Exercise 6.2

Q.1 Add the following algebraic expressions.

(i) $3a^2b, -4a^2b, 9a^2b$

Sol: $3a^2b + (-4a^2b) + (9a^2b)$

$= (3-4+9)\,a^2b$

$= 8a^2b$

(ii) $\frac{2}{3}a + \frac{3}{5}a - \frac{6}{5}a$

$= \left(\frac{2}{3} + \frac{3}{5} - \frac{6}{5}\right)a$

$= \left(\frac{10+3-6}{15}\right)a = \frac{7}{15}a$

(iii) $4x^2y - 7x^2y, \; 12x^2y - 6xy^2, \; -3x^2y + 5xy^2$

Solution $4x^2y - 7xy^2 + 12x^2y - 6xy^2 - 3x^2y + 5xy^2$

Collecting like terms.

$= (4x^2y + 12x^2y - 3x^2y) + (-7xy^2 - 6xy^2 + 5xy^2)$

$= 13x^2y + (-8xy^2)$

$= 13x^2y - 8xy^2$

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(iv) $\frac{3}{2}a-\frac{5}{4}b+\frac{2}{5}c$, $\frac{2}{3}a-\frac{7}{2}b+\frac{7}{2}c$, $\frac{5}{3}a+\frac{5}{2}b-\frac{5}{4}c$

Solution

$$\frac{3}{2}a-\frac{5}{4}b+\frac{2}{5}c+\frac{2}{3}a-\frac{7}{2}b+\frac{7}{2}c+\frac{5}{3}a+\frac{5}{2}b-\frac{5}{4}c$$

Collecting like terms.

$$\Rightarrow \left(\frac{3}{2}a+\frac{2}{3}a+\frac{5}{3}a\right)+\left(\frac{-5}{4}b-\frac{7}{2}b+\frac{5}{2}b\right)+\left(\frac{2}{5}c+\frac{7}{2}c-\frac{5}{4}c\right)$$

$$= \left(\frac{9a+4a+10a}{6}\right)+\left(\frac{-5b-14b+10b}{4}\right)+\left(\frac{8c+70c-25c}{20}\right)$$

$$= \frac{23}{6}a-\frac{9}{4}b+\frac{53}{20}a$$

(v) $\frac{11}{2}xy+\frac{12}{5}y+\frac{13}{7}x$, $-\frac{11}{2}y-\frac{12}{5}x-\frac{13}{7}xy$

Solution: $\frac{11}{2}xy+\frac{12}{5}y+\frac{13}{7}x-\frac{11}{2}y-\frac{12}{5}x-\frac{13}{7}xy$

Collecting like terms

$$\left(\frac{11}{2}xy-\frac{13}{7}xy\right)+\left(\frac{12}{5}y-\frac{11}{2}y\right)+\left(\frac{13}{7}x-\frac{12}{5}x\right)$$

$$= \left(\frac{11}{2}-\frac{13}{7}\right)xy+\left(\frac{12}{5}-\frac{11}{2}\right)y+\left(\frac{13}{7}-\frac{12}{5}\right)x$$

$$= \left(\frac{77-26}{14}\right)xy+\left(\frac{24-55}{10}\right)y+\left(\frac{65-84}{35}\right)x$$

$$= \frac{51}{14}xy-\frac{31}{10}y-\frac{19}{35}x$$

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(VI) $\frac{7}{2}x^3 \frac{1}{2}x^2+\frac{5}{3}$; $\frac{3}{2}x^3+\frac{7}{4}x^2-x+\frac{1}{3}$,

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

Sol: $\frac{7}{2}x^3-\frac{1}{2}x^2+\frac{5}{3}+\frac{3}{2}x^3+\frac{7}{4}x^2-x+\frac{1}{3}+\frac{3}{2}x^2-\frac{5}{2}x-2$

$\Rightarrow \left(\frac{7}{2}x^3+\frac{3}{2}x^3\right)+\left(-\frac{1}{2}x^2+\frac{7}{4}x^2+\frac{3}{2}x^2\right)+\left(\frac{5}{2}x-x\right)$

$+\left(\frac{5}{3}+\frac{1}{3}-2\right)$

$=\left(\frac{7}{2}+\frac{3}{2}\right)x^3+\left(-\frac{1}{2}+\frac{7}{4}+\frac{3}{2}\right)x^2+\left(-\frac{5}{2}-1\right)x+\left(\frac{5}{3}+\frac{1}{3}-2\right)$

