## Algebraic Expressions: Exercise 12.2

Q.1 Simplify combining like terms: (i) 21b - 32 + 7b - 20b $(ii) - z^2 + 13z^2 - 5z + 7z^3 - 15z$ (iii) p - (p - q) - q - (q - p)(iv) 3a - 2b - ab - (a - b + ab) + 3ab + b - a(v)  $5x^2y - 5x^2 + 3yx^2 - 3y^2 + x^2 - y^2 + 8xy^2 - 3y^2$ (vi)  $(3y^2 + 5y - 4) - (8y - y^2 - 4)$ *Sol:* Since, if expressions have the same algebraic factors, then they are like terms. (i) Given expression: 21b - 32 + 7b - 20b21b + 7b - 20b - 32By taking common, 21b + 7b - 20b - 32 = b(21 + 7 - 20) - 32= b(28 - 20) - 32= b(8) - 32= 8b - 32(ii) Given expression:  $-Z^2 + 13Z^2 - 5Z + 7Z^3 - 15Z$  $7Z^3 + (-Z^2 + 13Z^2) + (-5Z - 15Z)$ By taking common,  $7Z^{3} + (-Z^{2} + 13Z^{2}) + (-5Z - 15Z) = 7Z^{3} + Z^{2}(-1 + 13) + Z(-5 - 15)$  $= 7Z^{3} + Z^{2}(12) + Z(-20)$  $= 7Z^3 + 12Z^2 - 20Z$ (iii) Given expression: p - (p - q) - q - (q - p) = p - p + q - q - q + p= p - q(iv) Given expression: 3a - 2b - ab - (a - b + ab) + 3ab + b - a3a - 2b - ab - (a - b + ab) + 3ab + b - a = 3a - a - a - 2b + b + b - ab - ab + 3abBy taking common, = a (1 - 1 - 1) + b (-2 + 1 + 1) + ab (-1 - 1 + 3)= a(1) + b(0) + ab(1)= a + ab(v) Given expression:  $5x^2y - 5x^2 + 3yx^2 - 3y^2 + x^2 - y^2 + 8xy^2 - 3y^2$  $= 5x^2y + 3yx^2 - 5x^2 + x^2 - 3y^2 - y^2 - 3y^2$ By taking common,  $= x^{2}y(5+3) + x^{2}(-5+1) + y^{2}(-3-1-3) + 8xy^{2}$  $= 8x^2y - 4x^2 - 7y^2 + 8xy^2$ (vi) Given expression:  $(3y^2 + 5y - 4) - (8y - y^2 - 4) = 3y^2 + 5y - 4 - 8y + y^2 + 4$  $= 3y^{2} + y^{2} + 5y - 8y - 4 + 4$ By taking common,  $= y^{2}(3 + 1) + y(5 - 8) + (-4 + 4)$  $= 4y^2 - 3y$ **0.2 Add:** (i) 3mn, -5mn, 8mn, -4mn(ii) t - 8tz, 3tz - z, z - t(iii) - 7mn + 5, 12mn + 2, 9mn - 8, -2mn - 3

