

## Factoring

### 1 – Factoring by Grouping

Factor by grouping. Show all work to receive full credit.

#1)  $12x^3 - 9x^2 + 4x - 3$

$$\begin{aligned} &= (12x^3 - 9x^2) + (4x - 3) \\ &= 3x^2(4x - 3) + 1(4x - 3) \\ &= (4x - 3)(3x^2 + 1) \end{aligned}$$

#2)  $2x^3 + 5x^2 + 6x + 15$

$$\begin{aligned} &= (2x^3 + 5x^2) + (6x + 15) \\ &= x^2(2x + 5) + 3(2x + 5) \\ &= (2x + 5)(x^2 + 3) \end{aligned}$$

#3)  $3x^3 - 4x^2 + 9x - 12$

$$\begin{aligned} &= (3x^3 - 4x^2) + (9x - 12) \\ &= x^2(3x - 4) + 3(3x - 4) \\ &= (3x - 4)(x^2 + 3) \end{aligned}$$

#4)  $12x^3 + 4x^2 + 3x + 1$

$$\begin{aligned} &= (12x^3 + 4x^2) + (3x + 1) \\ &= 4x^2(3x + 1) + 1(3x + 1) \\ &= (3x + 1)(4x^2 + 1) \end{aligned}$$

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

$$\begin{aligned} &= (x^3 - x^2) + (2x - 2) \\ &= x^2(x - 1) + 2(x - 1) \\ &= (x - 1)(x^2 + 2) \end{aligned}$$

#6)  $5x^3 - 10x^2 + 3x - 6$

$$\begin{aligned} &= (5x^3 - 10x^2) + (3x - 6) \\ &= 5x^2(x - 2) + 3(x - 2) \\ &= (x - 2)(5x^2 + 3) \end{aligned}$$

#7)  $35xy - 5x - 56y + 8$

$$\begin{aligned} &= (35xy - 5x) + (-56y + 8) \\ &= 5x(7y - 1) + -8(7y - 1) \\ &= (7y - 1)(5x - 8) \end{aligned}$$

#8)  $224az + 56ac - 84yz - 21yc$

$$\begin{aligned} &\text{GCF} = 7 \\ &= 7[(32az + 8ac) + (-12yz - 3yc)] \\ &= 7[8a(4z + c) + -3y(4z + c)] \\ &= 7(4z + c)(8a - 3y) \end{aligned}$$

#9)  $mz - 5mh^2 - 5nz + 25nh^2$

$$\begin{aligned} &= (mz - 5mh^2) + (-5nz + 25nh^2) \\ &= m(z - 5h^2) + -5n(z - 5h^2) \\ &= (z - 5h^2)(m - 5n) \end{aligned}$$

#10)  $12xy - 28x - 15y + 35$

$$\begin{aligned} &= (12xy - 28x) + (-15y + 35) \\ &= 4x(3y - 7) + -5(3y - 7) \\ &= (3y - 7)(4x - 5) \end{aligned}$$

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#11)  $40xy + 30x - 100y - 75$

$$\begin{aligned} \text{GCF} = 5 &= 5 [8xy + 6x - 20y - 15] \\ &= 5 [(8xy + 6x) + (-20y - 15)] \\ &= 5 [2x(4y + 3) + -5(4y + 3)] \\ &= 5(4y + 3)(2x - 5) \end{aligned}$$

#12)  $75a^2c - 45a^2d - 30bc + 18bd$

$$\begin{aligned} \text{GCF} = 3 &= 3 [25a^2c - 15a^2d + (-10bc + 6bd)] \\ &= 3 [5a^2(5c - 3d) + -2b(5c - 3d)] \\ &= 3(5c - 3d)(5a^2 - 2b) \end{aligned}$$

#13)  $192x^2y + 72x^3 - 24rxy - 9rx^2$

$$\begin{aligned} \text{GCF} = 3x &= 3x [(64xy + 24x^2) + (-8ry - 3rx)] \\ &= 3x [8x(8y + 3x) + -r(8y + 3x)] \\ &= 3x(8y + 3x)(8x - r) \end{aligned}$$

#14)  $90au - 36av - 150yu + 60yv$

$$\begin{aligned} \text{GCF} = 6 &= 6 [(15au - 6av) + (-25yu + 10yv)] \\ &= 6 [3a(5u - 2v) + -5y(5u - 2v)] \\ &= 6(5u - 2v)(3a - 5y) \end{aligned}$$

#15)  $140ab - 60a^2 + 168b - 72a$

$$\begin{aligned} \text{GCF} = 4 &= 4 [(35ab - 15a^2) + (42b - 18a)] \\ &= 4 [5a(7b - 3a) + 6(7b - 3a)] \\ &= 4(7b - 3a)(5a + 6) \end{aligned}$$

#16)  $105ab - 90a - 21b + 18$

$$\begin{aligned} \text{GCF} = 3 &= 3 [(35ab - 30a) + (-7b + 6)] \\ &= 3 [5a(7b - 6) + -1(7b - 6)] \\ &= 3(7b - 6)(5a - 1) \end{aligned}$$

#17)  $16x^2c + 8xyd - 16x^2y - 8xyc$

$$\begin{aligned} \text{GCF} = 8x &= 8x [(2xc + yd) + (-2xy - yc)] \\ &= 8x [1(2xc + yd) + -1(2xy + yc)] \\ &\quad \text{Doesn't Factor Any more} \\ &= 8x(2xc + yd - 2xy - yc) \end{aligned}$$

#18)  $150m^2nz + 20mn^2c - 120m^2nc - 25mn^2z$

$$\begin{aligned} \text{GCF} = 5mn &= 5mn [30mz + 4nc + (-24mc - 5nz)] \\ &= 5mn [(30mz - 24mc) + (-5nz + 4nc)] \\ &= 5mn [6m(5z - 4c) + -n(5z - 4c)] \\ &= 5mn(5z - 4c)(6m - n) \end{aligned}$$

#19)  $105xuv + 60xv - 70xu - 90xv^2$

$$\begin{aligned} \text{GCF} = 5x &= 5x [21uv + 12v + (-14u - 18v^2)] \\ &= 5x [(21uv - 18v^2) + (-14u + 12v)] \\ &= 5x [3v(7u - 6v) + -2(7u - 6v)] \\ &= 5x(7u - 6v)(3v - 2) \end{aligned}$$

#20)  $112xy - 16x + 128x^2 - 14y$

$$\begin{aligned} \text{GCF} = 2 &= 2 [56xy - 8x + 64x^2 - 7y] \\ &= 2 [(56xy - 7y) + (64x^2 - 8x)] \\ &= 2 [7y(8x - 1) + 8x(8x - 1)] \\ &= 2(8x - 1)(7y + 8x) \end{aligned}$$