

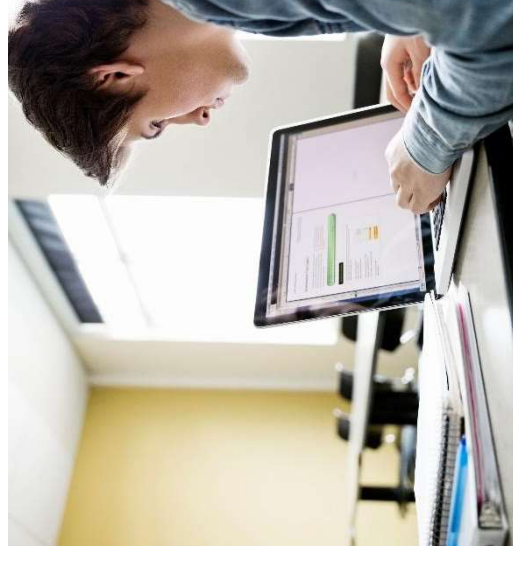
14th July 2020

Autograded Assessments with MATLAB Grader

Dr. Martina Sciola and Dr. Sheila Scialanga

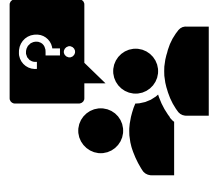
MathWorks Academia Team

msciola@mathworks.com and sscialan@mathworks.com

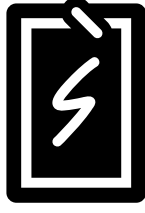


Autograded Assessments with MATLAB Grader

What is it?



How does it work?



Integration with LMS



Academic Experience

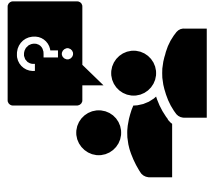


Summary



Autograded Assessments with MATLAB Grader

What is it?



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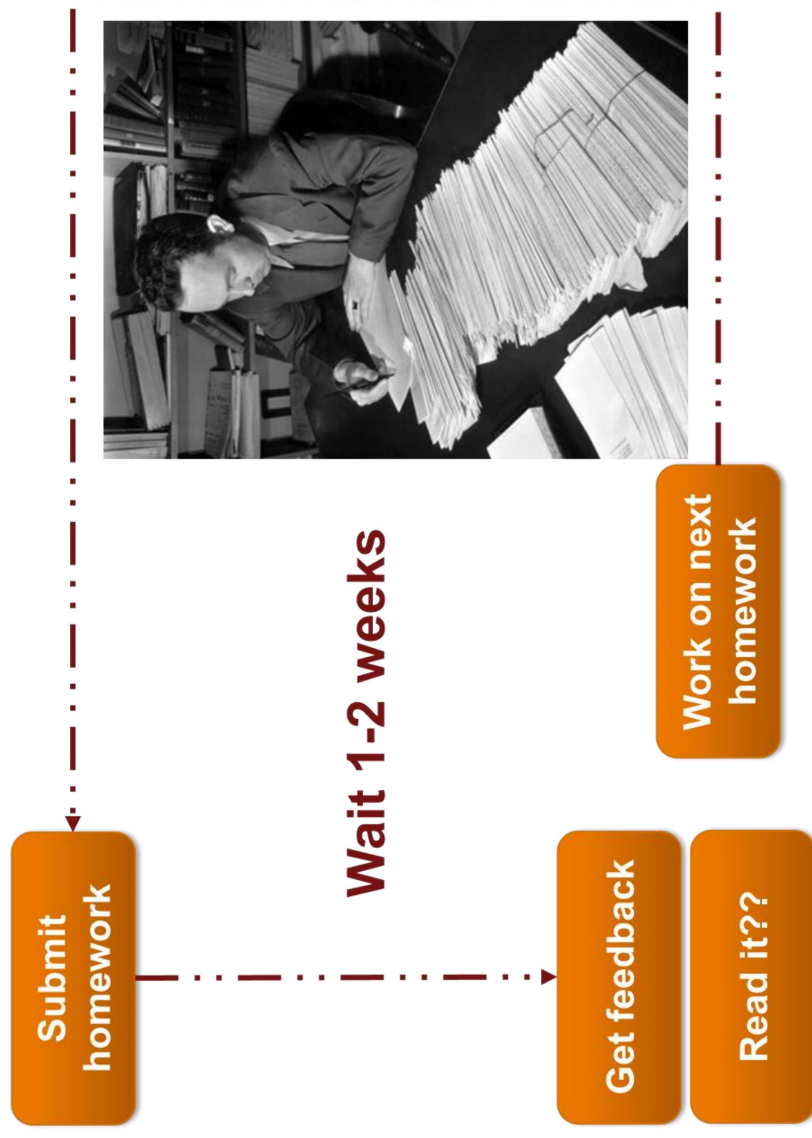
Summary



