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5 continued -

$k = -15$

$(x-5)(x+3)$
$= x^2 + 3x - 5x - 15$
$= x^2 - 2x - 15$

EIP (6) $\dfrac{4x^2+8x-5}{6x^2-7x+k} = \dfrac{2x+5}{3x-2}$.

↳ (factorise)

$4x^2 + 8x - 5$
$= (2x-1)(2x+5)$

$\dfrac{(2x-1)(2x+5)}{(3x-2)(2x+5)}$

both cancelled out to receive given answer

$\dfrac{(2x-1)(2x+5)}{(3x-2)(2x-1)} = \dfrac{(3x-2)(2x+5)}{6x^2+15x-4x-10}$
$= 6x^2 + 11x - 10$

$(3x-2)(2x-1) \Rightarrow 6x^2 - 3x - 4x + 2$
$= 6x^2 - 7x + 2$

$k = 2$

EIP (7) $\dfrac{6x^3 - 2x^2 - 4x}{2x^2 - 7x + 5}$

$\Rightarrow \dfrac{2x(3x+2)(x-1)}{(2x-5)(x-1)} = \dfrac{2x(3x+2)}{(2x-5)} = \dfrac{ax(bx+c)}{px+q}$

$a = 2, b = 3, c = 2, p = 2, q = -5$.

Dividing polynomials. 7.2

(1) a)

$$x-1 \;\overline{)\; 2x^3 - 5x^2 + 8x - 5}$$

$2x^2 - 3x + 5$

$-(2x^3 - 2x^2)$
$-3x^2 + 8x$
$-(-3x^2 + 3x)$
$5x - 5$
$-(5x - 5)$
0

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

b)

$$x+2 \;\overline{)\; 3x^3 + 8x^2 + 3x - 2}$$

$3x^2 + 2x - 1$

$-(3x^3 + 6x^2)$
$2x^2 + 3x$
$-(2x^2 + 4x)$
$-x - 2$
$-(-x - 2)$
0

$2x^2 + 3x$
$-2x^2 + 4x$
$-x - 2$ $(-1 \times (x+2))$
$-x - 2$
0

Ans: $(3x^2 + 2x - 1)(x+2)$

c)

$$x-3 \;\big|\; 2x^3 + x^2 - 17x - 12$$

$$2x^2 + 7x + 4$$

$-(2x^3 - 6x^2)$

$7x^2 - 17x$

$-(7x^2 - 21x)$

$4x - 12$

$-(4x - 12)$

0

Ans = $(2x^2 + 7x + 4)(x-3)$

d)

$$x+4 \;\big|\; 4x^3 + 13x^2 - 11x + 4$$

$$4x^2 - 3x + 1$$

$-(4x^3 + 16x^2)$

$-3x^2 - 11x$

$-(-3x^2 - 12x)$

$x + 4$

$-(x + 4)$

0

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

(2) a)

$$x+2 \;\big|\; 3x^4 + 8x^3 - x^2 - 13x - 6$$

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

$-(3x^4 + 6x^3)$

$2x^3 - x^2$

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

$-5x^2 - 13x$

$-(-5x^2 - 10x)$

$-3x - 6$

$-(-3x - 6)$

Answer = $(3x^3 + 2x^2 - 5x - 3)$

b)

$$2x+1 \;\big|\; 4x^4 - 8x^3 + x^2 - x - 2$$

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

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

$-10x^3 + x^2$

$-(-10x^3 - 5x^2)$

$6x^2 - x$

$-(6x^2 + 3x)$

$-4x - 2$

$-(-4x - 2)$

0

Answer = $(2x^3 - 5x^2 + 3x - 2)$

c)

$$3x-2 \;\big|\; 9x^4 - 3x^3 - 17x^2 + 13x - 2$$

$$3x^3 + x^2 - 5x + 1$$

$-(9x^4 - 6x^3)$

$3x^3 - 17x^2$

$-(3x^3 - 2x^2)$

$-15x^2 + 13x$

$-(-15x^2 + 10x)$

$3x - 2$

$-(3x - 2)$

0

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

d)

$$2x-3 \;\overline{)\; 4x^4 - 12x^3 - 5x^2 + 15x + 9}$$

$$\begin{array}{r} 2x^3 - 3x^2 - 7x - 3 \\ 4x^4 - 6x^3 \\ \hline -6x^3 - 5x^2 \\ -6x^3 + 9x^2 \\ \hline -14x^2 + 15x \\ -14x^2 + 21x \\ \hline -6x + 9 \\ -6x + 9 \\ \hline 0 \end{array}$$

