Math 238 Worksheet 1 Name____________________________________

4/6/18 [/15]

Show all your work for full credit. Unsupported answers = reduced points. Clearly identify your answers; use additional paper if necessary.

1. For small, slowly falling objects, the assumption made in the text that the drag force is proportional to the velocity is a good one. For larger, more rapidly falling objects, it is more accurate to assume that the drag force is proportional to the square of the velocity.

(a) Write a differential equation for the velocity of a falling object of mass m if the drag force is proportional to the square of the velocity.

(b) Determine the limiting velocity after a long time.

(c) If $m = 10$ kg,find the drag coefficient so that the limiting velocity is 49 m/s.

[/3]

---

2. Consider the differential equation $dy/dt = ay - b$.

(a) Find the equilibrium solution y_e

(b) Let $Y(t) = y - y_e$; thus $Y(t)$ is the deviation from the equilibrium solution. Find the differential equation satisfied by $Y(t)$.

[/3]

---

3. Determine which of the following equations is a solution to the differential equation:

$t^2 y'' + 5ty' + 4y = 0$

$y_1(t) = t^{-2}\ln(t)$ $y_2(t) = t^{-1}\ln(t)$ $y_3(t) = t^{-2}$

[/2]

---

4. Find the value(s) of r for which the function $y = e^{rt}$ is a solution to the differential equation:
$2y'' + y' - 10y = 0$

[/2]

---

5. Determine the values of r for which $y = t^r$ is a solution to the equation $t^2 y'' - 4ty' + 4y = 0$.

[/3]

---

6. Show that the multivariable equation $u = \left(\frac{\pi}{t}\right)^{1/2} e^{-x^2/(4\alpha^2 t)}$, for $t > 0$, is a solution to the partial differential equation

$\alpha^2 u_{xx} = u_t$.

[/2]
