

# Wiskunde Anibrand

Antwoordboek Graad 10



Annie Bothma

## Table of Contents

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Titelblad	2
Kopieregbladsy	3
VRAESTEL 1	4
Hoofstuk 1: Breuke	4
1. Vereenvoudiging	4
2. Vermenigvuldiging en deling	6
3. Optelling	8
4. Gemeng	11
Hoofstuk 2: Eksponente	14
1. Hersiening	14
2. Uitdrukkings met magte	16
3. Magte met breuk eksponente	21
4. Wortels	24
5. Vergelykings met magte	29
6. Gemeng	33
Hoofstuk 3: Faktorisering	38
1. Grootste gemeenskaplike faktor	38
2. Verskil tussen 2 vierkante	39
3. Kwadratiese 3 term	40
4. Groepering	46
5. Som en verskil van derdemagte	48
6. Gemeng	49
Hoofstuk 4: Finansies	54
1. Enkelvoudige en saamgestelde rente jaarliks bereken	54
2. Huurkoop	57
3. Tydlyne	60
4. Saamgestelde rente meer as een keer 'n jaar bereken	65
5. Inflasie en Wisselkoers	67
6. Gemeng	70
Hoofstuk 5: Getalstelsels	74

1. Getalgestelsels	74
2. Gemeng	78
Hoofstuk 6: Getalpatrone	81
1. Getalpatrone	81
2. Gemeng	86
Hoofstuk 7: Grafieke	90
1. Agtergrond	90
2. Reguitlyn/Linier	95
3. Parabool/Kwadratiese	103
4. Hiperbool	110
5. Eksponensieel	118
6. Interpretasie van grafieke	127
7. Gemeng	133
Hoofstuk 8: Uitdrukkings	145
1. Hersiening	145
2. Meer komplekse uitdrukkings	147
3. Gemeng	149
Hoofstuk 9: Vergelykings	151
1. Linier	151
2. Letterkoeffisiente en ongelykhede	155
3. Kwadratiese	159
4. Gelyktydige vergelykings	162
5. Woordprobleme	167
6. Gemeng	172
Hoofstuk 10: Waarskynlikheid	178
1. Hersiening	178
2. Gekombineerde gebeurtenisse	180
VRAESTEL 2	189
Hoofstuk 11: Analitiese Meetkunde	189
1. Afstandsformule	189
2. Middelpuntsformule	191
3. Hellings	193

4. Vergelyking van 'n reguitlyn	195
5. Toepassings in Meetkunde	197
6. Gemeng	204
Hoofstuk 12: Meetkunde	214
1. Hersiening	214
2. Parallelogramme	225
3. Ander reelmatige vierhoeke	236
4. Middelpuntstelling	244
5. Gemeng	250
Hoofstuk 13: Statistiek	258
1. Hersiening van grafiese voorstellings	258
2. Hersiening van maatstawwe van sentrale tendens	263
3. Maatstawwe van posisie en spreiding	265
4. Houer-en-punt diagramme	269
5. Gemeng	271
Hoofstuk 14: Trigonometrie	277
1. Definisie	277
2. Diagramme	279
3. Berekeninge met sakrekenaar	285
4. Spesiale hoeke	288
5. Praktiese toepassings	290
6. Trig grafieke	295
7. Gemeng	304
Hoofstuk 15: Volume en Buite-Oppervlakte	309
1. Prisma's	309
2. Piramiedes	313
3. Kegels en Sfeer	316
4. Gemeng	319

