

Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. One zero of the polynomial equation $x^4 - 2x^2 - 16x - 15 = 0$ is $x = 3$. Use polynomial division to reduce the polynomial. Then find the rest of the real and complex zeros of the function. You may use the Rational Zero's Theorem and/or The Remainder Theorem. Write the final factored form of the polynomial with linear factors or quadratics with real coefficients (when the roots are complex).

(3)

$$\begin{array}{r} x^3 + 3x^2 + 7x + 5 \\ \hline x-3) x^4 + 0x^3 - 2x^2 - 16x - 15 \\ - x^4 + 3x^3 \\ \hline 3x^3 - 2x^2 \\ - 3x^3 + 9x^2 \\ \hline 7x^2 - 16x \\ - 7x^2 + 21x \\ \hline 5x - 15 \\ - 5x + 15 \\ \hline 0 \end{array}$$

Rational zeros

 $\pm 1, \pm 5$

(-1)

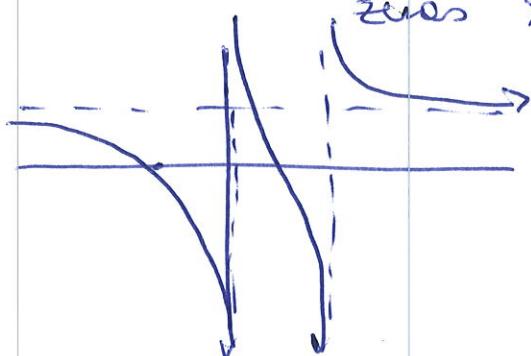
$$\begin{array}{r} x^2 + 2x + 5 \\ \hline x+1) x^3 + 3x^2 + 7x + 5 \\ - x^3 - x^2 \\ \hline 2x^2 + 7x \\ - 2x^2 - 2x \\ \hline 5x + 5 \end{array}$$

Graph passes through -1

2. Find any asymptotes (vertical, slant or horizontal), along with any intercepts of the function

$$R(x) = \frac{3x^2 + x - 4}{2x^2 - 5x}$$

$$\frac{(3x+4)(x-1)}{x(2x-5)}$$

vertical asymptotes $x=0, x=\frac{5}{2}$ horizontal asymptote $y=\frac{3}{2}$ zeros $x=-\frac{4}{3}, x=1$ 

$$\begin{aligned} & (x-3)(x^3 + 3x^2 + 7x + 5) \\ & (x-3)(x+1)(x^2 + 2x + 5) \\ & x = \frac{-2 \pm \sqrt{4 - 20}}{2} = \\ & \frac{-2 \pm 4i}{2} = -1 \pm 2i \end{aligned}$$

zeros:

 $-1 \pm 2i, -1, 3$