0.2.7) $y = e^{rx}$
$y' = re^{rx}$
$y'' = r^2e^{rx}$

$\Rightarrow \underset{\text{Never } 0}{e^{rx}} \underbrace{(r^2+2r-8)}_{\text{Needs to be } 0} = 0$, $r^2+2r-8 = (r+4)(r-2)$.

so this is 0 for $\boxed{r=2,-4}$

1.1.10) Just integrate. $x = C + \frac{t^2}{2} + \int \sin(t^2)\,dt$ but for I.C.,

$\rightsquigarrow$ $\boxed{x = 20 + \frac{t^2}{2} + \int_0^t \sin(s^2)\,ds}$

or could just have $\boxed{x = 20 + \int_0^t (s + \sin(s^2))\,ds}$.

1.2.4) $f(x,y) = \frac{xy}{\cos x}$ and $\frac{\partial f}{\partial y}(x,y) = \frac{x}{\cos x}$. Also $x_0 = 0$, $y_0 = 1$.

- f is continuous as long as $\cos x \neq 0 \iff x \neq \pm\frac{\pi}{2}, \pm\frac{3\pi}{2}, \ldots$

  Near our I.C. $x_0 = 0$, $y_0 = 1$, we are not at these bad pts so f is continuous near the I.C. $(x_0 = 0, y_0 = 1)$.

- f_y is continuous near the I.C. for the same reason.

Thus Picard's Thm $\Rightarrow$ Implies a solution exists & it is unique.

Thus, it's possible to find a solution ✓

1.3.10) We first read as $y' = \frac{e^{-y}}{x}$ $\xrightarrow{\text{separate}}$ $\frac{dy}{e^{-y}} = \frac{dx}{x}$. $\left(\frac{1}{e^{-y}} \text{ is } e^{+y}\right)$.

Note: $x \neq 0$. Integrating, $\int e^y\,dy = \int \frac{dx}{x}$ $\rightsquigarrow$ $\boxed{e^y = \ln|x| + C}$ General Implicit Soln

I.C. $y(1) = 1 \Rightarrow e^1 = \cancel{\ln|1|}^{\,0} + C$, so $\boxed{C = e}$. Also, since $x = 1$ to start, choose positive branch of $\ln(+x)$.

Thus, $e^y = \ln(x) + e$ $\xrightarrow{\text{undo } e}$ $\boxed{y = \ln(\ln(x) + e)}$.

For inside ln: $x > 0$ and $\ln x + e > 0$ $\Rightarrow$ $\ln x > -e$; $\boxed{x > e^{-e}}$ is our domain.