# **Wiskunde Anibrand**

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**Annie Bothma**

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# Hoofstuk 2

## EkspONENTE

### Antwoorde 1: Hersiening

1.  $2x^3 \times 3x^2 \times 4x^4 = 2 \times 3 \times 4 \times x^{3+2+4} = 24x^9$
2.  $\frac{a^8 \times a^3}{a^4} = \frac{a^{8+3}}{a^4} = \frac{a^{11}}{a^4} = a^7$  indien eksponent 'n konstante is,  
kanselleer uit
3.  $x^{2a} \cdot x \cdot x^{4a} \cdot x^5 = x^{2a+1+4a+5} = x^{6a+6}$
4.  $2 \cdot 5^x \times 5^{x-3} \times 7 \cdot 5^{3x} = 2 \cdot 7 \cdot 5^{x+x-3+3x} = 14 \cdot 5^{5x-3}$  moet nooit getalle met  
magte  $\times$  nie
5.  $\frac{7x^{3y}}{21x^{2y}} = \frac{1 \cdot x^{3y} \cdot x^{-2y}}{3} = \frac{x^{3y-2y}}{3} = \frac{x^y}{3}$  indien eksponent veranderlike bevat, vat alle magte boontoe
6.  $(x^3 y^5)^4 = (x^3)^4 (y^5)^4 = x^{12} y^{20}$
7.  $\left(\frac{a^2}{3^1 b^3}\right)^4 = \frac{(a^2)^4}{(3^1 b^3)^4} = \frac{a^8}{3^4 (b^3)^4} = \frac{a^8}{81 b^{12}}$
8.  $3(-2^1 x^2 y^1)^3 = 3(-2)^3 (x^2)^3 y^3 = 3(-8)x^6 y^3 = -24x^6 y^3$
9.  $3^x \cdot 3^2 = 3^{x+2}$
10.  $(2^a)^a = 2^{a \times a} = 2^{a^2}$
11.  $2^a \cdot 2^a = 2^{a+a} = 2^{2a}$
12.  $(-3x)^3 = (-3)^3 x^3 = -27x^3$
13.  $\frac{2(x^2)^3}{8x^2 x^3} = \frac{2x^6}{8x^{2+3}} = \frac{2x^6}{8x^5} = \frac{1x}{4} = \frac{x}{4}$
14.  $8a^0 = 8 \cdot 1 = 8$
15.  $(8a)^0 = 1$
16.  $3^1 x^{-2} = \frac{3}{x^2}$
17.  $(3^1 x^1)^{-2} = 3^{-2} \cdot x^{-2} = \frac{1}{3^2 x^2} = \frac{1}{9x^2}$
18.  $(-2a)^{-2} b^3 c^{-1} = \frac{b^3}{(-2a)^2 c^1} = \frac{b^3}{(-2)^2 a^2 c} = \frac{b^3}{4a^2 c}$
19.  $(2^{2x+4})^3 = 2^{3(2x+4)} = 2^{6x+12}$
20.  $(3^1 \cdot 2^{2x+4})^3 = 3^3 (2^{2x+4})^3 = 27 \cdot 2^{3(2x+4)} = 27 \cdot 2^{6x+12}$  jy kan nie die 27  
met die 2  $\times$  nie!
21.  $x^{-3} \times y^{-2} = \frac{1}{x^3 y^2}$
22.  $(x^3 y^{-2})^3 = (x^3)^3 (y^{-2})^3 = x^9 y^{-6} = \frac{x^9}{y^6}$
23.  $\frac{p^{x+2}}{p^{x-2}} = p^{x+2} \cdot p^{-x+2} = p^{x+2-x+2} = p^4$  indien eksponent veranderlike  
bevat, vat alle magte boontoe
24.  $2^{-2} \times 3^{-3} = \frac{1}{2^2 \times 3^3} = \frac{1}{4 \times 27} = \frac{1}{108}$
25.  $\frac{3a^{-3} b^2}{4ab^{-1}} = \frac{3b^2 \cdot b^1}{4a \cdot a^3} = \frac{3b^3}{4a^4}$  indien eksponent net getalle bevat, maak  
eksponente pos en kanselleer
26.  $(2x^5)^2 + (3x^2)^5 = (2)^2 (x^5)^2 + (3)^5 (x^2)^5 = 4x^{10} + 243x^{10} = 247x^{10}$

$$\begin{aligned}
27. \quad & 3(2y^3)^2 + 2(3y^2)^3 \\
& = 3(2)^2(y^3)^2 + 2(3)^3(y^2)^3 \\
& = 3 \cdot 4y^6 + 2 \cdot 27y^6 \\
& = 12y^6 + 54y^6 \\
& = 66y^6
\end{aligned}$$

$$28. \quad \left( \frac{a^4+a^4}{a^4 \times a^4} \right)^3 = \left( \frac{2a^4}{a^8} \right)^3 = \frac{2^3(a^4)^3}{(a^8)^3} = \frac{8a^{12}}{a^{24}} = \frac{8}{a^{12}}$$

