1. **A.** $2e^{j\pi/3} + 2e^{-j2\pi/3} - 1 = [1 + j\sqrt{3}] + [-1 - j\sqrt{3}] - 1 = -1$. Note the 180° apart.

2. **D.** $Re[2e^{-j\pi/6}(1 + j\sqrt{3})] = Re[2e^{-j\pi/6}2e^{j\pi/3}] = Re[4e^{j\pi/6}] = 2\sqrt{3}$.

3. **A.** $Im[(x + j\sqrt{3})e^{-j\pi/2}] = Im[(x + j\sqrt{3})(-j)] = Im[\sqrt{3} - jx] = -x = 2 \rightarrow x = -2$.

4. **A.** $(\sqrt{3} - j)^{11} = (2e^{-j\pi/6})^{11} = 2^{11}e^{-j11\pi/6} = 2^{11}e^{j\pi/6} \rightarrow \phi = \pi/6$.

5. **C.** Phasors: $3e^{j\pi/2} + e^{-j\pi/2} = 3j - j = 2e^{j\pi/2} \rightarrow A = 2$ (and $\phi = \pi/2$).

6. **B.** $e^{-j\pi/2} + e^{j(-\frac{\pi}{2}+\frac{2\pi}{3})} = -j + (\frac{\sqrt{3}}{2} + \frac{j}{2}) = \frac{\sqrt{3}}{2} - \frac{j}{2} = e^{-j\pi/6} \rightarrow \phi = -\frac{\pi}{6}$ (and A=1).

7. **A.** $1 + Ae^{j\pi/7} = 5e^{j\pi/4} = 3.5 + j3.5 \rightarrow Ae^{j26^o} = 2.5 + j3.5 = 4.35e^{j54^o} \rightarrow$ **No soln.**

8. **E.** All 3 signals are orthogonal, so just add their average powers: $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{3}{2}$.

9. **E.** $M(x) = \frac{1}{2-0}[\int_0^1 (1)dt + \int_1^2 (t)dt] = \frac{5}{4}$. Easier: do this by inspection.

10. **D.** Period of $x_8(t)$ is 2. Shift by 3$\rightarrow$ no effect. Scale by $\frac{1}{2} \rightarrow$ expand by 2. 2(2)=4.

11. **C.** $MS(x) = \frac{1}{2-0}[\int_0^1 (1)^2dt + \int_1^2 (t)^2dt] = \frac{5}{3} \approx 1$. Easier: by inspection.

12. **A. Supports:** Original: [1,3]. Shift by -1: [0,2]. Scale by $\frac{1}{2}$: [0,4].

13. **E.** $E(x) = \int_1^2 (1)^2dt + \int_{2.5}^3 (2)^2dt = 3$. Translation$\rightarrow$no effect. Easier: do by inspection.

14. **B.** $MS(x) = \frac{1}{3-1}E(x) = \frac{3}{2}$.

15. **D.** Frequencies=4,6 kHz$\rightarrow$GCD=2 kHz. OR: Periods=$\frac{1}{4000}, \frac{1}{6000} \rightarrow$ LCM=$\frac{1}{2000}$.

16. **B.** $|e^{-j\pi/3}|^2 + |2\sqrt{2}e^{j3\pi/4}|^2 + 4^2 + |2\sqrt{2}e^{-j3\pi/4}|^2 + |e^{j\pi/3}|^2 = 1+8+16+8+1=34$. rms=$\sqrt{34}$.

17. **E.** M(x)=DC component=4 is kept by the filter.

18. **B.** "Error" signal $e(t) = y(t) - x_{15}(t) = e^{j\pi/3}e^{j2\pi6000t} + e^{-j\pi/3}e^{-j2\pi6000t}$.
    $e(t)$ has average power=$|e^{-j\pi/3}|^2 + |e^{j\pi/3}|^2 = 2 \rightarrow RMS = \sqrt{2}$.

19. **E.** $(e^{-j\pi/3})e^{-j2\pi6000t} + (2\sqrt{2}e^{j3\pi/4})e^{-j2\pi4000t} + 4 + (e^{j\pi/3})e^{j2\pi6000t} + (2\sqrt{2}e^{-j3\pi/4})e^{j2\pi4000t}$
    $= 4 + 4\sqrt{2}\cos(2\pi4000t - \frac{3\pi}{4}) + 2\cos(2\pi6000t + \frac{\pi}{3})$.

20. **D.** Can use trig identities, but ugh! Easier: $8\cos^3(1000\pi t) =$
    $8[\frac{1}{2}(e^{j100\pi t} + e^{-j100\pi t})]^3 = e^{j300\pi t} + 3e^{j100\pi t} + 3e^{-j100\pi t} + e^{-j300\pi t} \rightarrow$ 4 lines.

EXAM SCORES BY LECTURE SECTION–SEE WHERE YOU STAND

11:30: $100, 95^8, 90^4, 85^5, 80^7, 75^{10}, 70^5, 65^8, 60^2, 55^7, 50^4, 45^4, 40^4$.   **Mean: 70.6. #: 69.**

1:30: $100, 90^4, 85^7, 80^7, 75^4, 70^7, 65^{10}, 60^4, 55^6, 50^7, 45^7, 40^4, 35^2, 30^3$. **Mean: 63.2. #: 73.**

398: $70^2, 65, 60, 55^3, 50^4, 45, 40, 35^2, 30^2, 25$. **Mean: 48.3. #: 18.**