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Reflections on using Maple T.A. for summative assessment

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Outline

- Mathematical Sciences at Essex
- How and why MapleTA
- Real world experiences and reflections
- Questions

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Some History…

Mathematical Sciences at Essex

- Why MapleTA
  - It allowed us to start working in an environment we were already familiar with;
  - It allows for an effectively limitless number of questions for students to attempt;
  - Students received instant feedback and staff could see a detailed breakdown of each student's work.

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How we use MapleTA

- Summative and formative homework assignments on several first and third year modules;
- MapleTA allows students multiple attempts at homework assignments;
- What about when there are problems?
- The impact on marking.

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Real world experiences and reflections

Getting Going with Maple TA

- Learning curve for Maple TA development
- Maintenance of Algorithms over time and Maple TA upgrades.
- Advantages and limitations in the admin facilities of Maple TA.

An ODE question: student view

second order non-homogeneous linear ODE 2 exp

Find the general solution of

$$\frac{d^2}{dx^2}y(x) - 3\left(\frac{d}{dx}y(x)\right) + 2y(x) = 210e^{-5x}$$

subject to the initial condition that

$$y(x) = 8 \text{ when } x = 0$$

and

$$\frac{d}{dx}y(x) = -29 \text{ when } x = 0$$

and enter your answer in the box below.

You must make sure you only take into account the initial conditions when you have the full solution (complementary function solution plus particular integral).

Algebraic answer required

-7*exp(x)+10*exp(x)+5*exp(-5*x)

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Student's work graded

second order non-homogeneous linear ODE 2 exp

Grade: 0.0

Find the general solution of

$$\frac{d^2}{dx^2}y(x) - 3\left(\frac{d}{dx}y(x)\right) + 2y(x) = 210\,e^{-5x}$$

subject to the initial condition that

$$y(x) = 8 \text{ when } x = 0$$

and

$$\frac{d}{dx}y(x) = -29 \text{ when } x = 0$$

and enter your answer in the box below.

You must make sure you only take into account the intial conditions when you ha… full solution (complementary function solution plus particular integral).

Incorrect

Your Answer: -7*exp(x)+10*exp(x)+5*exp(-5*x)

Correct Answer: -7*exp(2*x)+10*exp(x)+5*exp(-5*x)

Missing "2" in student's answer

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Feedback to the Student

You must make sure you only take into account the intial conditions when you have the full solution (complementary function solution plus particular integral).

Your Answer: -7*exp(x)+10*exp(x)+5*exp(-5*x)

Correct Answer: -7*exp(2*x)+10*exp(x)+5*exp(-5*x)

Step 1 (complementary function):

The auxillary equation is given by

$$m^2 - 3m + 2 = 0$$

which factorises to

$$(m-2)(m-1)$$

Hence the roots are given by 2 and 1 and the general solution is

$$y_c = C_1 e^{(2x)} + C_2 e^x$$

You must NOT take into account the initial conditions at this stage (as we still need to consider the particular integral).

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Feedback to the Student

Step 2 (particular integral):

Since -5 is not a root of the auxillary equation we try a solution of the form

Comment:

$$y_p = A\,\mathrm{e}^{-5x}$$

Plugging this into the differential equation gives

$$42A\,\mathrm{e}^{-5x} = 210\,\mathrm{e}^{-5x}$$

and hence the particular integral is given by

$$y_p = 5\,\mathrm{e}^{-5x}$$

Step 3 (full solution):

The full solution is given by the sum of the complementary equation solution and the particular integral:

$$y(x) = C_1\,\mathrm{e}^{(2x)} + C_2\,\mathrm{e}^{x} + 5\,\mathrm{e}^{(-5x)}$$

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Feedback to the Student

$$y_p = A\,e^{-5x}$$

Plugging this into the differential equation gives

$$42A\,e^{-5x} = 210\,e^{-5x}$$

and hence the particular integral is given by

$$y_p = 5\,e^{-5x}$$

Step 3 (full solution):

The full solution is given by the sum of the complementary equation solution and the particular integral:

$$y(x) = C_1\,e^{(2x)} + C_2\,e^{x} + 5\,e^{(-5x)}$$

which when we take into account the initial conditions gives

$$y(x) = -7\,e^{(2x)} + 10\,e^{x} + 5\,e^{(-5x)}$$

Feedback Done !