Answer $= (2x^3 - 3x^2 - 7x - 2)$

3 a)

$$x+1 \;\overline{)\; 2x^3 + 6x^2 + 0x - 4}$$

$$\begin{array}{r} 2x^2 + 4x - 4 \\ 2x^3 + 2x^2 \\ \hline 4x^2 + 0x \\ 4x^2 + 4x \\ \hline -4x - 4 \\ -4x - 4 \\ \hline 0 \end{array}$$

Answer $= (2x^2 + 4x - 4)$

b)

$$x+3 \;\overline{)\; 3x^3 + 7x^2 + 0x + 18}$$

$$\begin{array}{r} 3x^2 - 2x + 6 \\ 3x^3 + 9x^2 \\ \hline -2x^2 + 0x \\ -2x^2 - 6x \\ \hline 6x + 18 \\ 6x + 18 \\ \hline 0 \end{array}$$

Answer $= (3x^2 - 2x + 6)$

c)

$$x-2 \;\overline{)\; 4x^3 + 0x^2 - 11x - 10}$$

$$\begin{array}{r} 4x^2 + 8x + 5 \\ 4x^3 - 8x^2 \\ \hline 8x^2 - 11x \\ 8x^2 - 16x \\ \hline 5x - 10 \\ 5x - 10 \\ \hline 0 \end{array}$$

Answer $= (4x^2 + 8x + 5)$

d)

$$x+5 \;\overline{)\; 2x^3 + 7x^2 + 0x + 75}$$

$$\begin{array}{r} 2x^2 - 3x + 15 \\ 2x^3 + 10x^2 \\ \hline -3x^2 + 0x \\ -3x^2 - 15x \\ \hline 15x + 75 \\ 15x + 75 \\ \hline 0 \end{array}$$

$(x+5)(2x^2 - 3x + 5)$

answer.

7·2 continued

(4)

a)

$$\begin{array}{r} x^2 - x + 9 \\ x+4 \overline{\big) x^3 + 3x^2 + 5x - 8} \\ -\ \underline{x^3 + 4x^2} \\ -x^2 + 5x \\ -\ \underline{-x^2 - 4x} \\ 9x - 8 \\ -\ \underline{9x + 36} \\ -44. \end{array}$$

remainder $= -44.$

b)

$$\begin{array}{r} 2x^2 + x + 15 \\ x-3 \overline{\big) 2x^3 - 5x^2 + 12x - 20} \\ -\ \underline{2x^3 - 6x^2} \\ x^2 + 12x \\ -\ \underline{x^2 - 3x} \\ 15x - 20 \\ -\ \underline{15x - 45} \\ 25 \end{array}$$

remainder $= 25.$

c)

$$\begin{array}{r} 3x^2 - 13x + 25 \\ x+5 \overline{\big) 3x^3 + 2x^2 - 40x + 45} \\ -\ \underline{3x^3 + 15x^2} \\ -13x^2 - 40x \\ -\ \underline{-13x^2 - 65x} \\ 25x + 45 \\ -\ \underline{25x + 125} \\ -80 \end{array}$$

remainder $= -80.$

(5) (E)

$$\begin{array}{r} -3x^2 + 4x - 1 \\ 5x-2 \overline{\big) -15x^3 + 26x^2 - 13x + 5} \\ -\ \underline{-15x^3 + 6x^2} \\ 20x^2 - 13x \\ -\ \underline{20x^2 - 8x} \\ -5x + 5 \\ -\ \underline{-5x + 2} \\ 3 \end{array}$$

remainder $= 3.$

(E/P) (6) a)

$$\begin{array}{r} 6x^2 - 31x + 80 \\ x+3 \overline{\big) 6x^3 - 13x^2 - 13x + 30} \\ -\ \underline{6x^3 + 18x^2} \\ -31x^2 - 13x \\ -\ \underline{-31x^2 - 93x} \\ 80x + 30 \\ -\ \underline{80x + 240} \\ -210 \end{array}$$

remainder $= -210.$

b)

$$\begin{array}{r|l} & 6x^2 - x - 15 \\ \hline x-2 & 6x^3 - 13x^2 - 13x + 30 \\ & -\,6x^3 - 12x^2 \\ \hline & \quad -x^2 - 13x \\ & \quad -x^2 + 2x \\ \hline & \quad\quad -15x + 30 \\ & \quad\quad -15x + 30 \\ \hline & \quad\quad\quad 0 \end{array}$$