$=\left(\frac{7+3}{2}\right)x^3+\left(\frac{-2+7+6}{4}\right)x^2+\left(\frac{-5-2}{2}\right)x+\left(\frac{5+1-6}{3}\right)$

$=5x^3+\frac{11}{4}x^2-\frac{7}{2}x$

Q.2 Subtract:

(I) $-5xy$ from $12xy$

Sol: $12xy-(-5xy)$

$=12xy+5xy=17xy$

(II) $2a^2$ from $-7a^2$

Sol: $-7a^2-2a^2$

$=-9a^2$

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(iii) $2a-b$ from $3a-5b$

Solution: $(3a-5b)-(2a-b)$

$= 3a-5b-2a+b$

$= (3a-2a)+(-5b+b)$

$= a-4b$

(iv) $2x^3-4x^2+3x+5$ from $4x^3+x^2+x+6$

Sol: $(4x^3+x^2+x+6)-(2x^3-4x^2+3x+5)$

$\Rightarrow 4x^3+x^2+x+6-2x^3+4x^2-3x-5$

collecting like terms.

$\Rightarrow (4x^3-2x^3)+(x^2+4x^2)+(x-3x)+(6-5)$

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

(v) $\frac{2}{3}y^3-\frac{2}{7}y^2-5$ from $\frac{1}{3}y^3+\frac{5}{7}y^2+y-2$

Solution $\left(\frac{1}{3}y^3+\frac{5}{7}y^2+y-2\right)-\left(\frac{2}{3}y^3-\frac{2}{7}y^2-5\right)$

$\Rightarrow \frac{1}{3}y^3+\frac{5}{7}y^2+y-2-\frac{2}{3}y^3+\frac{2}{7}y^2+5$

$= \left(\frac{1}{3}y^3-\frac{2}{3}y^3\right)+\left(\frac{5}{7}y^2+\frac{2}{7}y^2\right)+y+(-2+5)$

$= \left(\frac{1-2}{3}\right)y^3+\left(\frac{5+2}{7}\right)y^2+y+3 = -\frac{1}{3}y^3+y^2+y+3$

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(VI) $\frac{3}{2}x - \frac{5}{4}y - \frac{7}{2}z$ from $\frac{2}{3}x + \frac{3}{2}y - \frac{4}{3}z$

Solution: $\left(\frac{2}{3}x + \frac{3}{2}y - \frac{4}{3}z\right) - \left(\frac{3}{2}x - \frac{5}{4}y - \frac{7}{2}z\right)$

$= \left(\frac{2}{3}x + \frac{3}{2}y - \frac{4}{3}z - \frac{3}{2}x + \frac{5}{4}y + \frac{7}{2}z\right)$

$= \left(\frac{2}{3}x - \frac{3}{2}x\right) + \left(\frac{3}{2}y + \frac{5}{4}y\right) + \left(-\frac{4}{3}z + \frac{7}{2}z\right)$

$= \left(\frac{4-9}{6}\right)x + \left(\frac{6+5}{4}\right)y + \left(\frac{-8+21}{6}\right)z$

$= -\frac{5}{6}x + \frac{11}{4}y + \frac{13}{6}z.$

(VII) $x^2y - \frac{4}{5}xy^2 + \frac{4}{3}xy$ from $\frac{2}{3}x^2y + \frac{3}{2}xy^2 - \frac{1}{3}xy$

Solution:

$\left(\frac{2}{3}x^2y + \frac{3}{2}xy^2 - \frac{1}{3}xy\right) - \left(x^2y - \frac{4}{5}xy^2 + \frac{4}{3}xy\right)$

$\Rightarrow \left(\frac{2}{3}x^2y + \frac{3}{2}xy^2 - \frac{1}{3}xy - x^2y + \frac{4}{5}xy^2 - \frac{4}{3}xy\right)$

$= \left(\frac{2}{3}x^2y - x^2y\right) + \left(\frac{3}{2}xy^2 + \frac{4}{5}xy^2\right) + \left(-\frac{1}{3}xy - \frac{4}{3}xy\right)$

$= \left(\frac{2-3}{3}\right)x^2y + \left(\frac{15+8}{10}\right)xy^2 + \left(-\frac{5}{3}\right)xy$

$= -\frac{1}{3}x^2y + \frac{23}{10}xy^2 - \frac{5}{3}xy$

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(viii) $\frac{ab}{7} - \frac{35}{3}bc + \frac{6}{5}ac$ from $\frac{3}{5}bc - \frac{4}{5}ac$

Solution: $\left(\frac{3}{5}bc - \frac{4}{5}ac\right) - \left(\frac{ab}{7} - \frac{35}{3}bc + \frac{6}{5}ac\right)$

$\Rightarrow \left(\frac{3}{5}bc - \frac{4}{5}ac - \frac{1}{7}ab + \frac{35}{3}bc - \frac{6}{5}ac\right)$

Collecting like terms.