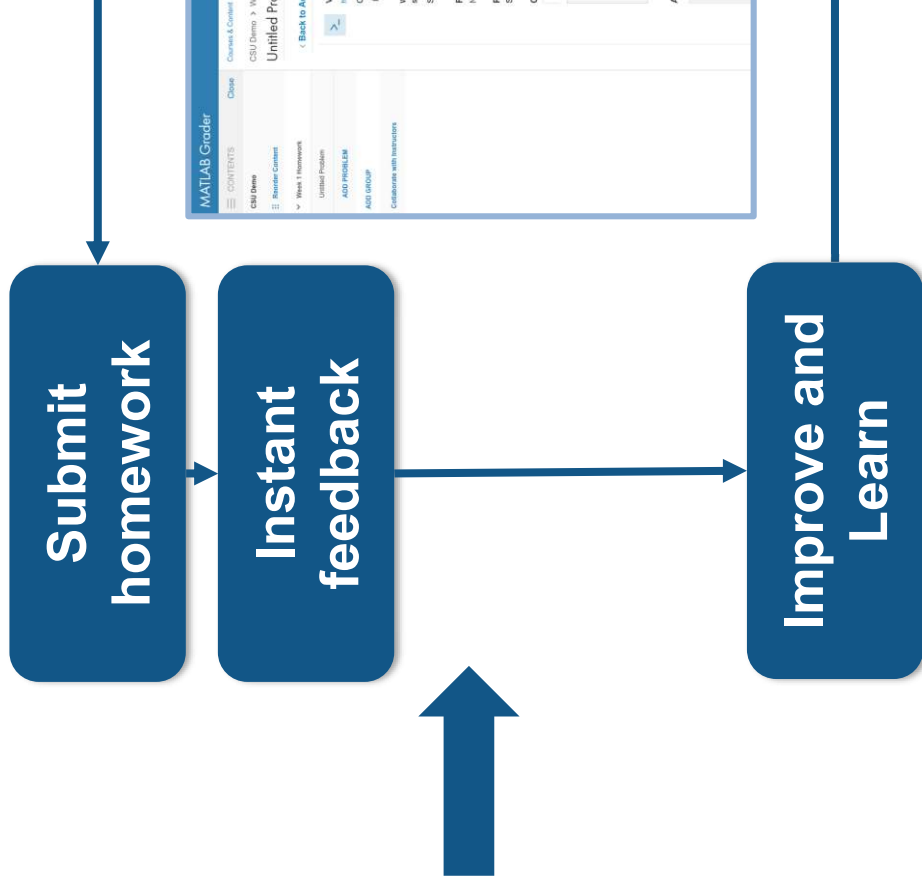
What is MATLAB Grader?

A tool to save time grading MATLAB code and provide immediate feedback to

Traditional Grading



Autograding



MATLAB Grader

- Creation and sharing of **MATLAB-based assignments**
- **Autograded student solutions** with custom scoring rubrics
- A library of **re-usable examples**
- **Learning management system integration**

Automatically grade MATLAB code in any learning environment.

