Division of Polynomials

To divide a polynomial by a monomial, divide each term in the polynomial by the monomial and simplify.

$$\frac{a+b}{c}=\frac{a}{c}+\frac{b}{c} \text{ when } c\neq 0$$

To divide $\frac{15x^2-25x+5x}{5x}$, think of it as $\frac{15x^3}{5x}-\frac{25x^2}{5x}+\frac{5x}{5x}$

Simplify each fraction to get $3x^2-5x+1$. (Be careful. 5x divided by itself is 1.)

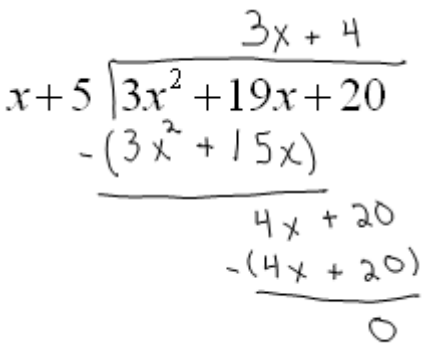
TRY: $\frac{12x^2+8x-16}{4}$

$$\frac{20x^2+30x}{10x}$$

To divide a polynomial by a binomial, use long division.

To divide: $\frac{3x^2+19x+20}{x+5}$

1. Write the problem as long division with the numerator as the dividend and the denominator as the divisor.
2. Think – what does one need to multiply the first term of the divisor by in order to obtain the first term of the dividend – what does one multiply x by to get $3x^2$? 3x
3. Place the answer over the correct column in the dividend. In this case, place the 3x over the 19x.



4. Multiply the 3x times the binomial x+5 and place the result under the dividend.
5. Put parentheses around the result and a minus sign in front to indicate subtraction. THIS IS VERY IMPORTANT as it helps one avoid errors.
6. Subtract.
7. Bring down the next term of the dividend.
8. Repeat the process.
9. Check the answer by multiplying the quotient times the divisor to obtain the dividend.

If the problem has a remainder, place it over the divisor to form a fraction.

$$16c^3 - 38c^2 - 11c + 19 \div 2c - 5 = 8c^2 + c - 3 + \frac{4}{2c-5}$$

If the dividend is missing terms of some degrees,
expand the dividend by adding place holders for the missing degrees.

For example, for $x^3 + 125 \div x + 5$ rewrite the dividend as:
$x^3 + 0x^2 + 0x + 125$ before performing long division.

$x^3 + 0x^2 + 0x + 125 \div x + 5 = x^2 - 5x + 25$ [Try it.]