This is for x_1

```
syms x(t) del0 mu A B
Dx = diff(x);

ode = diff(x,t,2) + del0*diff(x,t) - 2*mu*sin(t)*(A^2 + B^2)/B + A* sin(3*t) + B*cos(3*t) ;

cond1 = x(0) == 0;
cond2 = Dx(0) == 0;

conds = [cond1 cond2];
xSol(t) = dsolve(ode,conds);
xSol = simplify(xSol) ;
```

Now we solve for x2

```
syms y(t) del1 del2

ode2 = diff(y,t,2) + 2*mu* diff(xSol) + del0*y +del1*xSol + del2*(B*cos(t)+A*sin(t)) + 2* xSol*cos(2*t)
```

ode2(t) =

$$\frac{\partial^2}{\partial t^2}\, y(t) + \mathrm{del}_2\,(B\cos(t) + A\sin(t)) + 2\,\mu\,\left(\mathrm{e}^{\mathrm{del}_0\,t}\left(\frac{\sigma_7}{3\,B} + \frac{\cos(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,\sigma_8}{\mathrm{del}_0^{\,2}+9} - \frac{\sin(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,\sigma_9}{\mathrm{del}_0^{\,2}+9} + \frac{\mathrm{del}_0\cos(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,\sigma_9}{\sigma_5} + \frac{\mathrm{del}_0\sin(3}{}\right.\right.$$

where

$$\sigma_1 = B\,\mathrm{del}_0\,\left(\mathrm{del}_0^{\,2}+1\right)\left(\mathrm{del}_0^{\,2}+9\right)$$

$$\sigma_2 = \frac{\sigma_4}{3\,B\,\mathrm{del}_0} + \frac{\cos(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,\sigma_9}{\sigma_5} + \frac{\sin(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,\sigma_8}{\sigma_5} - \frac{2\,\mu\,\mathrm{e}^{\mathrm{del}_0\,t}\sin(t)\,\sigma_7}{\sigma_6} - \frac{2\,\mathrm{del}_0\,\mu\,\mathrm{e}^{\mathrm{del}_0\,t}\cos(t)\,\sigma_7}{\sigma_6}$$

$$\mathrm{e}^{-\mathrm{del}_0\,t}$$

```
ode3 = simplify(ode2)
```

ode3(t) =

$$\mathrm{del}_2\,(B\cos(t) + A\sin(t)) + \cos(2\,t)\left(2\,\mathrm{e}^{-\mathrm{del}_0\,t}\,\sigma_3 - \frac{2\,\mathrm{e}^{-\mathrm{del}_0\,t}\,\sigma_1}{\sigma_2}\right) + \mathrm{del}_0\,y(t) + \mathrm{del}_1\left(\mathrm{e}^{-\mathrm{del}_0\,t}\,\sigma_3 - \frac{\mathrm{e}^{-\mathrm{del}_0\,t}\,\sigma_1}{\sigma_2}\right) + \frac{36\,A^2\,\mu^2\,\mathrm{e}^{-\mathrm{del}_0\,t}+36\,B}{}$$

where

$$\sigma_1 = 2\,\mu\,A^2\,\mathrm{del}_0^{\,2} + 18\,\mu\,A^2 - 3\,A\,B\,\mathrm{del}_0^{\,2} - 3\,A\,B + B^2\,\mathrm{del}_0^{\,3} + 2\,\mu\,B^2\,\mathrm{del}_0^{\,2} + B^2\,\mathrm{del}_0 + 18\,\mu\,B^2$$

$$\sigma_2 = B\,\mathrm{del}_0\,\left(\mathrm{del}_0^{\,2}+1\right)\left(\mathrm{del}_0^{\,2}+9\right)$$

