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# 2.4 Remainder Theorem & Factor Theorem

Remainder Theorem: If a polynomial is divided by $x-a$, then the remainder is $P(a)$.

Ex 1: Determine the remainder for $(4x^2-2x+7) \div (x-1)$

$x-1=0$
$+1 \quad +1$
$x=1$

$4x^2-2x+7$
$4(1)^2-2(1)+7=\boxed{9}$ ← remainder

Ex 2: Determine the remainder for $(m^8+6m^5-5) \div (m+2)$

$m+2=0$
$-2 \quad -2$
$m=-2$

$m^8+6m^5-5$
$(-2)^8+6(-2)^5-5=\boxed{59}$ ← remainder

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Factor Theorem: If $P(a)=0$, then $x-a$ is a factor of the polynomial.

Ex 3: Is $x-5$ a factor of $2x^3-18x^2-2x+210$?

$x-5=0$
$+5 \quad +5$
$x=5$

$2x^3-18x^2-2x+210$
$2(5)^3-18(5)^2-2(5)+210=\boxed{0}$
yes, $x-5$ is a factor!

Ex 4: Is $x+8$ a factor of $9x^3+x-7$?

$x+8=0$
$-8 \quad -8$
$x=-8$

$9x^3+x-7$
$9(-8)^3+(-8)-7=\boxed{-4623}$
no, $x+8$ is not a factor.