

Mathematics

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(Chapter – 2) (Polynomials)(Exemplar Problems)

(Class – X)

Exercise 2.2

Question 1:

Answer the following and justify.

- (i) Can $x^2 - 1$ be the quotient on division of $x^6 + 2x^3 + x - 1$ by a polynomial in x in degree 5?
- (ii) What will the quotient and remainder be on division of $ax^2 + bx + c$ by $px^3 + qx^2 + rx + s$, $p \neq 0$?
- (iii) If on division of polynomial $p(x)$ by a polynomial $g(x)$, the quotient is zero, what is the relation between the degree of $p(x)$ and $g(x)$?
- (iv) If on division of a non-zero polynomial $p(x)$ by polynomial $g(x)$, the remainder is zero, what is the relation between the degrees of $p(x)$ and $g(x)$?
- (v) Can the quadratic polynomial $x^2 + kx + k$ have equal zeroes for some odd integers $k > 1$?



Answer 1:

(i) No

Because whenever we divide a polynomial $x^6 + 2x^3 + x - 1$ by a polynomial in degree 2, then we get quotient a polynomial in degree 4.

By division algorithm for polynomials,

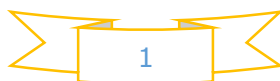
$$\text{Dividend} = \text{divisor} \times \text{quotient} + \text{remainder}$$

Sum of the degrees of divisor and quotient must be equal to degree of dividend.

(ii) Given that divisor = $px^3 + qx^2 + rx + s$, $p \neq 0$

and dividend = $ax^2 + bx + c$

If degree of dividend < degree of divisor, the quotient will be zero and remainder as same as dividend.



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(iii) If division of a polynomial $p(x)$ by a polynomial $g(x)$, the quotient is zero, then relation between the degrees of $p(x)$ and $g(x)$ is degree of $p(x) <$ degree of $g(x)$.

(iv) If division of a non-zero polynomial $p(x)$ by a polynomial $g(x)$, the remainder is zero, then $g(x)$ is a factor of $p(x)$ and has degree less than or equal to the degree of $p(x)$, i.e., degree of $g(x) \leq$ degree of $p(x)$.

(v) No

$$\text{Let } p(x) = x^2 + kx + k$$

Let α and α be the zeroes of the polynomial $p(x)$.

We know that,

$$\therefore \text{sum of zeroes } \alpha + \alpha = -\frac{b}{a}$$

$$\Rightarrow 2\alpha = -\frac{k}{1} = -k$$

$$\Rightarrow \alpha = -\frac{k}{2}$$



... (i)

$$\text{and product of zeroes } \alpha \cdot \alpha = \frac{c}{a}$$

$$\Rightarrow \alpha^2 = \frac{k}{1} = k \quad \dots \text{ (ii)}$$

Solving equations (i) and (ii), we get

$$\frac{k^2}{4} = k$$

$$\Rightarrow k^2 = 4k$$

$$\Rightarrow k^2 - 4k = 0$$

$$\Rightarrow k(k - 4) = 0$$

$$\Rightarrow k = 0 \text{ or } k = 4$$

But $k > 1$, so $k = 4$ which is even not odd number.