$\left(\frac{3}{5}bc + \frac{35}{3}bc\right) + \left(-\frac{4}{5}ac - \frac{6}{5}ac\right) + \left(-\frac{1}{7}ab\right)$

$= \left(\frac{9bc + 175bc}{15}\right) + \left(\frac{-4ac - 6ac}{5}\right) + \left(-\frac{1}{7}ab\right)$

$= \frac{184}{15}bc - 2ac - \frac{1}{7}ab$

Q3 Take away:

(i) $\frac{6}{5}x^2 - \frac{4}{5}x^3 + \frac{5}{6} + \frac{3}{2}x$ from $\frac{x^3}{3} - \frac{5}{2}x^2 + \frac{3}{5}x + \frac{1}{4}$

Solution: $\left(\frac{x^3}{3} - \frac{5}{2}x^2 + \frac{3}{5}x + \frac{1}{4}\right) - \left(\frac{6}{5}x^2 - \frac{4}{5}x^3 + \frac{5}{6} + \frac{3}{2}x\right)$

$= \frac{x^3}{3} - \frac{5}{2}x^2 + \frac{3}{5}x + \frac{1}{4} - \frac{6}{5}x^2 + \frac{4}{5}x^3 - \frac{5}{6} - \frac{3}{2}x$

Collecting like terms.

$= \left(\frac{x^3}{3} + \frac{4x^3}{5}\right) + \left(-\frac{5}{2}x^2 - \frac{6}{5}x^2\right) + \left(\frac{3}{5}x - \frac{3}{2}x\right) + \left(\frac{1}{4} - \frac{5}{6}\right)$

$= \left(\frac{5x^3 + 12x^3}{15}\right) + \left(\frac{-25x^2 - 12x^2}{10}\right) + \left(\frac{6x - 15x}{10}\right) + \left(\frac{3 - 10}{12}\right)$

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$= \frac{17}{15}x^3 - \frac{37}{10}x^2 - \frac{9}{10}x - \frac{7}{12}$

(ii) $\frac{5a^2}{2} + \frac{3a^3}{2} + \frac{a}{3} - \frac{6}{5}$ from $\frac{1}{3}a^3 - \frac{3}{4}a^2 - \frac{5}{2}$

Sol: $\left(\frac{1}{3}a^3 - \frac{3}{4}a^2 - \frac{5}{2}\right) - \left(\frac{5}{2}a^2 + \frac{3a^3}{2} + \frac{a}{3} - \frac{6}{5}\right)$

$= \frac{a^3}{3} - \frac{3}{4}a^2 - \frac{5}{2} - \frac{5}{2}a^2 - \frac{3a^3}{2} - \frac{a}{3} + \frac{6}{5}$

$= \left(\frac{a^3}{3} - \frac{3a^3}{2}\right) + \left(\frac{-3}{4}a^2 - \frac{5}{2}a^2\right) - \frac{a}{3} + \left(\frac{-5}{2} + \frac{6}{5}\right)$

$= \left(\frac{2a^3 - 9a^3}{6}\right) + \left(\frac{-3a^2 - 10a^2}{4}\right) - \frac{a}{3} + \left(\frac{-25+12}{10}\right)$

$= -\frac{7}{6}a^3 - \frac{13}{4}a^2 - \frac{a}{3} - \frac{13}{10}$

(iii) $\frac{7}{4}x^3 + \frac{3}{5}x^2 + \frac{1}{2}x + \frac{9}{2}$ from $\frac{7}{2} - \frac{x}{3} - \frac{x^2}{5}$

Solution $\left(\frac{7}{2} - \frac{x}{3} - \frac{x^2}{5}\right) - \left(\frac{7}{4}x^3 + \frac{3}{5}x^2 + \frac{1}{2}x + \frac{9}{2}\right)$

$= \frac{7}{2} - \frac{x}{3} - \frac{x^2}{5} - \frac{7}{4}x^3 - \frac{3}{5}x^2 - \frac{1}{2}x - \frac{9}{2}$

