

1. When preparing to graph the rational function  $y(x)$ , this algebra is done.

$$\begin{aligned}y(x) &= \frac{x^4 - 2x^3 - 3x^2 - 3x - 1}{x^3 - 3x^2 + x - 3} \\ &= x + 1 - \frac{(x-1)(x+2)}{(x-3)(x^2+1)} \\ &= x + 1 - \frac{1}{x-3} - \frac{1}{x^2+1}\end{aligned}$$

- (a) Specify, with reasons, the (largest) domain of  $y(x)$ . (You needn't repeat algebra)
- (b) Find where the graph crosses the  $y$ -axis.
- (c) Give all vertical asymptotes, and the graph's behaviour near such asymptotes.
- (d) Specify the equation of the oblique asymptote to the graph, and the co-ordinates of all points, if any, where the graph crosses this asymptote.
- (e) Specify the intervals of the  $x$ -axis, corresponding to values of  $y(x)$  which are greater than the corresponding point on the oblique asymptote.