Ex - 2.2

Q1. Find the value of the polynomial $5x - 4x^2 + 3$ at
(i) $x = 0$ (vi) $x = -1$ (iii) $x = 2$

Sol. Let $f(x) = 5x - 4x^2 + 3$

(i) Value of $f(x)$ at $x = 0 = f(0)$
$= 5(0) - 4(0)^2 + 3 = 3$

(ii) Value of $f(x)$ at $x = -1 = f(-1)$
$= 5(-1) - 4(-1)^2 + 3 = -5 - 4 + 3 = -6$

(iii) Value of $f(x)$ at $x = 2 = f(2)$
$= 5(2) - 4(2)^2 + 3$
$= 10 - 16 + 3 = -3$

Q2. Find $p(0)$, $p(1)$, $p(2)$, 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) $p(y) = y^2 - y + 1$
$\therefore p(0) = (0)^2 - (0) + 1 = 1,$
$p(1) = (1)^2 - (1) + 1 = 1,$
$p(2) = (2)^2 - (2) + 1 = 4 - 2 + 1 = 3.$

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

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

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

Q3. Verify whether the following are zeroes of the polynomial, indicated against them,

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

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

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

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

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

$\therefore -\frac{1}{3}$ is a zero of p(x).

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

$p\left(\frac{4}{5}\right) = 5\left(\frac{4}{5}\right) - \pi = 4 - \pi \neq 0$

$\therefore \frac{4}{5}$ is not a zero of p(x).

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

$p(1) = (1)^2 - 1 = 1 - 1 = 0$

$p(-1) = (-1)^2 - 1 = 1 - 1 = 0$

$\therefore$ 1, –1 are zero's of p(x).

(iv) $p(x) = (x + 1)(x - 2), \quad x = -1, 2$

$p(-1) = (-1 + 1)(-1 - 2) = (0)(-3) = 0$

$p(2) = (2 + 1)(2 - 2) = (3)(0) = 0$

$\therefore$ –1, 2 are zero's of p(x)

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

$p(0) = 0$

$\therefore$ 0 is a zero of p(x)

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

$p\left(\frac{-m}{\ell}\right) = \ell\left(\frac{-m}{\ell}\right) + m = -m + m = 0$

$\therefore \frac{-m}{\ell}$ is a zero of p(x).

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

$$p\left(-\frac{1}{\sqrt{3}}\right) = 3\left(-\frac{1}{\sqrt{3}}\right)^2 - 1 = 3\left(\frac{1}{3}\right) - 1$$
$$= 1 - 1 = 0$$

$$p\left(\frac{2}{\sqrt{3}}\right) = 3\left(\frac{2}{\sqrt{3}}\right)^2 - 1 = 3\left(\frac{4}{3}\right) - 1$$
$$= 4 - 1 = 3 \neq 0$$

So, $-\frac{1}{\sqrt{3}}$ is a zero of $p(x)$ and $\frac{2}{\sqrt{3}}$ is not a zero of $p(x)$.

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

$$p\left(\frac{1}{2}\right) = 2\left(\frac{1}{2}\right) + 1 = 1 + 1 = 2 \neq 0$$

$\therefore$ $\frac{1}{2}$ is not a zero of $p(x)$.

Q4. 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.

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

$p(x) = 0$

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

$\therefore$ -5 is zero of the polynomial $p(x)$.

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

$p(x) = 0$

$x - 5 = 0$

or $x = 5$

$\therefore$ 5 is zero of polynomial $p(x)$.

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

$p(x) = 0$

$2x + 5 = 0$

$2x = -5$

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

$\therefore$ $-\frac{5}{2}$ is zero of polynomial $p(x)$.

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

$p(x) = 0 \Rightarrow 3x - 2 = 0$

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

$\therefore \frac{2}{3}$ is zero of polynomial p(x).

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

$p(x) = 0 \Rightarrow 3x = 0$

or $x = 0$

$\therefore 0$ is zero of polynomial p(x).

(vi) $p(x) = ax, \quad a \neq 0$

$\Rightarrow ax = 0 \quad$ or $x = 0$

$\therefore 0$ is zero of p(x)

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

$cx + d = 0 \Rightarrow cx = -d$

$x = -\frac{d}{c}$

$\therefore -\frac{d}{c}$ is zero of polynomial p(x).