The screenshot displays the MATLAB Grader interface. At the top, the navigation bar includes 'MATLAB® Grader™', 'Courses & Content', 'LMS Integration', 'License Management', and 'Documentation & Support'. The main content area is divided into two sections. The left section, titled 'Courses', lists the course 'Introduction to Numerical Methods' created by Balaji Sharma, with a duration of 01 Jan 2018 - 03 Sep 2018 and 3 problems. Below this, a 'Copy of Introduction to Programming' is listed, created by Eric Davisshah, with a duration of 03 Apr 2018 - 15 Sep 2018 and 94 problems. The right section, titled 'Content', shows a list of assignments including 'Example Problems', 'Problem 1a: Estimating the value of pi', and 'Your Script'. The 'Example Problems' section is expanded, showing a list of problems with their durations and student counts. The 'Problem 1a' section is also expanded, showing the problem statement and the 'Your Script' area with a code editor.

MATLAB® Grader™

Courses & Content | LMS Integration | License Management | Documentation & Support ▾

Hello, Jeff Alderson

▼ **Get Started**

- Guided Tour (3-minute video)
- Documentation

Courses

Introduction to Numerical Methods (Instructor)

Created By Balaji Sharma (balaji.sharma@mathw.edu)

Duration (EDT): 01 Jan 2018 - 03 Sep 2018

3 Problems | 3 Students

Copy of Introduction to Programming (Instructor)

Created By Eric Davisshah (edavisshah@everettcc.edu)

Duration (PDT): 03 Apr 2018 - 15 Sep 2018

94 Problems | 0 Students

Example Problems (Instructor)

Created By Aditya Jain (aditya.jain@mathworks.com)

Duration (UTC): Not Specified - Not Specified

11 Problems | 0 Students

ADD COURSE

Content

Create problems outside of a course, store problems in courses. ?

ADD PROBLEM

Introduction to MATLAB

Dashboard / Courses / MATLAB 101 / Functions in MATLAB

Embedded

Problem 1a: Estimating the value of pi

One of the methods to estimate the value of pi is to use the number of terms and use the expression below to estimate the value of pi.

$$\pi/4 \approx 1 - 1/3 + 1/5 - 1/7 + \dots = \sum_{k=1}^n \frac{(-1)^{k+1}}{2k-1}$$

Using this expression, write a script to estimate the value of pi using the following variables:

```
estPi % Value of pi estimated using the expression
```

You can use the Learner Template code provided to estimate the value of pi.

Your Script

```
1 nTerms = 100; % Number of terms to use
2 %
3 % <Enter your code here>
4 %
5 estPi = ; % Estimated value of pi using the expression
```

Who would benefit from autograding MATLAB code in an LMS?

- **Instructors** teaching large and/or introductory level courses
 - Use off the shelf content and assessment examples to speed course development
 - Include MATLAB assignments for homework, exercises, and formative assessment
- **Teaching Assistants and Graders** for MATLAB-based courses
 - Less time spent grading code == more time working with students
- **Students** get immediate feedback, and improve mastery of skills and concepts

What can instructors use MATLAB Grader for?

- Convert **existing MATLAB** assignments for autograding with MATLAB Grader
- Provide students with **additional practice problems** in the LMS
- Use MATLAB Grader for **in-class coding exercises** and quizzes
- View **student performance analytics** at the individual and aggregate levels

Educators and Instructors are Teaching with MATLAB Grader

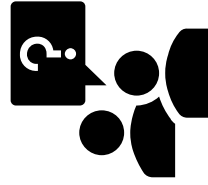
2,500+ instructors

100,000+ students

Over 10 million
submissions

Autograded Assessments with MATLAB Grader

What is it?



How does it work?