$$29. \quad \frac{(x^{-4}y^2)^2}{x^3y^{-2}} = \frac{(x^{-4})^2(y^2)^2}{x^3y^{-2}} = \frac{x^{-8}y^4}{x^3y^{-2}} = \frac{y^4 \cdot y^2}{x^3 \cdot x^8} = \frac{y^6}{x^{11}}$$

$$\begin{aligned}
30. \quad & \frac{3(a^{-3}b^3)^{-2} \times (ab)^{-5}}{(3b^{-2})^6} \\
& = \frac{3(a^{-3})^{-2}(b^3)^{-2} \times a^{-5} \cdot b^{-5}}{3^6(b^{-2})^6} \\
& = \frac{3a^6b^{-6}a^{-5} \cdot b^{-5}}{3^6b^{-12}} \\
& = \frac{3a^{6-5}b^{-6-5}}{3^6b^{-12}} \\
& = \frac{3ab^{-11}}{3^6b^{-12}} \\
& = \frac{3ab^{12}}{3^6b^{11}} \\
& = \frac{ab}{3^5} \\
& = \frac{ab}{243}
\end{aligned}$$



# Hoofstuk 2

## EkspONENTE

### Antwoorde 2: Uitdrukkings

Vereenvoudig:

$$\begin{aligned} 1. & \frac{3^{a-2} \cdot 9^a}{27^{a-1}} \\ &= \frac{3^{a-2} \cdot (3^2)^a}{(3^3)^{a-1}} \\ &= \frac{3^{a-2} \cdot 3^{2a}}{3^{3a-3}} \\ &= 3^{a-2} \cdot 3^{2a} \cdot 3^{-3a+3} \\ &= 3^{a-2+2a-3a+3} \\ &= 3^1 \\ &= 3 \end{aligned}$$

$$\begin{aligned} 3. & \frac{3^n \cdot 9^{n-2} \cdot \left(\frac{1}{27}\right)^{2n}}{3^{1-3n}} \\ &= \frac{3^n \cdot (3^2)^{n-2} \cdot (3^{-3})^{2n}}{3^{1-3n}} \\ &= \frac{3^n \cdot 3^{2n-4} \cdot 3^{-6n}}{3^{1-3n}} \\ &= 3^n \cdot 3^{2n-4} \cdot 3^{-6n} \cdot 3^{-1+3n} \\ &= 3^{n+2n-4-6n-1+3n} \\ &= 3^{-5} \\ &= \frac{1}{3^5} \\ &= \frac{1}{243} \end{aligned}$$

$$\begin{aligned} 5. & \frac{6^x \cdot 3^x}{2^x \cdot 9^x} \\ &= \frac{(2 \cdot 3)^x \cdot 3^x}{2^x \cdot (3^2)^x} \\ &= \frac{2^x \cdot 3^x \cdot 3^x}{2^x \cdot 3^{2x}} \\ &= 2^x \cdot 3^x \cdot 3^x \cdot 2^{-x} \cdot 3^{-2x} \\ &= 2^{x-x} \cdot 3^{x+x-2x} \\ &= 2^0 \cdot 3^0 \\ &= 1 \end{aligned}$$

$$\begin{aligned} 2. & \frac{a^{-2} \cdot x^2}{a^3 \cdot x^{-1}} \\ &= a^{-2} \cdot x^2 \cdot a^{-3} \cdot x^1 \\ &= a^{-2-3} \cdot x^{2+1} \\ &= a^{-5} \cdot x^3 \\ &= \frac{x^3}{a^5} \end{aligned}$$

$$\begin{aligned} 4. & \frac{2^n \times 8^{n+2} \times 4^{-3n}}{2^{-2n}} \\ &= \frac{2^n \times (2^3)^{n+2} \times (2^2)^{-3n}}{2^{-2n}} \\ &= \frac{2^n \times 2^{3n+6} \times 2^{-6n}}{2^{-2n}} \\ &= 2^n \times 2^{3n+6} \times 2^{-6n} \times 2^{2n} \\ &= 2^{n+3n+6-6n+2n} \\ &= 2^6 \\ &= 64 \end{aligned}$$

