This sheet does not have room to work on it, so please submit your completed assignment on your own paper. Note that you will also need to submit a Maple printout for the last problem.

1. (8 points)

   (a) Solve the differential equation below. Leave your answer in implicit form.

$$y\frac{dy}{dx} = e^x \sin(x)\sec(y)$$

   (b) Solve the initial value problem below.

$$\begin{cases} y\dfrac{dy}{dx} = e^x \sin(x)\sec(y) \\ y(0) = \pi \end{cases}$$

2. (5 points) construct a linear, first-order differential equation for which all solutions are asymptotic to $y = 3x^2 + 2x - 5$ as $x \to \infty$. Express your answer in standard form, with a $P(x) \neq 0$.

3. (4 points) In class, I solved the initial value problem $\dfrac{dT}{dt} = k\,(T - T_m)$ with $T(0) = T_0$ using separation of variables. Solve the same IVP using an integrating factor.

4. (10 points total) For each of the following differential equations, do three things. Solve the DE, give a largest interval over which your solution is defined, and state any transient terms.

   (a) $y' + 2xy = x^3$

   (b) $y\ dx = (ye^y - 2x)\ dy$

5. (5 points) Find a continuous solution $y = y(x)$ to the initial value problem below.

$$\left(1 + x^2\right)\frac{dy}{dx} + 2xy = f(x), y(0) = 0$$

$$\text{where } f(x) = \begin{cases} x \text{ if } 0 \leq x < 1 \\ -x \text{ if } x \geq 1 \end{cases} .$$

6. (8 points) Do #55 in Section 2.3. For parts (b) and (c), use Maple. You might want to review the following Maple commands in Maple's help: plot, Maximize (and how to load a package).