1. Suppose \( v' = \left( 10 \frac{m}{s} \right) \cos\{\omega t\} \cos\{6\lambda\} \)

(a) If \( q' = \left( 2 \frac{g}{kg} \right) \cos\{6\lambda\} \), what is \( [\overline{v' q'}] \) if time averaging covers the period \( 0 \leq t \leq 2\pi/\omega \)?

(b) If instead, \( q' = \left( 2 \frac{g}{kg} \right) \cos\{\omega t\} \cos\{6\lambda\} \), what is \( [\overline{v' q'}] \)?

2. (a) Suppose the 850 mb temperature field at 45 N is given by the function
\[
T_{850} = 278 \text{K} + (10 \text{K}) \cos(2\lambda) + (5 \text{K}) \cos(4\lambda)
\]
where \( \lambda \) is longitude. What is \([T]\)?

(b) Suppose that the 850 mb meridional wind field at 45 N is given by
\[
v_{850} = (10 \text{m/s}) \cos(4\lambda)
\]
What is \([vT]\)?

(c) What is \([v^*T^*]\)? How is it related to \([vT]\) in this problem? Why?

Some equations that might be useful:
\[
\int \cos(ax) \, dx = \frac{1}{a} \sin(ax)
\]
\[
\int \cos^2(ax) \, dx = \frac{1}{2} x + \frac{1}{4a} \sin(2ax)
\]
\[
\int \cos(ax) \cos(bx) \, dx = \frac{\sin((a - b)x)}{2(a - b)} - \frac{\sin((a + b)x)}{2(a + b)}
\]
\[
\int \cos^3(ax) \, dx = \frac{1}{3a} \sin(ax)(\cos^2(ax) + 2)
\]
\[
\sin\{n\pi\} = 0 \quad , n = 0, \pm 1, \pm 2, \ldots
\]