Exercise 4.2

$$ax^{2n} + bx^n + c = 0$$
Put $y = x^n$

Q1. $x^4 - 6x^2 + 8 = 0$

Put $y = x^2$

$$y^2 - 6y + 8 = 0$$
$$y^2 - 4y - 2y + 8 = 0$$
$$y(y-4) - 2(y-4) = 0$$
$$(y-2)(y-4) = 0$$

$y - 2 = 0$, $y - 4 = 0$

$y = 2$, $y = 4$

$x^2 = 2$, $x^2 = 4$

$x = \pm\sqrt{2}$, $x = \pm 2$

S.S. $= \{\pm\sqrt{2}, \pm 2\}$.

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(2) $x^{-2} - 10 = 3x^{-1}$

$$\frac{1}{x^2} - 10 = \frac{3}{x}$$

$$\frac{1 - 10x^2}{x^2} = \frac{3}{x}$$

$$1 - 10x^2 = 3x$$

$$0 = 3x + 10x^2 - 1$$

$$10x^2 + 3x - 1 = 0$$

$$10x^2 + 5x - 2x - 1 = 0$$

$$5x(2x+1) - 1(2x+1) = 0$$

$$(5x - 1)(2x+1) = 0$$

$5x - 1 = 0$, $2x + 1 = 0$

$5x = 1$, $2x = -1$

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

$$S.S. = \left\{ \frac{1}{5}, -\frac{1}{2} \right\}.$$

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$a^3-b^3=(a-b)(a^2+ab+b^2)$

(3)

$x^6-9x^3+8=0$

Let $y=x^3$

$y^2-9y+8=0$

$y^2-8y-y+8=0$

$y(y-8)-1(y-8)=0$

$(y-1)(y-8)=0$

$y-1=0$, $y-8=0$

$y=1$, $y=8$

$x^3=1$, $x^3=8$

$x^3-1^3=0$

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

$x-1=0$, $x^2+x+1=0$

$\boxed{x=1}$

$x=\dfrac{-1\pm\sqrt{1^2-4(1)(1)}}{2(1)}$

$x=\dfrac{-1\pm\sqrt{-3}}{2}$

$\boxed{x=\dfrac{-1\pm\sqrt{3}\,i}{2}}$

$x^3-2^3=0$

$(x-2)(x^2+2x+4)=0$

$x-2=0$, $x^2+2x+4=0$

$\boxed{x=2}$, $x=\dfrac{-2\pm\sqrt{2^2-4(1)(4)}}{2(1)}$

$x=\dfrac{-2\pm\sqrt{-12}}{2}$

$x=\dfrac{-2\pm\sqrt{12}\,i}{2}$

$x=\dfrac{-2\pm2\sqrt{3}\,i}{2}$

$x=\cancel{2}\left(\dfrac{-1\pm\sqrt{3}\,i}{\cancel{2}}\right)$

$\boxed{x=-1\pm\sqrt{3}\,i}$

So $S.S.=\left\{i,2,\dfrac{-1\pm\sqrt{3}\,i}{2},-1\pm\sqrt{3}\,i\right\}$.

(4) $8x^6 - 19x^3 - 27 = 0$

Let $y = x^3$ ✓

$8y^2 - 19y - 27 = 0$

$8y^2 - 27y + 8y - 27 = 0$

$y(8y - 27) + 1(8y - 27) = 0$

$(y+1)(8y-27) = 0$

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

$y + 1 = 0$

$x^3 + 1^3 = 0$

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

$x + 1 = 0$, $x^2 - x + 1 = 0$

$\boxed{x = -1}$, $x = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(1)}}{2(1)}$

$x = \frac{1 \pm \sqrt{-3}}{2}$

$\boxed{x = \frac{1 \pm \sqrt{3}\, i}{2}}$ ✓

$8y - 27 = 0$

$8x^3 - 27 = 0$

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

$(2x - 3)(4x^2 + 6x + 9) = 0$

$2x - 3 = 0$, $4x^2 + 6x + 9 = 0$

$\boxed{x = \frac{3}{2}}$, $x = \frac{-6 \pm \sqrt{(6)^2 - 4(4)(9)}}{2(4)}$

$x = \frac{-6 \pm \sqrt{36 - 144}}{8}$

$x = \frac{-6 \pm \sqrt{-108}}{8}$

$x = \frac{-6 \pm \sqrt{108}\, i}{8}$

$x = \frac{-6 \pm \sqrt{2^2 \times 3^2 \times 3}\, i}{8}$

$x = \frac{-6 \pm 6\sqrt{3}\, i}{8}$

$x = \frac{\cancel{6}^{3}}{\cancel{8}_{4}}\left(\frac{-1 \pm \sqrt{3}\, i}{}\right)$

$x = 3\left(\frac{-1 \pm \sqrt{3}\, i}{4}\right)$ ✓

2	108
2	54
3	27
3	9
	3

$S.S. = \left\{-1, \frac{3}{2}, \frac{1 \pm \sqrt{3}\, i}{2}, 3\left(\frac{-1 \pm \sqrt{3}\, i}{4}\right)\right\}$.

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$$x^{\frac{2}{5}} + 8 = 6x^{\frac{1}{3}}$$

$$x^{2/5} - 6x^{1/5} + 8 = 0$$

Let $y = x^{1/5}$, $y^2 = x^{2/5}$

$$y^2 - 6y + 8 = 0$$

$$y^2 - 4y - 2y + 8 = 0$$

$$y(y-4) - 2(y-4) = 0$$

$$(y-2)(y-4) = 0$$

$y - 2 = 0$,

$$x^{1/5} - 2 = 0$$

$$x^{1/5} = 2$$

$$\left(x^{1/5}\right)^5 = 2^5$$

$$\boxed{x = 32}$$

$y - 4 = 0$

$$x^{1/5} - 4 = 0$$

$$x^{1/5} = 4$$

$$\left(x^{1/5}\right)^5 = 4^5$$

$$\boxed{x = 1024}$$

S.S. $= \{32, 1024\}$.

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