$= \frac{7}{2} + \left(-\frac{x}{3} - \frac{x}{2}\right) + \left(-\frac{x^2}{5} - \frac{3x^2}{5}\right) + \left(-\frac{7}{4}x^3\right)$

$= \left(\frac{7}{2} - \frac{9}{2}\right) + \left(\frac{-2x-3x}{6}\right) + \left(\frac{-x^2-3x^2}{5}\right) + \left(-\frac{7}{4}x^3\right)$

$= -\frac{9}{2} - \frac{5x}{6} - \frac{4x^2}{5} - \frac{7}{4}x^3 = -\frac{7}{4}x^3 - \frac{4}{5}x^2 - \frac{5}{6}x - 1$

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(iv) $\frac{y^3}{3}+\frac{7}{3}y^2+\frac{1}{2}y+\frac{1}{2}$ from $\frac{1}{3}-\frac{5}{3}y^2$

Solution: $\left(\frac{1}{3}-\frac{5}{3}y^2\right)-\left(\frac{y^3}{3}+\frac{7}{3}y^2+\frac{1}{2}y+\frac{1}{2}\right)$

$= \frac{1}{3}-\frac{5}{3}y^2-\frac{1}{3}y^3-\frac{7}{3}y^2-\frac{1}{2}y-\frac{1}{2}$

$= \left(\frac{-1}{3}y^3\right)+\left(\frac{-5}{3}y^2-\frac{7}{3}y^2\right)+\left(\frac{-1}{2}y\right)+\left(\frac{1}{3}-\frac{1}{2}\right)$

$= -\frac{1}{3}y^3+\left(\frac{-12}{3}y^2\right)-\frac{1}{2}y+\left(\frac{2-3}{6}\right)$

$= -\frac{1}{3}y^3-4y^2-\frac{1}{2}y-\frac{1}{6}$

(v) $\frac{2}{3}ac-\frac{5}{7}ab+\frac{2}{3}bc$ from $\frac{3}{2}ab-\frac{7}{4}ac-\frac{5}{6}bc$

Sol: $\left(\frac{3}{2}ab-\frac{7}{4}ac-\frac{5}{6}bc\right)-\left(\frac{2}{3}ac-\frac{5}{7}ab+\frac{2}{3}bc\right)$

$= \frac{3}{2}ab-\frac{7}{4}ac-\frac{5}{6}bc-\frac{2}{3}ac+\frac{5}{7}ab-\frac{2}{3}bc$

$= \left(\frac{3}{2}ab+\frac{5}{7}ab\right)+\left(\frac{-7}{4}ac-\frac{2}{3}ac\right)+\left(\frac{-5}{6}bc-\frac{2}{3}bc\right)$

$= \left(\frac{21ab+10ab}{14}\right)+\left(\frac{-21ac-8ac}{12}\right)+\left(\frac{-5bc-4bc}{6}\right)$

$= \frac{31}{14}ab-\frac{29}{12}ac-\frac{9}{6}bc$

$= \frac{31}{14}ab-\frac{29}{12}ac-\frac{3}{2}bc$

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Q.4 Subtract $3x-4y-7z$ from the sum of $x-3y+2z$ and $-4x+9y-11z$

Solution:

$$\text{sum} = (x-3y+2z) + (-4x+9y-11z)$$

$$= (x-4x) + (-3y+9y) + (2z-11z)$$

$$= -3x+6y-9z$$

Now $(-3x+6y-9z) - (3x-4y-7z)$

$$\Rightarrow -3x+6y-9z-3x+4y+7z$$

$$\Rightarrow (-3x-3x) + (6y+4y) + (-9z+7z)$$

$$= -6x+10y-2z$$

Q.5 Subtract the sum of $3l-4m-7n^2$ and $2l+3m-4n^2$ from the sum of $9l+2m-3n^2$ and $-3l+m+4n^2$.

Solution:

$$\text{Sum} = (3l-4m-7n^2) + (2l+3m-4n^2)$$

$$= (3l+2l) + (-4m+3m) + (-7n^2-4n^2)$$

$$= 5l-m-11n^2$$

Again

$$\text{sum} = (9l+2m-3n^2) + (-3l+m+4n^2)$$

$$= (9l-3l) + (2m+m) + (-3n^2+4n^2)$$

$$= 6l+3m+n^2$$

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Now

$$\text{Difference} = (6l+3m+n^2) - (5l-m-11n^2)$$

$$= 6l+3m+n^2-5l+m+11n^2$$

$$= (6l-5l)+(3m+m)+(n^2+11n^2)$$

$$= l+4m+12n^2$$

Q6 Subtract the sum of $2x-x^2+5$ and

Solution: Sum of $2x-x^2+5$ and $-4x-3+7x^2$

$$= (2x-x^2+5)+(4x-3+7x^2)$$

$$= (2x-4x)+(-x^2+7x^2)+(5-3)$$

$$= -2x+6x^2+2$$

$$= 6x^2-2x+2$$

Now, Difference of 5 and $6x^2-2x+2$

$$= 5-(6x^2-2x+2)$$

$$= 5-6x^2+2x-2$$

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

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Q.7 Simplify each of the following:

