SpeedLabs

MATHS

CBSE 9th

TEEVRA EDUTECH PVT. LTD.

Polynomials

Exercise-2.3

1. Find the remainder when $x^2 + 3x^2 + 3x + 1$ is divided by

(i) x+1 (ii) $x - \frac{1}{2}$ (iii) x (iv) $x + \pi$ (v) $5 + 2x$

Ans - (i) x+1

By long division,

$$
\begin{array}{r|l}
 & x^2 + 2x + 1 \\ \hline
x + 1 & x^3 + 3x^2 + 3x + 1 \\
 & x^3 + x^2 \\
 & - \quad - \\ \hline
 & \quad 2x^2 + 3x + 1 \\
 & \quad 2x^2 + 2x \\
 & \quad - \quad - \\ \hline
 & \qquad x + 1 \\
 & \qquad x + 1 \\
 & \qquad - \quad - \\ \hline
 & \qquad 0 \\ \hline
\end{array}
$$

(ii) $x - \frac{1}{2}$

By long division,

$$
\begin{array}{r|l}
 & x^2 + \frac{7}{2} + \frac{19}{4} \\ \hline
x - \frac{1}{2} & x^3 + 3x^2 + 3x + 1 \\
 & x^3 - \frac{x^2}{2} \\
 & - \quad + \\ \hline
 & \quad \frac{7}{2}x^2 + 3x + 1 \\
 & \quad \frac{7}{2}x^2 - \frac{7}{4}x \\
 & \quad - \quad + \\ \hline
 & \qquad \frac{19}{4}x + 1 \\
 & \qquad \frac{19}{4}x - \frac{19}{8} \\
 & \qquad - \quad + \\ \hline
 & \qquad \frac{27}{8} \\ \hline
\end{array}
$$

+

(iii) x

By long division,

$$
\begin{array}{r|l}
 & x^2 + 3x + 3 \\
\hline
x & x^3 + 3x^2 + 3x + 1 \\
 & x^3 \\
 & - \\
\hline
 & 3x^2 + 3x + 1 \\
 & 3x^2 \\
 & - \\
\hline
 & 3x + 1 \\
 & 3x \\
 & - \\
\hline
 & 1 \\
\hline
\end{array}
$$

(iv) $x + \pi$

By long division,

$$
\begin{array}{r|l}
 & x^2 + (3 - \pi)\ x + (3 - 3\pi + \pi^2) \\
\hline
x + \pi & x^3 + 3x^2 + 3x + 1 \\
 & 3x + \pi x^2 \\
 & - \quad - \\
\hline
 & (3 - \pi)\ x^2 + 3x + 1 \\
 & (3 - \pi)\ x^2 + (3 - \pi)\pi x \\
 & - \qquad\qquad - \\
\hline
 & [3 - 3\pi + \pi^2]x + 1] \\
 & [3 - 3\pi + \pi^2]x + (3 - 3\pi + \pi^2)\pi \\
 & - \qquad\qquad\quad - \\
\hline
 & [1 - 3\pi + 3\pi^2 + \pi^2] \\
\hline
\end{array}
$$

(v) 5 + 2x

By long division,

$$
\begin{array}{r l}
 & \frac{x^2}{2}+\frac{x}{4}+\frac{7}{8} \\
\cline{2-2}
2x+5 \big) & x^3+3x^2+3x+1 \\
 & 3x+\frac{5}{2}\ x^2 \\
 & - \\
\cline{2-2}
 & \frac{x^2}{2}+3x+1 \\
 & \frac{x^2}{2}+\frac{5x}{4} \\
 & - \quad - \\
\cline{2-2}
 & \frac{7x}{4}+1 \\
 & \frac{7}{4}\ x+\frac{35}{8} \\
 & - \quad - \\
\cline{2-2}
 & \frac{27}{8} \\
\cline{2-2}
\end{array}
$$

2. Find the remainder when $x^3 - ax^2 + 6x - a$ is divided by $x - a$.

Ans - We need to find the zero of the polynomial $x - a$.

$x - a = 0 \qquad \Rightarrow x = a$

While applying the remainder theorem, we need to put the zero of the polynomial $x - a$ in the polynomial $x^3 - ax^2 + 6x - a$

$p(x) = x^3 - ax^2 + 6x - a$

$p(a) = (a)^3 - a\,(a)^2 + 6(a) - a$

$= a^3 - a^3 + 6a - a$

$= 5a$

Therefore, we conclude that on dividing the polynomial $x^3 - ax^3 + 6x - a$ by $x - a$, we will get the remainder as 5a.

3. Check whether $7 + 3x$ is a factor of $3x^3 + 7x$.

Ans - we know that if the polynomial $7 + 3x$ is a factor of $3x^3 + 7x$, then on dividing the polynomial $3x^3 + 7$ by $7 + 3x$, we must get the remainder as 0.

We need to find the zero of the polynomial $7 + 3x$.

$7x + 3x = 0 \qquad \Rightarrow x = -\frac{7}{3}$

While applying the remainder theorem, we need to put the zero of the polynomial $7 + 3x$ inthe polynomial$3x^3 + 7x$, to get

$p(x) = 3x^3 + 7x$

$= 3\left(-\frac{7}{3}\right)^3 + 7\left(\frac{7}{3}\right) = 3\left(-\frac{343}{27}\right) - \frac{49}{3}$

$= -\frac{343}{9} - \frac{49}{3} - \frac{-343 - 147}{9}$

$= \frac{-490}{9}$

We conclude that on dividing the polynomial $3x^3 + 7x$ by $7 + 3x$, we will get the remainder as$\frac{-490}{9}$, which is not 0.

Therefore, we conclude that $7 + 3x$ is not a factor of $3x^3 + 7x$.