I will not violate the University of Toledo Code of Ethics or assist others in doing so, especially by presenting others' work as mine, or allow them to present my work as theirs. **I am better than that** and I take pride in, and responsibility for, my work. I understand that violations of the Code may result in loss of credit for the exam, the course, or even jeopardize my academic standing.

Signed:

Problem	Max	Scored
Exam grade		

- Start the exam only at the proctor's signal.
- Closed books and notes, no brought-in summary sheets, formula sheets, or any such accessories.
- No external paper allowed; if you need extra paper, please ask the proctor for it.
- Only basic sci. calculators allowed; no graphing, matrix, or CAS calculators.
- If needed, use both sides of each sheet for your answers. Clearly indicate where the answer is written, if it is not in the space provided for it.

Question 1

Given the ODE $\dfrac{dy}{dt} = y^2(3 - y)$, fill in the information about the ODE:

(a) Order: _____

(b) Independent variable: _____

(c) Dependent variable: _____

(d) Time-dependence (circle one):

      dependent   —   independent

Question 2

Given the following linear ODE

$$\frac{dy}{dx} + xy(x) = x$$

(a) Calculate the general solution.

(b) Calculate value $y(5)$ of the particular solution that satisfies $y(0) = 2$. (You don't have to calculate the decimal value, just reduce the expression as well as you can.)

Make sure to label and annotate each step to get full credit.

Question 3

The following ODE is potentially linear, separable, and/or exact. It could be neither of the types, but also more than one. Determine **all the types that this ODE belongs to** and show your work for each type in spaces provided below.

$$x^2 \frac{dy}{dx} + 2xy(x) = \sin(x)$$

Linear?

Separable?

Exact?

Question 4

Prove or disprove that the function $y(x)$ is a solution of the ODE:

$$x\frac{dy}{dx} + y = x^2y^2 \qquad y(x) = \frac{1}{-x^2 + x}$$

Explain how your calculation will work **before** you get into the weeds of calculations.