$6x^2 - x - 15$ (factorise this)

$= 6x^2 + 9x - 10x - 15$

$= 3x(2x+3) - 5(2x+3)$

$= (3x-5)(2x+3)$.

E/P (7)

a)

$$\begin{array}{r|l} & 2x^2 + 3x + 5 \\ \hline x+3 & 2x^3 + 3x^2 - 4x + k \\ & -\,2x^3 + 6x^2 \\ \hline & \quad -3x^2 - 4x \\ & \quad -3x^2 - 9x \\ \hline & \quad\quad 5x + k \\ & \quad\quad 5x + 15 \\ \hline & \quad\quad k - 15 \end{array}$$

$k - 15 = 0$

$k = 15$.

b) $f(x) = (x+3)(2x^2 - 3x + 5)$

c) $f(x) = 0$

• $x + 3 = 0$

$x = -3$ ∴ one solution

• $2x^2 - 3x + 5$

$b^2 - 4ac < 0$

$a = 2, b = -3, c = 5$

$(-3)^2 - 4(2 \times 10)$

$= 9 - 4(20)$

$= -71$

$-31 < 0$

∴ no solution

E/P (8)

a)

$$\begin{array}{r|l} & 3x^2 + 16x + 24 \\ \hline x-2 & 3x^3 + 10x^2 - 8x - 5 \\ & -\,3x^3 - 6x^2 \\ \hline & \quad 16x^2 - 8x \\ & \quad 16x^2 - 32x \\ \hline & \quad\quad 24x - 5 \\ & \quad\quad -24x - 48 \\ \hline & \quad\quad\quad 43 \end{array}$$

remainder = 43.

b) $f(x) = (x-2)(3x^2 + 16x + 24) + 43$.

E/P (9)

a) $f(x) = 10x^3 - 29x^2 + 4x + 15$

$$\begin{array}{r|l} & 10x^2 - 19x - 15 \\ \hline x-1 & 10x^3 - 29x^2 + 4x + 15 \\ & -10x^3 - 10x^2 \\ \hline & \quad -19x + 4x \\ & \quad -19x + 19x \\ \hline & \qquad 15x + 15 \\ & \qquad -15x + 15 \\ \hline & \qquad 0 \end{array}$$

$(x-1)(10x^2 - 19x - 15)$

b) $(x-1)(10x^2 - 19x - 15)$

$10x^2 - 19x - 15$

$10x^2 - 25x + 6x - 15$

$5x(2x-5) + 3(2x-5)$

$(5x+3)(2x-5)$

Ans - $(x-1)(5x+3)(2x-5)$

c) $x - 1 = 0$, $x = 1$

$2x - 5 = 0$, $2x = 5$, $x = \frac{5}{2}$

$5x + 3 = 0$, $5x = -3$, $x = -\frac{3}{5}$

Ans - $x = 1, -\frac{3}{5}, \frac{5}{2}$.

7.3 The Factor Theorem

(1) a) $(x+1)$ is a factor of $2x^3 + 7x^2 - 5$. (given)

$x + 1 = 0$, $x = -1$

$2(-1)^3 + 7(-1)^2 - 5 = 0$.

$f(-1) = 0$

∴ as $f(x+1) = 0$ it is a factor.

b) $x + 2 = 0$, $x = -2$.

$f(-2)$

$(-2)^3 + 7(-2)^2 + 3(-2) - 2 = 0$

$f(-2) = 0$.

c) $x - 3 = 0$, $x = 3$.

$f(3) = 0$.

$2(3)^3 - 3(3)^2 - 7(3) - 6 = 0$

d) $x - 4 = 0$, $x = 4$

$f(4) = 0$

$2(4)^4 - 3(4)^3 - 15(4) - 4 = 0$.