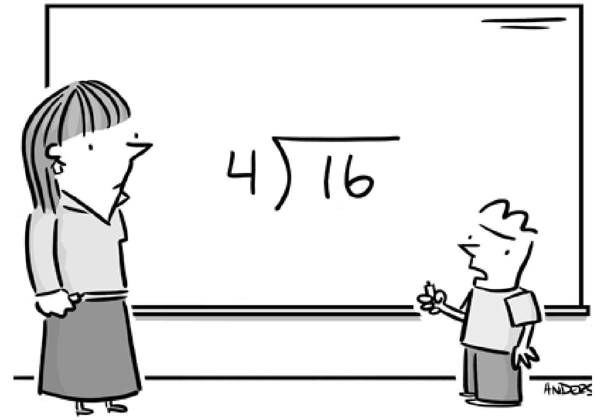
Polynomial Division:



"We've been dividing all week! When do we get to conquer?!"

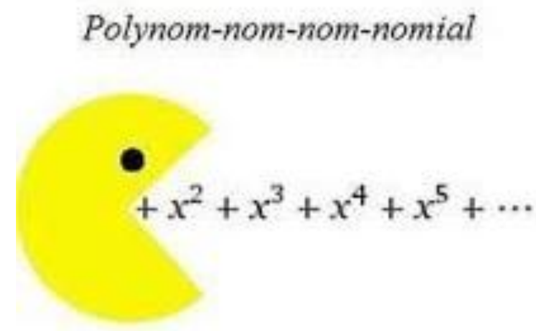
Long Division:

$(6x^2+13x+9)\div(2x+1)$

$$2x+1\overline{)6x^2+13x+9}$$

"Isn't there enough division in this country?!"

$$\left(2x^4-3x^3-3x^2+9x+2\right)\div\left(x^2-2x+1\right)$$



$$x^2-2x+1\overline{\big)\,2x^4-3x^3-3x^2+9x+2}$$

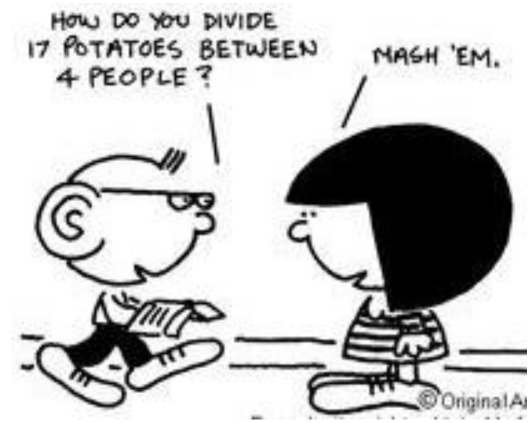
$$\left(8x^2 - 2x - 15\right) \div \left(4x + 5\right)$$

$$4x + 5\overline{\smash{)}8x^2 - 2x - 15}$$

"Division is just like addition except you have to use a different button on the calculator."

Synthetic Division:

Only works if you're dividing by $(x \pm c)$.



Examples:

$(2x^2 + x - 16) \div (x - 2)$

2 | 2 1 -16

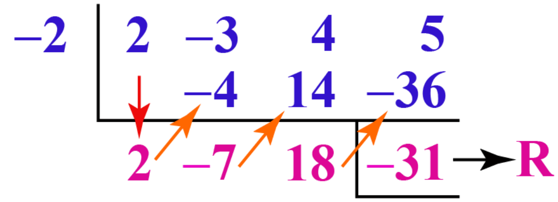
When cells divide

$$\left(3x^2-2x+5\right)\div\left(x-3\right)$$

3	3	-2	5

$$\left(x^2-8x-12\right)\div\left(x+4\right)$$

-4	1	-8	-12



Repeat the previous 2 steps and separate the last term as remainder.

$$(2x^2+8)\div(x+3)$$

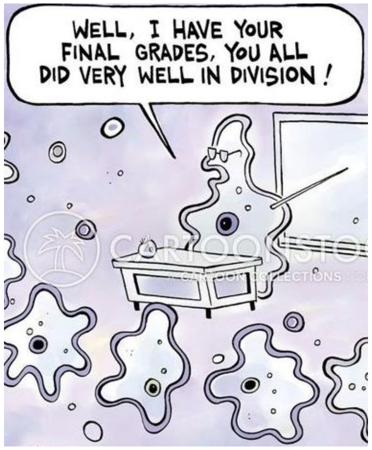
-3	2	0	8

$$(x^3-2x^2+5x-1)\div(x-5)$$

5	1	-2	5	-1

Remainder Theorem:

When the polynomial function $f(x)$ is divided by $(x-c)$, the remainder is equal to $f(c)$.



Here's why: $f(x)=(x-c)q(x)+r$**, so**

$$\begin{aligned} f(c) &= (c-c)q(c)+r \\ &= 0\cdot q(c)+r \\ &= r \end{aligned}$$

Examples:

1. Use synthetic division along with the Remainder Theorem to find the value of $f(2)$ for the polynomial function $f(x)=3x^3-2x^2+x-3$.

2	3	-2	1	-3

2. Use synthetic division along with the Remainder Theorem to find the value of $f(-3)$ for the polynomial function $f(x) = 5x^2 - 2x^3 + x - 4$.

"Can I carry the remainder over to the next question?"

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<u>Factor Theorem:</u>

For the polynomial function $f(x)$, if $f(c) = 0$, then $(x - c)$ is a factor of $f(x)$.

Here's why:

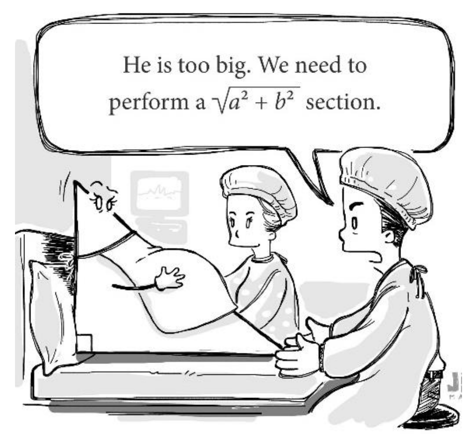
$f(x) = (x - c)q(x) + r$**, so if** $f(c) = 0$**, then** $r = 0$**, and so** $(x - c)$ **is a factor of** $f(x)$**.**

Examples:

1. Use synthetic division and the Factor Theorem to show that $x-3$ is a factor of the polynomial function $f(x)=x^3-3x^2+x-3$, and then find all of the zeros of the polynomial function.

2. Use synthetic division and the Factor Theorem to show that $x+2$ is a factor of the polynomial function $f(x)=2x^3+3x^2-5x-6$, and then find all of the zeros of the polynomial function.

3. Find the value of *k* so that $x-1$ is a factor of $x^5-4x^3+2x^2-3x+k$.



The Birth of a Right Triangle