Mathematics

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(Chapter – 2)(Polynomials)

(Class – 9)

Exercise 2.2

Question 1:

Find the value of the polynomial $5x - 4x^2 + 3$ at:

(i) $x = 0$ **(ii)** $x = -1$ **(iii)** $x = 2$

Answer 1:

Let $p(x) = 5x - 4x^2 + 3$

(i) Putting $x = 0$, we get

$p(0) = 5 \times 0 - 4(0)^2 + 3 = 3$

(ii) Putting $x = -1$, we get

$p(-1) = 5 \times (-1) - 4(-1)^2 + 3 = -5 - 4 + 3 = -6$

(iii) Putting $x = 2$, we get

$p(2) = 5 \times 2 - 4(2)^2 + 3 = 10 - 16 + 3 = -3$

Question 2:

Find $p(0)$, $p(1)$ and $p(2)$ for each of the following polynomials:

(i) $p(y) = y^2 - y + 1$ **(ii)** $p(t) = 2 + t + 2t^2 - t^3$

(iii) $p(x) = x^3$ **(iv)** $p(x) = (x - 1)(x + 1)$

Answer 2:

(i) $p(y) = y^2 - y + 1$

Putting $y = 0$, we get
$p(0) = 0^2 - 0 + 1 = 1$

Putting $y = 1$, we get
$p(1) = 1^2 - 1 + 1 = 1$

Putting $y = 2$, we get
$p(2) = 2^2 - 2 + 1 = 3$

(ii) $p(t) = 2 + t + 2t^2 - t^3$

Putting $t = 0$, we get
$p(0) = 2 + 0 + 2(0)^2 - (0)^3 = 2$

Putting $t = 1$, we get
$p(1) = 2 + 1 + 2(1)^2 - (1)^3 = 2 + 1 + 2 - 1 = 4$

Putting $t = 2$, we get
$p(2) = 2 + 2 + 2(2)^2 - (2)^3 = 2 + 2 + 8 - 8 = 4$

(iii) $p(x) = x^3$

Putting $x = 0$, we get
$p(0) = (0)^3 = 0$

Putting $x = 1$, we get
$p(1) = (1)^3 = 1$

Putting $x = 2$, we get
$p(2) = (2)^3 = 8$

(iv) $p(x) = (x-1)(x+1)$

Putting $x = 0$, we get
$p(0) = (0-1)(0+1) = -1$

Putting $x = 1$, we get
$p(1) = (1-1)(1+1) = 0 \times 2 = 0$
Putting $x = 2$, we get
$p(2) = (2-1)(2+1) = 3$

Question 3:

Verify whether the following are zeroes of the polynomial, indicated against them.

(i) $p(x) = 3x + 1;\quad x = -\frac{1}{3}$ **(ii)** $p(x) = 5x - \pi;\quad x = \frac{4}{5}$

(iii) $p(x) = x^2 - 1;\quad x = 1, -1$ **(iv)** $p(x) = (x+1)(x-2);\quad x = -1, 2$

(v) $p(x) = x^2;\quad x = 0$ **(vi)** $p(x) = lx + m;\quad x = -\frac{m}{l}$

(vii) $p(x) = 3x^2 - 1;\quad x = -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ **(viii)** $p(x) = 2x + 1;\quad x = \frac{1}{2}$

Answer 3:

(i) $p(x) = 3x + 1;\quad x = -\frac{1}{3}$

Putting $x = -\frac{1}{3}$, we get

$$p\left(-\frac{1}{3}\right) = 3 \times \left(-\frac{1}{3}\right) + 1 = -1 + 1 = 0$$

Here, $p\left(-\frac{1}{3}\right) = 0$, Hence, $x = -\frac{1}{3}$ is a solution of $p(x) = 3x + 1$.

(ii) $p(x) = 5x - \pi;\quad x = \frac{4}{5}$

Putting $x = \frac{4}{5}$, we get

$$p\left(\frac{4}{5}\right) = 5 \times \left(\frac{4}{5}\right) - \pi = 4 - \pi$$

Here, $p\left(\frac{4}{5}\right) \neq 0$, Hence, $x = \frac{4}{5}$ is not a solution of $p(x) = 5x - \pi$.

(iii) $p(x) = x^2 - 1; \quad x = 1, -1$
Putting $x = 1$, we get
$p(1) = (1)^2 - 1 = 1 - 1 = 0$
Here, $p(1) = 0$, Hence, $x = 1$ is a solution of $p(x) = x^2 - 1$.

Putting $x = -1$, we get
$p(-1) = (-1)^2 - 1 = 1 - 1 = 0$
Here, $p(-1) = 0$, Hence, $x = -1$ is a solution of $p(x) = x^2 - 1$.

