## Exerise 2.2

**1.** *Find the value of the polynomial* $5x - 4x^2 + 3$ *at*

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

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

(*i*) $f(0) = 0 - 0 + 3 = 3$ (*ii*) $f(-1) = -5 - 4 + 3 = -6$

(*iii*) $f(2) = 10 - 16 + 3 = -3$.

**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*) $p(0) = 0 - 0 + 1 = 1$; $p(1) = 1 - 1 + 1 = 1$;
$p(2) = 4 - 2 + 1 = 3$.

(*ii*) $p(0) = 2 + 0 + 0 - 0 = 2$; $p(1) = 2 + 1 + 2 - 1 = 4$;
$p(2) = 2 + 2 + 8 - 8 = 4$.

(*iii*) $p(0) = 0$; $p(1) = 1$; $p(2) = 8$.

(*iv*) $p(0) = (0 - 1)(0 + 1) = -1$; $p(1) = (1 - 1)(1 + 1) = 0$;
$p(2) = (2 - 1)(2 + 1) = 3$.

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

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

(*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*) $p(x) = lx + m$, $x = -\frac{m}{l}$

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

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

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

Hence, $x = \frac{4}{5}$ is not a zero of the polynomial $p(x)$.

(*iii*) $p(1) = 1 - 1 = 0$ and $p(-1) = 1 - 1 = 0$

Hence, $x = 1$ and $x = -1$ are zeroes of the polynomial $p(x)$.

(*iv*) $p(-1) = (-1 + 1)(-1 - 2) = 0$ and $p(2)$

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

Hence, $x = -1$ and $x = 2$ are zeroes of the polynomial $p(x)$.

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

(*vi*) $p\left(-\frac{m}{l}\right) = l \cdot \left(-\frac{m}{l}\right) + m = -m + m = 0$

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

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

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

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

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

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

**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.*

**Sol.** (*i*) For zero, $p(x) = 0 \Rightarrow x + 5 = 0$

$\Rightarrow x = -5$ is a zero of the polynomial $p(x)$.

(*ii*) For zero, $p(x) = 0 \Rightarrow x - 5 = 0$

$\Rightarrow x = 5$ is a zero of the polynomial $p(x)$.

(*iii*) For zero, $p(x) = 0 \Rightarrow 2x + 5 = 0$

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

(*iv*) For zero, $p(x) = 0 \Rightarrow 3x - 2 = 0$

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

(*v*) For zero, $p(x) = 0 \Rightarrow 3x = 0$

$\Rightarrow x = 0$ is a zero of the polynomial $p(x)$.

(*vi*) For zero, $p(x) = 0 \Rightarrow ax = 0$

$\Rightarrow x = 0$, as $a \neq 0$

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

(*vii*) For zero, $p(x) = 0 \Rightarrow cx + d = 0$

$\Rightarrow x = -\frac{d}{c},\ (c \neq 0)$

Therefore, $x = -\frac{d}{c}$ is a zero of the polynomial $p(x)$.