Math 274 | Quiz 3 | Name: ____________
29 June 2017 | Show Appropriate Work | Scaled to $\boxed{10}$.

We have discussed three types of first order differential equations; separable, linear, and exact. There is exactly one of each below.

1. $\boxed{4}$ Find the explicit general solution of

$$t\frac{dx}{dt} = t^2 - x.$$

$t\frac{dx}{dt} + x = t^2$

$\frac{dx}{dt} + \frac{1}{t}x = t$

$\mu(t) = e^{\int \frac{1}{t}dt} = e^{\ln|t|} = |t|$

we will use $\mu(t) = t$.

$x(t) = \frac{1}{t}\int t^2\,dt = \frac{1}{t}\left(\frac{t^3}{3} + C\right)$

$= \frac{t^2}{3} + \frac{C}{t}$

2. $\boxed{3}$ Find the explicit general solution of

$$\frac{dy}{dx} = y^2 x.$$

$\int \frac{dy}{y^2} = \int x\,dx$

$-\frac{1}{y} = \frac{x^2}{2} + C$

$y = \frac{1}{C - x^2/2} = \frac{2}{C - x^2}$

3. $\boxed{3}$ Find the general solution of

$$\frac{dy}{dx} = \frac{y - \sec^2 x}{e^y - x}.$$

$(e^y - x)dy = (y - \sec^2 x)dx$

$(\sec^2 x - y)dx + (e^y - x)dy = 0$

$\left.\begin{array}{l} \frac{\partial}{\partial y}(\sec^2 x - y) = -1 \\ \frac{\partial}{\partial x}(e^y - x) = -1 \end{array}\right\}$ so exact

$F(x,y) = \tan x - xy + e^y$, so

$\tan x - xy + e^y = C$