(iv) a + b - 3, b - a + 3, a - b + 3

(v) 14x + 10y - 12xy - 13, 18 - 7x - 10y + 8xy, 4xy

(vi) 5m - 7n, 3n - 4m + 2, 2m - 3mn - 5(vii)  $4x^2y$ ,  $-3xy^2$ ,  $-5xy^2$ ,  $5x^2y$ (viii)  $3p^2q^2 - 4pq + 5$ ,  $-10p^2q^2$ ,  $15 + 9pq + 7p^2q^2$ (ix) ab - 4a, 4b - ab, 4a - 4b(x)  $x^2 - y^2 - 1$ ,  $y^2 - 1 - x^2$ ,  $1 - x^2 - y^2$ Sol: (i) Given expressions: 3mn, – 5mn, 8mn, – 4mn By adding, (3mn) + (-5mn) + (8mn) + (-4mn) = 3mn - 5mn + 8mn - 4mn*= 2mn* (ii) Given expressions: t - 8tz, 3tz - z, z - tBy adding, t - 8tz + 3tz - z + z - t = t - t - 8tz + 3tz - z + zBy taking common, = t (1-1) + tz (-8+3) + z (-1+1)= t(0) + tz(-5) + z(0)= -5tz(iii) Given expressions: -7mn + 5, 12mn + 2, 9mn - 8, -2mn - 3By adding, (-7mn + 5) + (12mn + 2) + (9mn - 8) + (-2mn - 3)= -7mn + 5 + 12mn + 2 + 9mn - 8 - 2mn - 3= -7mn + 12mn + 9mn - 2mn + 5 + 2 - 8 - 3By taking common, = mn(-7 + 12 + 9 - 2) + (5 + 2 - 8 - 3)= mn(12) - 4= 12mn - 4(iv) Given expressions: a + b - 3, b - a + 3, a - b + 3By adding, (a + b - 3) + (b - a + 3) + (a - b + 3)= a + b - 3 + b - a + 3 + a - b + 3= a - a + a + b + b - b - 3 + 3 + 3By taking common, = a (1 - 1 + 1) + b (1 + 1 - 1) + (-3 + 3 + 3)= a + b + 3(v) Given expressions: 14x + 10y - 12xy - 13, 18 - 7x - 10y + 8xy, 4xyBy adding. (14x + 10y - 12xy - 13) + (18 - 7x - 10y + 8xy) + (4xy)= 14x + 10y - 12xy - 13 + 18 - 7x - 10y + 8xy + 4xy= 14x - 7x + 10y - 10y - 12xy + 8xy + 4xy - 13 + 18By taking common, = x (14 - 7) + y (10 - 10) + xy(-12 + 8 + 4) + (-13 + 18)= 7x + 5(vi) Given expressions: 5m - 7n, 3n - 4m + 2, 2m - 3mn - 5By adding, (5m - 7n) + (3n - 4m + 2) + (2m - 3mn - 5)= 5m - 7n + 3n - 4m + 2 + 2m - 3mn - 5= 5m - 4m + 2m - 7n + 3n - 3mn + 2 - 5= m (5 - 4 + 2) + n (-7 + 3) - 3mn + (2 - 5)= 3m - 4n - 3mn - 3(vii) Given expressions:  $4x^2y$ ,  $-3xy^2$ ,  $-5xy^2$ ,  $5x^2y$ By adding,  $(4x^2y) + (-3xy^2) + (-5xy^2) + (5x^2y)$ 

 $= 4x^{2}y - 3xy^{2} - 5xy^{2} + 5x^{2}y$ = 4x<sup>2</sup>y + 5x<sup>2</sup>y - 3xy<sup>2</sup> - 5xy<sup>2</sup> By taking common, = x<sup>2</sup>y (4 + 5) + xy<sup>2</sup> (-3 - 5) = 9x<sup>2</sup>y - 8xy<sup>2</sup>

## (viii) Given expressions: $3p^2q^2 - 4pq + 5$ , $-10p^2q^2$ , $15 + 9pq + 7p^2q^2$ By adding,

 $(3p^{2}q^{2} - 4pq + 5) + (-10p^{2}q^{2}) + (15 + 9pq + 7p^{2}q^{2}) = 3p^{2}q^{2} - 4pq + 5 - 10p^{2}q^{2} + 15 + 9pq + 7p^{2}q^{2} = 3p^{2}q^{2} - 10p^{2}q^{2} + 7p^{2}q^{2} - 4pq + 9pq + 5 + 15$ By taking common,  $= p^{2}q^{2} (3 - 10 + 7) + pq (-4 + 9) + (5 + 15) = 5pq + 20$ 

## (ix) Given expressions: ab - 4a, 4b - ab, 4a - 4bBy adding, (ab - 4a) + (4b - ab) + (4a - 4b)= ab - 4a + 4b - ab + 4a - 4b= ab - ab - 4a + 4a + 4b - 4bBy taking common, = ab (1 - 1) + a (4 - 4) + b (4 - 4)= 0

