Instructions: You must show all work to receive full credit for the problems below. You may check your work with a calculator, but answers without work will receive minimal credit. Use exact answers unless the problem starts with decimals or you are specifically asked to round.

1. Solve the first order linear ordinary differential equation $y' + \frac{2}{t}y = te^{-3t}$ by the method of integrating factors.

$$\mu = e^{\int \frac{2}{t}dt} = e^{2\ln t} = t^2$$

$$t^2 y' + 2ty = t^3 e^{-3t}$$

$$(t^2 y)' = \int t^3 e^{-3t} dt$$

+/−	u	dv
+	t^3	e^{-3t}
−	$3t^2$	$-\frac{1}{3}e^{-3t}$
+	$6t$	$\frac{1}{9}e^{-3t}$
−	6	$-\frac{1}{27}e^{-3t}$
	0	$\frac{1}{81}e^{-3t}$

$$t^2 y = \frac{-1}{3}t^3 e^{-3t} - \frac{1}{3}t^2 e^{-3t} - \frac{2}{9}te^{-3t} - \frac{2}{27}e^{-3t} + C$$

$$y = -\frac{1}{3}te^{-3t} - \frac{1}{3}e^{-3t} - \frac{2}{9}\frac{e^{-3t}}{t} - \frac{2}{27}\frac{e^{-3t}}{t^2} + \frac{C}{t^2}$$