**Review:**

**factor: $729y^3 + 64$**

$(9y)^3 + (4)^3 = (9y+4)(81y^2 - 36y + 16)$

**factor by CTS: $x^4 + 324y^4$**

$\left(x^4 + \underbrace{36x^2y^2}_{2(x^2)(18y^2)} + \underbrace{324y^4}_{(18y^2)^2}\right) - 36x^2y^2 = \left(x^2 + 18y^2\right)^2 - 36x^2y^2$

$= (x^2 + 18y^2 + 6xy)(x^2 + 18y^2 - 6xy)$

**factor by CTS $x^2 - 64x + 1023$**

$(x^2 - 64x + 1024) + 1023 - 1024$

$(x-32)^2 - 1 = (x-32+1)(x-32-1)$

$(x-31)(x-33)$

## 6-5 Polynomial Division / Synthetic Division

**Polynomial Division**

**ex. 1** $(2x^3 + 9x^2 - 13x + 30) \div (x+6)$

dividend $\div$ divisor $=$ quotient

$= 2x^2 - 3x + 5$

$$
\begin{array}{r}
2x^2 - 3x + 5 \\
x+6 \overline{)\,2x^3 + 9x^2 - 13x + 30} \\
-(2x^3 + 12x^2) \\
\hline
-3x^2 - 13x \\
-(-3x^2 - 18x) \\
\hline
5x + 30 \\
5x + 30 \\
\hline
0
\end{array}
$$

**ex. 2** $(y^4 + 2y^2 - y + 1) \div (y^2 - y + 1)$

$$y^2 - y + 1 \;\overline{)\; y^4 + 0y^3 + 2y^2 - y + 1}$$

$$y^2 + y + 2 - \frac{1}{y^2 - y + 1}$$

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

$$y^3 + y^2 - y$$

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

$$2y^2 - 2y + 1$$

$$-(2y^2 - 2y + 2)$$

$$-1$$

CK: $(y^2 - y + 1)\left(y^2 + y + 2 - \frac{1}{y^2 - y + 1}\right)$

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**Synthetic Division**

**ex. 3** $(2x^3 + 9x^2 - 13x + 30) \div (x + 6)$

$x - (-6)$ K

| | 2 | 9 | −13 | 30 |
|---|---|---|---|---|
| −6 | | −12 | 18 | −30 |
| | 2 | −3 | 5 | 0 |

$2x^2 - 3x + 5$

Remainder = 0 so $x+6$ is a factor of $2x^3 + 9x^2 - 13x + 30$

**ex. 4** $(x^4 - 6x^3 - 40x^2 + 33) \div (x - 7)$ K

| | 1 | −6 | 0 | −40 | 33 |
|---|---|---|---|---|---|
| 7 | | 7 | 7 | 49 | 63 |
| | 1 | 1 | 7 | 9 | 96 |

$x^3 + x^2 + 7x + 9$ R

$$= x^3 + x^2 + 7x + 9 + \frac{96}{x - 7}$$