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[ > restart:
[ > # problem 1
[ > # we will use exp(it) instead of cosine, and at the end take real parts
[ > y:=K*exp(I*t);
                                     y := K exp(I t)
[ > eq:=diff(y,t,t)+3*diff(y,t)+2*y=exp(I*t);
                                     eq := K exp(I t) + 3 I K exp(I t) = exp(I t)
[ > K:=solve(eq,K);
                                     K := 1/10 - 3/10 I
[ > r:=abs(K);
                                     r := 1/10 sqrt(10)
[ > phi:=argument(K);
                                     phi := -arctan(3)
[ > Y:=r*exp(phi*I)*exp(I*t);
                                     Y := 1/10 sqrt(10) exp(-I arctan(3)) exp(I t)
[ > Y:=combine(Y);
                                     Y := 1/10 sqrt(10) exp(-I arctan(3) + I t)
[ > assume(t,real);
[ > Yr:=Re(Y);
                                     Yr := 1/10 sqrt(10) cos(-arctan(3) + t~)
[ > # the above is the answer; the tilde is a Maple notation to indicate that
[ > # Maple knows that t is real (instead of an abstract variable)
[ > # let us now test if the answer is right
[ > test:=simplify(diff(Yr,t,t)+3*diff(Yr,t)+2*Yr)-cos(t);
[ >
                                     test := 1/10 sqrt(10) cos(-arctan(3) + t~) - 3/10 sqrt(10) sin(-arctan(3) + t~) - cos(t~)
[ > # hmm, this doesn't look like zero; so let us use some Maple magic
[ > expand(test,trig);
                                     0
[ > # yep, it checks! :)
[ > # problem 3
[ > Yi:=Im(Y);
                                     Yi := 1/10 sqrt(10) sin(-arctan(3) + t~)
[ > # the above is the answer
[ > test:=simplify(diff(Yi,t,t)+3*diff(Yi,t)+2*Yi)-sin(t);
                                     test := 1/10 sqrt(10) sin(-arctan(3) + t~) + 3/10 sqrt(10) cos(-arctan(3) + t~) - sin(t~)
[ > expand(test,trig);
                                     0
[ > restart:
[ > # problem 5
[ > y:=K*exp(I*t);
                                     y := K exp(I t)
[ > eq:=diff(y,t,t)+6*diff(y,t)+8*y=exp(I*t);
                                     eq := 7 K exp(I t) + 6 I K exp(I t) = exp(I t)
[ > K:=solve(eq,K);
                                     K := 7/85 - 6/85 I
[ > r:=abs(K);
                                     r := 1/85 sqrt(85)
[ > phi:=argument(K);

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[
[ > Y:=r*exp(phi*I)*exp(I*t);
[ > Y:=combine(Y);
[ > assume(t,real);
[ > Yr:=Re(Y);
[ > test:=simplify(diff(Yr,t,t)+6*diff(Yr,t)+8*Yr)-cos(t);
[ > expand(test,trig);
[ > restart;
[ > # problem 7
[ > y:=K*exp(2*I*t);
[ > eq:=diff(y,t,t)+4*diff(y,t)+13*y=3*exp(2*I*t);
[ > K:=solve(eq,K);
[ > r:=abs(K);
[ > phi:=argument(K);
[ > Y:=r*exp(phi*I)*exp(2*I*t);
[ > Y:=combine(Y);
[ > assume(t,real);
[ > Yr:=Re(Y);
[ > test:=simplify(diff(Yr,t,t)+4*diff(Yr,t)+13*Yr)-3*cos(2*t);
[ > expand(test,trig);
[ > restart;
[ > # problem 9
[ > y:=K*exp(2*I*t);
[ > eq:=diff(y,t,t)+4*diff(y,t)+20*y=-3*exp(2*I*t);
[ > K:=solve(eq,K);
[ > r:=abs(K);
[

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$$\text{phi} := -\arctan(6/7)$$

$$Y := 1/85 \sqrt{85} \exp(-I \arctan(6/7)) \exp(I t)$$

$$Y := 1/85 \sqrt{85} \exp(-I \arctan(6/7) + I t)$$

$$Yr := 1/85 \sqrt{85} \cos(-\arctan(6/7) + t)$$

$$\text{test} := 7/85 \sqrt{85} \cos(-\arctan(6/7) + t) - 6/85 \sqrt{85} \sin(-\arctan(6/7) + t) - \cos(t)$$

$$0$$

$$y := K \exp(2 I t)$$

$$\text{eq} := 9 K \exp(2 I t) + 8 I K \exp(2 I t) = 3 \exp(2 I t)$$

$$K := \frac{27}{145} - \frac{24}{145} I$$

$$r := 3/145 \sqrt{145}$$

$$\text{phi} := -\arctan(8/9)$$

$$Y := 3/145 \sqrt{145} \exp(-I \arctan(8/9)) \exp(2 I t)$$

$$Y := 3/145 \sqrt{145} \exp(-I \arctan(8/9) + 2 I t)$$

$$Yr := 3/145 \sqrt{145} \cos(-\arctan(8/9) + 2 t)$$

$$\text{test} := \frac{27}{145} \sqrt{145} \cos(-\arctan(8/9) + 2 t) - \frac{24}{145} \sqrt{145} \sin(-\arctan(8/9) + 2 t) - 3 \cos(2 t)$$

$$0$$

$$y := K \exp(2 I t)$$

$$\text{eq} := 16 K \exp(2 I t) + 8 I K \exp(2 I t) = -3 \exp(2 I t)$$

$$K := -3/20 + 3/40 I$$

$$r := 3/40 \sqrt{5}$$

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[ > phi:=argument(K);
                                     phi := -arctan(1/2) + Pi
[ > Y:=r*exp(phi*I)*exp(2*I*t);
                                     Y := 3/40 sqrt(5) exp(I (-arctan(1/2) + Pi)) exp(2 I t)
[ > Y:=combine(Y);
                                     Y := 3/40 sqrt(5) exp(I (-arctan(1/2) + Pi) + 2 I t)
[ > assume(t,real);
[ > Yi:=Im(Y);
                                     Yi := - 3/40 sqrt(5) sin(-arctan(1/2) + 2 t~)
[ > test:=simplify(diff(Yi,t,t)+4*diff(Yi,t)+20*Yi)+3*sin(2*t);
                                     test := - 6/5 sqrt(5) sin(-arctan(1/2) + 2 t~) - 3/5 sqrt(5) cos(-arctan(1/2) + 2 t~) + 3 sin(2 t~)
[ > expand(test,trig);
                                     0
[ >

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