Intermediate Algebra
Skill-Builder # AE - 10
Dividing Polynomials Using Long Division

Arrange both dividend and divisor in **descending order**. Supply any missing term by using a coefficient of zero.

<u>Examples</u>

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

Solution:

Rearrange and rewrite the dividend as $x^3+\mathbf{0x^2}+x-5$ and rewrite the divisor as $x+3$. Apply the **D**ivide-**M**ultiply-**S**ubtract-**B**ring down process:

$$\begin{array}{r l}
 & \quad x^2-3x+10 \\
x+3\,\big) & x^3+\mathbf{0x^2}+x-5 \\
 & -\left(x^3+3x^2\right) \\ \hline
 & \quad -3x^2+x \\
 & \quad -\left(-3x^2-9x\right) \\ \hline
 & \qquad 10x-5 \\
 & \qquad -(10x+30) \\ \hline
 & \qquad\quad -35
\end{array}$$

Thus, we get $\left(x+x^3-5\right)\div(3+x)=x^2-3x+10-\dfrac{35}{x+3}$.

2. $\left(x^4-16y^4\right)\div(x-2y)$

Solution:

Rewrite the dividend as $x^4+\mathbf{0x^3y}+\mathbf{0x^2y^2}+\mathbf{0xy^3}-16y^4$ (descending in *x* and ascending in *y*).

$$\begin{array}{r l}
 & \quad x^3+2x^2y+4xy^2+8y^3 \\
x-2y\,\big) & x^4+\mathbf{0x^3y}+\mathbf{0x^2y^2}+\mathbf{0xy^3}-16y^4 \\
 & -\left(x^4-2x^3y\right) \\ \hline
 & \quad 2x^3y+0x^2y^2 \\
 & \quad -\left(2x^3y-4x^2y^2\right) \\ \hline
 & \qquad 4x^2y^2 \ +0xy^3 \\
 & \qquad -\left(4x^2y^2-8xy^3\right) \\ \hline
 & \qquad\quad 8xy^3-16y^4 \\
 & \qquad\quad -\left(8xy^3-16y^4\right) \\ \hline
 & \qquad\qquad 0
\end{array}$$

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Divide using long division.

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

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

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

4. $\left(x^3 + 81y^3\right) \div \left(x + 3y\right)$

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Answers
1.
2.
3.
4.

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