Integration with LMS



Acad
Expe

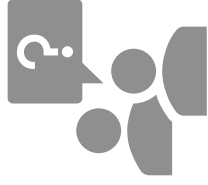


Summary



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Summary





MATLAB Grader Demo

Instructor Workflow



Create Content

- Create a new problem
- Add a problem from Examples
- Create a problem from scratch

Share Content / Courses

- Invite TAs/graders/instructors
- Invite students / add to course syllabus

Assess Learning

- Download submissions or view in LMS
- Create grading rubrics

[For Instructors: Create Courses and Coding Problems](#)

<https://grader.mathworks.com>

Student Workflow

Develop Solutions

- Write MATLAB solutions in the browser
- Use MATLAB desktop to develop solutions

Test and Submit

- Get instant feedback from test suites
- Submit solutions for assessment

Refine Solutions

- Use Solution Map to write better code
- Compare solution with peer submissions

[For Learners: Participate in Courses and Solutions](#)

Vector Creation (creating equally spaced vectors)

Write a script with commands to create the following vectors and assign to the indicated variable names.

- Create an evenly-spaced row vector **A** with elements starting at 0 and ending at 50 with increments of 0.5.
- Create a row vector **B** with 80 evenly-spaced elements starting at 0 and ending at $\pi/2$.
- Create a row vector **C** that is an unsigned 8-bit integer data type with elements counting backward from 200 to 0 in increments of 5.

Your code should not include the following MATLAB functions or keywords: **for**, **while**

Script

```
1 % Create an evenly-spaced row vector A with elements starting at 0 and ending at 50 with increments of 0.5
2
3 % Create a row vector B with 80 evenly-spaced elements starting at 0 and ending at pi/2
4
5 % Create a row vector C that is an unsigned 8-bit integer data type with elements counting backward from 200 to 0 in increments of 5
```

Assessment:

Is first variable A correct?

Is first variable B correct?

Is first variable C correct?

Exercise 1 - Statistics of Cambridge Temperature

- Load data from CambridgeTemperatures.dat and save in variable **T**
- Compute the mean temperature
- Compute the standard deviation normalised by the number of observations.



Student Performance Analytics

For each assignment...

CONTENTS

Close

ENG6200 2019

Introduction to MATLAB

Reorder Content

> RESIT - GRADED ASSESSMENT 1 6
DECEMBER 2019

> RESIT - GRADED ASSESSMENT 2 6
DECEMBER 2019

> Practice exercises 1

Create vector

Random integer

Address column

Address odd values

Replace column

Delete last row

Count the positives

BONUS Problem

ADD PROBLEM

> Practice exercises 2

> Practice exercises 3

> Practice exercises 4

Courses & Content

LMS Integration

Documentation & Support

ENG6200 2019

Introduction to MATLAB

Practice exercises 1

Visible: 03 Sep 2019 6:00 AM UTC

Due: 06 Jan 2020 11:00 PM UTC

Submissions Per Problem: Unlimited

Assignment Description

Practice MATLAB exercises.

Not assessed.

Problems

Create vector

Random integer

Address column

Address odd values (DRAFT)

