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Polynomials (Division Algorithm for Polynomials)

Chapter: 2(exercise: 2.3)

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Divide $2x^2 + 3x + 1$ by $x + 2$.

$$\begin{array}{r} \underline{x+2} \overline{) 2x^2 + 3x + 1} \quad (2x-1) \\ \underline{2x^2 + 4x} \\ -x + 1 \\ \underline{-x - 2} \\ 3 \end{array}$$

$$\begin{array}{r} -x + 1 \\ -x - 2 \\ \hline 3 \end{array}$$

$$\underline{2x^2 + 3x + 1 = (x+2)(2x-1) + 3}$$

$$\begin{array}{r} 2 \overline{) 412} \\ \underline{4} \\ x12 \\ \underline{x12} \\ x \end{array}$$

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Divide $3x^3 + x^2 + 2x + 5$ by $1 + 2x + x^2$.

$$\begin{array}{r} \underline{x^2 + 2x + 1) \overline{3x^3 + x^2 + 2x + 5}} \\ \underline{3x^3 + 6x^2 + 3x} \\ -5x^2 - x + 5 \\ \underline{-5x^2 - 10x - 5} \\ + + + \\ \hline (9x + 10) \end{array}$$

$(3x - 5)$

$$\begin{array}{r} 3x^3 + x^2 + 2x + 5 \\ = (x^2 + 2x + 1)(3x - 5) + \\ \quad (9x + 10) \end{array}$$

Divide the polynomial $p(x)$ by the polynomial $g(x)$ and find the quotient and remainder in each of the following :

$$p(x) = x^4 - 3x^3 + 4x + 5, \quad g(x) = x^2 + 1 - x$$

$$x^2 - x + 1 \overline{) x^4 - 3x^3 + 0x^2 + 4x + 5} \quad \left(\underline{1x^2 - 2x - 3} \right)$$

$$\begin{array}{r} x^4 - x^3 + x^2 \\ \hline \end{array}$$

$$\begin{array}{r} -2x^3 - x^2 + 4x + 5 \\ \hline \end{array}$$

$$\begin{array}{r} -2x^3 + 2x^2 - 2x \\ \hline \end{array}$$

$$\begin{array}{r} -3x^2 + 6x + 5 \\ \hline \end{array}$$

$$\begin{array}{r} -3x^2 + 3x - 3 \\ \hline \end{array}$$

$$3x + 8$$

$$x^4 - 3x^3 + 4x + 5 = (x^2 - x + 1)$$

$$\underline{(x^2 - 2x - 3) + (3x + 8)}$$



facto →

$$t^2 - 3, \quad 2t^{\textcircled{4}} + 3t^3 - 2t^2 - 9t - 12$$

$$\begin{array}{r} \textcircled{t^2 - 3} \overline{) 2t^4 + 3t^3 - 2t^2 - 9t - 12} \end{array} \quad \textcircled{2t^2 + 3t + 4}$$

$$2t^4 + 3t^3 - 2t^2 - 9t - 12$$

$$= \textcircled{(2t^2 + 3t + 4)}(t^2 - 3) + (0)$$

②

$$\begin{array}{r} 2t^4 + 3t^3 - 2t^2 - 9t - 12 \\ - 2t^4 - 6t^2 - 12 \\ \hline 3t^3 + 4t^2 - 9t - 12 \\ - 3t^3 - 9t \\ \hline 4t^2 - 12 \\ 4t^2 - 12 \\ \hline 0 \end{array}$$

↑

$$t^2 = 3$$

$$t = \pm\sqrt{3}$$

$$(t - \sqrt{3})$$

$$(t + \sqrt{3})$$



$$(a-b)(a+b) = a^2 - b^2$$

Find all the zeroes of $2x^4 - 3x^3 - 3x^2 + 6x - 7$, if you know that two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

$$x = \sqrt{2}, -\sqrt{2} \Rightarrow (x - \sqrt{2})(x + \sqrt{2}) \Rightarrow (x^2 - (\sqrt{2})^2) = x^2 - 2$$

