

Term: Winter, 2021

Name: _____

Instructor: Patricia Wrean

Math 252-DX01

Test 2

Total = $\overline{20}$

- **Show your work.** All of the work on this test must be your own. While writing this test, you may not consult any other person, website, or other resource not listed below. If you have a question during the test, you may email me.
- Here is a list of the resources that you are allowed to use during this test:
 - your own notes
 - lecture notes, videos, handouts, practice questions, and practice tests from either my website at <http://wrean.ca/math252> or the Math 252 websites of any of the other instructors linked on the landing page of my site
 - your textbook (Zill), or any of the texts listed on the Textbook page at http://wrean.ca/math252/math252_textbook.htm
 - the Math 252 D2L website
 - the Math 252 WeBWorK online homework site
 - a scientific calculator. You may not use a calculator with graphing capability. If you like, you may use a scientific calculator app like the one at Desmos: <https://www.desmos.com/scientific>
 - a handy reference is the Math 252 Formula Sheet at http://wrean.ca/math252/tests/math252_formula.pdf
 - if you have questions during the test, you may email me
- To submit this test, please use the Dropbox feature in the Assignments tab of D2L. Please assemble your answers into a single PDF or Word document, unless you've made other arrangements with me beforehand. Helpful software:
 - Genius Scan app at <https://www.thegrizzlylabs.com/genius-scan/>
 - CombinePDF at <https://combinepdf.com/>

GOOD LUCK!

1. (4 points) Find a second solution to the following DE, given that $y_1 = x$ is a solution. You may assume that $x > 0$.

$$x^2y'' - x(x+2)y' + (x+2)y = 0$$

2. (6 points) Solve the following DE.

$$y'' + 4y' + 3y = 5e^{-x} + 7$$

3. (6 points) Use variation of parameters to solve the following DE for $x > 0$.

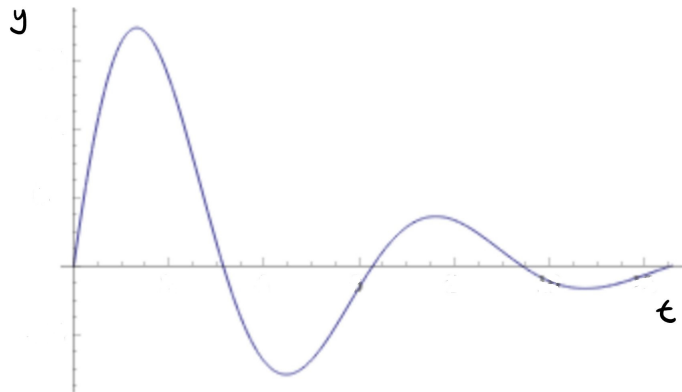
$$x^2 y'' + x y' - 4y = \sqrt{x}$$

4. (4 points) When a mass of 0.25 kg is attached to an ideal spring, the spring stretches by a length of 1.25 m. The mass-spring system is allowed to come to equilibrium, and then set in motion with some initial conditions. The air resistance is proportional to the speed of the mass with damping constant equal to b .

Use 9.8 m/s^2 for the acceleration due to gravity.

- (a) Give the differential equation that shows the relationship between the position $y(t)$ of the mass and the time elapsed t .

- (b) For what numerical values of the damping constant b will $y(t)$ have the shape shown in the graph below? (Don't bother with the units.)



- (c) The motion described by the graph in part (b) is: (choose one)
- (i) overdamped
 - (ii) critically damped
 - (iii) underdamped