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## NCERT Class 9 Solutions: Polynomials (Chapter 2) Exercise 2.3

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Q-1 Find the remainder when $x^{3}+3 x^{2}+3 x+1$ is divided by

1. $x+1$
2. $x-\frac{1}{2}$
3. 
4. $x+\pi$
5. $5+2 x$

## Solution:



1. $x+1$

By long division,

$$
x+1) \frac{x^{2}+2 x+1}{} \begin{array}{rlll}
x^{3} & +3 x^{2} & +3 x & +1 \\
x^{3} & +x^{2} & & \\
& - & - & \\
\hline & 2 x^{2} & +3 x & +1 \\
2 x^{2} & +2 x & \\
& - & - & \\
\hline & x & +1 \\
\hline & x & +1 \\
& & - & - \\
\hline & 0 &
\end{array}
$$

Therefore, the remainder is 0 .

1. $x-\frac{1}{2}$

By long division,

$$
\begin{aligned}
& \left.x-\frac{1}{2}\right) \frac{x^{2}+\frac{7}{2} x+\frac{19}{4}}{x^{3}+3 x^{2}+3 x+1} \\
& x^{3}-\frac{x^{2}}{2} \\
& \begin{array}{cccc}
- & + & \\
\hline \frac{7}{2} x^{2} & +3 x & +1 \\
7 & 2 & &
\end{array} \\
& \frac{7}{2} x^{2} \quad-\frac{7}{4} x \\
& \begin{array}{cc}
- & + \\
\hline \frac{19}{4} x & +1 \\
\frac{19}{4} x & -\frac{19}{8} \\
- & + \\
\hline \frac{27}{8} &
\end{array}
\end{aligned}
$$

Therefore, the remainder is $\frac{27}{8}$
1.

By long division,

$$
\begin{gathered}
x) \frac{x^{2}+3 x+3}{x^{3}+3 x^{2}+3 x+1} \\
x^{3} \\
- \\
\begin{array}{ccc}
3 x^{2} \quad+3 x \quad+1 \\
3 x^{2} \\
- & \\
\hline
\end{array} \\
\begin{array}{c}
3 x \\
3 x
\end{array} \\
\hline
\end{gathered}
$$

Therefore, the remainder is

1. $x+\pi$

By long division,

$$
\begin{aligned}
& x+\pi) \frac{x^{2}+(3-\pi) x+\left(3-3 \pi+\pi^{2}\right)}{x^{3}+3 x^{2}+3 x+1} \\
& x^{3}+\pi x^{2} \\
& \begin{array}{lll}
- & - & \\
\hline(3-\pi) x^{2} & +3 x & +1 \\
(3-\pi) x^{2} & +(3-\pi) \pi &
\end{array} \\
& (3-\pi) x^{2} \quad+(3-\pi) \pi x \\
& \begin{array}{ll}
- & - \\
{\left[3-3 \pi+\pi^{2}\right] x} & +1
\end{array} \\
& {\left[3-3 \pi+\pi^{2}\right] x \quad+\left[3-3 \pi+\pi^{2}\right] \pi} \\
& \frac{-}{\left[1-3 \pi+3 \pi^{2}-\pi^{3}\right]}
\end{aligned}
$$

Therefore, the remainder is $\left[1-3 \pi+3 \pi^{2}-\pi^{3}\right]$

1. $5+2 x$

By long division,


Therefore, the remainder is $-\frac{27}{8}$
Q-2 Find the remainder when $x^{3}-a x^{2}+6 x-a$ is divided by $x-a$.

$$
4 x+1 \begin{aligned}
& \frac{3}{4} x-\frac{3}{16} \\
& \frac{3 x^{2}+\frac{3}{4} x}{}+1 \\
& \frac{-\frac{3}{4} x+1}{4} \\
& \frac{-\frac{3}{4} x-\frac{3}{16}}{\frac{19}{16}}
\end{aligned}
$$

Solution:
By long Division,

$$
\begin{aligned}
& x-a) \frac{x^{2}+6}{x^{3}-a x^{2}+6 x-a} \\
& x^{3}-a x^{2} \\
& \frac{-\quad+}{6 x-a} \\
& 6 x-6 a \\
& \frac{-\quad+}{5 a}
\end{aligned}
$$

Therefore, remainder obtained is ${ }_{5 a}$ when $x^{3}-a x^{2}+6 x-a$ is divided by $x-a$
Q-3 Check whether $7+3 x$ is a factor of $3 x^{3}+7 x$

Solution:

- We have to divide $3 x^{3}+7 x$ by $7+3 x$.
- If remainder comes out to be 0 then $7+3 x$ will be a factor of $3 x^{3}+7 x$
- By Long Division,

$$
\begin{aligned}
& 3 x-7) \frac{x^{2}-\frac{7}{3} x+\frac{70}{9}}{3 x^{3}+0 x^{2}+7 x} \\
& 3 x^{3}+7 x^{2} \\
& \frac{-}{-7 x^{2}+7 x} \\
& -7 x^{2} \quad-\frac{49}{3} x \\
& \frac{+\quad+}{\frac{70}{3} x} \\
& \frac{70}{3} x+\frac{490}{9} \\
& \frac{-}{-\frac{490}{9}}
\end{aligned}
$$

As remainder is not zero so $7+3 x$ is not a factor of $3 x^{3}+7 x$