$$\begin{aligned} 6. & \frac{(a^4)^{n+1} (a^2 b)^{-3n}}{(ab)^{-2n} b^{-n}} \\ &= \frac{a^{4n+4} \cdot a^{-6n} \cdot b^{-3n}}{a^{-2n} b^{-2n} b^{-n}} \\ &= a^{4n+4} \cdot a^{-6n} \cdot b^{-3n} \cdot a^{2n} \cdot b^{2n} \cdot b^n \\ &= a^{4n+4-6n+2n} \cdot b^{-3n+2n+n} \\ &= a^4 \cdot b^0 \\ &= a^4 \cdot 1 \\ &= a^4 \end{aligned}$$

$$\begin{aligned}
7. & \left(\frac{a}{b}\right)^{x+y} \left(\frac{b}{a}\right)^{x-y} \\
&= \left(\frac{a}{b}\right)^{x+y} \left(\frac{a}{b}\right)^{-x+y} \\
&= \left(\frac{a}{b}\right)^{x+y-x+y} \\
&= \left(\frac{a}{b}\right)^{2y}
\end{aligned}$$

$$\begin{aligned}
9. & \frac{27^{n-2} \times 6^n}{162^n} \\
&= \frac{(3^3)^{n-2} \times (2 \cdot 3)^n}{(3^4 \cdot 2)^n} \quad 162 = 81 \cdot 2 = 3^4 \cdot 2 \\
&= \frac{3^{3n-6} \times 2^n \cdot 3^n}{3^{4n} \cdot 2^n} \\
&= 3^{3n-6} \cdot 2^n \cdot 3^n \cdot 3^{-4n} \cdot 2^{-n} \\
&= 3^{3n-6+n-4n} \cdot 2^{n-n} \\
&= 3^{-6} \cdot 2^0 \\
&= \frac{1}{3^6} \\
&= \frac{1}{729}
\end{aligned}$$

$$\begin{aligned}
11. & \frac{10^n \times 25^{n-1} \times 2}{50^{n+1}} \\
&= \frac{(2 \cdot 5)^n \times (5^2)^{n-1} \times 2^1}{(2 \cdot 5^2)^{n+1}} \quad 50 = 2 \cdot 25 = 2 \cdot 5^2 \\
&= \frac{2^n \cdot 5^n \times 5^{2n-2} \times 2^1}{2^{n+1} \cdot 5^{2n+2}} \\
&= 2^n \cdot 5^n \times 5^{2n-2} \times 2^1 \cdot 2^{-n-1} \cdot 5^{-2n-2} \\
&= 2^{n+1-n-1} \cdot 5^{n+2n-2-2n-2} \\
&= 2^0 \cdot 5^{n-4} \\
&= 1 \cdot 5^{n-4} = 5^{n-4}
\end{aligned}$$

$$\begin{aligned}
13. & \frac{(18^y)^2 \cdot (8^{y-1})^3}{(9^{y+1})^2 \cdot (4^{2y-1})^3} \\
&= \frac{18^{2y} \cdot 8^{3y-3}}{9^{2y+2} \cdot 4^{6y-3}} \quad 18 = 2 \cdot 9 = 2 \cdot 3^2 \\
&= \frac{(2 \cdot 3^2)^{2y} \cdot (2^3)^{3y-3}}{(3^2)^{2y+2} \cdot (2^2)^{6y-3}} \\
&= \frac{2^{2y} \cdot 3^{4y} \cdot 2^{9y-9}}{3^{4y+4} \cdot 2^{12y-6}} \\
&= 2^{2y} \cdot 3^{4y} \cdot 2^{9y-9} \cdot 3^{-4y-4} \cdot 2^{-12y+6} \\
&= 2^{2y+9y-9-12y+6} \cdot 3^{4y-4y-4} \\
&= 2^{-y-3} \cdot 3^{-4}
\end{aligned}$$

$$\begin{aligned}
8. & \frac{12^{n+1} \cdot 9^{2n-1}}{36^n \cdot 8^{1-n}} \\
&= \frac{(2^2 \cdot 3)^{n+1} \cdot (3^2)^{2n-1}}{(2^2 \cdot 3^2)^n \cdot (2^3)^{1-n}} \\
&= \frac{2^{2n+2} \cdot 3^{n+1} \cdot 3^{4n-2}}{2^{2n} \cdot 3^{2n} \cdot 2^{3-3n}} \\
&= 2^{2n+2} \cdot 3^{n+1} \cdot 3^{4n-2} \cdot 2^{-2n} \cdot 3^{-2n} \cdot 2^{-3+3n} \\
&= 2^{2n+2-2n-3+3n} \cdot 3^{n+1+4n-2-2n} \\
&= 2^{3n-1} \cdot 3^{3n-1} \\
&= (2 \cdot 3)^{3n-1} \\
&= 6^{3n-1}
\end{aligned}$$