(iv) $p(x) = (x + 1)(x - 2); \quad x = -1, 2$
Putting $x = -1$, we get
$p(-1) = (-1 + 1)(-1 - 2) = 0 \times (-3) = 0$
Here, $p(-1) = 0$, Hence, $x = -1$ is a solution of $p(x) = (x + 1)(x - 2)$.

Putting $x = 2$, we get
$p(2) = (2 + 1)(2 - 2) = 3 \times 9 = 0$
Here, $p(2) = 0$, Hence, $x = 2$ is a solution of $p(x) = (x + 1)(x - 2)$.

(v) $p(x) = x^2; \quad x = 0$
Putting $x = 0$, we get
$p(0) = (0)^2 = 0$
Here, $p(0) = 0$, Hence, $x = 0$ is a solution of $p(x) = x^2$.

(vi) $p(x) = lx + m; \quad x = -\frac{m}{l}$
Putting $x = -\frac{m}{l}$, we get
$p\left(-\frac{m}{l}\right) = l \times \left(-\frac{m}{l}\right) + m = -m + m = 0$
Here, $p\left(-\frac{m}{l}\right) = 0$, Hence, $x = -\frac{m}{l}$ is a solution of $p(x) = lx + m$.

(vii) $p(x) = 3x^2 - 1; \quad x = -\frac{1}{\sqrt{3}}, \frac{2}{\sqrt{3}}$
Putting $x = -\frac{1}{\sqrt{3}}$, we get
$p\left(-\frac{1}{\sqrt{3}}\right) = 3\left(-\frac{1}{\sqrt{3}}\right)^2 - 1 = 3 \times \frac{1}{3} - 1 = 1 - 1 = 0$
Here, $p\left(-\frac{1}{\sqrt{3}}\right) = 0$, Hence, $x = -\frac{1}{\sqrt{3}}$ is a solution of $p(x) = 3x^2 - 1$.

Putting $x = \frac{2}{\sqrt{3}}$, we get
$p\left(\frac{2}{\sqrt{3}}\right) = 3\left(\frac{2}{\sqrt{3}}\right)^2 - 1 = 3 \times \frac{4}{3} - 1 = 4 - 1 = 3$
Here, $p\left(\frac{2}{\sqrt{3}}\right) \neq 0$, Hence, $x = \frac{2}{\sqrt{3}}$ is not a solution of $p(x) = 3x^2 - 1$.

(viii) $p(x) = 2x + 1;\ \ x = \frac{1}{2}$

Putting $x = \frac{1}{2}$, we get

$p\left(\frac{1}{2}\right) = 2 \times \left(\frac{1}{2}\right) + 1 = 1 + 1 = 2$

Here, $p\left(\frac{1}{2}\right) \neq 0$, Hence, $x = \frac{1}{2}$ is not a solution of $p(x) = 2x + 1$.

Question 4:

Find the zero of the polynomial in each of the following cases:

(i) $p(x) = x + 5$ **(ii)** $p(x) = x - 5$ **(iii)** $p(x) = 2x + 5$

(iv) $p(x) = 3x - 2$ **(v)** $p(x) = 3x$ **(vi)** $p(x) = ax,\ \ a \neq 0$

(vii) $p(x) = cx + d;\ \ c \neq 0,\ c,\ d$ are real numbers.

Answer 4:

(i) $p(x) = x + 5$

Putting $p(x) = 0$, we get

$x + 5 = 0$

$\Rightarrow x = -5$

Hence, $x = -5$ is a zero of the polynomial $p(x)$.

(ii) $p(x) = x - 5$

Putting $p(x) = 0$, we get

$x - 5 = 0$

$\Rightarrow x = 5$

Hence, $x = 5$ is a zero of the polynomial $p(x)$.

(iii) $p(x) = 2x + 5$

Putting $p(x) = 0$, we get

$2x + 5 = 0$

$\Rightarrow x = -\frac{5}{2}$

Hence, $x = -\frac{5}{2}$ is a zero of the polynomial $p(x)$.

(iv) $p(x) = 3x - 2$

Putting $p(x) = 0$, we get

$3x - 2 = 0$

$\Rightarrow x = \frac{2}{3}$

Hence, $x = \frac{2}{3}$ is a zero of the polynomial $p(x)$.

(v) $p(x) = 3x$

Putting $p(x) = 0$, we get

$3x = 0$

$\Rightarrow x = 0$

Hence, $x = 0$ is a zero of the polynomial $p(x)$.

(vi) $p(x) = ax, \quad a \neq 0$
Putting $p(x) = 0$, we get
$ax = 0$
$\Rightarrow x = 0$
Hence, $x = 0$ is a zero of the polynomial $p(x)$.

(vii) $p(x) = cx + d; \quad c \neq 0, \ c, \ d$ are real numbers.
Putting $p(x) = 0$, we get
$cx + d = 0$
$\Rightarrow x = -\frac{d}{c}$
Hence, $x = -\frac{d}{c}$ is a zero of the polynomial $p(x)$.