



## Uitwerkingen extra opgaven hoofdstuk 3 Letterrekenen, ontbinden en herleiden

### 3.1 Haakjes wegwerken

#### Opgave 1

a  $-4p(-3p^2 + 7) = 12p^3 - 28p$

b  $(1+7x)(x+5) = x+5+7x^2+35x = 7x^2+36x+5$

c  $(2p-4)^2 = (2p)^2 - 2 \cdot 2p \cdot 4 + 4^2 = 4p^2 - 16p + 16$

d  $(q-9)(q+11) = q^2 + 2q - 99$

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

f  $-2x(x^2+5)(x^2-1) = -2x(x^4+4x^2-5) = -2x^5 - 8x^3 + 10x$

g

$$(2x-z)5y - 6y(x-3z) = 10xy - 5yz - 6xy + 18yz \\ = 4xy + 13yz$$

h

$$(2p-3q-r)(p+4q) = 2p^2 + 8pq - 3pq - 12q^2 - pr - 4qr \\ = 2p^2 + 5pq - 12q^2 - pr - 4qr$$

i  $-3p(7q-4)(7q+4) = -3p(49q^2-16) = -147q^3 + 48q$

j

$$(a+b+c)^2 = (a+(b+c))^2 = a^2 + 2a(b+c) + (b+c)^2 \\ = a^2 + 2ab + 2ac + b^2 + 2bc + c^2 \\ = a^2 + b^2 + c^2 + 2ab + 2ac + 2bc$$

### 3.2 Ontbinden in factoren

#### Opgave 1

a  $2p^2 - 72 = 2(p^2 - 36) = 2(p-6)(p+6)$

b  $x^2 - 10x - 24 = (x-12)(x+2)$

c  $2x^3 - 12x^2 + 16x = 2x(x^2 - 6x + 8) = 2x(x-2)(x-4)$

d  $z^4 - 81 = (z^2 - 9)(z^2 + 9) = (z-3)(z+3)(z^2 + 9)$

e  $p^3 + 8p^2 + 15p = p(p^2 + 8p + 15) = p(p+3)(p+5)$

f  $t^2 + t - 56 = (t+8)(t-7)$

g

$$3q^7 - 12q^3 = 3q^3(q^4 - 4) \\ = 3q^3(q^2 - 2)(q^2 + 2) \\ = 3q^3(q - \sqrt{2})(q + \sqrt{2})(q^2 + 2)$$



## Toegepaste Wiskunde inleiding

h

$$\begin{aligned}v^4 + 7v^3 + 10v^2 &= v^2(v^2 + 7v + 10) \\ &= v^2(v+2)(v+5)\end{aligned}$$

i

$$\begin{aligned}2y^4 + 6y^2 - 36 &= 2(y^4 + 3y^2 - 18) = 2(y^2 + 6)(y^2 - 3) \\ &= 2(y^2 + 6)(y - \sqrt{3})(y + \sqrt{3})\end{aligned}$$

j

$$36x^2 - 9y^2 = (6x)^2 - (3y)^2 = (6x - 3y)(6x + 3y)$$

k

$$9x^2 - 30x + 25 = (3x)^2 - 2 \cdot 3x \cdot 5 + 5^2 = (3x - 5)^2$$

l

$$\begin{aligned}p^4 - 18p^2 + 81 &= (p^2 - 9)^2 \\ &= ((p-3)(p+3))^2 \\ &= (p-3)^2(p+3)^2\end{aligned}$$

### 3.3 Breuken met letters

#### Opgave 1

a 
$$\frac{t^3 - t^2v}{t^2 + 4tv} = \frac{t^2(t-v)}{t(t+4v)} = \frac{t(t-v)}{t+4v} = \frac{t^2 - tv}{t+4v}$$

b 
$$\frac{p^2 - 4p + 4}{p^2 - 4} = \frac{(p-2)^2}{(p-2)(p+2)} = \frac{p-2}{p+2}$$

c

$$\begin{aligned}\frac{2x^2 + 6x - 20}{x^2 + 7x + 10} &= \frac{2(x^2 + 3x - 10)}{(x+2)(x+5)} = \frac{2(x+5)(x-2)}{(x+2)(x+5)} \\ &= \frac{2(x-2)}{x+2} = \frac{2x-4}{x+2}\end{aligned}$$

d 
$$\frac{x^2 + 10x - 24}{x^2 - 10x + 24} = \frac{(x+12)(x-2)}{(x-6)(x-4)}$$
: niet te vereenvoudigen

#### Opgave 2

a 
$$\frac{5}{x} + \frac{3x}{x-4} = \frac{5(x-4) + 3x \cdot x}{x(x-4)} = \frac{3x^2 + 5x - 20}{x(x-4)}$$

b

$$\begin{aligned}\frac{3}{x^2 - 2x} - \frac{1}{x^2 + x} &= \frac{3}{x(x-2)} - \frac{1}{x(1+x)} \\ &= \frac{3(1+x) - (x-2)}{x(x-2)(1+x)} = \frac{2x+5}{x(x-2)(1+x)}\end{aligned}$$



## Toegepaste Wiskunde inleiding

c 
$$6p + \frac{5p}{p-q} = \frac{6p(p-q) + 5p}{p-q} = \frac{6p^2 - 6pq + 5p}{p-q}$$

d

$$\begin{aligned} \frac{2}{x^2 - 8x + 12} - \frac{x}{x^2 + 2x - 8} &= \frac{2}{(x-6)(x-2)} - \frac{x}{(x+4)(x-2)} \\ &= \frac{2(x+4) - x(x-6)}{(x-6)(x-2)(x+4)} = \frac{-x^2 + 8x + 8}{(x-6)(x-2)(x+4)} \end{aligned}$$

e

$$\frac{\frac{x-4}{3x}}{\frac{x+2}{x-5}} = \frac{x-4}{3x} \cdot \frac{3x(x-5)}{x+2} = \frac{(x-4)(x-5)}{3x(x+2)}$$

f

$$\begin{aligned} \frac{\frac{4x+8}{x-1} \cdot \frac{xy-y}{x-2}}{\frac{xy}{4x-8}} &= \frac{(4x+8)(xy-y)}{(x-1)(x-2)} \cdot \frac{4(x-1)(x-2)}{4(xy)} \\ &= \frac{4(4x+8)(xy-y)}{xy(x-1)} = \frac{16y(x+2)(x-1)}{xy(x-1)} = \frac{16(x+2)}{x} \end{aligned}$$

g

$$\frac{3p - \frac{p}{q}}{3p + \frac{p}{q}} = \frac{p\left(3 - \frac{1}{q}\right)}{p\left(3 + \frac{1}{q}\right)} \cdot \frac{q}{q} = \frac{3q-1}{3q+1}$$

h

$$\begin{aligned} \frac{\left(3 + \frac{b}{a}\right) \cdot \frac{c}{a}}{\frac{4a}{2-a}} &= \frac{\frac{3c}{a} + \frac{bc}{a^2}}{\frac{4a}{2-a}} \\ &= \frac{\frac{3ac+bc}{a^2}}{\frac{4a}{2-a}} \cdot \frac{a^2(2-a)}{a^2(2-a)} \\ &= \frac{(3ac+bc)(2-a)}{4a^3} = \frac{c(3a+b)(2-a)}{4a^3} \end{aligned}$$