(i) $x^2 - 3x + 5 - \frac{1}{2}(3x^2 - 5x + 7)$

Sol: $x^2 - 3x + 5 - \frac{3}{2}x^2 + \frac{5}{2}x - \frac{7}{2}$

$= \left(x^2 - \frac{3}{2}x^2\right) + \left(-3x + \frac{5}{2}x\right) + \left(5 - \frac{7}{2}\right)$

$= \left(\frac{2x^2 - 3x^2}{2}\right) + \left(\frac{-6x + 5x}{2}\right) + \left(\frac{10 - 7}{2}\right)$

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

(ii) $[5 - 3x + 2y - (2x - y)] - (3x - 7y + 9)$

$= [5 - 3x + 2y - 2x + y] - (3x - 7y + 9)$

$= 5 - 3x + 2y - 2x + y - 3x + 7y - 9$

$= (5 - 9) + (-3x - 2x - 3x) + (2y + y + 7y)$

$= -4 - 8x + 10y$

(iii) $\frac{11}{2}x^2y - \frac{9}{4}xy^2 + \frac{1}{4}xy - \frac{1}{14}y^2x + \frac{1}{15}yx^2 + \frac{1}{2}xy$

Collecting like terms.

$= \left(\frac{11}{2}x^2y + \frac{1}{15}x^2y\right) + \left(-\frac{9}{4}xy^2 - \frac{1}{14}xy^2\right) + \left(\frac{1}{4}xy + \frac{1}{2}xy\right)$

$= \frac{165x^2y + 2x^2y}{30}\left(\frac{-63xy^2 - 2xy^2}{28}\right) + \left(\frac{xy + 2xy}{4}\right)$

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$= \frac{167}{30} x^2y - \frac{65}{28} xy^2 + \frac{3}{4} xy$

(iv) $\left(\frac{1}{3}y^2 - \frac{4}{7}y + 11\right) - \left(\frac{1}{7}y - 3 + 2y^2\right) - \left(\frac{2}{7}y - \frac{2}{3}y^2 + 2\right)$

$= \frac{1}{3}y^2 - \frac{4}{7}y + 11 - \frac{1}{7}y + 3 - 2y^2 - \frac{2}{7}y + \frac{2}{3}y^2 - 2$

Collecting like Terms.

$= \left(\frac{1}{3}y^2 - 2y^2 + \frac{2}{3}y^2\right) + \left(-\frac{4}{7}y - \frac{1}{7}y - \frac{2}{7}y\right) + (11 + 3 - 2)$

$= \left(\frac{1 - 6 + 2}{3}\right)y^2 + \left(\frac{-4 - 1 - 2}{7}\right)y + 12$

$= -\frac{3}{3}y^2 - \frac{7}{7}y + 12$

$= -y^2 - y + 12$

(v) $-\frac{1}{2}a^2b^2c + \frac{1}{3}ab^2c - \frac{1}{4}abc^2 - \frac{1}{5}cb^2a^2 + \frac{1}{6}cb^2a$

$- \frac{1}{7}c^2ab + \frac{1}{8}ca^2b$

$= \left(-\frac{1}{2}a^2b^2c - \frac{1}{5}cb^2a^2\right) + \left(\frac{1}{3}ab^2c + \frac{1}{6}cb^2a\right)$

$+ \left(-\frac{1}{4}abc - \frac{1}{7}c^2ab\right) + \frac{1}{8}a^2bc$

$= \left(\frac{-5 - 2}{10}\right)a^2b^2c + \left(\frac{2 + 1}{6}\right)ab^2c + \left(\frac{-7 - 4}{28}\right)abc^2$

$+ \frac{1}{8}a^2bc$

$= -\frac{7}{10}a^2b^2c + \frac{1}{2}ab^2c - \frac{11}{28}abc^2 + \frac{1}{8}a^2bc$

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