Replace column

Delete last row

Count the positives

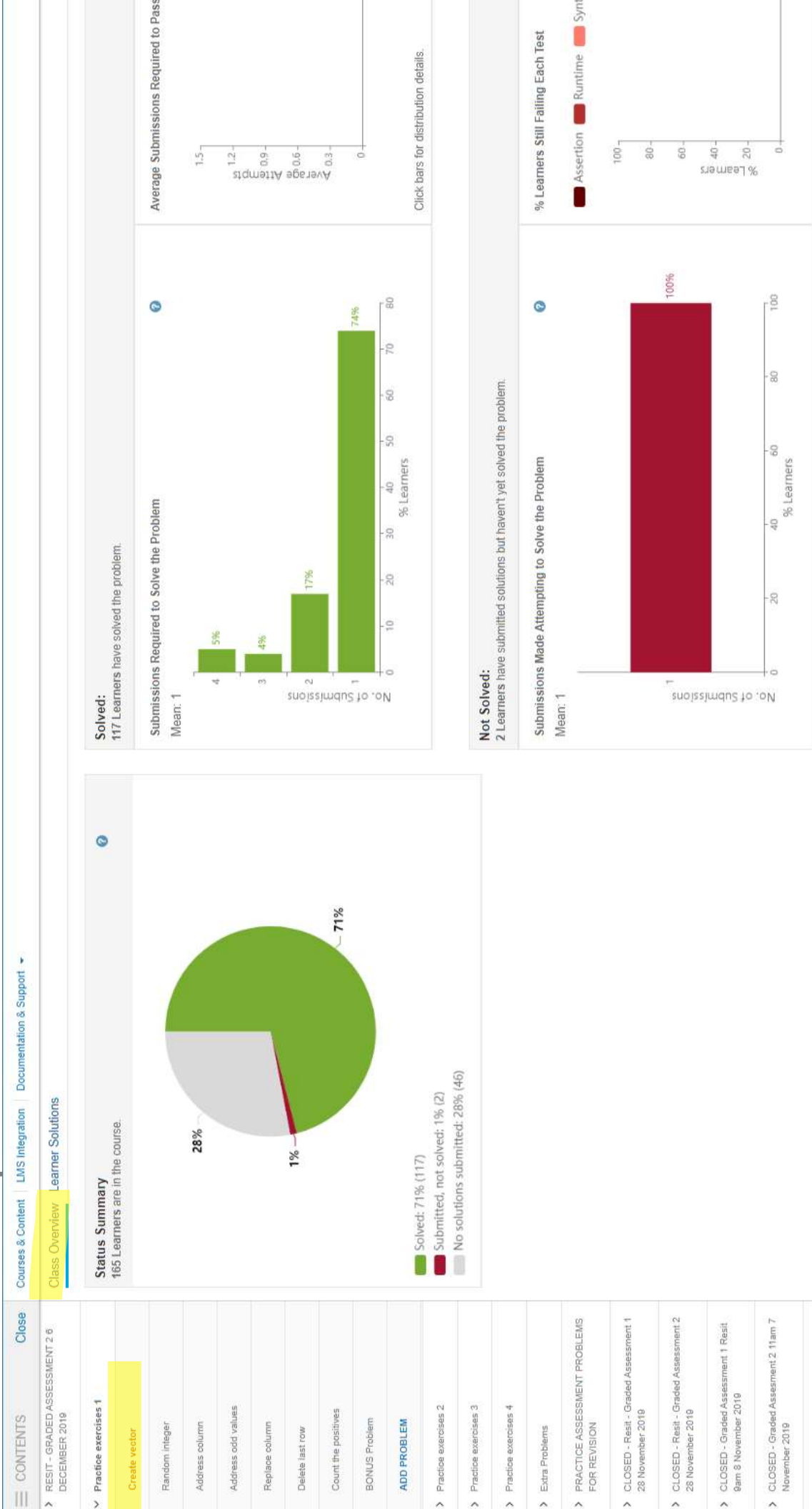
BONUS Problem

ADD PROBLEM

Student Performance Analytics

For each problem...

- # of correct submissions
- # of attempts for each learner



Student Performance Analytics

For each problem...

- Each single solution

CONTENTS	Close
> RESIT - GRADED ASSESSMENT 2 8 DECEMBER 2019	
> Practice exercises 1	
Create vector	
Random integer	
Address column	
Address odd values	
Replace column	
Delete last row	
Count the positives	
BONUS Problem	
ADD PROBLEM	
> Practice exercises 2	
> Practice exercises 3	
> Practice exercises 4	
> Extra Problems	
> PRACTICE ASSESSMENT PROBLEMS FOR REVISION	
> CLOSED - Resit - Graded Assessment 1 28 November 2019	
> CLOSED - Resit - Graded Assessment 2 28 November 2019	
> CLOSED - Graded Assessment 1 Resit 8am 8 November 2019	

