Graph & Analyze: $y = x^3 - 4x^2 - 12x$

$$x(x^2 - 4x - 12) = y$$
$$x(x-6)(x+2) = y$$
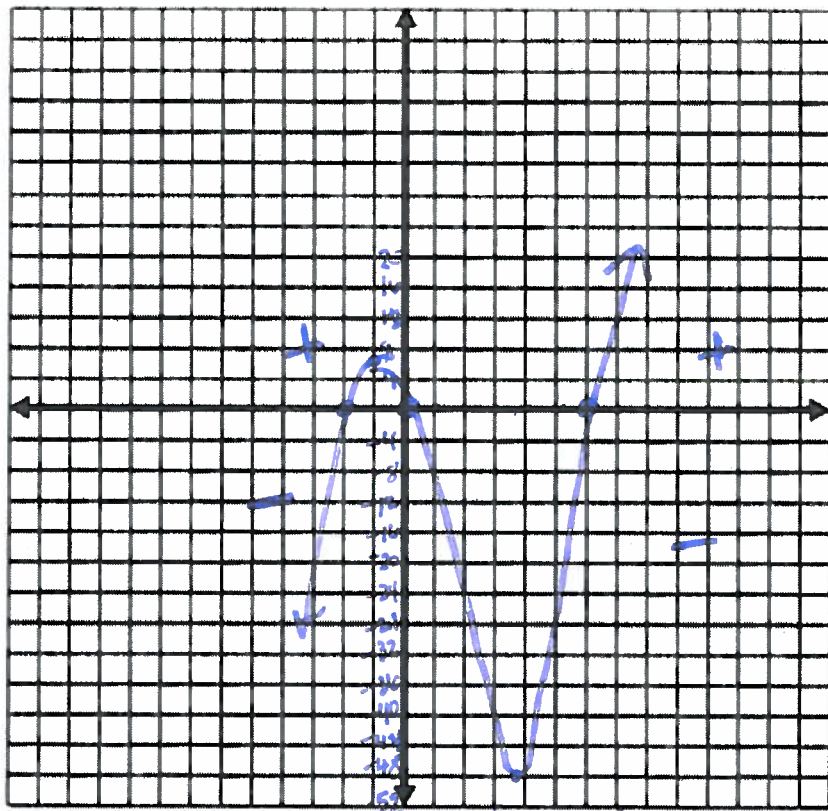
↑ y (by 4's)

Key Characteristics

Roots: $x = 0$
        $x = 6$
        $x = -2$

Rel max @ $y \approx 7.04$

Rel min @ $y \approx -48.52$

Domain: $\mathbb{R}$
Range: $\mathbb{R}$

y int @ $(0,0)$

positive: $(-2, 0) \cup (6, \infty)$
negative: $(-\infty, -2) \cup (0, 6)$

3 $\mathbb{R}$ roots

Using long division, divide the given polynomial by x + 2

$$x+2 \overline{\smash{\big)}\, x^3 - 4x^2 - 12x + 0}$$

$$ x^2 - 6x$$

$-x^3 - 2x^2$
$ -6x^2 - 12x$
$ +6x^2 + 12x$
$ 0$

$(x+2)(x^2 - 6x)$

$y = (x+2)(x-6)x$

Using synthetic division, divide the given polynomial by x – 6

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6 |  1   -4   -12    0
   |       6    12    0
   ------------------------
      1    2    0   | 0
```

$(x^2 + 2x)(x-6)$

$y = x(x+2)(x-6)$

What relationships are you noticing between factors, division and zeros?

→ zeros help get factors
→ Divide by a factor to get over factors
→ Answers vary