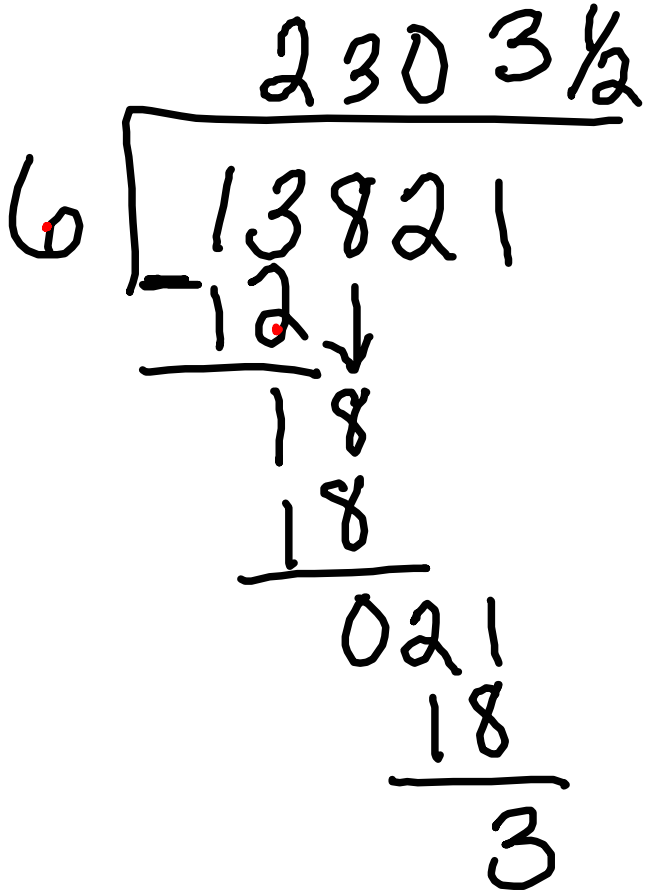
Products and Factors of Polynomials
Day 2

Dividing Polynomials

A multiplication equation can be written as two or more division equations.

$$x^3+3x^2-4x-12=(x^2+5x+6)(x-2)$$

$$\frac{x^3+3x^2-4x-12}{x^2+5x+6}=x-2 \qquad \frac{x^3+3x^2-4x-12}{x-2}=x^2+5x+6$$