## (x) Given expressions: $x^2 - y^2 - 1$ , $y^2 - 1 - x^2$ , $1 - x^2 - y^2$ By adding, $(x^2 - y^2 - 1) + (y^2 - 1 - x^2) + (1 - x^2 - y^2)$ $= x^2 - y^2 - 1 + y^2 - 1 - x^2 + 1 - x^2 - y^2$ $= x^2 - x^2 - x^2 - y^2 + y^2 - y^2 - 1 - 1 + 1$ By taking common, $= x^2 (1 - 1 - 1) + y^2 (-1 + 1 - 1) + (-1 - 1 + 1)$ $= -x^2 - y^2 - 1$

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Q.3 Subtract:
(i) -5y^2 from y^2
(ii) 6xy from -12xy
(iii) (a - b) from (a + b)
(iv) a(b-5) from b(5-a)
(v) -m^2 + 5mn from 4m^2 - 3mn + 8
(vi) - x^2 + 10x - 5 from 5x - 10
(vii) 5a^2 - 7ab + 5b^2 from 3ab - 2a^2 - 2b^2
(viii) 4pq - 5q^2 - 3p^2 from 5p^2 + 3q^2 - pq
Sol:
(i) Given: -5y^2 from y^2
By subtracting,
y^2 - (-5y^2) = y^2 + 5y^2
         = 6y^{2}
(ii) Given: 6xy from -12xy
By subtracting,
-12xy - 6xy = -18xy
(iii) Given: (a - b) from (a + b)
By subtracting,
(a + b) - (a - b) = a + b - a + b
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= a - a + b + b
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By taking common, = a(1-1) + b(1+1)= 2b (iv) Given: a(b-5) from b(5-a)By subtracting, b(5-a) - a(b-5) = 5b - ab - ab + 5aBy taking common, = 5b + ab(-1 - 1) + 5a= 5a + 5b - 2ab(v) Given:  $-m^2 + 5mn$  from  $4m^2 - 3mn + 8$ By subtracting,  $(4m^2 - 3mn + 8) - (-m^2 + 5mn) = 4m^2 - 3mn + 8 + m^2 - 5mn$  $=4m^{2}+m^{2}-3mn-5mn+8$ By taking common,  $= m^{2}(4+1) - mn(3+5) + 8$  $= 5m^2 - 8mn + 8$ (vi) Given:  $-x^2 + 10x - 5$  from 5x - 10By subtracting,  $(5x - 10) - (-x^2 + 10x - 5) = 5x - 10 + x^2 - 10x + 5$  $= x^{2} + 5x - 10x - 10 + 5$ By taking common,  $= x^{2} + x (5-10) - 5$  $= x^2 - 5x - 5$ (vii) Given:  $5a^2 - 7ab + 5b^2$  from  $3ab - 2a^2 - 2b^2$ By subtracting,  $(3ab - 2a^2 - 2b^2) - (5a^2 - 7ab + 5b^2) = 3ab - 2a^2 - 2b^2 - 5a^2 + 7ab - 5b^2$  $= 3ab + 7ab - 2a^2 - 5a^2 - 2b^2 - 5b^2$ By taking common,  $= ab(3+7) - a^{2}(2+5) - b^{2}(2+5)$  $= 10ab - 7a^2 - 7b^2$ (viii) Given:  $4pq - 5q^2 - 3p^2$  from  $5p^2 + 3q^2 - pq$ By subtracting,  $5p^{2} + 3q^{2} - pq - (4pq - 5q^{2} - 3p^{2}) = 5p^{2} + 3q^{2} - pq - 4pq + 5q^{2} + 3p^{2}$  $= 5p^2 + 3p^2 + 3q^2 + 5q^2 - pq - 4pq$ By taking common,  $= p^{2} (5+3) + q^{2} (3+5) - pq (1+4)$  $= 8p^2 + 8q^2 - 5pq$ Q.4 (a) What should be added to  $x^2 + xy + y^2$  to obtain  $2x^2 + 3xy$ ? (b) What should be subtracted from 2a + 8b + 10 to get -3a + 7b + 16? Sol: (a) Let Z be the required term. So, according to question,  $Z + (x^2 + xy + y^2) = 2x^2 + 3xy$ On transposing,  $Z = (2x^2 + 3xy) - (x^2 + xy + y^2)$  $Z = 2x^2 + 3xy - x^2 - xy - y^2$ 

