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1. c, f
2. a
3. b
4. c
5. a (zero vector)
6. a, b, c
7. a
8. d
9. b
10. b
11. c
12. b, d
13. e
14. c
15. a
16. c
17. e
18. a, b, d, e
19. c
20. c
21. e
22. b
23. a, c
24. d
25. c
26. b
27. Span $\{[1,1,1,0]^T, [0,1,1,0]^T\}$
28. c
29. c
30. b
31. e
32. $\cos x \sim \cos x$
33. $|\sin x| \sim \frac{2}{\pi} + \frac{4}{\pi}\sum_{k=1}^{\infty} \frac{\cos 2kx}{1-4k^2}$.
    a. For $x = 0$, we have $\frac{1}{2} = \sum_{k=1}^{\infty} \frac{-1}{1-4k^2}$.
    b. For $x = \frac{\pi}{2}$, we have $\pi = 2 + 4\sum_{k=1}^{\infty} \frac{(-1)^k}{1-4k^2}$.
34. $|\cos x| \sim \frac{2}{\pi} + \frac{2}{\pi}\sum_{k=1}^{\infty}\left(\frac{(-1)^k}{1+2k} + \frac{(-1)^k}{1-2k}\right) \cos 2kx$
35. $(\cos x)^2 \sim \frac{1}{2} + \frac{1}{2}\cos 2x$

36. $(\sin x)^2 \sim \frac{1}{2} - \frac{1}{2}\sin 2x$
37. $|\sin x \cos x| \sim \frac{1}{\pi} - \sum_{k=1}^{\infty} \frac{2}{\pi(4k^2-1)} \cos 4kx$
38. $\sin x \sim \frac{2}{\pi} + \frac{1}{\pi}\sum_{k=1}^{\infty}\left(\frac{2}{1+2k} + \frac{2}{1-2k}\right)\cos 2kx\ \{0 \le x \le \pi\}$.
    a. For $x = \frac{\pi}{2}$, we have $\pi = 2 + 4\sum_{k=1}^{\infty} \frac{(-1)^k}{1-4k^2}$.
39. The method of "variation of parameters" is used to find a particular solution to the nonhomogeneous equation $y''(t) + a_1(t)y'(t) + a_0(t) = g(t)$. After finding two solutions y_1 and y_2 to the homogeneous equation $y''(t) + a_1(t)y'(t) + a_0(t) = 0$, set up the following system of equations and solve for $v_1{}'$ and $v_2{}'$: $\begin{cases} v_1{}'y_1 + y_2{}'y_2 = 0 \\ v_1{}'y_1{}' + y_2{}'y_2{}' = g(t) \end{cases}$. Then, integrate to find v_1 and v_2. A particular solution to the nonhomogeneous equation is $y_p = v_1y_1 + v_2y_2$.
40. $y(t) = \begin{cases} 1 + \frac{6}{e}e^{\cos t}\ \{0 \le t \le \pi\} \\ -1 + \left(2e + \frac{6}{e}\right)e^{\cos t}\ \{\pi \le t \le 2\pi\} \end{cases}$
41. $y = c\sec x - \frac{\cos 175x}{175\cos x}$, where c is any constant
42. Maximum displacement is $\frac{\sqrt{2}}{e^{\pi}}$
43. $a = -2, b = 5, f(t) = 4e^{2t}\sin t + 2e^{2t}\cos t + 5t - 2$
44. $x^4 \ln x$
45. Match the graphs:
    a. 2
    b. 1
    c. 4
    d. 3
46. $y = 8e^{7t} - 49te^{7t}$
47. $\boldsymbol{x}'(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & \frac{-1}{1+t} \end{bmatrix}\boldsymbol{x}(t) + \begin{bmatrix} 0 \\ 0 \\ \sin t \end{bmatrix}$
48. $y = c_1\cos 4x + c_2\sin 4x + \frac{1}{4}x\sin 4x + \frac{1}{16}\ln|\cos 4x|\cos 4x$
49. $\boldsymbol{x}(t) = \begin{bmatrix} 5e^{8t} - 2e^{-8t} \\ -2e^{-8t} \end{bmatrix}$
50. $\boldsymbol{y}(t) = \begin{bmatrix} 6\cos t + 8\sin t \\ -5\cos t - 15\sin t \end{bmatrix}$

51. $\boldsymbol{v_1}\xi_1' + \boldsymbol{v_2}\xi_2' = 1\,\boldsymbol{v_1}\xi_1 + 2\boldsymbol{v_2}\xi_2 + \boldsymbol{v_1}(-2\sin t - 3e^t) + \boldsymbol{v_2}(\sin t + e^t)$, where $\boldsymbol{v_1} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ and $\boldsymbol{v_2} = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$. Then solve for ξ_1 and ξ_2.

52. Decide if the statements are *always true* or *sometimes false.*

a. F
b. T
c. F
d. T
e. T
f. T
g. T
h. F
i. T
j. F
k. T