Courses & Content	LMS Integration	Documentation & Support
Class Overview	Learner Solutions	
Map View	List View	Date Created (Newest – Oldest)
Search by last name, code or solution ID		

Solution 2: All tests passed
Submitted on 16 Jan 2020 by **Arko Tuisk** | ID: **18422420** | Size: 11

```
1 % Create your expression below, using the variable vec
2
3 vec = linspace(0, 2*pi, 50)
4
```

Solution 1: 0 of 1 test passed
Submitted on 16 Jan 2020 by **Arko Tuisk** | ID: **18422368** | Size: 0

```
1 % Create your expression below, using the variable vec
2
3 vec = linspace(0, 2pi, 50)
4
```

Solution 3: All tests passed
Submitted on 15 Jan 2020 by **Matthew Perry** | ID: **18397958** | Size: 11

```
1 % Create your expression below, using the variable vec
2
3 vec = linspace(0, 2*pi, 50)
4
```

Solution 4: All tests passed
Submitted on 15 Jan 2020 by **Max Brown** | ID: **18398501** | Size: 11

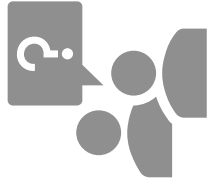
```
1 % Create your expression below, using the variable vec
2
3 vec = linspace(0, 2*pi, 50)
4
```

Solution 3: All tests passed
Submitted on 17 Dec 2019 by **Max Brown** | ID: **18092513** | Size: 11

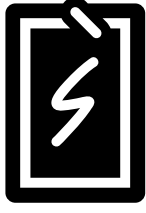
```
1 % Create your expression below, using the variable vec
2
```

Autograded Assessments with MATLAB Grader

What is it?



How does it
work?



Integration
with LMS



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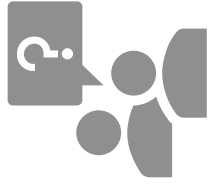


Summary



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Expe



Summary



MATLAB Grader – LMS integration

- MATLAB Grader can be **integrated in your LMS** (e.g. Moodle, Blackboard)
- MATLAB Grader is now part of the Campus Wide Licence for Universities
- LMS integration requires the **LMS administrator** at your University
- Instructions are in our documentation: [LMS Integration](#)
- LTI Certification - MATLAB Grader supports LTI 1.1

Active Certifications

IMS certifications are listed below.



MATLAB Grader
1 VERSION TESTED

LEARNING TOOLS INTEROPERABILITY® (LTI)

- Learning Tools Interoperability (LTI) v1.1
- Learning Tools Interoperability (LTI) v1.0
- LTI Basic Outcomes 1.0

Certified with vMarch 2020
Certified with vMarch 2020
Certified with vMarch 2020

Last updated 3 months ago

Documentation

CONTENTS

Close

Documentation Home

← MATLAB Grader

← Create Courses and Coding Problems

Create a Problem

Create and Manage Courses

Run a Course

Create Content

LMS Integration

LMS Integration

Add problems you create

Integrate MATLAB Grader

add MATLAB problems

MATLAB Grader integration not see your LMS listed

Topics

Integrate MATLAB Grader

Add problems created

Integrate MATLAB Grader

Add problems created

Integrate MATLAB Grader

















Add problems created

Related Information

Select a Problem

Create a Problem

Let's look at an example of MATLAB Grader LMS integration

 My first course
 Participants
 Badges
 Competencies
 Grades
 General
 Topic 1
 Topic 2
 Topic 3
 Topic 4
 Topic 5
 Home
 Dashboard
 Calendar
 Private files
 My courses

