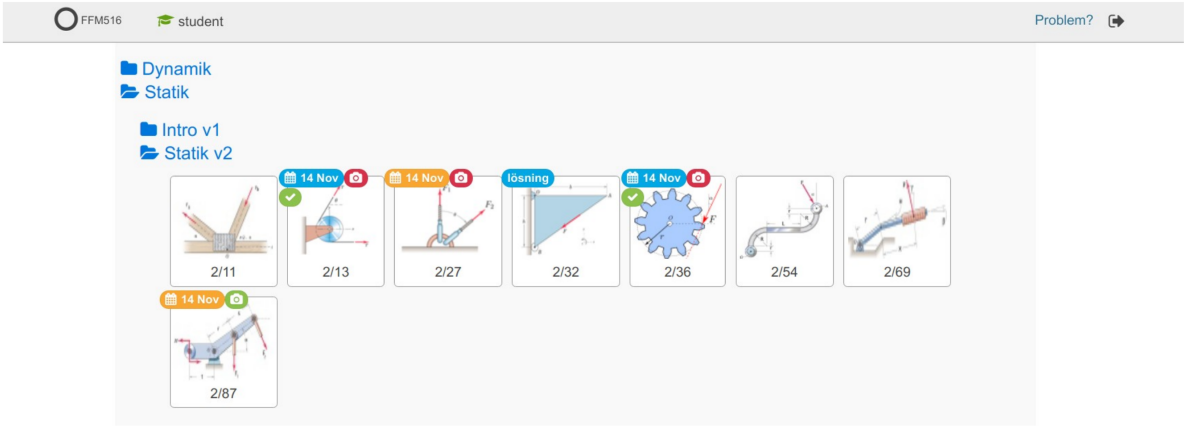
## 1.3 User interface

We first take a look at how a student sees the platform in our *Mek1* course. First a login screen. In fact a launch in Canvas can also be used.




After logging into OpenTA, folders with assignments are shown. In this case some icons that indicate which problems are to be solved. Some icons have embellishments that are discussed below.

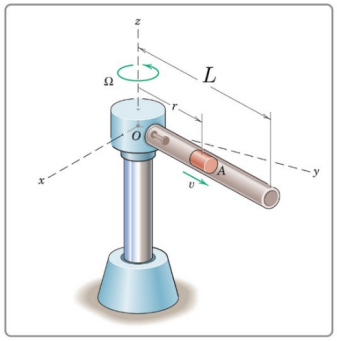
The following example comes from the Chalmers course in introductory mechanics.




The student selects a problem and is presented with several questions to be answered and an answer box in which to type the answer.

student FFM516-2019

# 3/86




Det ihåliga röret med längden $L$ roterar runt en vertikal axel genom $O$ med en konstant vinkelhastiget $\dot{\theta} = \omega$. En cylinder med massa $m$ glider friktionsfritt inuti röret. Cylindern börjar på ett avstånd $r_0$ och har då farten $v_0$ längs röret. Beräkna magnituden av den horisontella kraften $P$ som verkar på cylindern precis när den lämnar röret. Svara i termer av L, v0, m, omega och r0.

$|P|$

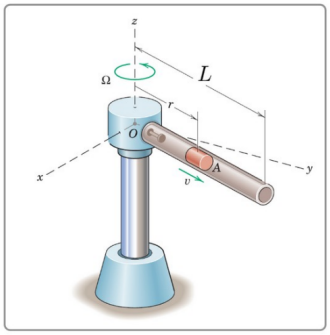
(i termer av v0, r0, L, m, omega)

A A A

The variables that are permitted in the answer are indicated and the answer is entered in a natural AsciiMath syntax. The program typesets the input during input, which is not only useful for checking more complex formulas, but is also fun since the input looks quite a bit more elegant than the AsciiMath input form.

student FFM516-2019

# 3/86




Det ihåliga röret med längden $L$ roterar runt en vertikal axel genom $O$ med en konstant vinkelhastiget $\dot{\theta} = \omega$. En cylinder med massa $m$ glider friktionsfritt inuti röret. Cylindern börjar på ett avstånd $r_0$ och har då farten $v_0$ längs röret. Beräkna magnituden av den horisontella kraften $P$ som verkar på cylindern precis när den lämnar röret. Svara i termer av L, v0, m, omega och r0.

$|P|$

(i termer av v0, r0, L, m, omega)

2 m omega sqrt(v0 + omega^2 (L^2 - r0^2))

$2 \cdot m \cdot \omega \cdot \sqrt{v_0 + \omega^2 \cdot (L^2 - r_0^2)}$

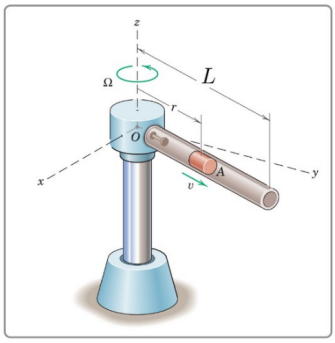
A A A

The student attempts the answer by pressing the Send button.

In this case, the answer was not only incorrect but the units were wrong. OpenTA points out in the response.

student FFM516-2019

# 3/86




Det ihåliga röret med längden $L$ roterar runt en vertikal axel genom $O$ med en konstant vinkelhastiget $\dot{\theta} = \omega$. En cylinder med massa $m$ glider friktionsfritt inuti röret. Cylindern börjar på ett avstånd $r_0$ och har då farten $v_0$ längs röret. Beräkna magnituden av den horisontella kraften $P$ som verkar på cylindern precis när den lämnar röret. Svara i termer av L, v0, m, omega och r0.

$|P|$

(i termer av v0, r0, L, m, omega)

2 m omega sqrt(v0 + omega^2 (L^2 - r0^2))

Uttrycket verkar inte ha rätt enhet.

$2 \cdot m \cdot \omega \cdot \sqrt{v_0 + \omega^2 \cdot (L^2 - {r_0}^2)}$ är inte korrekt.

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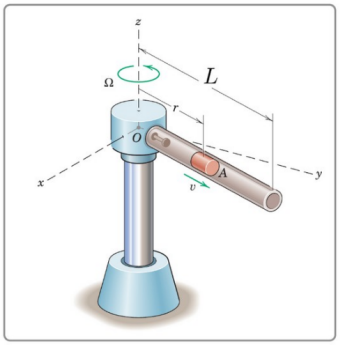
On the next attempt, the student enters in the correct answer and gets a correct response back.

student FFM516-2019

# 3/86




Det ihåliga röret med längden $L$ roterar runt en vertikal axel genom $O$ med en konstant vinkelhastiget $\dot{\theta} = \omega$. En cylinder med massa $m$ glider friktionsfritt inuti röret. Cylindern börjar på ett avstånd $r_0$ och har då farten $v_0$ längs röret. Beräkna magnituden av den horisontella kraften $P$ som verkar på cylindern precis när den lämnar röret. Svara i termer av L, v0, m, omega och r0.

$|P|$

(i termer av v0, r0, L, m, omega)

2 m omega sqrt(v0^2 + omega^2 (L^2 - r0^2))

$2 \cdot m \cdot \omega \cdot \sqrt{v_0^2 + \omega^2 \cdot (L^2 - r_0^2)}$ är korrekt.

