Factorization

Solution

1. **(a)** $3a + 6b + 12c = 3(a + 2b + 4c)$

   (b) $-4x^2 - 6y - 20y^2 = -2(2x^2 + 3y + 10y^2)$

   (c) $-27 - 15t - 18t^2 = -3(9 + 5t + 6t^2)$

2. **(a)** $abc - 2c + ab - 2$
   $= c(ab - 2) + ab - 2$
   $= (ab - 2)(c + 1)$

   (b) $x^2 + y - xy - x$
   $= x^2 - xy + y - x$
   $= x(x - y) - (x - y)$
   $= (x - y)(x - 1)$

3. **(a)** $ab + 1 + a + b = ab + a + b + 1$
   $= a(b + 1) + b + 1$
   $= (b + 1)(a + 1)$

   (b) $mn + 1 - m - n = mn - m - n + 1$
   $= m(n - 1) - (n - 1)$
   $= (n - 1)(m - 1)$

4. **(a)** $2ab - bc + cd - 2ad$
   $= b(2a - c) + d(c - 2a)$
   $= (2a - c)(b - d)$

   (b) $3mn - 2m + 4 - 6n$
   $= m(3n - 2) + 2(2 - 3n)$
   $= (3n - 2)(m - 2)$

5. **(a)** $16m^2n - 4m^3$
   $= 4m^2(4n - m)$

   (b) $3a(b - 2c) - 2(b - 2c)$
   $= (b - 2c)(3a - 2)$

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

6. **(a)** $4b^2 - 49$
   $= (2b)^2 - 7^2$
   $= (2b + 7)(2b - 7)$

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

   (c) $64r^2 - 25s^2$
   $= (8r)^2 - (5s)^2$
   $= (8r + 5s)(8r - 5s)$

7. **(a)** $a^2 - 12a + 36$
   $= a^2 - 2(a)(6) + 6^2$
   $= (a - 6)^2$

   (b) $81 + 18b + b^2$
   $= b^2 + 18b + 81$
   $= b^2 + 2(b)(9) + 9^2$
   $= (b + 9)^2$

   (c) $c^2 - 22c + 121$
   $= c^2 - 2(c)(11) + 11^2$
   $= (c - 11)^2$

8. **(a)** $3t^2 - 30t + 75 = 3(t^2 - 10t + 25)$
   $= 3[t^2 - 2t(5) + 5^2]$
   $= 3(t - 5)^2$

   (b) $96 + 48y + 6y^2 = 6(y^2 + 8y + 16)$
   $= 6[y^2 + 2y(4) + 4^2]$
   $= 6(y + 4)^2$

   (c) $16y^2 - 36x^2 = 4(4y^2 - 9x^2)$
   $= 4[(2y)^2 - (3x)^2]$
   $= 4(2y + 3x)(2y - 3x)$

9. **(a)** $25m^2 - 36n^2 - 5m - 6n$
   $= (5m)^2 - (6n)^2 - 5m - 6n$
   $= (5m + 6n)(5m - 6n) - (5m + 6n)$
   $= (5m + 6n)(5m - 6n - 1)$

   (b) $81x^4 - 256$
   $= (9x^2)^2 - (16)^2$
   $= (9x^2 + 16)(9x^2 - 16)$
   $= (9x^2 + 16)[(3x)^2 - 4^2]$
   $= (9x^2 + 16)(3x + 4)(3x - 4)$

10. **(a)** $x^2 - y^2 + y + x = (x^2 - y^2) + (x + y)$
    $= (x + y)(x - y) + (x + y)$
    $= (x + y)(x - y + 1)$

    (b) $9m^2 - 9 + 24mn + 16n^2$
    $= (9m^2 + 24mn + 16n^2) - (3)^2$
    $= (3m + 4n)^2 - (3)^2$
    $= (3m + 4n + 3)(3m + 4n - 3)$

11. (a) $6(x-y)^2 + 3(x-y)(k+2)$

$= 3(x-y)[2(x-y)+(k+2)]$

$= 3(x-y)(2x-2y+k+2)$

(b) $(2a+c)(a-b)+(b-a)(c-2a)$

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

$= 4a(a-b)$

(c) $am-bm-an+bn+a-b$

$= m(a-b)+n(-a+b)+a-b$

$= (a-b)(m-n+1)$

(d) $(5x-2)(y-3k)-(2-5x)(3y-k)$

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

$= (5x-2)(4y-4k)$

$= 4(5x-2)(y-k)$