1. Write a program to generate a well-resolved elegantly prepared plot of all of the real roots of

\[ a^2x^2 - x - a = 0, \]

for \( a \in [-2, 2] \). Give your plot with \( a \) on the abscissa and \( x \) on the ordinate. Take care that your plot reflects the mathematics correctly near \( a = 0 \) and filters any obviously numerical artifacts.

You can either write a single program to calculate the roots and run the program many times or, if you are ambitious, can read ahead and write a subroutine to calculate the roots and have the main program calculate the roots for various \( a \) in one run of the program. Use only real or integer variables, and make effective use of control statements such as if.

2. Repeat the previous exercise using complex variables as appropriate. Use your program to generate a well-resolved elegantly prepared plot of all of the real roots of

\[ a^2x^2 - x - a = 0, \]

for \( a \in [-2, 2] \). Give your plot with \( a \) on the abscissa and \( x \) on the ordinate.

Prepare your homework with the \LaTeX{} text processor. Include at least one equation. Write with concision and precision (but not derision!). Three page maximum. Include verbatim listings of your codes. Grading: technical merit, 50 points; æsthetics, 50 points.