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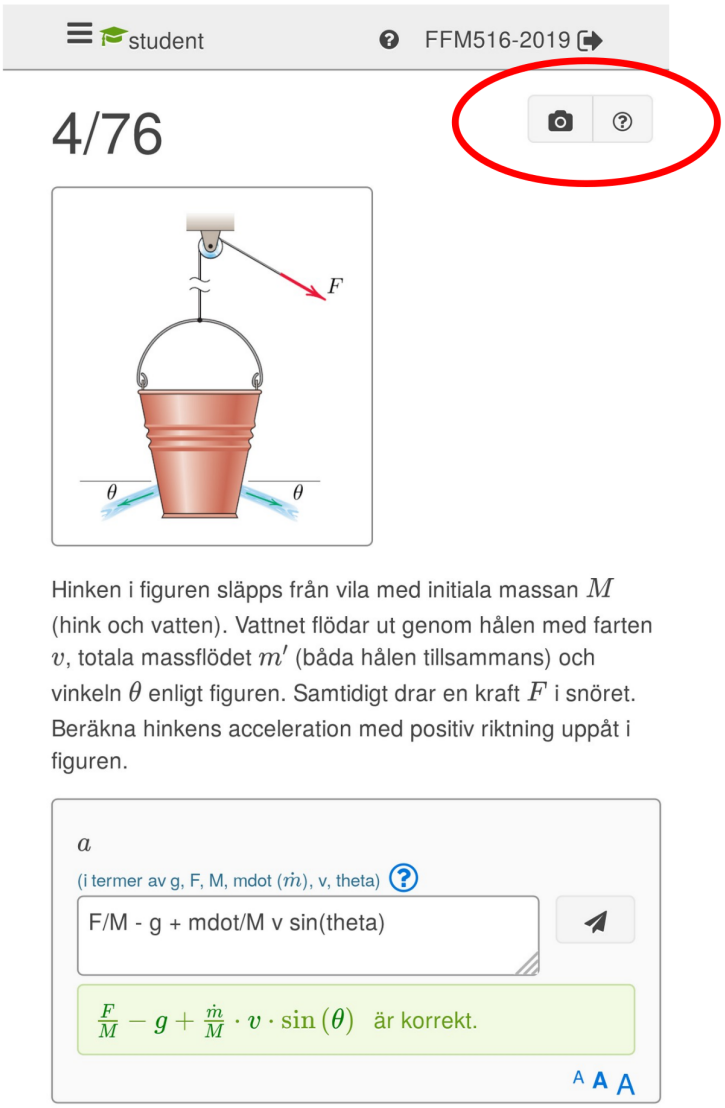
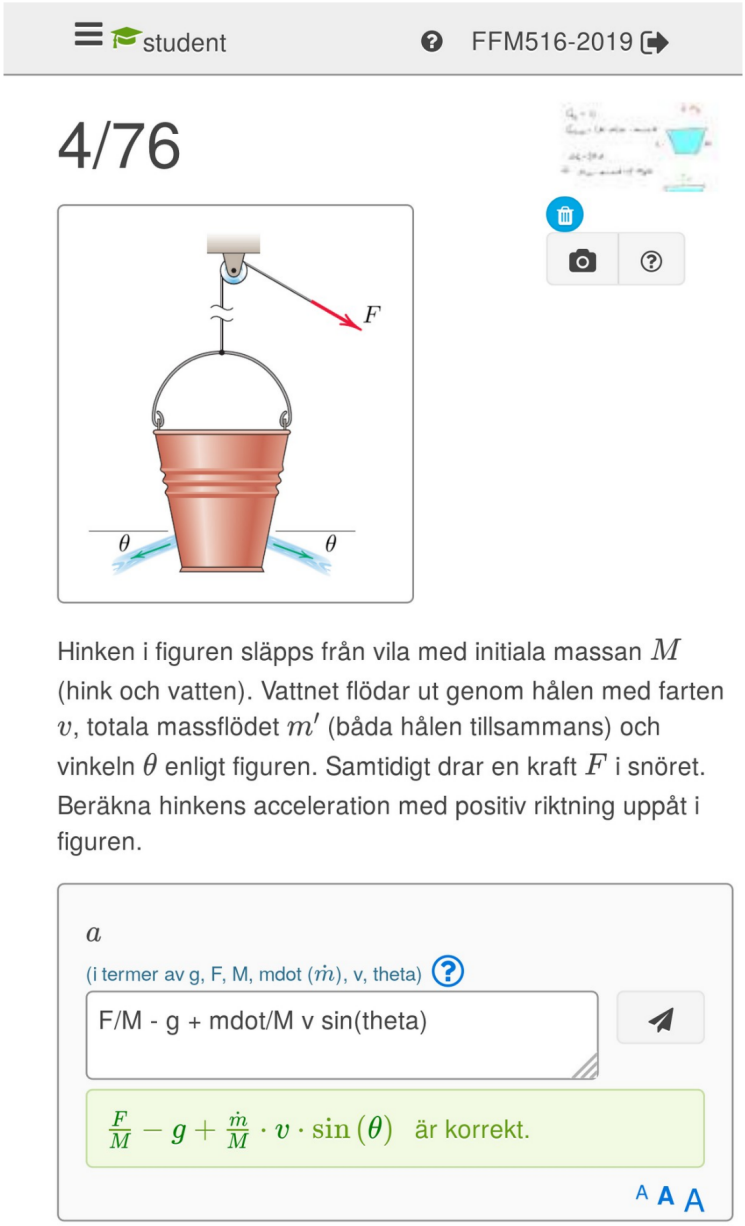
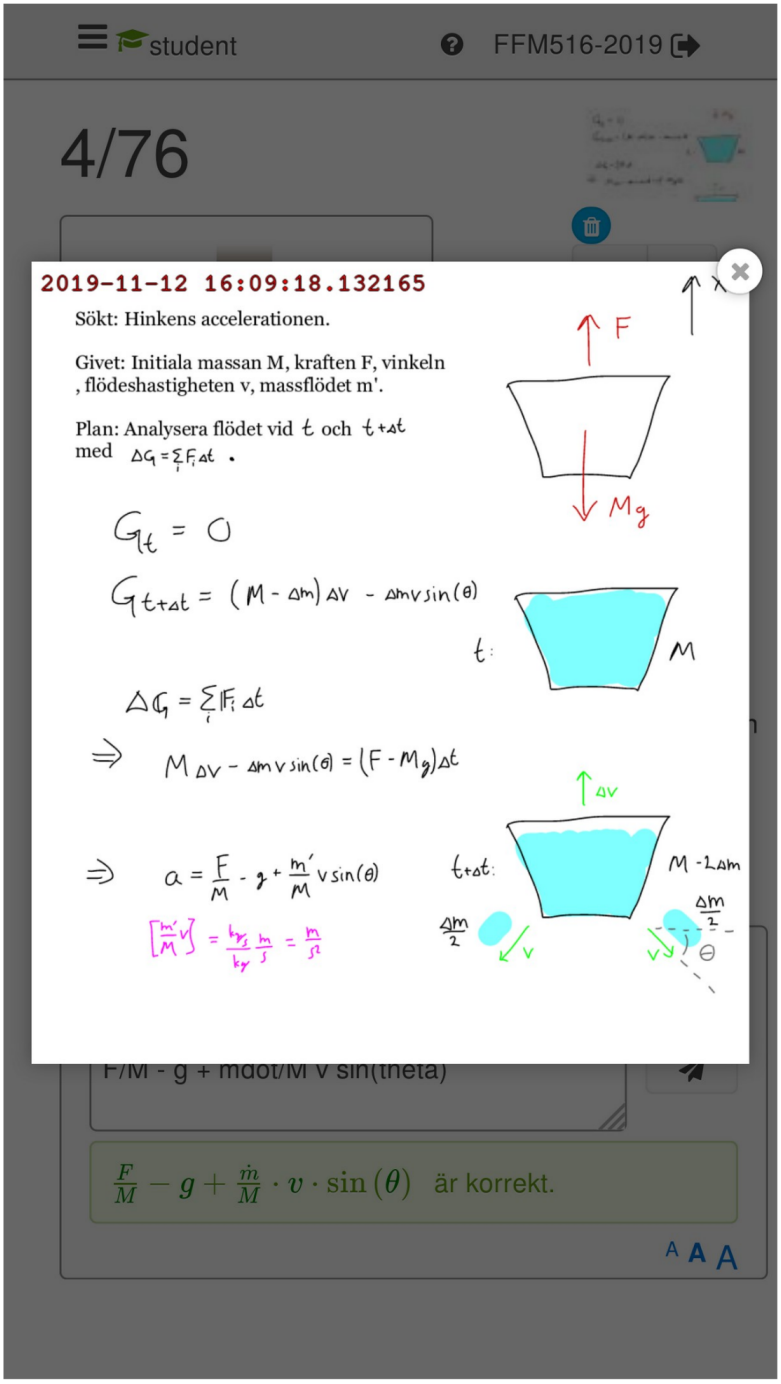
The examiner can demand not only that the input answer is correct, but can indicate that the student should upload their calculations that led to the answer. In that case a camera icon is shown and either an image or a PDF file is uploaded by the student to complete the exercise.




A thumbnail of the upload is then shown.



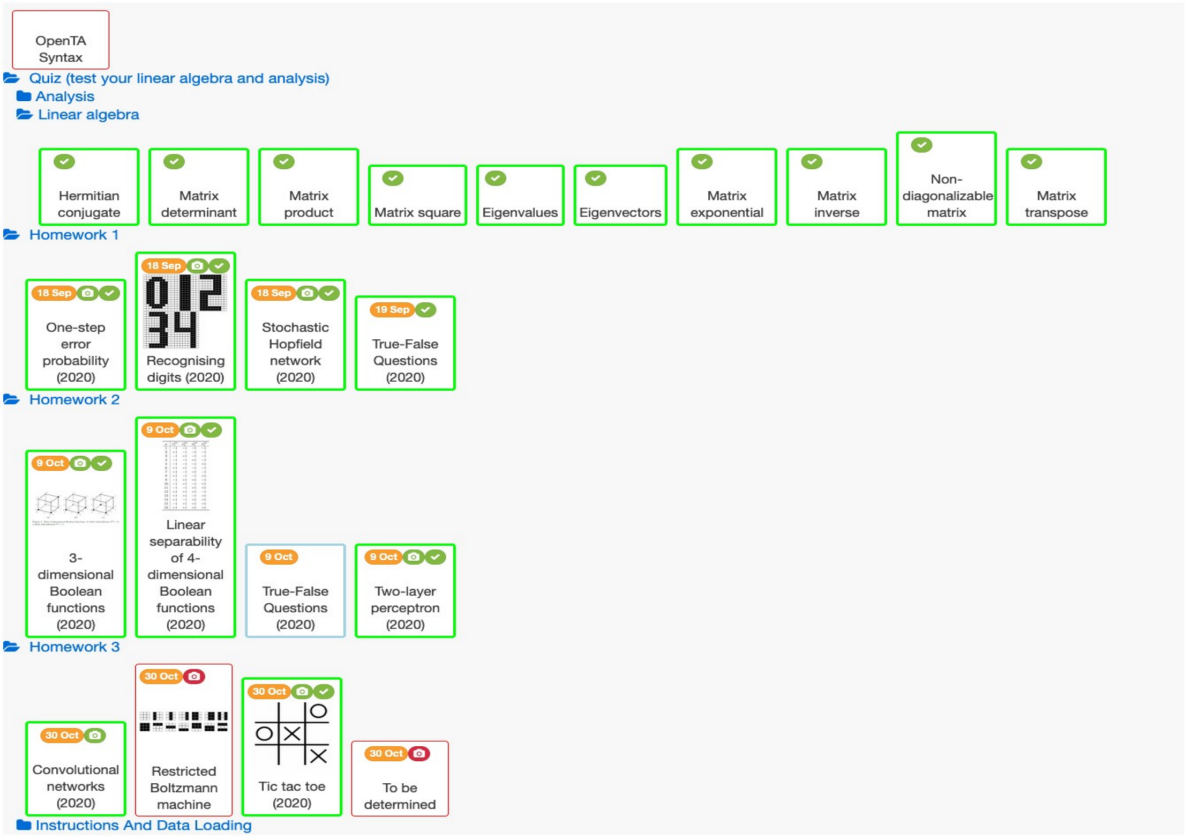

The slides presented above show OpenTA on a laptop screen, but the smartphone format is sufficiently easy to use that many of the students use that instead of a laptop. And, the uploads can be done directly from the smartphone's camera.