$$\begin{aligned}
10. & \frac{18^{n+1} \cdot 8^n}{9^{n+1} \cdot 4^{2n-1}} \\
&= \frac{18^{n+1} \cdot 8^n}{9^{n+1} \cdot 4^{2n-1}} \\
&= \frac{(2 \cdot 3^2)^{n+1} \cdot (2^3)^n}{(3^2)^{n+1} \cdot (2^2)^{2n-1}} \\
&= \frac{2^n \cdot 3^{2n} \cdot 2^{3n}}{3^{2n+2} \cdot 2^{4n-2}} \\
&= 2^n \cdot 3^{2n} \cdot 2^{3n} \cdot 3^{-2n-2} \cdot 2^{-4n+2} \\
&= 2^{n+3n-4n+2} \cdot 3^{2n-2n-2} \\
&= 2^2 \cdot 3^{-2} \\
&= \frac{2^2}{3^2} \\
&= \frac{4}{9}
\end{aligned}$$

$$\begin{aligned}
12. & \frac{5^{2n} \cdot 15^{n-1} \cdot 3^n}{125^n \cdot 3^{n-1}} \\
&= \frac{5^{2n} \cdot (3 \cdot 5)^{n-1} \cdot 3^n}{(5^3)^n \cdot 3^{n-1}} \\
&= \frac{5^{2n} \cdot 3^{n-1} \cdot 5^{n-1} \cdot 3^n}{5^{3n} \cdot 3^{n-1}} \\
&= 5^{2n} \cdot 3^{n-1} \cdot 5^{n-1} \cdot 3^n \cdot 5^{-3n} \cdot 3^{-n+1} \\
&= 5^{2n+n-1-3n} \cdot 3^{n-1+n-n+1} \\
&= 5^{-1} \cdot 3^n \\
&= \frac{3^n}{5}
\end{aligned}$$

$$\begin{aligned}
14. & \frac{18^y \cdot 8^{y-1}}{9^{y+1} \cdot 4^{2y-1}} \\
&= \frac{(2 \cdot 3^2)^y \cdot (2^3)^{y-1}}{(3^2)^{y+1} \cdot (2^2)^{2y-1}} \\
&= \frac{2^y \cdot 3^{2y} \cdot 2^{3y-3}}{3^{2y+2} \cdot 2^{4y-2}} \\
&= 2^y \cdot 3^{2y} \cdot 2^{3y-3} \cdot 3^{-2y-2} \cdot 2^{-4y+2} \\
&= 2^{y+3y-3-4y+2} \cdot 3^{2y-2y-2} \\
&= 2^{-1} \cdot 3^{-2} \\
&= \frac{1}{2 \cdot 3^2} = \frac{1}{18}
\end{aligned}$$

$$\begin{aligned}
15. \quad & \frac{3^n + 3^{n+2}}{3^{n-1}} \\
&= \frac{3^n + 3^n \cdot 3^2}{3^n \cdot 3^{-1}} \quad \frac{3^n}{3^n} + \frac{3^n \cdot 3^2}{3^n} \\
&= \frac{3^n(1+3^2)}{3^n \cdot 3^{-1}} \\
&= \frac{1+3^2}{3^{-1}} \\
&= \frac{1+9}{3^{-1}} \\
&= \frac{10}{3^{-1}} \\
&= 10 \cdot 3^1 = 10 \cdot 3 = 30
\end{aligned}$$

$$\begin{aligned}
17. \quad & \frac{2^{3+x} - 3 \cdot 2^x}{3 \cdot 2^{x-1} + 2^x} \\
&= \frac{2^3 \cdot 2^x - 3 \cdot 2^x}{3 \cdot 2^x \cdot 2^{-1} + 2^x} \\
&= \frac{2^x(2^3 - 3)}{2^x(3 \cdot 2^{-1} + 1)} \\
&= \frac{2^3 - 3}{3 \cdot 2^{-1} + 1} \\
&= \frac{8 - 3}{\frac{3}{2} + 1} \\
&= 2
\end{aligned}$$

