# FACTORING – Extra Practice

## Definition:

1. Determine if the following expressions are sums or products, and make the list of their factors or terms.

a) $3x(x+2)-2x$ SUM : 2 terms : $3x(x+2)$ and $-2x$

b) $5x(x-1)$ PRODUCT : 3 factors 5 ; $x$ and $x-1$

c) $(2x-3)^2$ PRODUCT : 2 factors : $(2x-3)$ twice

d) $(5+x)(5-x)$ PRODUCT : 2 factors : $5+x$ and $5-x$

e) $(2x-3)^2-3(x+2)$ SUM : 2 terms : $(2x-3)^2$ and $-3(x+2)$

2. Expand the following expressions :

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

b) $(2x-3)(3x+2) =$ $6x^2+4x-9x-6 = 6x^2-5x-6$

c) $(5x-4)^2 =$ $25x^2-40x+16$

d) $(2x+1)^2-4x(2x-5) =$ $4x^2+4x+1-8x^2+20x$
$= -4x^2+24x+1$

e) $(2x+1)(3x-2)-(4x+3)(x-4) =$ $6x^2-4x+3x-2-(4x^2-16x+3x-12)$
$= 6x^2-x-2-4x^2+13x+12$
$= 2x^2+12x+10$

f) $(2x-1)(x+3)(x-5) =$ $(2x^2+6x-x-3)(x-5) = (2x^2+5x-3)(x-5)$
$= 2x^3-10x^2+5x^2-25x-3x+15$
$= 2x^3-5x^2-28x+15$

## Factoring by common factor:

3. Factor the following expressions

a) $16x^2-12x =$ $4x(4x-3)$

b) $5x^2-10x+25 =$ $5(x^2-2x+5)$

c) $(2x+3)(x-2)-5x(2x+3) =$ $(2x+3)(x-2-5x) = (2x+3)(-4x-2)$
$= -2(2x+3)(2x+1)$

d) $2(x+4)^2-(x-4)(x+4) =$ $(x+4)\big(2(x+4)-(x-4)\big)$
$= (x+4)(2x+8-x+4) = (x+4)(x+12)$

## Factoring trinomials of the form $ax^2+bx+c$:

4. Factor the following expressions :

a) $x^2+7x+12 =$ $(x+3)(x+4)$

b) $2x^2-14x+12 =$ $2(x^2-7x+6) = 2(x-6)(x-1)$

c) $x^2+3x-10 =$ $(x+5)(x-2)$

d) $2x^2+7x-4 =$ $2x^2+8x-x-4 = 2x(x+4)-1(x+4)$
$= (2x-1)(x+4)$
⊗ $-8$ } $-8\,\&\,1$
⊕ $7$ }

e) $-x^2+5x+6 =$ $-(x^2-5x-6)$
$= -(x-6)(x+1)$

f) $-8x^3+10x^2+12x =$ $-2x(4x^2-5x-6) = -2x(4x^2-8x+3x-6)$
⊗ $-24$ } $-8\,\&\,3$
⊕ $-5$ } $= -2x(4x(x-2)+3(x-2)) = -2x(4x+3)(x-2)$

g) $4x^2+14x-8 =$ $2(2x^2+7x-4) = 2(2x^2+8x-x-4)$
⊗ $-8$
⊕ $7$ $= 2(2x(x+4)-1(x+4)) = 2(2x-1)(x+4)$

## Factoring Special polynomials:

5. Factor the following expressions :

a) $16-25x^2 =$ $(4+5x)(4-5x)$

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

c) $x^2 - 12x + 36 =$ $(x-6)^2$

d) $2x^2 - 28x + 98 =$ $2(x^2-14x+49) = 2(x-7)^2$

e) $9x^2 - 24x + 16 =$ $(3x-4)^2$

f) $3x^2 + 24x + 48 =$ $3(x^2+8x+16) = 3(x+4)^2$

g) $\frac{1}{9}x^2 - \frac{2}{3}x + 1 =$ $\left(\frac{1}{3}x-1\right)^2$ or $\frac{1}{9}(x^2-6x+9) = \frac{1}{9}(x-3)^2$

h) $0.16x^2 - 0.09 =$ $(0.4x+0.3)(0.4x-0.3)$

i) $\frac{2}{3}x^2 + \frac{20}{3}x + \frac{50}{3} =$ $\frac{2}{3}(x^2+10x+25) = \frac{2}{3}(x+5)^2$

j) $-50x^2 + 40x - 8 =$ $-2(25x^2-20x+4) = -2(5x-2)^2$

**Other techniques:**

6. Factor the following expressions :

a) $3(2x-1)^2 + 14(2x-1) + 8 =$ $3t^2+14t+8 = (3t+2)(t+4)$

let $t = 2x-1$ $= (3(2x-1)+2)(2x-1+4) = (6x-1)(2x+3)$

b) $(x^2+2x)^2 - 2(x^2+2x) - 3 =$ $t^2-2t-3 = (t-3)(t+1)$

let $t = x^2+2x$ $= (x^2+2x-3)(x^2+2x+1) = (x+3)(x-1)(x+1)^2$

c) $(x^2+1)^2 - 15(x^2+1) + 50 =$ $t^2-15t+50 = (t-5)(t-10)$

let $t = x^2+1$ $= (x^2-4)(x^2-9) = (x+2)(x-2)(x+3)(x-3)$

d) $4(x^2-25)^2 - 9(x-5)^2 =$ $4(x+5)^2(x-5)^2 - 9(x-5)^2$

$= (x-5)^2\left[4(x+5)^2-9\right]$

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

$= (x-5)^2(2x+13)(2x+7)$