student
FFM516-2019
4/76
2019-11-12 16:09:18.132165
Sökt: Hinkens accelerationen.
Givet: Initiala massan M, kraften F, vinkeln , flödeshastigheten v, massflödet m'.
Plan: Analysera flödet vid t och t+Δt med ΔG = Σ F_i Δt .
G_t = 0
G_{t+Δt} = (M - Δm) Δv - Δm v sin(θ)
ΔG = Σ F_i Δt
⇒ M Δv - Δm v sin(θ) = (F - Mg)Δt
⇒ a = F/M - g + ṁ/M v sin(θ)
[ṁ/M v] = kg/kg · m/s = m/s²
F
Mg
t:
M
t+Δt:
Δv
M - 2Δm
Δm/2
v
θ
F/M - g + mdot/M v sin(theta)
F/M − g + ṁ/M · v · sin(θ) är korrekt.
A A A

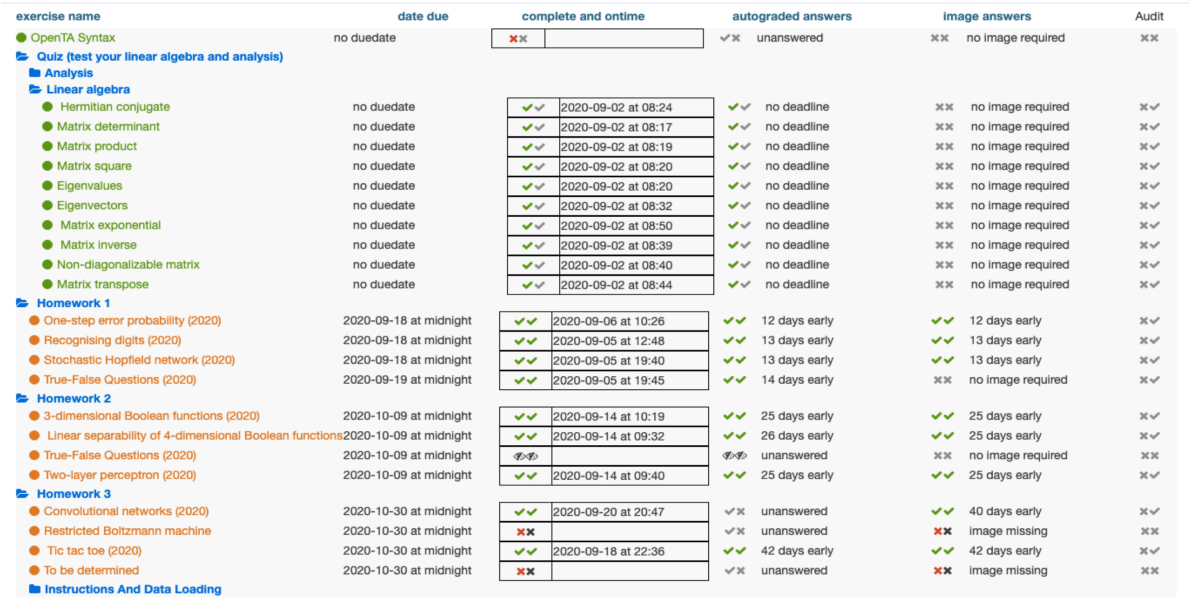
## 1.4 Progress Tracking

The following slide shows what a student's OpenTA page, from the Neural Networks course Bernhard Mehlig is teaching, might look like after a week or two.

We note now the embellishments on the icons. Questions are categorized as `Obligatory` (blue) , `Bonus` (orange) or `Optional` (no badge).



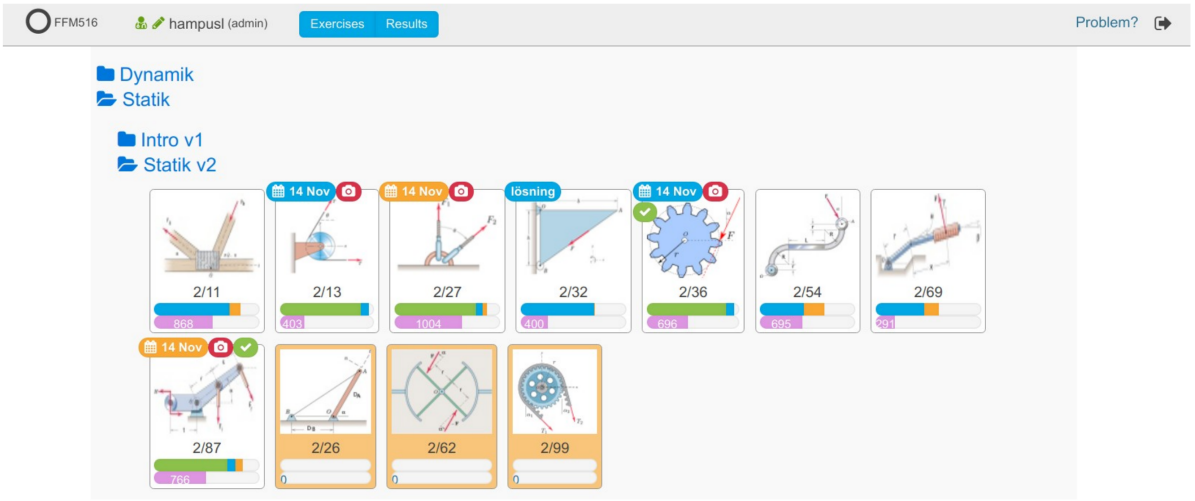

Due dates are listed, and green check mark indicates the answer was correct, and a green or red camera icon indicates an image was uploaded or missing.



| exercise name | date due | complete and ontime | | autograded answers | | image answers | | Audit |
|---|---|---|---|---|---|---|---|---|
| OpenTA Syntax | no duedate | ✗✗ | | ✓✗ | unanswered | ✗✗ | no image required | ✗✗ |
| **Quiz (test your linear algebra and analysis)** | | | | | | | | |
| **Analysis** | | | | | | | | |
| **Linear algebra** | | | | | | | | |
| Hermitian conjugate | no duedate | ✓✓ | 2020-09-02 at 08:24 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Matrix determinant | no duedate | ✓✓ | 2020-09-02 at 08:17 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Matrix product | no duedate | ✓✓ | 2020-09-02 at 08:19 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Matrix square | no duedate | ✓✓ | 2020-09-02 at 08:20 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Eigenvalues | no duedate | ✓✓ | 2020-09-02 at 08:20 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Eigenvectors | no duedate | ✓✓ | 2020-09-02 at 08:32 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Matrix exponential | no duedate | ✓✓ | 2020-09-02 at 08:50 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Matrix inverse | no duedate | ✓✓ | 2020-09-02 at 08:39 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Non-diagonalizable matrix | no duedate | ✓✓ | 2020-09-02 at 08:40 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| Matrix transpose | no duedate | ✓✓ | 2020-09-02 at 08:44 | ✓✓ | no deadline | ✗✗ | no image required | ✗✓ |
| **Homework 1** | | | | | | | | |
| One-step error probability (2020) | 2020-09-18 at midnight | ✓✓ | 2020-09-06 at 10:26 | ✓✓ | 12 days early | ✓✓ | 12 days early | ✗✓ |
| Recognising digits (2020) | 2020-09-18 at midnight | ✓✓ | 2020-09-05 at 12:48 | ✓✓ | 13 days early | ✓✓ | 13 days early | ✗✓ |
| Stochastic Hopfield network (2020) | 2020-09-18 at midnight | ✓✓ | 2020-09-05 at 19:40 | ✓✓ | 13 days early | ✓✓ | 13 days early | ✗✓ |
| True-False Questions (2020) | 2020-09-19 at midnight | ✓✓ | 2020-09-05 at 19:45 | ✓✓ | 14 days early | ✗✗ | no image required | ✗✓ |
| **Homework 2** | | | | | | | | |
| 3-dimensional Boolean functions (2020) | 2020-10-09 at midnight | ✓✓ | 2020-09-14 at 10:19 | ✓✓ | 25 days early | ✓✓ | 25 days early | ✗✓ |
| Linear separability of 4-dimensional Boolean functions | 2020-10-09 at midnight | ✓✓ | 2020-09-14 at 09:32 | ✓✓ | 26 days early | ✓✓ | 25 days early | ✗✓ |
| True-False Questions (2020) | 2020-10-09 at midnight | ✓✓ | | ✓✓ | unanswered | ✗✗ | no image required | ✗✗ |
| Two-layer perceptron (2020) | 2020-10-09 at midnight | ✓✓ | 2020-09-14 at 09:40 | ✓✓ | 25 days early | ✓✓ | 25 days early | ✗✓ |
| **Homework 3** | | | | | | | | |
| Convolutional networks (2020) | 2020-10-30 at midnight | ✓✓ | 2020-09-20 at 20:47 | ✓✗ | unanswered | ✓✓ | 40 days early | ✗✓ |
| Restricted Boltzmann machine | 2020-10-30 at midnight | ✗✗ | | ✓✗ | unanswered | ✗✗ | image missing | ✗✗ |
| Tic tac toe (2020) | 2020-10-30 at midnight | ✓✓ | 2020-09-18 at 22:36 | ✓✓ | 42 days early | ✓✓ | 42 days early | ✗✓ |
| To be determined | 2020-10-30 at midnight | ✗✗ | | ✓✗ | unanswered | ✗✗ | image missing | ✗✗ |
| **Instructions And Data Loading** | | | | | | | | |