$$\begin{aligned}
16. \quad & \frac{3^{n+4} - 6 \cdot 3^{n+1}}{3^{n+2} \cdot 7} \\
&= \frac{3^n \cdot 3^4 - 6 \cdot 3^n \cdot 3^1}{3^n \cdot 3^2 \cdot 7} \quad \frac{3^n \cdot 3^4}{3^n} - \frac{6 \cdot 3^n \cdot 3^1}{3^n} \\
&= \frac{3^n(3^4 - 6 \cdot 3^1)}{3^n \cdot 3^2 \cdot 7} \\
&= \frac{3^4 - 6 \cdot 3}{3^2 \cdot 7} \\
&= \frac{81 - 18}{63} \\
&= \frac{63}{63} \\
&= 1
\end{aligned}$$

$$\begin{aligned}
18. \quad & \frac{2^{2n+1} - 2^{2n}}{4^n + 2^{2n-1}} \\
&= \frac{2^{2n} \cdot 2^1 - 2^{2n}}{(2^2)^n + 2^{2n} \cdot 2^{-1}} \\
&= \frac{2^{2n} \cdot 2^1 - 2^{2n}}{2^{2n} + 2^{2n} \cdot 2^{-1}} \quad \frac{2^{2n} \cdot 2^1}{2^{2n}} - \frac{2^{2n}}{2^{2n}} \\
&= \frac{2^{2n}(2^1 - 1)}{2^{2n}(1 + 2^{-1})} \quad \frac{2^{2n}}{2^{2n}} + \frac{2^{2n} \cdot 2^{-1}}{2^{2n}} \\
&= \frac{2 - 1}{1 + \frac{1}{2}} \\
&= \frac{2}{3}
\end{aligned}$$

$$\begin{aligned}
 19. \quad & \frac{x^{n+1}-x^n}{x-1} \\
 &= \frac{x^n \cdot x^1 - x^n}{x-1} \\
 &= \frac{x^n(x^1-1)}{(x-1)} \\
 &= x^n
 \end{aligned}$$

$$\begin{aligned}
 21. \quad & \frac{2^{x+1}+2^{x+2}}{2^x+2^{x+2}} \\
 &= \frac{2^x \cdot 2^1 + 2^x \cdot 2^2}{2^x + 2^x \cdot 2^2} \\
 &= \frac{2^x(2^1+2^2)}{2^x(1+2^2)} \\
 &= \frac{2+4}{1+4} = \frac{6}{5}
 \end{aligned}$$

$$\begin{aligned}
 20. \quad & \frac{5^0 \cdot 3^n - 3^{n+2}}{3^n} \\
 &= \frac{1 \cdot 3^n - 3^n \cdot 3^2}{3^n} \\
 &= \frac{3^n(1-3^2)}{3^n} \\
 &= 1 - 3^2 = -8
 \end{aligned}$$

$$\begin{aligned}
 22. \quad & \frac{2^{3+x} - 3 \cdot 2^x}{3 \cdot 2^{x+1} + 2^x} \\
 &= \frac{2^3 \cdot 2^x - 3 \cdot 2^x}{3 \cdot 2^x \cdot 2^1 + 2^x} \\
 &= \frac{2^x(2^3-3)}{2^x(3 \cdot 2^1+1)} \\
 &= \frac{2^3-3}{3 \cdot 2^1+1} = \frac{5}{7}
 \end{aligned}$$

$$\begin{aligned}
23. & \left[ \frac{2 \cdot 2^n + 6 \cdot 2^{n-1}}{5 \cdot 4^n} \right]^{-1} \\
&= \left[ \frac{2 \cdot 2^n + 6 \cdot 2^n \cdot 2^{-1}}{5 \cdot (2^2)^n} \right]^{-1} \\
&= \left[ \frac{2^n(2+6 \cdot 2^{-1})}{5 \cdot 2^{2n}} \right]^{-1} \\
&= \left[ \frac{2^n(2+\frac{6}{2})}{5 \cdot 2^{2n}} \right]^{-1} \\
&= \left[ \frac{2^n \cdot 5}{5 \cdot 2^{2n}} \right]^{-1} \\
&= [2^n \cdot 2^{-2n}]^{-1} \\
&= [2^{n-2n}]^{-1} \\
&= [2^{-n}]^{-1} \\
&= 2^n
\end{aligned}$$

