

MTH 302: Skill Quiz 10

This quiz contains the **third and final attempt** at Skill DE.3, and the **second appearance** of Skill DE.4.

Instructions:

- If you had a "Success" mark on a skill from the first quiz, **do not do the problem for that skill again**. You only need one "Success" on each skill, then you're done.
- You should only be working on the skills that you **need** to work on (because you've never tried them, or you did and got "Retry") *and* you feel **ready** to work on.
- Make sure to consult the [Standards for Student Work in MTH 302](#) document before starting on your work, so you're clear on what is expected and what constitutes a "successful" attempt. Also check the *Success criteria* below each problem.
- As before, you may hand-write your work on paper, hand-write it in a notes app, or type it up. But **please start a new page for each Skill**. If a Skill takes more than one page, that's OK, but **don't put two skills on the same page**.
- When you are ready to submit your work: **Scan** your handwritten work to a clear, legible, black-and-white PDF using a scanner or scanning app -- **one PDF per problem**. So if you are doing both problems, you will have two PDFs: one for Skill LA.1 and another for Skill LA.2 (all parts).
- Then, **upload each PDF to its designated folder** on Blackboard. For example the PDF for Skill LA.2 goes into the folder for Skill LA.2. **Please make sure you have put your work in the right folder, because work in the wrong folder significantly delays the grading process.**
- Make sure to **click "Submit"** after uploading each item, before exiting.

Foundational Skill DE.3

DE.3: I can generate a numerical solution to a first-order differential equation using Euler's method.

Given the differential equation:

$$\frac{dy}{dt} = -2ty^2$$

Consider the solution with $y(0) = 1$. Using a step size of $h = 0.1$, use Euler's method to estimate $y(0.1)$, $y(0.2)$, $y(0.3)$, $y(0.4)$, and $y(0.5)$.

You must set up all calculations, and clearly show what you are doing. But you may carry out arithmetic calculations using a calculator. **Answers without corresponding calculations shown do not constitute acceptable work.** You **may not** use a spreadsheet on this problem. Carry all approximations out to six (6) decimal places.

Success criteria: The algorithm for Euler's method must be correct. All computations must be clearly set up with all details present. Computations themselves must be correct, with **one** "simple" mistake allowed. (Note this is lower than the usual two "simple" mistakes allowed.) Decimal approximations must be to six decimal places; truncations to anything less than 6 places will be treated as a "simple" error or a non-simple error depending on the severity of the rounding. **Keep computations at six decimal places to avoid errors due to rounding.** For example, 3.141597 is an approximation to six decimal places; 3.14159 is not (that's five decimal places).

Foundational Skill DE.4

DE.4: I can solve a linear system of two differential equations.

Consider the system of differential equations:

$$\frac{dx}{dt} = -9x + 4y$$

$$\frac{dy}{dt} = -6x + y$$

- (a) Find the straight-line solutions for the system.
- (b) State the general solution for the system.
- (b) Find the particular solution satisfying $x(0) = 4, y(0) = -2$.

You may use a computer to do basic arithmetic and eigenvalue/eigenvector computations without needing to show work. All other work must be shown in detail.

Success criteria: The general solution is completely correct. The particular solution is correct with up to two simple errors allowed. All work other than basic arithmetic and eigenvalue/eigenvector computations is shown in detail – this includes any matrix row reduction steps. Producing a row-reduced matrix without all intermediate steps shown will result in a "Retry".