My first course

Home / My courses / My first course

 News forum

Topic 1

Topic 2

Topic 3

Topic 4

Topic 5

See

Adv

Lat

Add (No pos

Up

The Go

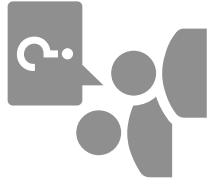
Rec

Act

No

Autograded Assessments with MATLAB Grader

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Summary



Autograded Assessments with MATLAB Grader

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Acad
Expe



Summary



Teaching with MATLAB Grader ... at

Dr. L. Corner and Dr. S. Soldini

- Beginners' **Programming** course (7.5 credits) – 2nd year UG General Engineering (200 students).
- MATLAB Grader timed-problems used as **coursework**:
 - 40 min problems, taken as open-book exam –
- **Multiple submissions** allowed, with pre-tests
- 2 sets of open-book exam with the “**time released**” **feature**

➤ Students solutions downloaded as **.xlsx** or **.m** files to provide feedback

➤ Marks transferred by Hand to VLE - Collaborating with MathWorks to complete LMS integration

The screenshot displays the MATLAB Grader interface for the University of Liverpool. The top navigation bar includes the University of Liverpool logo and the 'Assessment' tab. The main content area is divided into several sections: 'Build Content', 'Assessments', 'Project upload', 'Mini-project assessment', and 'On-ramp certificate'. The 'Project upload' section includes a file upload icon and a note about the deadline. The 'Mini-project assessment' section includes a folder icon and a note about the assessed mini-project. The 'On-ramp certificate' section includes a certificate icon and a note about the certificate of completion. The bottom right corner shows a table of test results with columns for Solution, D, E, F, and Tests Pass Total Test Submissions.

Solution	D	E	F	Tests Pass	Total Test Submissions
load RaceResults.datRaceTimes = RaceResults(2:5);Mean				5	5
load RaceResults.datDataFile=RaceResultsRaceTimes= [5	5
Results = load('RaceResults.dat')RaceTimes = Results([2				5	5
Results = open('RaceResults.dat')RaceTimes = Results(2				0	5
load RaceResults.datRaceTimes = (RaceResults(2:5))Mean				5	5
load RaceResults.datRaceTimes=[RaceResults(2:5)]Mean				5	5
load RaceResults.datRaceTimes=RaceResults(2:5);MeanT				5	5
load RaceResults.datM = RaceResults.dat;x= M(1,:);y= M(:,				0	5
load RaceResults.dat RaceTimes=a(2,5);MeanTime=mean				0	5
Race = load('RaceResults.dat')RaceTimes = Race(:,2:5);M				5	5
fileID = load('RaceResults.dat');				1	5
load RaceResults.datM = RaceResultsRaceTimes = M(2:e				3	5

MATLAB Grader trial... at

Dr. Edward Tart, School of Engineering



UNIVERSITY OF
BIRMINGHAM

Current Phasor

- **Introduction to MATLAB** course for whole School of Engineering – 1st year (>300 students)

- Two applications this year:

- A **formative exercise** carried out in class campus
- A timed **summative exercise** carried out remotely

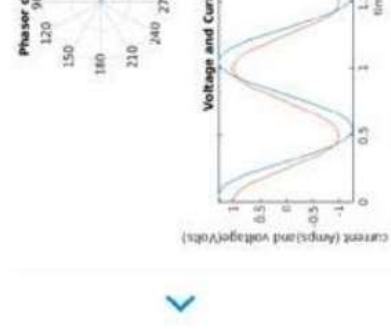
- **Advantages:**

- Rapid feedback and marking for a cohort of this size.
- Students did not need to have MATLAB installed on their machines.

- **Helpful tips:**

- Clear direction to the students to use the same variable names as Grader.
- Clear directions to students as to how you want a problem solved if there is more than one approach.

