$\text{Divisor}\overline{)\,\text{Dividend}}\ \begin{matrix}\text{Quotient} \\ +\ \frac{\text{remainder}}{\text{divisor}}\end{matrix}$	Dividend = (Quotient)(Divisor) + Remainder

Warm-ups with Long Division (no calculator!)

1. $2445 \div 3$	2. $976 \bullet 5^{-1}$	3. $\frac{2089}{4}$

Use the same procedure with polynomials!

4. $\left(4x^3 - 9x^2 - 10x - 2\right) \div \left(x - 3\right)$

Remainder Theorem: If a polynomial $f(x)$ is divided by $(x-k)$ then the remainder is $R = f(k)$.	**Factor Theorem:** A polynomial $f(x)$ has a factor $(x-k)$ if and only if $f(k) = 0$.
Verify the Remainder Theorem for #4:	Is (x-3) a factor of the polynomial in #4?

5. $(-x^4 + 5x^3 - 10x - 4) \bullet (x + 1)^{-1}$

Is the divisor a factor?

Evaluate the polynomial for $x = -1$

6. $\frac{(4x^3 - 7x^2 - 11x + 5)}{(4x + 5)}$

Is the divisor a factor?

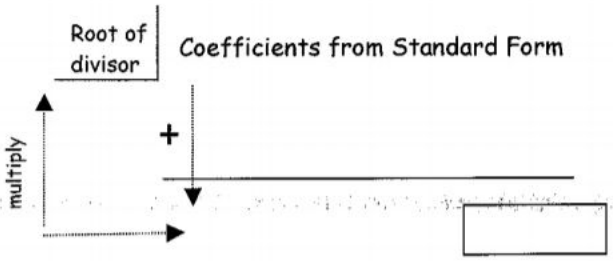
Evaluate the polynomial for $x = -\frac{5}{4}$

7. $(5x^4 + 2x^3 - 9x + 12) \div (x^2 - 3x + 4)$

Is the divisor a factor?

Synthetic Division: used to divide a polynomial by a binomial divisor in the form $(x-c)$ in which c is a constant **and the coefficient of x is 1.**

* You will need a place-holder of the coefficient "zero" for each missing term!



1. $\left(x^3-6x^2+2x-4\right)\div\left(x-2\right)$

Is the divisor a factor?

2. $\left(2x^3+x^2-8x+16\right)\bullet\left(x+4\right)^{-1}$

Is the divisor a factor?

3. $\dfrac{\left(4x^4-2x^2+x+1\right)}{\left(x-1\right)}$

Is the divisor a factor?

4. $\left(x^3-64\right)\div\left(x-4\right)$

Is the divisor a factor?

What if the coefficient of x is not 1?

5. $\left(6x^2-5x+9\right)\div\left(2x-1\right)$

Find the value of k so that the remainder for each of the following is 3.

6. $\left(x^2-x+k\right)\div\left(x-1\right)$

7. $\left(x^3+4x^2+x+k\right)\div\left(x+2\right)$

8. $\left(x^2+5x+7\right)\div\left(x+k\right)$