$$\begin{aligned}
25. & (2^{-1} + 3^{-1})^2 \\
&= \left( \frac{1}{2} + \frac{1}{3} \right)^2 \\
&= \left( \frac{1 \cdot 3 + 1 \cdot 2}{6} \right)^2 \\
&= \left( \frac{5}{6} \right)^2 = \frac{25}{36}
\end{aligned}$$

$$\begin{aligned}
26. & \frac{1}{2^{-1}+3^{-1}} + (2^{-1} + 3^{-1})^2 \\
&= \frac{1}{\frac{1}{2}+\frac{1}{3}} + \left( \frac{1}{2} + \frac{1}{3} \right)^2 \\
&= \frac{1}{\frac{1 \cdot 3 + 1 \cdot 2}{6}} + \left( \frac{1 \cdot 3 + 1 \cdot 2}{6} \right)^2 \\
&= \frac{1}{\frac{5}{6}} + \left( \frac{5}{6} \right)^2 \\
&= 1 \times \frac{6}{5} + \frac{25}{36} \\
&= \frac{6}{5} + \frac{25}{36} \\
&= \frac{6 \cdot 36 + 25 \cdot 5}{180} = \frac{341}{180}
\end{aligned}$$

$$\begin{aligned}
24. & \frac{4^{x-1} - 3 \cdot 2^{2x-4}}{2^{2x+1} - 5 \cdot 2^{2x-3}} \\
&= \frac{(2^2)^{x-1} - 3 \cdot 2^{2x-4}}{2^{2x+1} - 5 \cdot 2^{2x-3}} \\
&= \frac{2^{2x-2} - 3 \cdot 2^{2x-4}}{2^{2x+1} - 5 \cdot 2^{2x-3}} \\
&= \frac{2^{2x} \cdot 2^{-2} - 3 \cdot 2^{2x} \cdot 2^{-4}}{2^{2x} \cdot 2^1 - 5 \cdot 2^{2x} \cdot 2^{-3}} \\
&= \frac{2^{2x}(2^{-2} - 3 \cdot 2^{-4})}{2^{2x}(2^1 - 5 \cdot 2^{-3})} \\
&= \frac{2^{-2} - 3 \cdot 2^{-4}}{2^1 - 5 \cdot 2^{-3}} \\
&= \frac{\frac{1}{2^2} - \frac{3}{2^4}}{2^1 - \frac{5}{2^3}} \\
&= \frac{\frac{1}{4} - \frac{3}{16}}{2 - \frac{5}{8}} \\
&= \frac{\frac{1 \cdot 4 - 3}{16}}{\frac{2 \cdot 8 - 5}{8}} \\
&= \frac{\frac{1}{16}}{\frac{11}{8}} = \frac{1}{16} \times \frac{8}{11} = \frac{1}{22}
\end{aligned}$$

$$\begin{aligned}
27. & \frac{(x^2)^{n-1} \cdot (x^3 y)^{-2n} \cdot x^2}{(xy)^{-3n} \cdot y^{-n}} \\
&= \frac{x^{2n-2} \cdot x^{-6n} y^{-2n} \cdot x^2}{x^{-3n} y^{-3n} \cdot y^{-n}} \\
&= x^{2n-2} \cdot x^{-6n} \cdot y^{-2n} \cdot x^2 \cdot x^{3n} y^{3n} \cdot y^n \\
&= x^{2n-2-6n+2+3n} \cdot y^{-2n+3n+n} \\
&= x^{-n} \cdot y^{2n} \\
&= \frac{y^{2n}}{x^n}
\end{aligned}$$

