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Division – a shortcut for dividing a polynomial by a binomial of the form $x - r$.

- X cannot be of a higher degree than the divisor.
- The divisor $x - r$ has to be a binomial.
- $(x-3)$ means $r = 3$
- $(x+3)$ means $r = -3$

1. Write up terms in descending order of power of x , putting a 0 where there is a missing power of x .
2. Take the leading coefficient of the divisor, and the constant term from $(x-r)$, keeping the sign.
3. Bring down your leading coefficient.
4. Multiply your 1st coefficient by r .
5. Write the result from step 4 under the next term, then subtract.
6. Bring down the sum, by r , write under the next term, and then subtract. Repeat these steps until all terms have been processed for.
7. The result represents the quotient. The other #s are the remainder of the polynomial, which has a degree less than your divisor polynomial.

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Theorem – the binomial factor theorem is a shortcut for finding factors of the polynomial if there is a root when you substitute the root into the polynomial.

This will also mean that $(x - r)$ is a factor of $P(x)$. So if you divide $P(x)$ by $(x - r)$, you will get a polynomial $Q(x)$ and a remainder R .

Synthetic Division LL

Divide.

1) $(3b^3 + 14b^2 + 12b + 16) \div (b + 4)$

2) $(4r^3 + 19r^2 + 20r - 1) \div (r + 3)$

3) $(n^3 - 2n^2 + 4n + 1) \div (n - 1)$

4) $(a^3 - 17a^2 + 71a - 1) \div (a - 10)$

5) $(x^3 - 2x^2 - 8x - 9) \div (x + 1)$

6) $(n^4 + 8n^3 - 7n^2 + 28n + 95) \div (n + 9)$

7) $(m^4 - m^3 - 25m^2 + 32m + 44) \div (m + 5)$

8) $(2x^4 + 14x^3 + 18x^2 - 21x - 9) \div (x + 3)$

9) $(n^4 - 8n^3 + 12n^2 - 10n + 5) \div (n - 1)$

10) $(x^4 - 9x^3 + 10x - 90) \div (x - 9)$

11) $(r^4 - 7r^3 - 19r^2 + 17r - 72) \div (r - 9)$

12) $(n^4 + 9n^3 + 12n^2 - 48n - 40) \div (n + 5)$