

REVIEW FOR MIDTERM EXAM 1

Chapter 1 - Hints and Solutions

- (1) Answer: (a) $P'(t) = \frac{1}{5}P(t) - 10$, (b) $P(t) = -10e^{t/5} + 50$, (c) $t_1 = 5 \ln(5)$.
- (2) Answer for (c): $P(t) = 500 + 100e^{t/5}$.
- (3) Partial Answer: $y_3(t) = 4 + 8t^4 + 8t^8 + \frac{16}{3}t^{12}$.
- (4) Answer: $y(t) = \left(-8 \sin(t) + \frac{7}{4} \cos(4t) + c\right)^{-1}$
- (5) Answer for (c): $P(t) = 3 + 67e^{-2t}$.
- (6) Answer: $y(t) = \left(\frac{16}{7} \sin(7t) + \frac{1}{4}\right)^{-1/2}$
- (7) Answer: $y(t) = \frac{3}{4}t^2(1 - \sin(4t))$
- (8) Answer to a portion of (b): critical pts: -2 (unstable), 0 (stable) , 2 (unstable).
- (9) Answer: $y(t) = \frac{8}{\cos(t)} - 5t \tan(t) - 5$
- (10) Answer: $y(t) = t \left(\frac{17}{2}t^6 - \frac{1}{2}\right)^{1/3}$.
- (11) Answer: (a) $T' = -k(T - 30)$; (b) $T(t) = 30 - 28e^{-kt}$; (c) $k = \frac{1}{40} \ln\left(\frac{7}{5}\right)$.

Review for Chapter 2 - Hints and Solutions

- (1) Answer: $E = (y')^2 + \frac{3}{2}y^2$; $y_{max} = \sqrt{15}$.
- (2) Answer: $y(t) = c_1 e^{4t} + c_2 t e^{4t}$.
- (3) Answer: $y(t) = \frac{8}{3}e^{4t} - \frac{23}{3}e^t$.
- (4) Answer: $y(t) = -2e^{4t} \cos(4t) + e^{4t} \sin(4t)$.
- (5) Answer: $y(t) = -\frac{13}{2}e^{5t} + 11e^{3t} + \frac{4}{8}e^t$.
- (6) Answer: $y(t) = c_1 e^{4t} + c_2 e^{2t} - \frac{3}{2} t e^{2t}$.
- (7) Answer: $y(t) = c_1 e^{3t} + c_2 t e^{3t} + 2 t^2 e^{3t}$.
- (8) Answer: $y(t) = c_1 e^{4t} + c_2 e^{6t} - \frac{3}{40}(\cos(2t) + \sin(2t))$.

Review for Chapter 3 - Hints and Solutions

(1) Answer: $Y(s) = \frac{-5(s+3) - 19}{(s+3)^2 + 1}$, $y(t) = -5e^{-3t} \cos(t) - 19e^{-3t} \sin(t)$.

(2) Answer: $y(t) = 5u(t-3) \cdot (t-3)e^{4(t-3)}$.

(3) Answer: $H(s) = \frac{1}{(s-2)^2 + 4^2}$, $h(t) = e^{2t} \frac{\sin(4t)}{4}$.

(4) Answer: $\mathcal{L}[f](s) = e^{-3s} \left(\frac{2}{s^3} - \frac{2}{s} \right)$.

(5) Answer: $Y(s) = \frac{5e^{-3s}}{(s+3)(s^2-7s+12)}$, $y(t) = 5u(t-3) \left(-\frac{1}{6}e^{3(t-3)} + \frac{1}{42}e^{-3(t-3)} + \frac{1}{7}e^{4(t-3)} \right)$.

(6) Answer: $y(t) = -5u(t-9) \left(\frac{1}{4} + \frac{e^{4(t-9)}}{12} - \frac{e^{t-9}}{3} \right)$.

(7) Answer: $y(t) = \frac{e^{25}}{5} u(t-5) (e^{6(t-5)} - e^{t-5})$.

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7:30 - 9:00 pm