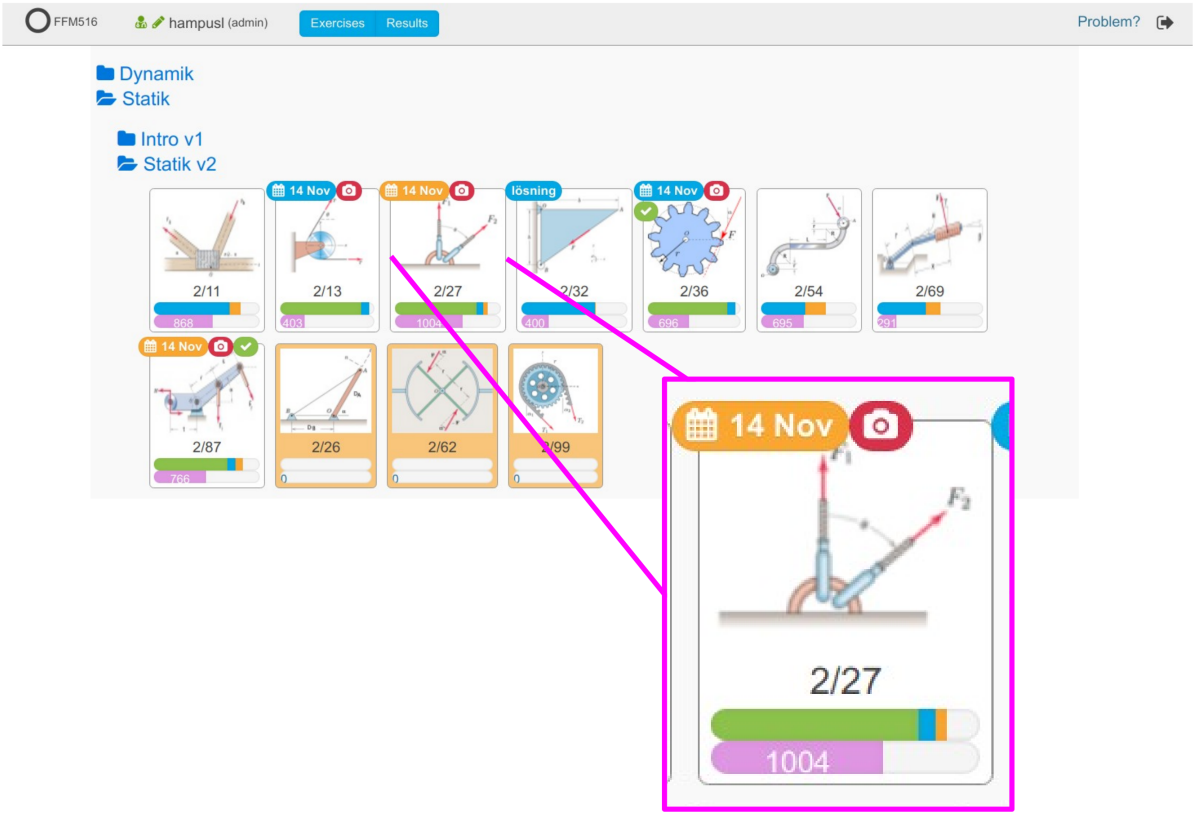
## 1.5 Teacher View

The teacher sees essentially the same view as the student, but with some more badges on the exercise icon.

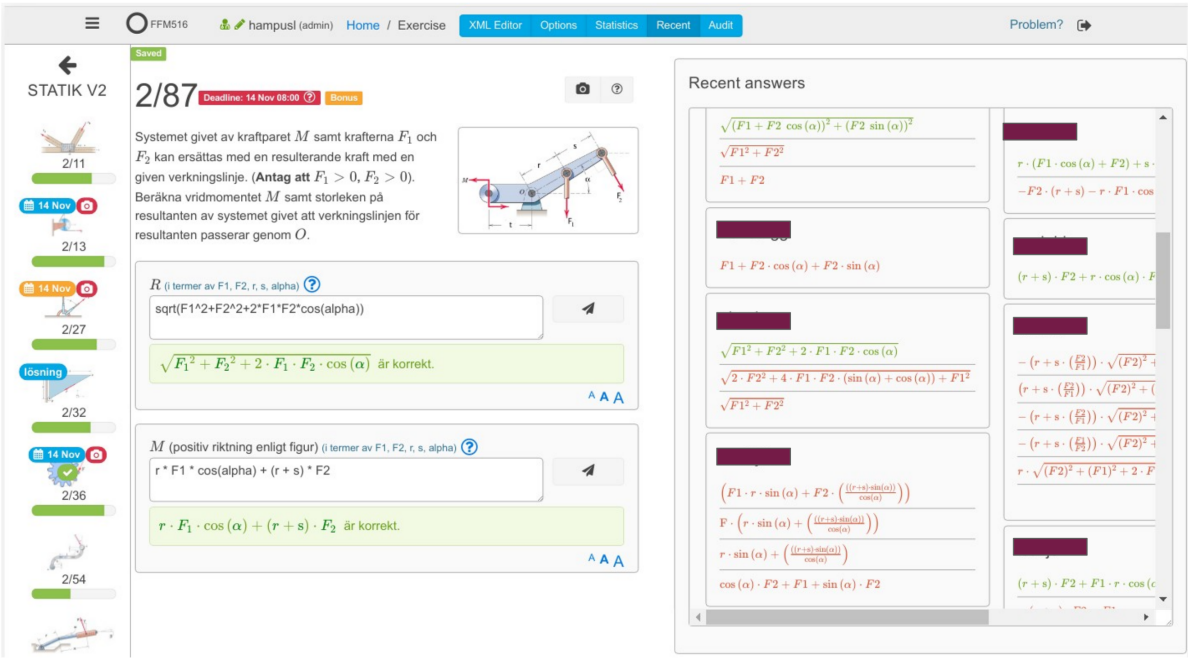



There are violet activity bars indicating how many student attempts there are on the particular question, green bar indicating how many have answered correctly and turned in their image, a blue bar indicating how many students have answered correctly, and an orange bar indicating how many students have tried but failed to answer the question.

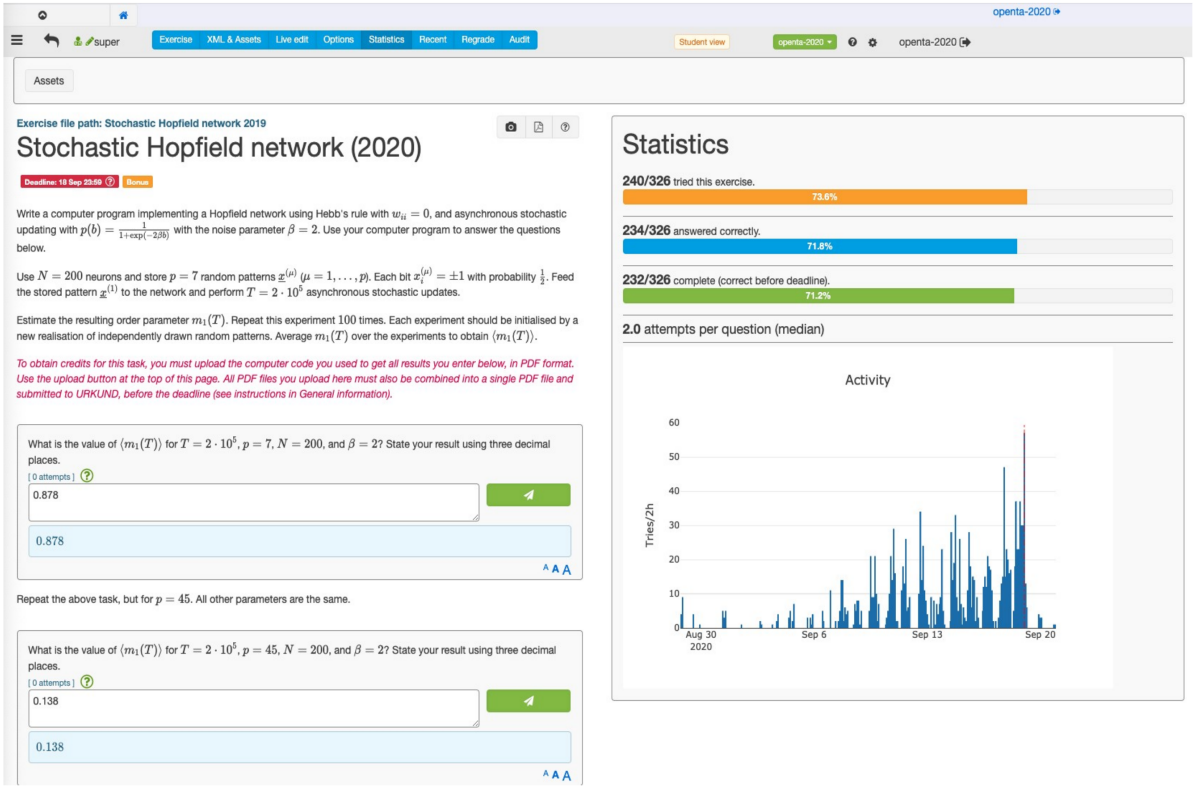
The violet activity bar can be set to measure all activity, activity latest week, day or hour. Thus a teacher can see not only cumulative student progress but which questions are being worked on at at the time.




Recently submitted answers can also be read, and not only the latest, but also all of the attempts made by the student to answer the question. The teacher can thereby find out common mistakes that students might be making.