$x^2 - 2$

$$\begin{array}{r} 2x^4 - 3x^3 - 3x^2 + 6x - 7 \\ \underline{-(x^2 - 2)} \\ -3x^3 + x^2 + 6x - 2 \\ \underline{+3x^3} \quad \quad \quad \underline{+6x} \\ x^2 - 2 \\ \underline{-(x^2 - 2)} \\ 0 \end{array}$$

$(x^2 - 2)$
 $(\sqrt{2}, -\sqrt{2}, \frac{1}{2}, 1)$

$(2x^2 - 3x + 1)$
 $2x^2 - 2x - x + 1 = 0$
 $2x(x-1) - 1(x-1) = 0$
 $(2x-1)(x-1)$
 $2x-1=0 \quad | \quad x-1=0$
 $x = \frac{1}{2} \quad | \quad x = 1$

$2 \times 1 = 2$
 $1 \times 2 = 2$
 $-2 - 1 = -3$



Obtain all other zeroes of $3x^4 + 6x^3 - 2x^2 - 10x - 5$, if two of its zeroes are $\sqrt{\frac{5}{3}}$ and $-\sqrt{\frac{5}{3}}$.

$$x = \sqrt{\frac{5}{3}}, -\sqrt{\frac{5}{3}}, \quad (x - \sqrt{\frac{5}{3}})(x + \sqrt{\frac{5}{3}}) = x^2 - \frac{5}{3}$$

$-\frac{5}{3}x^2$

$-\frac{5}{3}x^2$

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$$x^2 - \frac{5}{3} \overline{) 3x^4 + 6x^3 - 2x^2 - 10x - 5} \quad (3x^2 + 6x + 3)$$

$$3x^2 + 6x + 3 = 0$$

$$3x^2 + 3x + 3(x + 3) = 0$$

$$3x(x + 1) + 3(x + 1) = 0$$

$$(3x + 3)(x + 1) = 0$$

$$3x + 3 = 0 \quad | \quad x + 1 = 0$$

$$3x = -3 \quad | \quad x = -1$$

$$x = -1$$

$$6x^3 + 3x^2 - 10x - 5$$

$$\underline{6x^3} \quad \quad \quad \underline{-10x}$$

$$3x^2 - 5$$

$$\underline{3x^2 - 5}$$

$$0$$

$(\sqrt{\frac{5}{3}}, -\sqrt{\frac{5}{3}}, -1)$



On dividing $x^3 - 3x^2 + x + 2$ by a polynomial $g(x)$, the quotient and remainder were $x - 2$ and $-2x + 4$, respectively. Find $g(x)$.

$$\text{Div} \quad x^3 - 3x^2 + x + 2$$

$$\begin{array}{r} 1x^2 - 1x + 1 \\ x-2 \overline{) 1x^3 - 3x^2 + 3x - 2} \\ \underline{-x^3 + 2x^2} \\ -x^2 + 3x - 2 \\ \underline{+x^2 + 2x} \\ x - 2 \\ \underline{ x - 2} \\ 0 \end{array}$$

$$P(x) = g(x)(x-2) + (-2x+4)$$

$$x^3 - 3x^2 + x + 2 - (-2x + 4) = g(x)(x-2)$$

$$x^3 - 3x^2 + \underline{1} + 2 + \underline{2x} - 4 = g(x)(x-2)$$

$$x^3 - 3x^2 + 3x - 2 = g(x)(x-2)$$

$$\frac{x^3 - 3x^2 + 3x - 2}{x-2} = g(x)$$

$$g(x) = (x^2 - x + 1)$$





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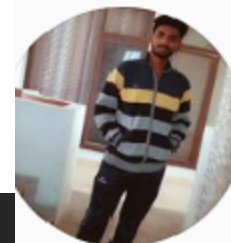
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