(8)

$$\int \frac{\partial}{\partial \eta}(Y_1 e^{\eta}) = \int + \frac{9x^2}{2\alpha^6}(\alpha + x^3)^4 e^{-\eta}\, d\eta$$

$$Y_1 e^{\eta} = -\frac{9x^2}{2\alpha^6}(\alpha + x^3)^4 e^{-\eta}$$

$$Y_1 = -\frac{9x^2(\alpha + x^3)^4}{2\alpha^6} e^{-2\eta}$$

$$y(\varepsilon, x) = \frac{3}{\alpha + x^3} - \frac{3}{\alpha^3}(\alpha + x^3)^2 e^{-x/\varepsilon}$$

$$-\frac{9\varepsilon x^2}{2\alpha^6}(\alpha + x^3)^4 e^{-2x/\varepsilon} + O(\varepsilon^2).$$

(-1) Total (19) / 25

Why did [illegible] need to fit initial conditions to the general soln here?? See model for this.

3) a) when $\varepsilon = 0$ equation reduces to $\ddot{x} + x = 0$ which has a soln $x = a\cos t$ with angular frequency $\omega = 1$. Assume that perturbed soln has angular frequency close to 1 and put $\omega = 1 + \varepsilon\omega_1 + O(\varepsilon^2)$, put also that perturbed soln is close to unperturbed soln so put $x = x_0 + \varepsilon x_1 + O(\varepsilon^2)$, $x_0 = a\cos\tau$, with $\tau = \omega t$.

$$\frac{dx}{dt} = \frac{\partial x}{\partial \tau}\frac{\partial \tau}{dt} = \omega x'$$

$$\frac{d^2x}{dt^2} = \omega x''$$ so modified eqtn becomes

$$\omega^2 x'' + \varepsilon(x^2 - 1)\omega x' + x + \varepsilon\alpha^2 x^3 = 0.$$

$$(1+\varepsilon\omega_1)^2(x_0'' + \varepsilon x_1'') + \varepsilon((x_0 + \varepsilon x_1)^2 - 1)(1 + \varepsilon\omega_1)(x_0' + \varepsilon x_1')$$
$$+ x_0 + \varepsilon x_1 + \varepsilon\alpha^2(x_0 + \varepsilon x_1)^3 + O(\varepsilon^2) = 0$$

$$(1 + 2\varepsilon\omega_1)(x_0'' + \varepsilon x_1'') + \varepsilon(x_0^2 - 1)x_0' + x_0 + \varepsilon x_1$$
$$+ \varepsilon\alpha^2 x_0^3 + O(\varepsilon^2) = 0$$