

## Working with Polynomials

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

$$= 4x^2 - 6x - 6x + 9$$

$$= 4x^2 - 12x + 9$$

1. Simplify.

$$\text{a) } (x^2 - 3x + 5) - (2x^2 - 5x - 7)$$

$$= x^2 - 3x + 5 - 2x^2 + 5x + 7$$

$$= -x^2 + 2x + 12$$

$$\text{b) } x(2x-3)^2 - 2x(x-4)$$

$$= x(4x^2 - 12x + 9) - 2x^2 + 8x$$

$$= 4x^3 - 12x^2 + 9x - 2x^2 + 8x$$

$$= 4x^3 - 14x^2 + 17x$$

2. Simplify. Hint: work inside out (do inside brackets first, then bigger outside brackets).

$$\text{a) } 4[2x - (3 - 5x)] + 3[3x - (4 + x)]$$

$$\text{b) } 5[x - (2x + 3)] - 2[4x - (x + 1)]$$

$$= 4[2x - 3 + 5x] + 3[3x - 4 - x]$$

$$= 5[x - 2x - 3] - 2[4x - x - 1]$$

$$= 4[7x - 3] + 3[2x - 4]$$

$$= 5[-x - 3] - 2[3x - 1]$$

$$= 28x - 12 + 6x - 12$$

$$= -5x - 15 - 6x + 2$$

$$= 34x - 24$$

$$= -11x - 13$$

3. Simplify.

$$\text{a) } (x+2)(x^2 - x - 2)$$

$$\text{b) } (1-x)(x^3 - x^2 + 3x)$$

$$= x^3 - x^2 - 2x + 2x^2 - 2x - 4$$

$$= x^3 - x^2 + 3x - x^4 + x^3 - 3x^2$$

$$= x^3 + x^2 - 4x - 4$$

$$= -x^4 + 2x^3 - 4x^2 + 3x$$

$$\text{c) } (2 - x^2)(3 + x^2 - x^3)$$

$$\text{d) } (x^2 + 1)(x^2 - 3x + 5)$$

$$= 6 + 2x^2 - 2x^3 - 3x^2 - x^4 + x^5$$

$$= x^4 - 3x^3 + 5x^2 + x^2 - 3x + 5$$

$$= x^5 - x^4 - 2x^3 - x^2 + 6$$

$$= x^4 - 3x^3 + 6x^2 - 3x + 5$$

Solutions:

1. a)  $-x^2 + 2x + 12$

b)  $4x^3 - 14x^2 + 17x$

2. a)  $34x - 24$

b)  $-11x - 13$

3. a)  $x^3 + x^2 - 4x - 4$

b)  $-x^4 + 2x^3 - 4x^2 + 3x$

c)  $x^5 - x^4 - 2x^3 - x^2 + 6$

d)  $x^4 - 3x^3 + 6x^2 - 3x + 5$

4. Simplify.

$$\begin{aligned} & \text{a) } (x+3)(x-1) - (x-5)(x-2) \\ & = x^2 - x + 3x - 3 - [x^2 - 2x - 5x + 10] \\ & = x^2 - x^2 + 2x + 9x - 3 - 10 \\ & = 9x - 13 \end{aligned}$$

$$\begin{aligned} & \text{b) } (2x^2 - 1)^2 - (4 - x^2)^2 \\ & = (2x^2 - 1)(2x^2 - 1) - [(4 - x^2)(4 - x^2)] \\ & = 4x^4 - 2x^2 - 2x^2 + 1 - [16 - 4x^2 - 4x^2 + x^4] \\ & = 4x^4 - 4x^2 - 4x^2 + 8x^2 + 1 - 16 \\ & = 3x^4 + 4x^2 - 15. \end{aligned}$$

5. Simplify.

$$\begin{aligned} & \text{a) } (x-1)(x+3)(x+1) + (2x-1)(x-2) \\ & = (x-1)[x^2 + 3x + 3x + 3] + 2x^2 - 4x - x + 2 \\ & = (x-1)(x^2 + 4x + 3) + 2x^2 - 5x + 2 \\ & = x^3 + 4x^2 + 3x - x^2 - 4x - 3 + 2x^2 - 5x + 2 \\ & = x^3 + 5x^2 - 6x - 1 \end{aligned}$$

$$\text{b) } (2a+7)^2(a-2) + 2(a^2-1)(4a+3)$$


6. Jake wrote the following:  $(x+1)^2 - (x+2)(x-3) = x^2 + 2x + 1 - x^2 - x - 6 = x - 5$

What mistake(s) did he make? Write a correct simplification, and explain how to avoid making Jake's error.

Brackets are needed around  $(x+2)(x-3)$ .

7. If  $x+y+z=1$  and  $x^2+y^2+z^2=3$ , find the value of  $xy+xz+yz$ .

$$\begin{aligned} & (x+y+z)^2 = 1 \\ & (x+y+z)(x+y+z) = 1 \\ & (x^2 + xy + xz + yx + y^2 + yz + zx + yz + z^2) = 1 \\ & x^2 + y^2 + z^2 + 2xy + 2xz + 2yz = 1 \end{aligned}$$

$$\begin{aligned} & 3 + 2(xy+xz+yz) = 1 \\ & 2(xy+xz+yz) = -2 \\ & xy+xz+yz = -1 \end{aligned}$$


Solutions:

4. a)  $9x - 13$     b)  $3x^4 + 4x^2 - 15$     5. a)  $x^3 + 5x^2 - 6x - 1$     b)  $12a^3 + 26a^2 - 15a - 104$

6. Jake did not subtract the last 2 terms. The correct answer is  $3x + 7$ . Avoid this error by using brackets. 7. -1

Homework: p. 88 # (4-6)ef, 10-12, 17a

p. 95 #2,4ef,5e,8-10,13,14a

Nelson, Mathematics 11 pp. 375-376