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1.
 - (a) Expand $\cos^4(\theta)$ in Legendre polynomials, $P_\ell(\cos \theta)$
 - (b) Expand $\cos(4\theta)$ in Legendre polynomials, $P_\ell(\cos \theta)$
 2. Consider the first full period of the cosine function: $\cos(x)$, $0 < x < 2\pi$.
 - (a) Expand this in a Fourier **cosine** series and list the first few non-zero Fourier coefficients.
 - (b) Expand this in a Fourier **sine** series and list the first few non-zero Fourier coefficients. (This is not a trick question. The answer is not that all the coefficients are zero. You can expand any function outside its given range as either an even or an odd function.)
 - (c) Plot the original function and your four-term approximation using a computer for the range $0 < x < 2\pi$.
 - (d) Plot the original function and your four-term approximation using a computer for the range $-2\pi < x < 0$. Comment.