

## Homework on Rational Functions

Nikos Apostolakis

**Please note:** You should fully justify your answers.

1. For each of the following rational functions draw a qualitatively accurate graph. The graph should correctly indicate the  $x$  and  $y$  intercepts, the end behavior, the behavior near the  $x$  intercepts, the domain, the sign of the function, and any vertical or horizontal asymptotes. After completing the graph “by hand” use SAGE to verify that you got the correct graph.

$$(a) f(x) = \frac{4x - 3}{2x + 1}$$

$$(b) f(x) = \frac{x^2 - x - 2}{x^2 - 9}$$

$$(c) g(x) = \frac{x^2 + 2x - 3}{x^3 + 4x^2 + x - 6}$$

$$(d) h(x) = \frac{x^3 - 4x^2 + x - 6}{x^2 + 2x - 3}$$

$$(e) g(x) = \frac{x^2 + x - 6}{x^2 + 5x + 6}$$

$$(f) f(x) = \frac{x^2 - x + 6}{x^2 + 1}$$

$$(g) h(x) = \frac{3x}{x^2 - 4}$$

$$(h) g(x) = \frac{x}{x^2 + 4}$$

$$(i) g(x) = \frac{x^2 + x - 2}{x^3 - x^2 - 2x}$$

$$(j) f(x) = \frac{x^4 - 5x^2 + 4}{x^2 - x - 12}$$

$$(k) g(x) = \frac{x^3 + 3x^2 - 4}{x^2 - 9}$$

$$(l) h(x) = \frac{x^2 - 9}{x^3 + 3x^2 - 4}$$

$$(m) h(x) = \frac{x^3 - x^2 - 5x - 3}{x^3 - 5x^2 + 3x + 9}$$