given a homogeneous second-order differential equation
\[ y'' + py' + qy = 0 \]

is the origin an ordinary point?  yes

standard power series method will give both solutions

no

is the origin a regular singularity?  no

STOP—Laurent series not treated in this course

yes

look for a solution by the Method of Frobenius

does the quadratic indicial equation have real solutions?  no

STOP—complex series not treated in this course

yes

the two solutions are \( S[s] \) and \( S[s] \ln x + S[r] \), where \( r \) must be found by substitution

no

do the two values \( s_1 \) and \( s \) differ by an integer?  yes

the two solutions are \( S[s_1] \) and \( S[s] \)

no

two things can happen:
(1) smaller value of \( s \) gives both solutions or (2) smaller index \( s_1 \) fails to give any solutions, while the larger index \( s \) gives one solution \( S[s_1] \) and the other solution is \( S[s] \ln x + S[s_1] \)