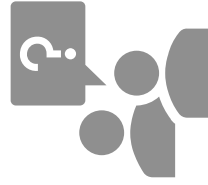
> Is input voltage correct? (Pretest)
> Is input frequency correct? (Pretest)
> Is Zreal correct? (Pretest)
> Is Zimag correct? (Pretest)
> Is complex impedance correct? (Pretest)
> Is current phasor correct?
> Is time correct? (Pretest)
> Is time dependent voltage correct? (Pretest)
> Is time dependent current correct? (Pretest)
> Is subplot, xlabel, ylabel and title present?
> Is subplot(2,1,1) correct? (Pretest)
> Is subplot(2,1,2) correct? (Pretest)



Output from ref

Autograded Assessments with MATLAB Grader

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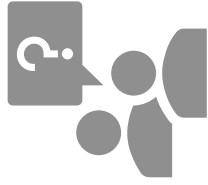


Summary



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Summary



MATLAB Grader



Create interactive course assignments



Reusable problem collection



Automatically grade student work and provide feedback



Run your assignments on any learning device

<https://grader.mathworks.com>

Teaching with MATLAB

Engage your students and scale your instruction with online learning tools from MathWorks

[Launch the course](#)



Access to MATLAB through your web browser

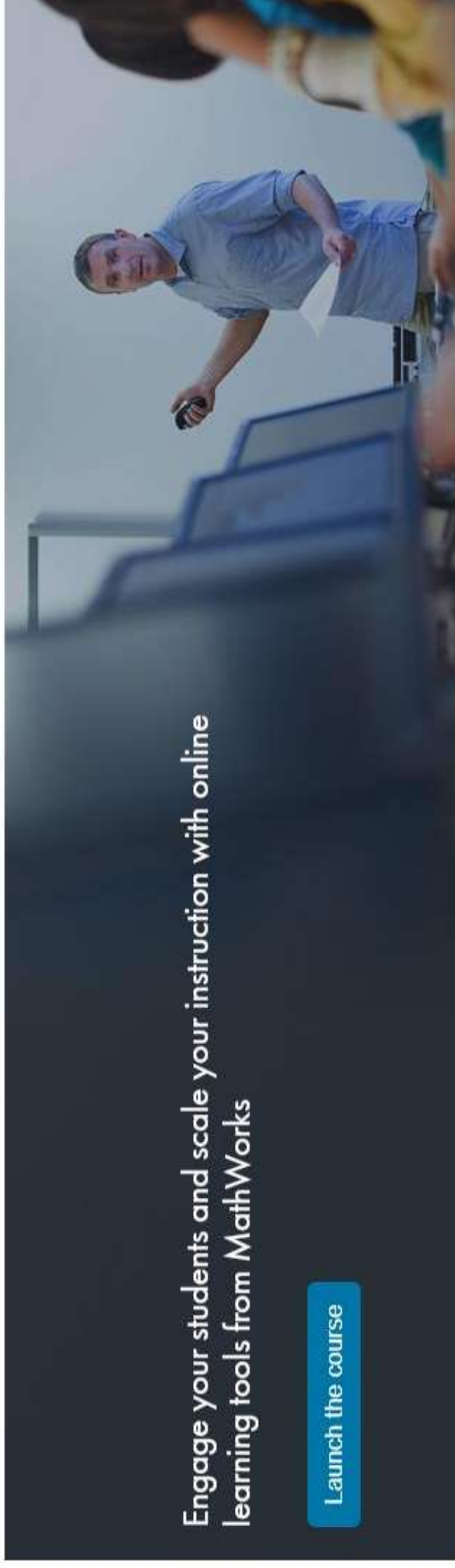


MATLAB integrated file sharing



Hands-on exercises with automated assessments and feedback

Ready-to-use



THANKS FOR YOUR ATTENTION!

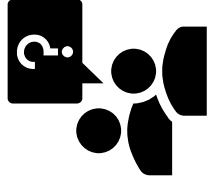
Any questions?

https://www.mathworks.com/support/contact_us
EMEAseries@mathworks.com

Dr. Sheila Scialanga and Dr. Martina Sciola
MathWorks Academia Team

Autograded Assessments with MATLAB Grader

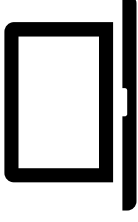
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