2303½
6
13821
12
18
18
021
18
3

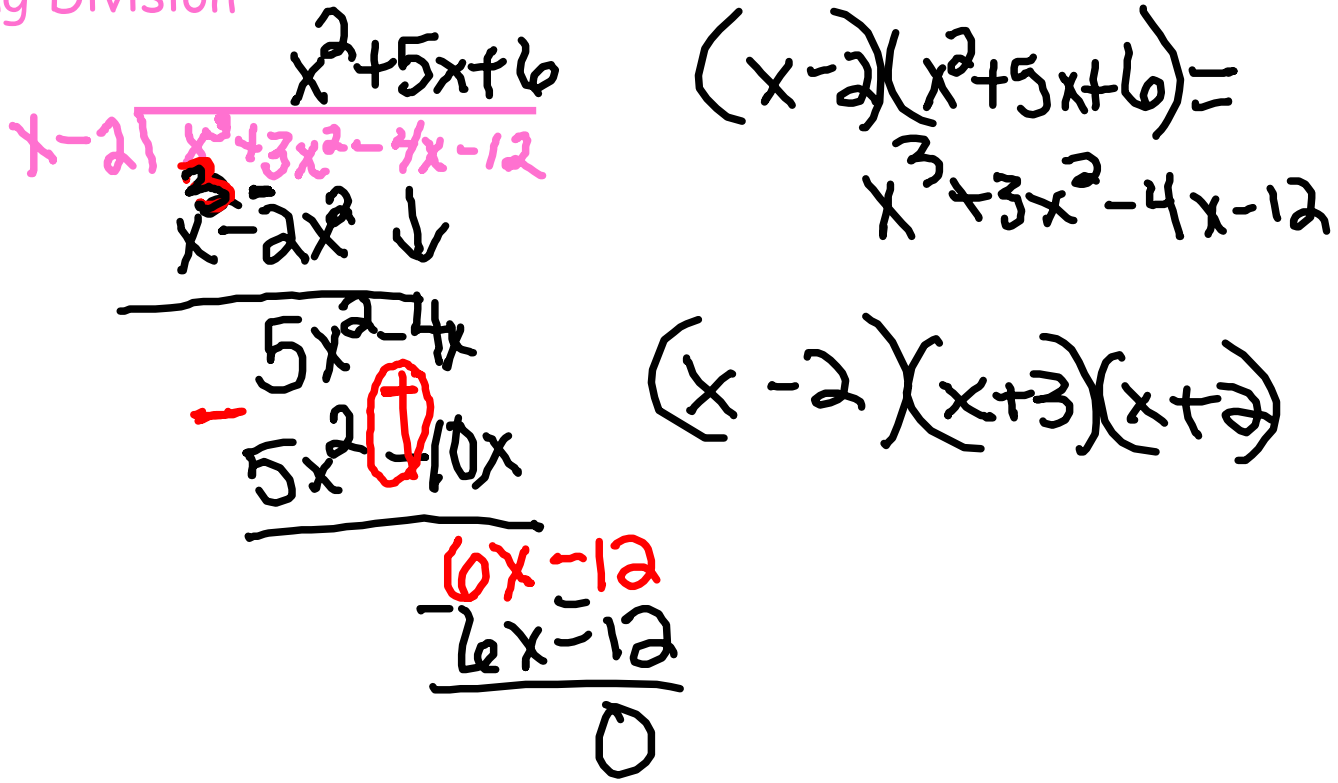
$$10 = 2 \times 5$$

$$\frac{10}{2} = 5$$

$$\frac{10}{5} = 2$$

A polynomial can be divided by a divisor of the form x−r by using log division or a shortened form of long division called synthetic division

Long Division



$(x-2)(x^2+5x+6)=$

$x^3+3x^2-4x-12$

$(x-2)(x+3)(x+2)$

Synthetic Division

$$\begin{array}{r|rrrr} 2 & 1 & 3 & -4 & -12 \\ & & 2 & 10 & 12 \\ \hline & 1 & 5 & 6 & 0 \end{array}$$

$1x^2+5x+6$

Write the coefficients of the polynomial and then write the r-value of the divisior on the left. Write the first coefficient, 1, below the line.

$x-2$ $\qquad$ $x^3+3x^2-4x-12$

Multiply the r-value, 2, by the number below the line, and write the product below the next coefficient

$(x-2)(x^2+5x+6)$

$x^3+3x^2+3x+2 \div x^2+x+1$

$$
\begin{array}{r}
x+2 \\
x^2+x+1 \overline{\big)\, x^3+3x^2+3x+2} \\
\underline{x^3+x^2+x} \\
2x^2+2x+2 \\
\underline{2x^2+2x+2} \\
0 \quad 0 \quad 0
\end{array}
$$

$x^3 - x^2 - 4 \div x^2 + x + 2 = x - 2$

$$
\begin{array}{r}
x - 2 \\
x^2 + x + 2 \overline{\big)\, x^3 - x^2 + 0x - 4} \\
\underline{x^3 + x^2 + 2x} \\
-2x^2 - 2x - 4 \\
\underline{-2x^2 - 2x - 4} \\
0
\end{array}
$$

$x^3+48 \div x+3$

$$x+3 \overline{)\, x^3+0x^2+0x+48}$$

$$x^2-3x+9+\frac{21}{x+3}$$

$$x^3+3x^2$$

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

$$-3x^2-9x$$

$$9x+48$$

$$9x+27$$

$$21$$

Given 2 is a zero of x^3+x-10
use division to factor

x^3+0x^2+x-10

2

	1	0	1	−10
↓		2	4	10
	$1x^2$	2x	5	0 R

$(x-2)(x^2+2x+5)$

$x^3 - 13x - 12$

$$\begin{array}{r|rrr} -3 & 1 & 0 & -13 & -12 \\ & & -3 & 9 & 12 \\ \hline & 1 & -3 & -4 & \boxed{0} \end{array}$$

$$(x+3)(x^2-3x-4) = x^3-13x-12$$

$P(x) = 3x^3 + 2x^2 - 3x + 4$ find $P(3)$

plug 3 in for x

$3(3^3) + 2(3^2) - 3(3) + 4$

94

3	3	2	-3	4
		9	33	90
	3	11	30	94