1. The square plate in the figure below is deformed into the configuration depicted with dashed lines such that the plate is in a state of plane strain \((\varepsilon_{zz} = \varepsilon_{xx} = \varepsilon_{yy} = 0)\). Determine the displacement functions \((u, v, w)\) relative to the coordinate axes in lower case \((x, y)\). Determine the six components of the strain matrix as a function of \(x, y\) and \(z\). Do not assume small strain theory. Finally if \(E = 30,000 \text{ ksi}\) and \(\nu = .3\), find the six components of the stress matrix as functions of \(x\) and \(y\).

2. If

\[
w = \cos (x + y) + \sin (x - y)
\]

Show that

\[
\frac{\partial^2 w}{\partial x^2} = \frac{\partial^2 w}{\partial y^2}
\]
3. If

\[ w = \ln(2x + 2y) + \tan(2x - 2y) \]

Show that

\[ \frac{\partial^2 w}{\partial x^2} = \frac{\partial^2 w}{\partial y^2} \]

4. If “c” is a constant and

\[ w = (5)\cos(3x + 3ct) - (7)\sinh(4x - 4ct) \]

Show that

\[ \frac{\partial^2 w}{\partial t^2} = (c^2)\frac{\partial^2 w}{\partial x^2} \]

5. If

\[ V = \left(x^2 + y^2 + z^2\right)^{1/2} \]

verify that V satisfies the Laplace’s equation, i.e.,

\[ \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0 \]