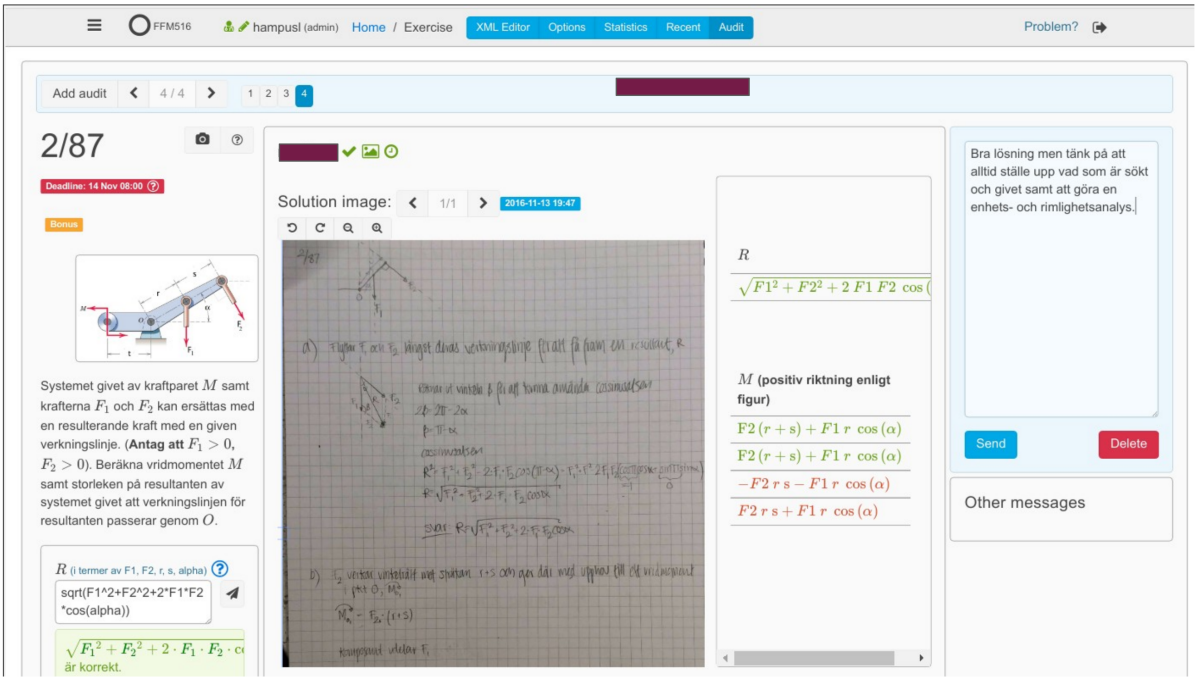



More detail about a particular exercise is available. The time that submissions were made, typically hitting a peak just before deadline.



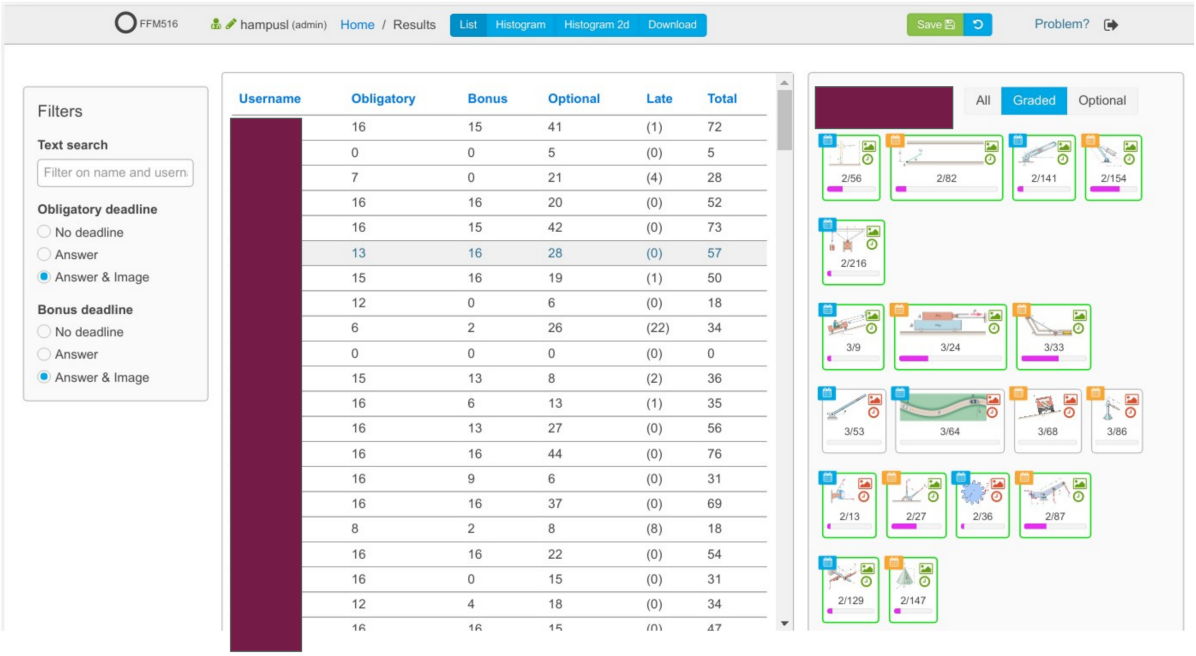

Late submissions are never rejected, they are always just marked late so the teacher has an option to accept them if they are feeling generous.

The examiner can also *audit* the student responses. I.e. go through the student answers and uploads and override the automatic settings generated by the computer. We typically use this as spot-checks on the student submissions. In the next slide, a student submission is shown together with comments to be transmitted to the student.

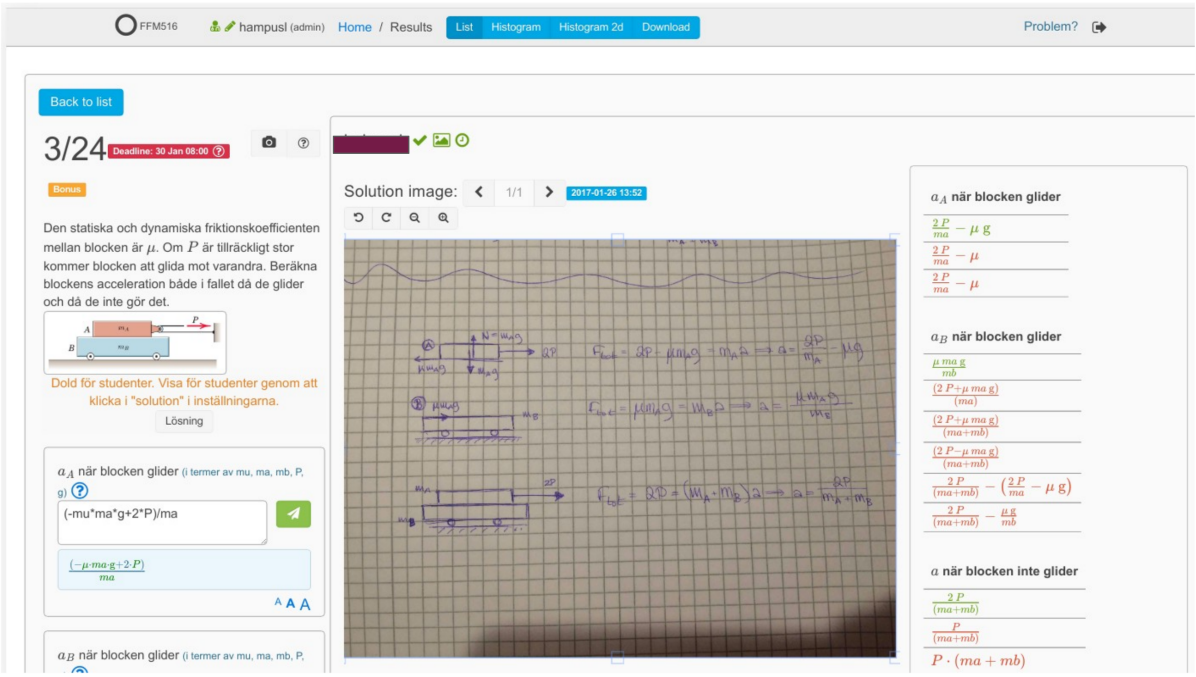


An exercise is accepted on the basis of a correct answer and a submitted image unless there is intervention by an audit by TA or teacher. Several TA's can share the task of auditing exercises.

The follwing image show what a *grade sheet* for a student. It shows how a student has performed and the number of questions that have been completed.




A teacher can also examine a student's work by entering OpenTA as that student. This is useful if an individual is having difficulties with either the physics or the OpenTA technology.



## 1.6 Technical Information

The OpenTA client, i.e. where the screen shots come from, is a *desktop app* written in JavaScript using React.

The OpenTA server is based on Django, a framework based on Python version 3.

All packages are OpenSource.

Canvas and Moodle can be configured to use OpenTA as a tool.


OpenTA is designed as a learning tool, not as an examination tool. We encourage collaboration and trying answers multiple times.

Thus, we have not limited the number of responses and make no attempts to *lock down* access to other media. We do find, however that students work very hard for *Bonus* points and that has turned out to be an important motivation for the students to take the exercises seriously.

The opinions from both teachers and students who have used OpenTA has been overwhelmingly positive.

