Differential Equations **Homework 3** **Name:**
MWF 10-10:50 or MWF 11-11:50

Show your work! Answers without supporting work will not be given credit. Print this assignment and write your work in the spaces provided.

1. On a clear and calm day, a diver weighing 80 kg falls downward from altitude of 1500 m and opens the parachute after 10 sec of free fall. Assume that the vertical force of drag for free fall is $8|v|$ and vertical force of drag when parachute is open is $100|v|$. [1]

   (a) What is the ode and the initial value that represents the velocity of the free fall?

   ode:

   $v(0) =$

   (b) Solve the IVP in part (a). $v(t) =$

   (c) What is the speed of skydiver at the time the parachute opens? $v(10) =$

   (d) How far has the skydiver traveled before the parachute opens? [2] $d(10) =$

   (e) What is the ode and the initial value that represents the velocity of skydiver after the parachute opens? [3]

   ode:

   Initial Value:

   (f) What is the velocity of the skydiver t seconds after the parachute opens?

   $v(t) =$

   (g) What is the terminal velocity after the parachute opens?

   $V_{Terminal} =$

   (h) Should the skydiver waited longer to open the parachute?

[1] Assume $g = 9.8\ m/s^2$ and the positive direction is upward.
[2] Find the formula for distance using calculus and the formula for velocity in part (b).
[3] You can use reset the timer when parachute opens.

2. Consider the Separable equation: $y' = \dfrac{x^2}{y(1+x^3)}, \quad y(0) = 2, \quad x > -1.$

(a) What is the standard form?

(b) What is the general solution?

(c) What is the explicit solution?

(d) What is the singular solution?

3. Consider the separable IVP $xy' = (1-y^2)^{1/2}$, $y(1) = 0.5$.

(a) What is the standard form?

(b) What is the general solution?

(c) What is the explicit solution?

(d) What are the singular solutions?

4. Consider the Separable IVP $y' = \dfrac{2x}{(y + x^2 y)}$, $y(0) = -2$.

(a) What is the standard form?

(b) What is the general solution?

(c) What is the explicit solution?

(d) What is the singular solution?

(e) What is the domain of the explicit solution?

5. Consider ode $\dfrac{xdx}{(x^2+y^2)^{\frac{3}{2}}} + \dfrac{ydy}{(x^2+y^2)^{\frac{3}{2}}} = 0.$

- Determine whether this equation is an Exact ode?

- If the answer is yes in (a), solve the equation.

6. Consider the IVP $(9x^2 + y - 1)dx - (4y - x)dy = 0$, $y(1) = 0$

- Determine whether the equation is an Exact ode?

- If the answer is yes in (a), solve the equation.

7. (**Linear First Order without a closed form solution**.) Solve $ty' - y = t\sin(t)$, $y(2) = 7$ and $t > 0$.