BAL BHARATI PUBLIC SCHOOL , PITAMPURA

Class -9 Mathematics

<u>POLYNOMIALS</u> (Part – 4)

Guidelines :

Dear Students

Kindly read the content given below and view the links shared for better understanding.

- **Solve the given questions in the yellow register provided in the notebook set.**

Link for the chapter : http://ncert.nic.in/textbook/textbook.htm?jemh1=3-15

Introduction : In this lesson we will learn " Division of Polynomials " (By long division method)

Let us consider two numbers 15 and 6. You know that when we divide 15 by 6, we get the quotient 2 and remainder 3. Do you remember how this fact is expressed? We write 15 as

$15 = (6 \times 2) + 3$

We observe that the remainder 3 is less than the divisor 6. Similarly, if we divide 12 by 6, we get

$12 = (6 \times 2) + 0$

What is the remainder here? Here the remainder is 0, and we say that 6 is a factor of 12 or 12 is a multiple of 6.

Now, the question is: Can we divide one polynomial by another? To start with, let us try doing this when the divisor is a monomial. So, let us divide the polynomial $2x + x^2 + x$ by the monomial x.

We have $(2x^3 + x^2 + x) \div x = 2x^3/x + x^2/x + x/x = 2x^2 + x + 1$

In fact, you may have noticed that x is common to each term of $2x^3 + x^2 + x$. So , we can write $2x^3 + x^2 + x$ as $x(2x^2 + x + 1)$

We say that x and $2x^2 + x + 1$ are the factors of $2x^3 + x^2 + x$ and

$2x^3 + x^2 + x$ is a multiple of x as well as a multiple of $2x^2 + x + 1$.

We know that Dividend = (Divisor × Quotient) + Remainder

In general, if p(x) and g(x) are two polynomials such that degree of p(x) ≥ degree of g(x) and g(x) ≠ 0, then we can find polynomials q(x) and r(x) such that:

p(x) = g(x)q(x) + r(x),

where r(x) = 0 or degree of r(x) < degree of g(x). Here we say that p(x) divided by g(x), gives q(x) as a quotient and r(x) as a remainder.

Examples of Long division :

Example 1: Evaluate $(x^2 + 10x + 21) \div (x + 7)$ using long division.

Solution :

$(x^2 + 10x + 21)$ is called the dividend and $(x + 7)$ is called the divisor

Step 1: Divide the first term of the dividend with the first term of the divisor and write the result as the first term of the quotient.

$$\begin{array}{r} x \\ x+7\overline{)x^2+10x+21} \end{array}$$

Step 2: Multiply that term with the divisor.

$$\begin{array}{rl} & x \\ x+7\big) & \overline{x^2+10x+21} \\ & x^2+7x \end{array}$$

(Please note that x is getting multiplied by (x + 7) to get (x^2 + 7x)

Step 3: Subtract and write the result to be used as the new dividend

$$
\begin{array}{r}
x \\
x+7\overline{\smash{)}\,x^2+10x+21} \\
x^2+7x \\
\hline
3x+21
\end{array}
$$

Step 4: Divide the first term of this new dividend by the first term of the divisor and write the result as the second term of the quotient.

$$
\begin{array}{r}
x+3 \\
x+7\overline{\smash{)}\,x^2+10x+21} \\
x^2+7x \\
\hline
3x+21
\end{array}
$$

Step 5: Multiply that term and the divisor and write the result under the new dividends.

$$
\begin{array}{r}
x+3 \\
x+7\overline{\smash{)}\,x^2+10x+21} \\
x^2+7x \\
\hline
3x+21 \\
3x+21
\end{array}
$$

Step 6: Subtract to get the remainder

$$
\begin{array}{r}
x+3 \\
x+7\overline{\smash{)}\,x^2+10x+21} \\
x^2+7x \\
\hline
3x+21 \\
3x+21 \\
\hline
0
\end{array}
$$

Note : It is possible that the remainder of a polynomial division may not be zero.

Example 2: Evaluate ($23y^2 + 20y^3 - 13y + 9$) ÷ ($-3y + 5y^2 + 2$)

Solution:

$$
\begin{array}{r}
4y+7 \\
5y^2-3y+2\,\overline{\big)\,20y^3+23y^2-13y+9} \\
20y^3-12y^2+8y \\
\hline
35y^2-21y+9 \\
35y^2-21y+14 \\
\hline
-5
\end{array}
$$

(Please note that in dividend and divisor , we have to arrange the terms in descending powers)

In this example p(x) = $20y^3 + 23y^2 - 13y + 9$ (dividend)

g(x) = $5y^2 - 3y + 2$ (divisor)

q(x) = $4y + 7$ (quotient)

r(x) = -5 (remainder)

Hence , **p(x) = g(x)q(x) + r(x), where r(x) = 0 or degree of r(x) < degree of g(x).**

Here, degree of r(x) is 0 which is less than degree of g(x) which is 2 .

Key points and important links for reference :

Refer to this link to enhance your knowledge :
https://www.youtube.com/watch?v=l6_ghhd7kwQ

Example of division of polynomials : https://www.khanacademy.org/math/algebra-home/alg-polynomials/alg-long-division-of-polynomials/v/dividing-polynomials-1

For further reference : https://www.youtube.com/watch?v=FTRDPB1wR5Y

Following questions are to be attempted in the register :

Exercise 2.3 Q1 : (i) , (v)

Q2. $(5x^3 - 6x^2 - 28x - 2) \div (x + 2)$

Q3. $(x^3 - 1) \div (x - 1)$

ASSIGNMENT :-

Note : Following questions are for the practice only and should be done in a separate practice register/copy of maths

1. $(x^2 + 7x + 12) \div (x + 3)$
2. $(15x^2 + 26x + 8) \div (5x + 2)$
3. $(4x^2 + 8x - 5) \div (2x + 1)$
4. $(x^4 + 3x^2 - 6x - 10) \div (x^2 + 3x - 5)$

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