CHAPTER

TWO

# ADOPTION

## 2.1 Gothenburg University and Chalmers

OpenTA has been in use at Gothenburg University and Chalmers University since 2017. The following courses have used it:

| Course | Description |
|---|---|
| FFM516 | Mekanik 1 |
| FFM521 | Mekanik 2 |
| FFY143 | Fysik 2 |
| LFY073 | Fortbildning fysiklärare |
| FKA081 | Quantum mechanics |
| FFM234 | Vektorfält och klassisk fysik |
| FIM770 | Dynamical systems |
| FYP102 | Mekanik A |
| FIM720 | Neural networks |
| FFY012 | Fasta tillståndets fysik |
| LGFY10 | Fysik för gymnasielärare |

CHAPTER

THREE

# GETTING STARTED

## 3.1 Known bugs

**Note:**

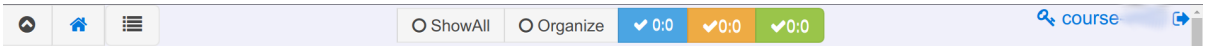
- Thumbnails sometimes do not show in student images
- Password reset from canvas fails since it demands old password

## 3.2 Login for the first time

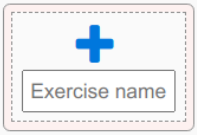
- Login to to the server with your email and password which is probably your email.
- If this is your fist login, you will prompted to change your password.

## 3.3 Create the first exercise

- After login , several buttons are visible on the toolbar.




- The `ShowAll` button toggles the display of unpublished exercises.
- Press the `ShowAll` button and now the circle icon to the left is now filled in. Below the toolbar, you will now now see a ✚symbol along with `Exercise name`.




- Use your mouse to click on `Exercise name`.
- Now you can enter title of the new exercise. E.g. `Kinetic energy of an ideal gas`.
- Hit the `Return` key.

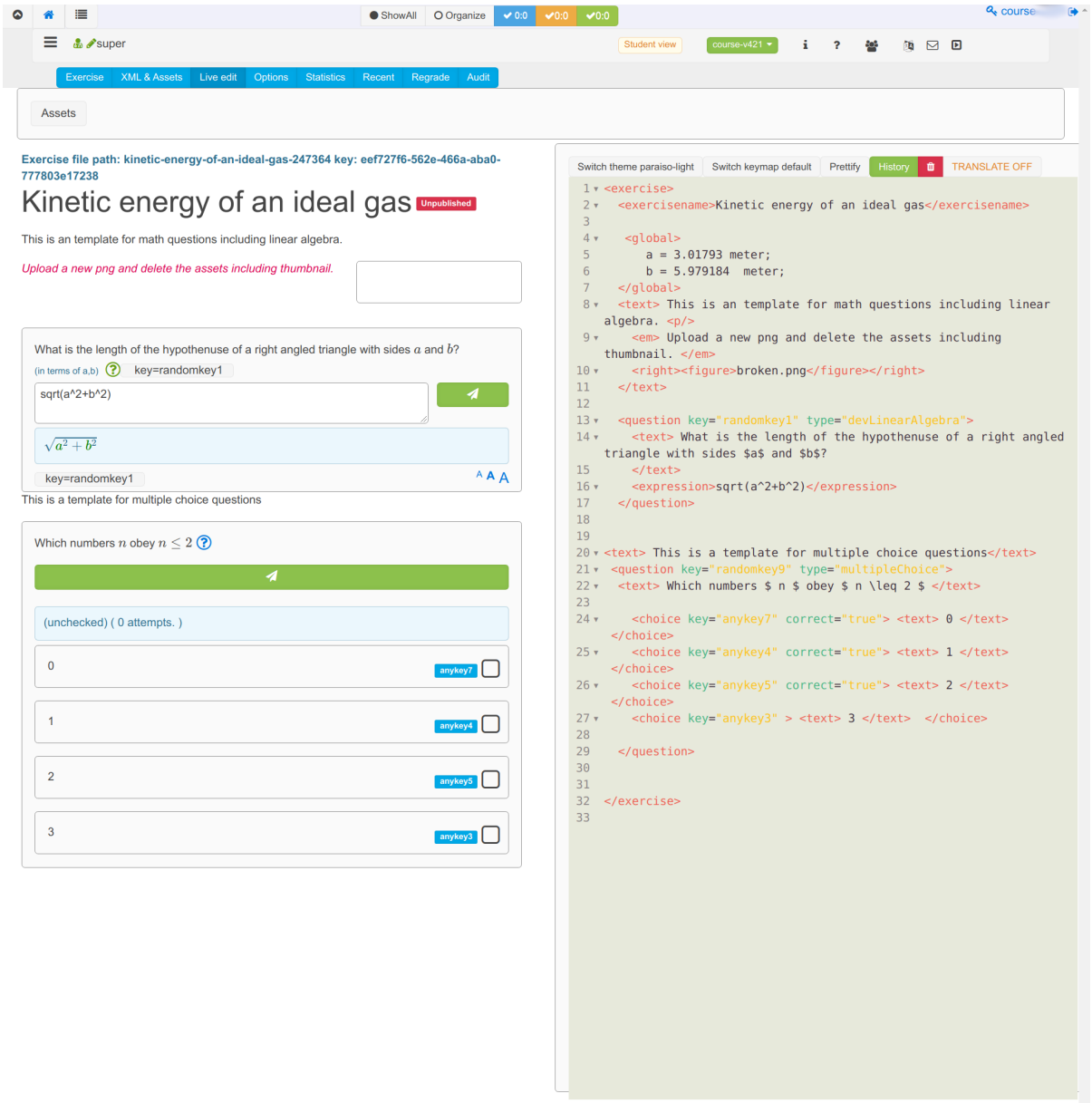
The new exercise will now be shown under the toolbar.


## 3.4 Edit the exercise

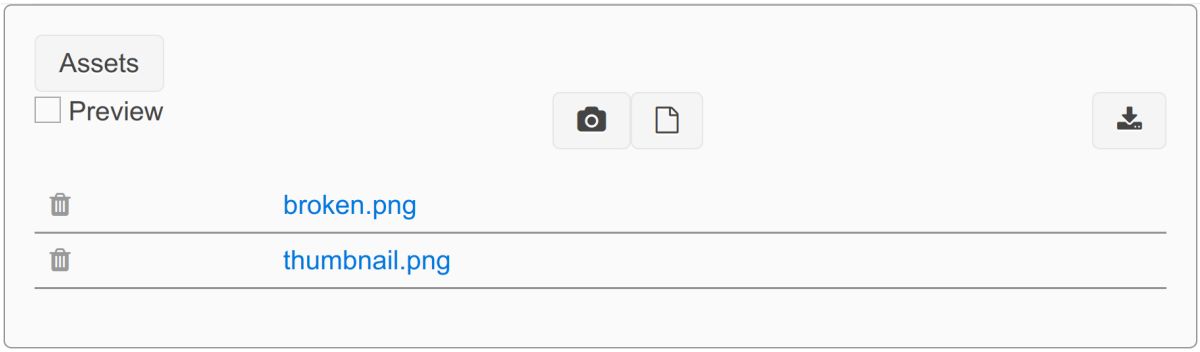
- Click the exercise and select the icon on the top left of the toolbar. This reveals a second toolbar:


- Click on the `LiveEdit` button.

You will now have a split screen with the formatted exercise on the left and the XML representation on the right.




- Press the `Assets` button below the toolbar. The box expands to show the attachments for this exercise.




- Press the Camera icon (📷) to upload a JPG or PNG file. *Use a small file, a few 100Kb at most.*

- In the XML representation, change the value contained in the <figure> tag to be the name of the file you uploaded.
- Press the Save button on the XML representation panel. You will now see a thumbnail of the image along with the exersize.
- In the the XML, you can rename the exercise by changing the contents of the <exercisname> tag.

If you are impatient to improvise on the file by editing the XML, note the following basic points.

- Delete any sections you want; make sure XML remains legal
- You can try some standard HTML syntax. Remember though:
  - all tags must be closed.
  - not all HTML is implemented.
  - all text and HTML belongs inside the <text> tags
- The <expression> tag contains the question's correct answer
- All variables in <expression> must receive numerical assignments in the <global> tag
- All question keys must be unique in the exercise
- All choices keys must be unique in the multiple choice question.
- Vi mode is enabled if you choose Switch keymap default.
- The <right> tag is used to right justify a figure on the page. Delete the entire line if you are not going to use a figure.
- Mathematical expressions are interpreted through KaTeX, which is a subset of LaTeX.

## 3.5 Save the exercise

- Press Save when there are no errors

---

**Note:**

- You will not be able to save if there are errors in the XML

---

**Warning:**

- In case you make a mess of the XML and can't recover:
  - Press the ↻button (reset), it is the blue button next to the Save button in the editing box
  - Start over completely and reload the question
  - If the XML is really messed up , try XML & assets instead of Live Edit

## 3.6 Publish the exercise

- Press `Options` in the toolbar, which is next to `LiveEdit` in the blue toolbar.
- Click on the `Published` checkbox to enable it
- Press the `Save` button to publish the exercise

## 3.7 Publish the course

Ensure you are displaying the toolbar shows. If it's not visible press the icon in the top left corner.

- Press the `Course` button from the toolbar
- A new toolbar is now shown, from it press `Options`
- Change the following settings:
  - In the **Email reply to** card, replace the email with yours
  - In the **Owners** card, select yourself and `super`
  - In the **Course name** card, change the name of the course if you wish. It defaults to your CID.
  - In the **Allow anonymous student** card, check off `Allow anonymous student` if you want to permit anonymous logins. *(If you want, you can disable this at a later time and remove anonymously registered students).*
- Press the `Save` button when you've make all the changes to the course.
- You can now see what the course looks like for students by checking `Student view`

## 3.8 More examples

To see some example questions and how they are formatted, you can log into https://examples.opentaproject.com. This site allows anonymous login.

If you wish to save your work, a self registration should be possible after a successful anonymous login.

Make sure the toolbar is visible by clicking icon at the top left.

