Polynomials: Exercise 2.2

Q.1 Find the value of the polynomial $5x-4x^2+3$ at
(i) $x = 0$ (ii) $x = -1$ (iii) $x = 2$

Sol. Suppose, $p(x) = 5x - 4x^2 + 3$

(i) At $x = 0$: $p(0) = 5(0) - 4(0)^2 + 3$
$= 0 - 0 + 3$
$= 3$

(ii) At $x = -1$: $p(-1) = 5(-1) - 4(-1)^2 + 3$
$= -5 - 4 + 3$
$= -6$

(iii) At $x = 2$: $p(2) = 5(2) - 4(2)^2 + 3$
$= 10 - 16 + 3$
$= -3$

Q.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) $p(x) = (x-1)(x+1)$**

Sol.

(i) Given: $p(y) = y^2 - y + 1$
$p(0) = (0)^2 - 0 + 1$
$= 0-0+1$
$=1$
$p(1) = (1)^2 - 1 + 1$
$= 1 - 1 + 1$
$= 1$
and $p(2) = (2)^2 - 2 + 1$
$= 4 - 2 + 1$
$= 3$

(ii) Given: $p(t) = 2 + t + 2t^2 - t^3$
$p(0) = 2 + 0 + 2(0)^2 - (0)^3$
$= 2 + 0 + 0 - 0$
$= 2$
$p(1) = 2 + 1 + 2(1)^2 - (1)^3$
$= 2 + 1 + 2 - 1$
$= 5 - 1$
$=4$
and $p(2) = 2 + 2 + 2(2)^2 - (2)^3$
$= 2 + 2 + 8 - 8$
$=4$

(iii) Given: $p(x) = x^3$
$p(0) = (0)^3$
$= 0$
$p(1) = (1)^3$
$=1$
and $p(2) = (2)^3$
$=8$

(iv) Given: $p(x) = (x-1)(x+1)$
$p(0) = (0-1)(0+1)$
$= (-1)(1)$
$= -1$
$p(1) = (1-1)(1+1)$
$= (0)(2)$
$= 0$
and $p(2) = (2-1)(2+1)$
$= (1)(3)$
$= 3$

Q.3 Verify whether the following are zeroes of the polynomial, indicated against them.

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

(ii) p(x) = 5x−π, x = $\frac{4}{5}$

(iii) p(x) = $x^2 - 1$, x = 1, −1

(iv) p(x) = (x+1)(x−2), x = −1, 2

(v) p(x) = x^2, x = 0

(vi) p(x) = lx + m, x = $-\frac{m}{\ell}$

(vii) p(x) = $3x^2 - 1$, x = $-\frac{1}{\sqrt{3}}, \frac{2}{\sqrt{3}}$

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

Sol.

(i) Given: p(x) = 3x + 1

At $x = -\frac{1}{3}$, $p(-\frac{1}{3}) = 3(-\frac{1}{3})+1$

$= -1+1= 0$

Thus, $-\frac{1}{3}$ is a zero of polynomial p(x) = 3x + 1.

(ii) Given: p(x) = 5x−π

At $x = \frac{4}{5}$

$P(\frac{4}{5}) = 5(\frac{4}{5}) - \pi = 4-\pi$

Thus, $\frac{4}{5}$ is not a zero of polynomial p(x) = 5x−π

(iii) Given: p(x) = x^2-1

At x = 1, p(1) = $(1)^2 - 1$

=1−1

= 0

Thus, 1 is a zero of p (x) = x^2-1.

Also, at x = -1 p(−1) = $(-1)^2-1$

=1−1= 0

Thus, -1 is a zero of polynomial p(x)= x^2-1.

(iv) Given: p(x) = (x+1) (x−2)

At x = −1, p(−1) = (−1+1)(−1−2)

= (0)(−3) = 0

Thus, -1 is a zero of p (x)= (x+1) (x−2) .

Also, at x = 2, p(2) = (2+1)(2−2)

= (3) (0) = 0

Thus, 2 is zero of polynomial p(x) = (x + 1) (x + 2).

(v) Given: p(x) = x^2

At x = 0, p(0) = $(0)^2$

= 0

Thus, 0 is a zero of polynomial p(x) = x^2.

(vi) Given: $p(x) = \ell x + m$

At $x= -\frac{m}{\ell}$, $p(-\frac{m}{\ell}) = \ell(-\frac{m}{\ell}) + m$

$= -m + m = 0$

Thus, $-\frac{m}{\ell}$ is a zero of polynomial $p(x)= lx + m$.

(vii) Given: $p(x) = 3x^2-1$

At $x = -\frac{1}{\sqrt{3}}$; $p(-\frac{1}{\sqrt{3}}) = 3(\frac{1}{\sqrt{3}})^2-1$

$= 3\times-\frac{1}{3}-1$

$=1-1= 0$

Thus, $-\frac{1}{\sqrt{3}}$ is a zero of polynomial $p(x) = 3x^2-1$

At $x = \frac{2}{\sqrt{3}}$, $p(\frac{2}{\sqrt{3}}) = 3(\frac{2}{\sqrt{3}})^2 - 1$

$= 3\times\frac{4}{3}-1$

$= 4-1 = 3$

Thus, $\frac{2}{\sqrt{3}}$ is not a zero of polynomial $p(x) = 3x^2-1$.

(viii) Given: $p(x) = 2x+1$

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

$=1+1= 2$

Thus, $\frac{1}{2}$ is not a zero of polynomial $p(x) = 2x + 1$.

Q.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) $p(x) = ax$, $a\neq0$
(vii) $p(x) = cx + d$, $c \neq 0$, c, d are real numbers.

Sol.

(i) For zero, we need to solve $p(x) = 0$

$\Rightarrow x + 5 = 0 \Rightarrow x = -5$

Hence, - 5 is a zero of the polynomial x + 5.

(ii) For zero, we need to solve $p(x) = 0$

$\Rightarrow x - 5 = 0 \Rightarrow x = 5$

Hence, 5 is a zero of the polynomial x – 5.

(iii) For zero, we need to solve $p(x) = 0$

$\Rightarrow 2x + 5 = 0 \Rightarrow x = -\frac{5}{2}$

Hence, $-\frac{5}{2}$ is a zero of the polynomial 2x + 5.

(iv) For zero, we need to solve p(x) = 0

$$\Rightarrow 3x - 2 = 0 \Rightarrow x = \frac{2}{3}$$

Thus, $\frac{2}{3}$ is a zero of the polynomial 3x – 2.

(v) For zero, we have to solve p(x) = 0

$$\Rightarrow 3x = 0 \Rightarrow x = 0$$

Thus, 0 is a zero of the polynomial 3x.

(vi) For zero, we need to solve p(x) = ax, a≠0

$$\Rightarrow ax = 0 \Rightarrow x = 0$$

Hence, 0 is a zero of the polynomial ax.

(vii) For zero, we need to solve p(x) = 0, c ≠ 0

$$\Rightarrow cx + d = 0 \Rightarrow x = -\frac{d}{c}$$

Hence, $-\frac{d}{c}$ is a zero of the polynomial cx + d.