 $Z = 2x^2 - x^2 + 3xy - xy - y^2$ 

Thus, the required term is  $x^2 + 2xy - y^2$ .

 $\mathbf{Z} = x^2 + 2xy - y^2$ 

(b) Let Z be the required term. So, according to question, (2a + 8b + 10) - Z = -3a + 7b + 16On transposing, Z = (2a + 8b + 10) - (-3a + 7b + 16)Z = 2a + 8b + 10 + 3a - 7b - 16Z = 2a + 3a + 8b - 7b + 10 - 16Z = 5a + b - 6Thus, the required term is 5a + b - 6.

Q.5 What should be taken away from  $3x^2 - 4y^2 + 5xy + 20$  to obtain  $-x^2 - y^2 + 6xy + 20$ ? Sol: Let Z be the required term, So, according to question,  $(3x^2 - 4y^2 + 5xy + 20) - Z = -x^2 - y^2 + 6xy + 20$ On transposing,  $Z = (3x^2 - 4y^2 + 5xy + 20) - (-x^2 - y^2 + 6xy + 20)$  $Z = 3x^2 - 4y^2 + 5xy + 20 - (-x^2 - y^2 + 6xy + 20)$  $Z = 3x^2 - 4y^2 + 5xy + 20 + x^2 + y^2 - 6xy - 20$  $Z = 3x^2 + x^2 - 4y^2 + y^2 + 5xy - 6xy + 20 - 20$  $Z = 4x^2 - 3y^2 - xy$ 

Q.6 (a) From the sum of 3x - y + 11 and -y - 11, subtract 3x - y - 11. (b) From the sum of 4 + 3x and  $5 - 4x + 2x^2$ , subtract the sum of  $3x^2 - 5x$ . Sol: (a) Given: From the sum of 3x - y + 11 and -y - 11, subtract 3x - y - 11. Firstly, sum of 3x - y + 11 and -y - 11, (3x - y + 11) + (-y - 11) = 3x - y + 11 - y - 11= 3x - y - y + 11 - 11= 3x - 2yNow, subtract 3x - y - 11 from 3x - 2y, (3x - 2y) - (3x - y - 11) = 3x - 2y - 3x + y + 11= 3x - 3x - 2y + y + 11= -y + 11(b) Given: From the sum of 4 + 3x and  $5 - 4x + 2x^2$ , subtract the sum of  $3x^2 - 5x$  and  $-x^2 + 2x + 5$ . Firstly, sum of 4 + 3x and  $5 - 4x + 2x^2$  $(4+3x) + (5-4x+2x^2) = 4+3x+5-4x+2x^2$  $= 4 + 5 + 3x - 4x + 2x^{2}$  $= 2x^2 - x + 9$ And sum of  $3x^2 - 5x$  and  $-x^2 + 2x + 5$  $(3x^2 - 5x) + (-x^2 + 2x + 5) = 3x^2 - 5x - x^2 + 2x + 5$  $= 3x^2 - x^2 - 5x + 2x + 5$  $= 2x^2 - 3x + 5$ Now, subtract  $2x^2 - 3x + 5$  from  $2x^2 - x + 9$ ,  $2x^2 - x + 9 - (2x^2 - 3x + 5) = 2x^2 - x + 9 - 2x^2 + 3x - 5$  $= 2x^2 - 2x^2 - x + 3x + 9 - 5$ = 2x + 4