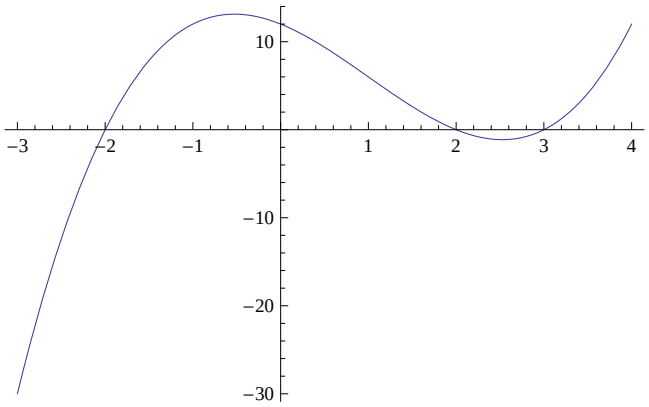
Problem 1.

Part A Factor $x^3 - 3x^2 - 4x + 12$ completely. (2 points)

$$\begin{aligned} x^3 - 3x^2 - 4x + 12 &= (x^3 - 3x^2) - (4x - 12) \\ &= x^2(x-3) - 4(x-3) \\ &= (x^2 - 4)(x-3) \\ &= (x+2)(x-2)(x-3) \end{aligned}$$

Part B Graph $f(x) = x^3 - 3x^2 - 4x + 12$. (4 points)

- x-intercepts: $(-2, 0)$, $(2, 0)$, $(3, 0)$.
- y-intercept: $0^3 - 3 \cdot 0^2 - 4 \cdot 0 + 12 = 12$, so $(0, 12)$.
- end behaviors: $\swarrow$, $\nearrow$
- multiplicities: -2 (odd), 2 (odd), 3 (odd)



Problem 2. Compute $(x^3 - 2) \div (x - 1)$. (4 points)

$$\begin{array}{r|rrrr} & & x^2 & +x & +1 \\ \hline x-1 & x^3 & & & -2 \\ & -x^3 & +x^2 & & \\ \hline & & x^2 & & \\ & & -x^2 & +x & \\ \hline & & & x & -2 \\ & & & -x & +1 \\ \hline & & & & -1 \end{array}$$