## 3.9 See who has used your site

Click the Users icon ( ) in the toolbar to see all the users in the course.

**Note:** Please don't add or delete users until you know what you are doing.

## 3.10 Panic: Exercises are messed up

**Warning:** To recover from a broken state:

- From the toolbar, press `Exercises -> Reload Exercises` and then the `Perform reload` button.

CHAPTER

FOUR

# MANAGING THE COURSE

## 4.1 More Course Options

Make sure the toolbar is visible by clicking icon at the top left.

- Press the `Course` button
- In the new toolbar, press `Options`

This page shows the settings for a course. Each setting is grouped by and presented in it's own card. These are:

**Published** Enable this checkbox if you wish to publish the course (i.e. allow students to log in and answer questions).

**Course name** A short name suitable for links without spaces or special charcters.

**Course long name** A descriptive name to be used in and appear in Web pages.

**Url** The full url of the course.

**Motd** A short message for web pages; typically blank.

**Difficulties** Choices of badges to decorate exercises:

- `+:Recommended,*:Easy ..` for instance makes a badge '+' correspond to the label recommended etc.
- This can be anything you want; choices appear later in exercise options

**Deadline time** Time of day when exercises are due.

**Use lti** unchecked

> **Note:** The *Use lti* setting is meant for advanced users. Novice users should leave it unchecked.

**Registration by password** Allow password for registration.

**Registration domains** Domains from which to allow registration. Wildcard '*' OK.

> **Note:** This is currently only a checkbox.

**Use email** Enable email.

- Put in your own email in `email reply to`
- Ignore the following settings for **opentaproject.com** sites
  - `Email host user` - The SMTP server's host name
  - `Email username` - The SMTP username

  - `Email host password` - The user's email password; stored unencrypted

**Use autotranslation** Novice users should leave this unchecked.

**Languages** The Default is `en`; language codes separated by comma, for instance `sv,en,de`. Not particularly useful without auto translation.

**Owners** Check your username and `super` as owners. In addition, select any other users who should be able to view *unpublished* questions.

**Allow anonymous student** Enable this setting` to allow anonymous logins.

> **Note:** Enable this setting only if you do not plan to use LTI (i.e. Canvas) or Moodle

Press the `Save` button after you have changed the setting you are interesed in chaning.

To see what the course looks like for a student, press `Student view` button.

## 4.2 Enable LTI i.e. Canvas or Moodle

*This section is relevant only to those who will be using OpenTA from an LTI CMS such as Canvas or Moodle.*

More information about LTI can be found here: Learning Tools Interoperability(LTI).

**Note:** *Important*: do not allow students to first authenticate outside of Canvas if that's how they will be expected to login later. A student's identity must be first verified by LTI. You cannot migrate a student into Canvas if the identity is not first established that way.

This assumes that you are able to install an LTI app in Canvas or Moodle.

- In the `Canvas` interface, choose
- Choose `Settings -> Apps`
- Choose `View App Configurations -> +App -> Configuration Type ->`
- Choose `Configuration Type -> ByURL`
- In another tab or window, in OpenTA choose `Course Options`
- Check `Use LTI` and `Save` and go back to `Options`
- Copy the (OpenTA) entire config URL , including the `https://` into (LTI) `Config URL`
- Copy the entire (OpenTA) `Lti key` into the LTI `Consumer Key`
- Copy the entire (OpenTA) `Lti secret` into the LTI `Shared Secret`
- Choose (Canvas) `Submit`
- If all went well, the App has been added to Canvas.
- To allow students to easily break OpenTA out from the Canvas frame:
- Add the Canvas app *Redirect Tool* and point it to the hostname running OpenTA
- *Instructions only for those whose superuser identity coincides with your Canvas identity*
  - Create a new superuser identity for yourself so it will be different from the identity you have in Canvas.
  - Note that you can assign yourself a password in the admin interface (click the gear icon in the header)

  - **Make sure you can login as the new superuser**
  - Then delete the original user so that identity can be recreated with an LTI login
- Try to login through the LTI CMS.

---

**Note:**

  - Canvas opens OpenTA in a frame, not only taking valuable desktop space with sidebars and headers, but also causing security issues through third-party cookies. Some admin features may not work in the Canvas frames, so it is best to administer the course as superuser via direct login and not through Canvas.
  - *If you already have a user identity that coincides with that from Canvas, change username and email of the old superuser to allow a new identity to be created from Canvas. If you want the Canvas identity to be superuser, change the user in the admin interface. It can be useful to retain a student identity when used through Canvas.*
  - To guard against misconfigurations by LTI admins, an LTI authenticated user will never automatically have access other than Student in OpenTA even if they are examiner or CourseDeveloper. The superuser must provide suitable non-student access to LTI authenticated users manually.

---

- Suggestion on dealing with course assistants and other admins
  - The best way to proceed is that the course createor obtains a new superuser identity, including password and then, after it is verified working, deletes the original identity. Then course creator logs in **through Canvas**. The superuser login is then used to provide whatever privileges is desired to the new identity. Same procedure with course assistants; first the course assistant logs in through Canvas, then superuser promote privileges.
  - This could of course have been done automatically if OpenTA respected a Canvas identity such as Examiner or CourseDeveloper. However, we have chosen not to rely on that, since a misconfiguration of roles from University Canvas services could mistakenly compromise the OpenTA site.

CHAPTER

FIVE

# MANAGING PARTICIPANTS

## 5.1 Manage users

- Try out anonymous logins
  - Open this page in a browser: https://examples.opentaproject.com/lti.
  - anonymous logins should now allowed
  - A self registration should be possible after a successful anonymous login
- Make sure the toolbar is visible by clicking the icon at the top left
- Click the Users icon ( ) in the toolbar to see who is registered and their status

**Important:** Please don't add or delete fields that are available until you know what you are doing.

## 5.2 Creating additional privileged users

Once an anonymous user has registered, the user is promoted to ordinary student. A superuser can further escalate the privileges. To promote a user to full superuser, do the following

- Click the Users icon ( ) in the toolbar to see who is registered and what their status is,
- Click on the ID of the user to be promoted,
- You are now at the `Change User` page,
- On this page do the following:
  - Enable the `Staff Status` and `Superuser status` checkboxes,
  - Remove the `Student` and `AnonymousStudent` groups from, *Chosen groups* (if they are present),
  - Add the `Admin`, `Author` and `View` to the *Chosen groups*
  - Set `LtiRoles` to `ContentDeveloper,Instructor` i.e. a string with a comma in the middle

**Note:** No permissions are necessary; they come automatically with the group

- If you wish to give the user all privileges, enable the *Superuser status* checkbox.
- Press the `Save` button at the bottom of the page to finish.

## 5.3 Deleting Users

- Click the Users icon (🐾) in the toolbar
- Click on the checkboxes corresponding to the users you wish to delete
- In the `Action` pull down, select `Delete selected user`
- Press the `Go` button,
- You are now presented with a confirmation page,
- Press the `Yes, I'm sure` button to confirm the deletion

When OpenTA is used in with LTI authentication, a student who is deleted will be reauthorized upon LTI access. The student must be removed from Canvas enrollment to disable all further access.

### 5.3.1 Alternate Method

Another way to disable an individual student is to select the student, then remove the student from all groups.

## 5.4 Disable all student access

To disable all student access, unpublish the course.

CHAPTER

SIX

# AUTHORING

## 6.1 TL;DR

See some examples on this website https://examples.opentaproject.com/lti.

## 6.2 Introduction

Content in OpenTA consists of exercises with one or many questions. An exercise and its questions are created using a custom XML format. For example,

`example.xml`

```
<exercise>
  <exercisename>Momentum and energy</exercisename>
  <text>
    A particle with mass $m$ is moving with velocity $v$.
  </text>
  <question key="1" type="compareNumeric">
    <variables>
      m = 3 kg; v = 5 meter / second;
    </variables>
    <text>What is the particles kinetic energy?</text>
    <expression>m*v^2/2</expression>
  </question>
</exercise>
```

In this example the question type is *compareNumeric*. It is used to compare the student answer with the correct answer by random sampling.

## 6.3 Mathematics typesetting

OpenTA supports typesetting mathematical expressions in text through KaTeX. This means that whenever you want to show some mathematics, for example $\frac{1+x^2}{\sqrt{1-x}}$, you write the corresponding LaTeX syntax within dollar signs: `$\frac{1+x^2}{\sqrt{1-x}}$`.

See the LaTeX wiki for a syntax reference.

For some more hands-on examples see this stackexchange collection (this is aimed at MathJax which also uses the same syntax).

## 6.4 Creating Exercises

### 6.4.1 File structure

Exercises are stored on the server's file system. An exercise consists of a directory containing a definition file `exercise.xml` together with a file `exercisekey` and possibly additional assets such as `figures/pdf`. This directory must be located somewhere under the root `exercises/` directory to be recognized by the system.

**Directory structure**

```
exercises
├── ...
├── exercise_folder
│   ├── exercise.xml
│   ├── exercisekey
│   └── ...
├── ...
```

#### *exercise.xml*

An XML file containing all information about the exercise, see below for the XML format.

#### *exercisekey*

A text file containing a unique key (up to 255 bytes of UTF8 encoded ASCII) that identifies the exercise in the database. A key file can be added and assigned manually, but is automatically generated as a uuid4 identifier if not present.

### 6.4.2 Exercise XML format

This first part describes the XML tags that are common to all exercises.

