It can be shown that there are no eigenvalues \( \lambda \) for
\[
\lambda \leq \frac{(1-a)^2}{4b^2}.
\]

We now turn to the solution of \((P_3)_6\):

We first re-write the eq. \( x^2 \phi'' + x \phi' + 3 \phi = 0 \) in Sturm–Liouville form:

\[
x^2 \phi'' + x \phi' + 3 \lambda \phi = 0.
\]

We chose \( u(x) \) so that the preceding eq. reduces to
\[
\left( u(x) \phi' \right)' + \lambda \frac{u(x)}{x^2} u(x) \phi = 0.
\]

Since \( (u(x) \phi')' = u(x) \phi'' + u'(x) \phi' \) we must have
\[
u' = \frac{x}{a} \Rightarrow u = e^{\int \frac{x}{a} \, dx} = e^{\frac{x^2}{2a}}
\]

\[
\Rightarrow \quad \left( x^2 \phi' \right)' + \lambda \frac{3}{x^2-4} \phi = 0
\]

The general Sturm–Liouville equation is
\[
(p(x) \phi')' + \left[ \lambda \sigma(x) - q(x) \right] \phi = 0
\]

\[
\Rightarrow \quad p(x) = x^2, \quad \sigma(x) = \frac{3}{x^2-4}, \quad q(x) = 0
\]
in the given problem. It follows that