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An ODE Question: Devs View

leq	$-15\,A\,e^{-6x} = -120\,e^{-6x}$
leqt2	diff(y(x),`$`(x,2))+10*diff(y(x),x)+9*y(x) = -120*exp(-6*x)
eq	$\frac{d^2}{dx^2}y(x) + 10\left(\frac{d}{dx}y(x)\right) + 9\,y(x) = -120\,e^{-6x}$
ycom	C[1]*exp(-x)+C[2]*exp(-9*x)
soli	-6*exp(-x)-7*exp(-9*x)+8*exp(-6*x)
sol	C[1]*exp(-x)+C[2]*exp(-9*x)+8*exp(-6*x)
mycom	$y_c = C_1\,e^{(-x)} + C_2\,e^{(-9x)}$
msol	$y(x) = C_1\,e^{(-x)} + C_2\,e^{(-9x)} + 8\,e^{(-6x)}$
misol	$y(x) = -6\,e^{(-x)} - 7\,e^{(-9x)} + 8\,e^{(-6x)}$
check	true
aux	$m^2 + 10\,m + 9 = 0$
auxf	$(m+1)\,(m+9)$
m1	-1
m2	-9
m3	-6
yo	$y(x) = -5$

m1,m2,m3 random variables

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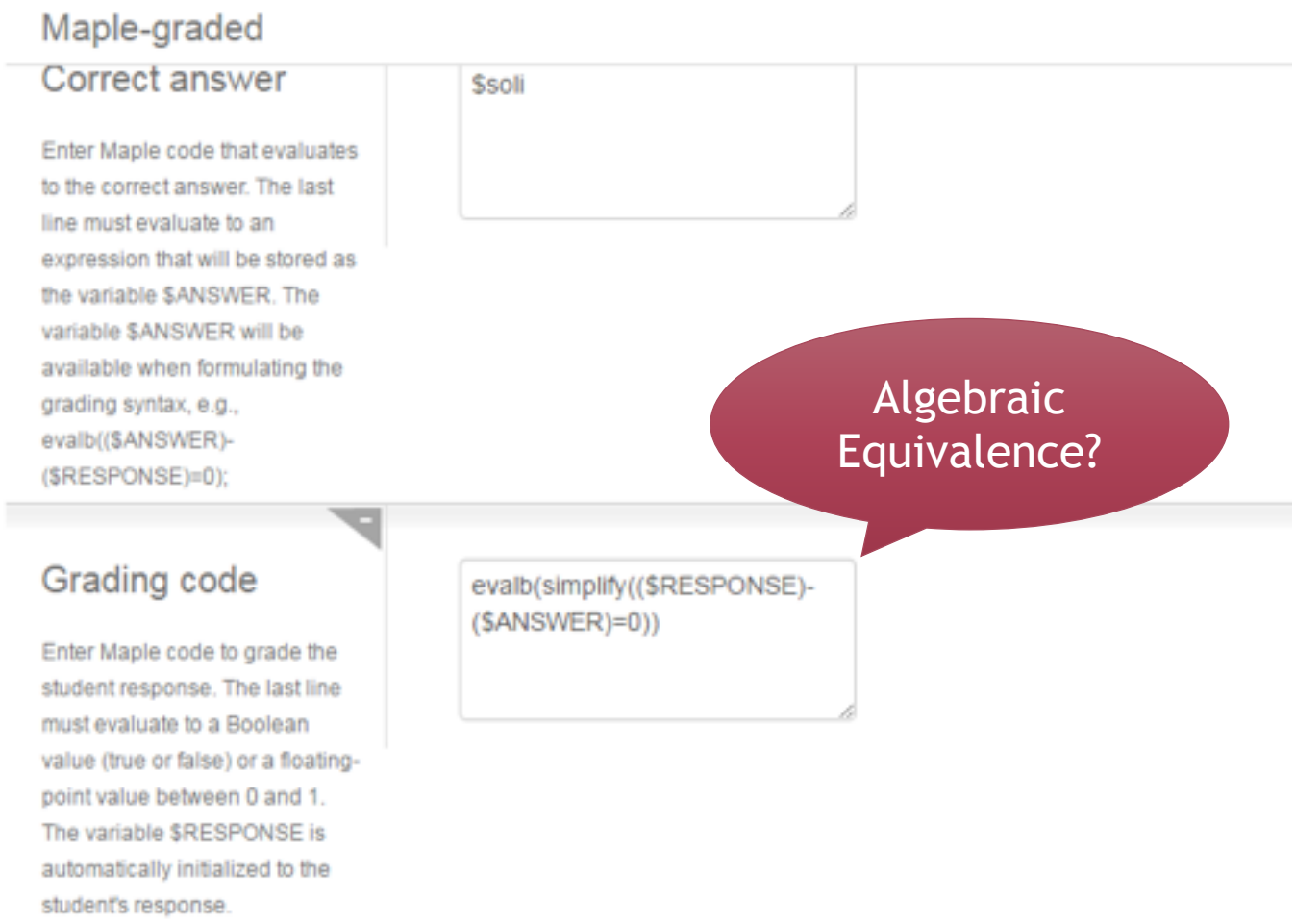
An ODE Question: Devs View



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“simplify”

The Maple command “simplify” is required to check for algebraic equivalence:

```
evalb(simplify(($ANSWER)-
($RESPONSE)=0) ;
```

The “simplify” command in Maple is sophisticated. Alternative software might need this level of sophistication ???

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Students acclimatising to MTA

"...there was a problem with the syntax of your Maple TA homework -- you must write the word "Matrix" every time to input a matrix, e.g., Matrix([[1,0],[0,1]]) for the 2x2 identity"

... from a lecturer's email to a Linear Algebra student .

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What next?

- Implementation in Stats modules and more widely
- Encouraging lecturers to engage

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Any Questions?