#### Example

```
<exercise>
  <exercisename>Momentum and energy</exercisename>
  <text>
    A particle with mass $m$ is moving with velocity $v$.
  </text>
  <question key="1" type="compareNumeric">
    <variables>
      m = 3 kg; v = 5 meter / second;
    </variables>
    <text>What is the particles kinetic energy?</text>
    <expression>m*v^2/2</expression>
```

(continues on next page)

(continued from previous page)

```
  </question>
</exercise>
```

### Specifications

Table 1: Top level tags :header-rows: 1

| Tag | Attributes | Description |
|---|---|---|
| `<exercise>` | | Root tag |
| `<exercisename>` | | The visible name/title of the exercise |
| `<question>` | **key [string]** unique id (within the exercise)<br>**type [string]** *question type* [compareNumeric, ...] | Question root tag. See *Question Types*. |
| `<global>` | **type [string]** question type (optional, if not specified all questions will recieve this data). | Data that will be passed to all questions in this exercise. For example variables for multiple symbolic questions. |
| `<figure>` | **size [string]** optional size specification. Choices are small*, *medium* or *large*. | A figure (usually an image) that aids in explaining the question. Specify the filename of image that was added to the exercise folder, or uploaded via the assets browser in `XML & Assets` when editing the exercise. |

## 6.4.3 Question Types

### compareNumeric

```
<question type="compareNumeric">
 ...
</question>
```

The answer is a symbolic or numeric expression in a set of variables. Student answers are graded by comparing them with the correct expression by random numeric sampling.

The following tags can be used inside a **compareNumeric** block.

| Tag | Attributes | Description |
|---|---|---|
| `<text>` | | Question text shown in viscinity of the input field. |
| `<expression>` | | Expression for the correct answer |
| `<variables>` | | Variables in semicolon separated list of var=value, e.g. `x=1;y=2;` |

### Examples

#### Basic

```
<question type="compareNumeric">
  <text>What is 1+1?</text>
  <expression>2</expression>
</question>
```

#### Variables

```
<question type="compareNumeric">
  <variables>
    a=3; b=5;
  </variables>
  <text>
    What is the length of the hypotenuse of a right angled
    triangle with sides a and b?
  </text>
  <expression>sqrt(a^2+b^2)</expression>
</question>
```

#### Global variables, multiple questions, latex, units

```
<exercise>
  <exercisename>Momentum and energy</exercisename>
  <text>
    A particle with mass $m$ is moving with velocity $v$.
  </text>

  <global type="compareNumeric">
    m = kg; v = meter / second;
  </global>

  <question type="compareNumeric">
    <text>
      What is the linear momentum of the particle?
    </text>
    <expression>m*v</expression>
  </question>

  <question type="compareNumeric">
    <text>
      What is the kinetic energy of the particle?
    </text>
    <expression>m*v^2/2</expression>
  </question>
</exercise>
```

### linearAlgebra

```
<question type="linearAlgebra">
 ...
</question>
```

Can be used when the answer is a symbolic or numeric expression in a set of variables, possibly vector or matrix-valued. Student answers are graded by comparing them with the correct expression, optionally by random sampling. This questiontype should be thought of as a superset of *compareNumeric*, containing the same functionality but with greater flexibility, including vector and matrix support.

Vectors and matrices are defined using square brackets and can be unitful. For example a 3-vector can be written as `[1,2,3]`. A matrix is similarly entered as `[[1,0], [0,1]]`, where the inner vectors corresponds to the rows of the matrix. There are a number of vector operators available (see the help button for a linearAlgebra question for the full list) such as `cross(v1,v2)`, `dot(v1,v2)` and `norm(v)`.

Scalar variables can be defined as random sampled using the function `sample(value1, value2, ...)`. The answer will be compared using random sampling in a neighbourhood around each value.

---

**Note:** This is not automatic as with *compareNumeric*.

---

For example to correctly grade an answer containing the absolute value function,

```
<question type="linearAlgebra">
  <variables>
    x = sample(1, -1)
  </variables>
  <text>
   What is $\sqrt(x^2)$?
  </text>
  <expression>abs(x)</expression>
</question>
```

The following tags can be used inside a **linearAlgebra** block.

| Tag | Attributes | Description |
|---|---|---|
| <text> | | Question text shown in viscinity of the input field. |
| <expression> | | Expression for the correct answer |
| <variables> | | Variables in semicolon separated list of var=value, e.g. `x=1;y=2;` |
| <blacklist> | | List of subtags <token></token> containing tokens (variables, functions or operators) that are not allowed in the answer. |

## Examples

### Basic

```
<question type="linearAlgebra">
  <text>What is 1+1?</text>
  <expression>2</expression>
</question>
```

### Variables

```
<question type="linearAlgebra">
  <variables>
    omega=[1,0,0]; r=[0,1,0];
  </variables>
  <text>
    What is the velocity of a particle at a point $\vec{r}$ rotating around the origin␣
↪with angular velocity $\vec{omega}$?
  </text>
  <expression>cross(omega, r)</expression>
</question>
```

### Global variables, multiple questions, latex, units

```
<exercise>
  <exercisename>Momentum and energy</exercisename>
  <text>
    A particle with mass $m$ is moving with velocity $\vec{v}$.
  </text>

  <global type="linearAlgebra">
    x = sample(1)
    m = kg; v = [x, 0, 0] meter / second;
  </global>

  <question type="linearAlgebra">
    <text>
      What is the linear momentum of the particle?
    </text>
    <expression>m*v</expression>
  </question>

  <question type="linearAlgebra">
    <text>
      What is the kinetic energy of the particle?
    </text>
    <expression>m*dot(v, v)/2</expression>
  </question>
</exercise>
```

### multipleChoice

```
<question type="multipleChoice">
 ...
</question>
```

Multiple choice questions contains different alternatives where one or more can be correct. They are answered by marking the correct alternatives and then submitting. The content of the alternatives can be text, math or elements such as figures.

```
<question type="multipleChoice">
  <text>Pick the correct alternatives below.</text>
  <choice key="0">The first choice</choice>
  <choice key="1" correct="true">The second choice</choice>
  <choice key="2">The third choice</choice>
  <choice key="3" correct="true">The fourth choice</choice>
</question>
```

The following tags can be used inside a **multipleChoice** block.

| Tag | Attributes | Description |
|---|---|---|
| <text> | | Question text. |
| <choice> | **key [string]**<br>• unique id (within question)<br>**correct ["true"]**<br>• marks this alternative as correct. | An alternative for the answer. |
| <hint> | | Shows a hint if the student answers incorrectly. |
| <rate> | | Specifies how many tries a student can make per duration of time. The time is specified as `number/unit` where unit is `s` (second) or `h` (hour). For example `<rate>3/h</rate>` permits three tries per hour. See rates for the detailed syntax description. |

### Examples

### Basic (with math)

```
<question type="multipleChoice">
  <text>How many people live of planet earth?</text>
  <choice key="0">$9\ctimes 10^9$</choice>
  <choice key="1" correct="true">$9\ctimes 10^10$</choice>
  <choice key="2">$9\ctimes 10^11$</choice>
</question>
```

### numeric

```
<question type="Numeric">
 ...
</question>
```

Question with a numeric answer that has a certain tolerance for error.

```
<question type="Numeric" precision="0.005">
  <text>What is $\sqrt{2}$?</text>
  <expression>1.44</expression>
</question>
```

The following tags can be used inside a **Numeric** block.

| Tag | Attributes | Description |
|---|---|---|
| <question> | **precision [string]**<br>• A floating point number, surrounded by quotes, representing the relative tolerance of the answer. | For example <question type="Numeric" precision="0.05"> will accept answers within a 5% interval of the correct answer, i.e. $correct \pm 0.05 \cdot correct$. |
| <text> | | Question text. KaTeX allowed. |
| <expression> | | The correct answer. |
| <rate> | | Specifies how many tries a student can make per length of time. The time is specified as number/unit where unit is s (second) or h (hour). For example <rate>3/h</rate> permits three tries per hour. See rates for the detailed syntax description. |

### Examples

### Basic

```
<question type="Numeric">
</question>
```

### Advanced

```
<question type="Numeric">
</question>
```

CHAPTER

SEVEN

# ACCESS AND FIRST TIME LOGIN

## 7.1 LTI (Canvas or Moodle Access )

- Click on the OpenTA Link in Canvas or Moodle, (Canvas and Moodle referred to as *LTI* in this documentation).
- If you want to get rid of the Canvas frame
  - Click on `Frameless OpenTA` *after* you have opened logged in on OpenTA Canvas link
- If you want to access OpenTA outside of Canvas
  - Login via Canvas
  - Click on the key icon in the header and assign yourself a password
  - Then access the site directly via the URL and login you see in `Frameless OpenTA`

## 7.2 Problems with LTI access:

- Multiple OpenTA identities or a hash as username ?
  - This has happened for GU students taking Chalmers courses.
  - Make sure you are logged in only through the Chalmers Canvas.
- Access denied : *Please enable cookies (and third-party cookies) to access OpenTA*
  - Canvas sets third party cookies to open an app in a frame.
  - Enable third party cookies in your browser
  - If you don't want to allow all third party cookies, allow those from `[*.]instructure.com`
- Update your browswer; OpenTA enforces security settings that are violated in earlier browswers.
- If you still get problems with LTI access write an email

## 7.3 Non-LTI (standalone app)

Several methods; the examiner has chosen one and it should be obvious from the OpenTA page. All methods require a valid email from which you will need to retrive an email from opentaproject@gmail.com.

- **Anonymous login method**
  - Login anonymously
  - A bogus login attempt may be required generate an anonymous link
  - After you login, you can and follow the instructions.

    **Note:** In order to keep the bots away, you may need to answer a few exercises correctly before you will be allowed to register.

  - You must use a valid email which you can validate
- **Password method**
  - The course examiner has given a signup password
- **Self registration by email**
  - Use your university email

## 7.4 Problems gaining Non-LTI access

- Find the email in spam or junk. This solves 95% of signup problems.