Let's have a Math Chat

Multiplication of Polynomials

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Multiplication of Polynomials

What is the distributive law of multiplication?

Multiplication of polynomials can be performed by applying the **distributive law of multiplication**:

$k(x + y) = kx + ky$ or $(x + y)k = xk + yk$

$kx + ky$ and $xk + yk$ are the **expansions** of $k(x + y)$ and $(x + y)k$ respectively.

Multiplication of Polynomials

Expand each of the following expressions.

(a) $2(3a + 5b)$

$= 2(3a) + 2(5b)$

$= \underline{6a + 10b}$

(b) $-a(4a - 3)$

$= -a(4a) + (-a)(-3)$

$= \underline{-4a^2 + 3a}$

Multiplication of Polynomials

When we expand the product of two binomials $(p + q)(x + y)$, we can also use the distributive law of multiplication to do so.

$$(p + q)(x + y)$$

$$= p(x + y) + q(x + y)$$

$$= px + py + qx + qy$$

Consider $x + y$ as a single term to expand the product.

Multiplication of Polynomials

Expand each of the following expressions.

(a) $(a + 4)(3 - a)$

$= a(3) + a(-a) + 4(3) + 4(-a)$

$= 3a - a^2 + 12 - 4a$

$= \underline{\underline{-a^2 - a + 12}}$

(b) $(b - a)(6a + 5b)$

$= b(6a) + b(5b) + (-a)(6a) + (-a)(5b)$

$= 6ab + 5b^2 - 6a^2 - 5ab$

$= \underline{-6a^2 + ab + 5b^2}$

Multiplication of Polynomials

We can also perform multiplication of polynomials in columns.

e.g. Expand $(b^2 - 2)(b + 5)$.

$$
\begin{array}{rrrrrrrr}
 & & b^2 & + & 0b & - & 2 \\
\times) & & & & b & + & 5 \\
\hline
b^3 & + & 0b^2 & - & 2b & & \\
+) & & 5b^2 & + & 0b & - & 10 \\
\hline
b^3 & + & 5b^2 & - & 2b & - & 10 \\
\hline\hline
\end{array}
$$

Arrange the terms in descending powers of b and add ‘$+0b$’ for the missing term.

Multiplication of Polynomials

Expand $(3b + 1)(4b - 5)$ and present the steps in columns.

$$
\begin{array}{lrrrrrr}
 & & & 3b & + & 1 \\
\times) & & & 4b & - & 5 \\
\hline
 & 12b^2 & + & 4b & & \\
+) & & - & 15b & - & 5 \\
\hline
 & 12b^2 & - & 11b & - & 5 \\
\hline\hline
\end{array}
$$

Multiplication of Polynomials

Expand $(8 - b^2)(2b + 9)$ and present the steps in columns.

$$
\begin{array}{rrrrrrrr}
 & & - & b^2 & + & 0b & + & 8 \\
\times) & & & & & 2b & + & 9 \\
\hline
 & -2b^3 & + & 0b^2 & + & 16b & & \\
+) & & - & 9b^2 & + & 0b & + & 72 \\
\hline
 & -2b^3 & - & 9b^2 & + & 16b & + & 72 \\
\hline\hline
\end{array}
$$