AE22B070

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Remainder Theorem

Statement: The Remainder Theorem states that the remainder of any polynomial $f(x)$ when divided by a linear polynomial $(x - a)$ is equal to the value of the function at the root of the divisor polynomial, i.e., the remainder is equal to $f(a)$.

Proof: The polynomial remainder theorem follows from the theorem of Euclidean division, which, given two polynomials $f(x)$ (the dividend) and $g(x)$ (the divisor), asserts the existence (and uniqueness) of a quotient $Q(x)$ and a remainder $R(x)$ such that $f(x) = g(x) \cdot Q(x) + R(x)$. In the case of division by a linear polynomial, the remainder is a constant. So we can rewrite the above equation as $f(x) = (x - a) \cdot Q(x) + R$. Now we can clearly see that when $x = a$, this equation reduces to $R = f(a)$.
[1]

[1] https://en.wikipedia.org/wiki/Polynomial_remainder_theorem