

Exercises 20-24 (evens) from Section 3.5 (use these as a template to solve the odd numbered exercises)

Go through each line and press "Enter" (anywhere on the line) to execute that command. Or, press the button: !!! above to execute all commands.

> Eqn20:=diff(y(t),t\$2)+y(t)=t*(1+sin(t));

$$Eqn20 := \frac{d^2}{dt^2} y(t) + y(t) = t (1 + \sin(t)) \quad (1)$$

> dsolve(Eqn20);

$$y(t) = \sin(t) _C2 + \cos(t) _C1 + t + \frac{1}{4} \cos(t) + \frac{1}{4} t \sin(t) - \frac{1}{4} \cos(t) t^2 \quad (2)$$

> Eqn22:=diff(y(t),t\$2)+2*diff(y(t),t)+2*y(t)=3*exp(-t)+2*exp(-t)*cos(t)+4*exp(-t)*t^2*sin(t);

$$Eqn22 := \frac{d^2}{dt^2} y(t) + 2 \left(\frac{d}{dt} y(t) \right) + 2 y(t) = 3 e^{-t} + 2 e^{-t} \cos(t) + 4 e^{-t} t^2 \sin(t) \quad (3)$$

> dsolve(Eqn22);

$$y(t) = e^{-t} \sin(t) _C2 + e^{-t} \cos(t) _C1 + \frac{1}{3} \left((3 t + 3 t^2) \sin(t) + 9 + (3 + 3 t - 2 t^3) \cos(t) \right) e^{-t} \quad (4)$$

> Eqn24:=diff(y(t),t\$2)+4*y(t)=t^2*sin(2*t)+(6*t+7)*cos(2*t);

$$Eqn24 := \frac{d^2}{dt^2} y(t) + 4 y(t) = t^2 \sin(2 t) + (6 t + 7) \cos(2 t) \quad (5)$$

> dsolve(Eqn24);

$$y(t) = \sin(2 t) _C2 + \cos(2 t) _C1 + \frac{1}{96} (39 t + 84 - 8 t^3) \cos(2 t) + \frac{13}{16} \sin(2 t) t \left(t + \frac{28}{13} \right) \quad (6)$$

Exercise 29 is below as a sample for Exercise 30.

First, solve the IVP for time running from 0 to pi:

> Eqn29:=diff(y(t),t\$2)+y(t);

$$Eqn29 := \frac{d^2}{dt^2} y(t) + y(t) \quad (7)$$

> Y1:=dsolve({Eqn29=t, y(0)=0, D(y)(0)=1},y(t));

$$Y1 := y(t) = t \quad (8)$$

> Y2:=rhs(Y1);

$$Y2 := t \quad (9)$$

Now get the initial value for the second part of the equation:

> Y3:=subs(t=Pi,Y2); Y4:=subs(t=Pi,diff(Y2,t));

$$Y3 := \pi$$

$$Y4 := 1$$

(10)

> **Y4:=dsolve({Eqn29=Pi*exp(Pi-t),y(Pi)=Y3, D(y)(Pi)=Y4 },y(t));**

$$Y4 := y(t) = \sin(t) \left(-1 - \frac{1}{2} \pi \right) - \frac{1}{2} \cos(t) \pi + \frac{1}{2} \pi e^{\pi-t}$$

(11)

> **Y5:=rhs(Y4);**

$$Y5 := \sin(t) \left(-1 - \frac{1}{2} \pi \right) - \frac{1}{2} \cos(t) \pi + \frac{1}{2} \pi e^{\pi-t}$$

(12)

Plot F- It is defined piecewise (note the condition comes first, then the formula)

> **F:=piecewise(t<=Pi, Y2, t>Pi, Y5);**

$$F := \begin{cases} t & t \leq \pi \\ \sin(t) \left(-1 - \frac{1}{2} \pi \right) - \frac{1}{2} \cos(t) \pi + \frac{1}{2} \pi e^{\pi-t} & \pi < t \end{cases}$$

(13)

> **plot(F,t=0..10);**

