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1.5.1 Differential Equations

> restart

1.20A

> deqnA := diff(x(t), t) + 7 · x(t) = 5 · cos(2 · t)

$$\text{deqnA} := \frac{d}{dt} x(t) + 7 x(t) = 5 \cos(2 t) \quad (1)$$

> solA = simplify(dsolve({deqnA, x(0) = 0}, [x(t)]));

$$\text{solA} = \left(x(t) = \frac{35 \cos(2 t)}{53} + \frac{10 \sin(2 t)}{53} - \frac{35 e^{-7 t}}{53} \right) \quad (2)$$

1.20B

> deqnB := diff(x(t), t\$2) + 6 · diff(x(t), t) + 8 · x(t) = 5 · sin(t)

$$\text{deqnB} := \frac{d^2}{dt^2} x(t) + 6 \left(\frac{d}{dt} x(t) \right) + 8 x(t) = 5 \sin(t) \quad (3)$$

> solB = simplify(dsolve({deqnB, x(0) = 0, (D)(x)(0) = 0}, [x(t)]))

$$\text{solB} = \left(x(t) = -\frac{5 e^{-4 t}}{34} - \frac{6 \cos(t)}{17} + \frac{7 \sin(t)}{17} + \frac{e^{-2 t}}{2} \right) \quad (4)$$

1.20C

> deqnC := diff(x(t), t\$2) + 8 · diff(x(t), t) + 25 · x(t) = 10 · Heaviside(t)

$$\text{deqnC} := \frac{d^2}{dt^2} x(t) + 8 \left(\frac{d}{dt} x(t) \right) + 25 x(t) = 10 \text{Heaviside}(t) \quad (5)$$

> solC = simplify(dsolve({deqnC, x(0) = 9, (D)(x)(0) = 0}, [x(t)]))

$$\text{solC} = \left(x(t) = -\frac{2 \left(\text{Heaviside}(t) - \frac{45}{2} \right) \left(\cos(3 t) + \frac{4 \sin(3 t)}{3} \right) e^{-4 t}}{5} + \frac{2 \text{Heaviside}(t)}{5} \right) \quad (6)$$

1.21A

> deqn21A := diff(x(t), t\$2) + 2 · diff(x(t), t) + 2 · x(t) = sin(2 · t)

$$\text{deqn21A} := \frac{d^2}{dt^2} x(t) + 2 \left(\frac{d}{dt} x(t) \right) + 2 x(t) = \sin(2 t) \quad (7)$$

> sol21A = simplify(dsolve({deqn21A, x(0) = 2, (D)(x)(0) = -3}, [x(t)]));

$$\text{sol21A} = \left(x(t) = \frac{(22 \cos(t) - 6 \sin(t)) e^{-t}}{10} - \frac{\cos(2 t)}{5} - \frac{\sin(2 t)}{10} \right) \quad (8)$$

1.21B

> deqn21B := diff(x(t), t\$2) + 2 * (diff(x(t), t)) + x(t) = 5 · exp(-2 · t) + t;

$$deqn21B := \frac{d^2}{dt^2} x(t) + 2 \left(\frac{d}{dt} x(t) \right) + x(t) = 5 e^{-2t} + t \quad (9)$$

$$\begin{aligned} &> sol21B = simplify(dsolve(\{deqn21B, x(0) = 2, (D(x))(0) = 1\}, [x(t)])) \\ &sol21B = (x(t) = (9t - 1) e^{-t} + t - 2 + 5 e^{-2t}) \end{aligned} \quad (10)$$

1.21C

$$\begin{aligned} &> deqn21C := diff(x(t), t\$2) + 4 \cdot x(t) = t^2 \\ &deqn21C := \frac{d^2}{dt^2} x(t) + 4 x(t) = t^2 \end{aligned} \quad (11)$$

$$\begin{aligned} &> sol21C = simplify(dsolve(\{deqn21C, x(0) = 1, (D(x))(0) = 2\}, [x(t)])) \\ &sol21C = \left(x(t) = \sin(2t) + \frac{9 \cos(2t)}{8} + \frac{t^2}{4} - \frac{1}{8} \right) \end{aligned} \quad (12)$$

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