

ANSWER KEY

1. A

2. B

3. D

4. B

5. B

6. A

7.  $f(t) = (1 - u_5(t))(\pi - t^2) + u_5(t)(4e^{-2t})$

$$F(s) = \frac{\pi}{s} - \frac{2}{s^3} + e^{-5s} \left( \frac{4e^{-10}}{s+2} + \frac{2}{s^3} + \frac{10}{s^2} + \frac{25-\pi}{s} \right)$$

8.  $y(t) = u_2(t) \left( \frac{-1}{4} + \frac{1}{5} e^{-t+2} + \frac{1}{20} e^{4t-8} \right) - u_6(t) \left( \frac{-1}{4} + \frac{1}{5} e^{-t+6} + \frac{1}{20} e^{4t-24} \right)$

9. (a)  $x(t) = \begin{pmatrix} 8 \\ -8 \end{pmatrix} e^{-2t} + \begin{pmatrix} -8 \\ 12 \end{pmatrix} e^{-4t}$

(b) It is a node, asymptotically stable (i.e. it is a *nodal sink*).

10. (a)  $x(t) = e^{3t} \begin{pmatrix} 2 \sin(2t) - 2 \cos(2t) \\ 2 \cos(2t) \end{pmatrix}$

(b) It is a spiral point, unstable (i.e. it is a *spiral source*).

11. (a) (0,0), (0,-2), (1,-1)

(b) It is a saddle point; unstable.