$$\sigma_3 = \frac{\mathrm{e}^{\mathrm{del}_0\,t}\,(6\,\mu\,A^2 - A\,B + 6\,\mu\,B^2)}{3\,B\,\mathrm{del}_0} + \frac{\cos(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,(3\,B + A\,\mathrm{del}_0)}{\sigma_4} + \frac{\sin(3\,t)\,\mathrm{e}^{\mathrm{del}_0\,t}\,(3\,A - B\,\mathrm{del}_0)}{\sigma_4} - \frac{2\,\mu\,\mathrm{e}^{\mathrm{del}_0\,t}\sin(t)\,\sigma_6}{\sigma_5} - \frac{2\,\mathrm{del}_0\,\mu\,\mathrm{e}^{\mathrm{del}_0}}{\sigma_5}$$

$$\sigma_4 = 3\,\left(\mathrm{del}_0^{\,2}+9\right)$$

$$\sigma_5 = B\,\left(\mathrm{del}_0^{\,2}+1\right)$$

$$\sigma_6 = A^2 + B^2$$

```
e1 = coeffs(ode2,cos(t),"All")
```

e1(t) =

$$\left(B\,\text{del}_2 - 2\,\mu\,\left(e^{-\text{del}_0\,t}\,\left(\frac{2\,\mu\,e^{\text{del}_0\,t}\,\sigma_5}{\sigma_4} + \frac{2\,\text{del}_0^2\,\mu\,e^{\text{del}_0\,t}\,\sigma_5}{\sigma_4} \right) - \frac{2\,\text{del}_0^2\,\mu\,\sigma_5}{\sigma_4} \right) - \frac{4\,\text{del}_0\,\mu\,\cos(2\,t)\,\sigma_5}{\sigma_4} - \frac{2\,\text{del}_0\,\text{del}_1\,\mu\,\sigma_5}{\sigma_4} \right) \frac{\partial^2}{\partial t^2}\,y(t) + \cos$$

where

$$\sigma_1 = B\,\text{del}_0\,\left(\text{del}_0^2 + 1 \right)\left(\text{del}_0^2 + 9 \right)$$

$$\sigma_2 = \frac{\sigma_6}{3\,B\,\text{del}_0} + \frac{\cos(3\,t)\,e^{\text{del}_0\,t}\,\sigma_9}{\sigma_7} + \frac{\sin(3\,t)\,e^{\text{del}_0\,t}\,\sigma_8}{\sigma_7} - \frac{2\,\mu\,e^{\text{del}_0\,t}\,\sin(t)\,\sigma_5}{\sigma_4}$$

$$^{-\text{del}_0\,t}$$

```
e2 = coeffs(ode2,sin(t),"All")
```

e2(t) =

$$\left(A\,\text{del}_2 + \frac{4\,\text{del}_0\,\mu^2\,\sigma_5}{\sigma_4} - \frac{4\,\mu\,\cos(2\,t)\,\sigma_5}{\sigma_4} - \frac{2\,\text{del}_1\,\mu\,\sigma_5}{\sigma_4} \right) \frac{\partial^2}{\partial t^2}\,y(t) + 2\,\mu\,\left(e^{-\text{del}_0\,t}\,\left(\frac{\sigma_6}{3\,B} + \frac{\cos(3\,t)\,e^{\text{del}_0\,t}\,\sigma_8}{\text{del}_0^2 + 9} - \frac{\sin(3\,t)\,e^{\text{del}_0\,t}\,\sigma_9}{\text{del}_0^2 + 9} + \text{del}_0\,\text{co} \right. \right.$$

where

$$\sigma_1 = B\,\text{del}_0\,\left(\text{del}_0^2 + 1 \right)\left(\text{del}_0^2 + 9 \right)$$

$$\sigma_2 = \frac{\sigma_6}{3\,B\,\text{del}_0} + \frac{\cos(3\,t)\,e^{\text{del}_0\,t}\,\sigma_9}{\sigma_7} + \frac{\sin(3\,t)\,e^{\text{del}_0\,t}\,\sigma_8}{\sigma_7} - \frac{2\,\text{del}_0\,\mu\,e^{\text{del}_0\,t}\,\cos(t)\,\sigma_5}{\sigma_4}$$

$$^{-\text{del}_0\,t}$$