# Hoofstuk 2

## EkspONENTE

### Antwoorde 3: Magte met breuk eksponente

$$\begin{aligned}
 1. \quad & \left(x^{-\frac{1}{2}} \cdot y^{\frac{1}{2}}\right)^{-2} \\
 &= x^{-\frac{1}{2} \times -2} \cdot y^{\frac{1}{2} \times -2} \\
 &= x^1 \cdot y^{-1} \\
 &= \frac{x}{y}
 \end{aligned}$$

$$\begin{aligned}
 3. \quad & \left(\frac{a^{\frac{1}{2}}}{a^{-\frac{3}{2}}}\right)^{-\frac{1}{2}} \\
 &= \left(a^{\frac{1}{2}} \cdot a^{\frac{3}{2}}\right)^{-\frac{1}{2}} \\
 &= \left(a^{\frac{1}{2} + \frac{3}{2}}\right)^{-\frac{1}{2}} \\
 &= \left(a^{\frac{2}{1}}\right)^{-\frac{1}{2}} \\
 &= a^{-1} \\
 &= \frac{1}{a}
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & \frac{(ab)^{\frac{1}{2}} \cdot (a^{-3})^{\frac{1}{6}} \cdot (ab)^{\frac{3}{2}}}{(a^{-2})^{\frac{5}{4}}} \\
 &= \frac{a^{\frac{1}{2}} \cdot b^{\frac{1}{2}} \cdot a^{-\frac{3}{1} \times \frac{1}{6}} \cdot a^{\frac{3}{2}} \cdot b^{\frac{3}{2}}}{a^{-\frac{2}{1} \times \frac{5}{4}}} \\
 &= \frac{a^{\frac{1}{2}} \cdot b^{\frac{1}{2}} \cdot a^{-\frac{1}{2}} \cdot a^{\frac{3}{2}} \cdot b^{\frac{3}{2}}}{a^{-\frac{5}{2}}} \\
 &= a^{\frac{1}{2}} \cdot b^{\frac{1}{2}} \cdot a^{-\frac{1}{2}} \cdot a^{\frac{3}{2}} \cdot b^{\frac{3}{2}} \cdot a^{\frac{5}{2}} \\
 &= a^{\frac{1}{2} - \frac{1}{2} + \frac{3}{2} + \frac{5}{2}} \cdot b^{\frac{1}{2} + \frac{3}{2}} \\
 &= a^4 b^2
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & 4x^{\frac{1}{2}} \div (4x)^{-\frac{1}{2}} \\
 &= \frac{4x^{\frac{1}{2}}}{(4x)^{-\frac{1}{2}}} \\
 &= \frac{2^2 x^{\frac{1}{2}}}{(2^2 x)^{-\frac{1}{2}}} \\
 &= \frac{2^2 x^{\frac{1}{2}}}{2^{\frac{2}{1} \times -\frac{1}{2}} x^{-\frac{1}{2}}} \\
 &= \frac{2^2 x^{\frac{1}{2}}}{2^{-1} x^{-\frac{1}{2}}} \\
 &= 2^2 \cdot x^{\frac{1}{2}} \cdot 2^1 \cdot x^{\frac{1}{2}} \\
 &= 2^3 x^1 \\
 &= 8x
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & \frac{8b^{\frac{3}{4}} \times 2b^{\frac{1}{4}} \times c^{-\frac{1}{2}}}{c^{\frac{1}{2}} \times b^{\frac{1}{2}} \times c^{\frac{1}{2}}} \\
 &= 2^3 b^{\frac{3}{4}} \times 2b^{\frac{1}{4}} \times c^{-\frac{1}{2}} \times c^{-\frac{1}{2}} \times b^{-\frac{1}{2}} \times c^{-\frac{1}{2}} \\
 &= 2^4 \times b^{\frac{3}{4} + \frac{1}{4} - \frac{1}{2}} \times c^{-\frac{1}{2} - \frac{1}{2} - \frac{1}{2}} \\
 &= 16b^{\frac{1}{2}} c^{-\frac{3}{2}} \\
 &= \frac{16b^{\frac{1}{2}}}{c^{\frac{3}{2}}}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & \left(a^{\frac{1}{2}} + b^{\frac{1}{3}}\right)^2 \\
 &= \left(a^{\frac{1}{2}}\right)\left(a^{\frac{1}{2}}\right) + 2\left(a^{\frac{1}{2}}\right)\left(b^{\frac{1}{3}}\right) + \left(b^{\frac{1}{3}}\right)\left(b^{\frac{1}{3}}\right) \\
 &= a^{\frac{1}{2} + \frac{1}{2}} + 2a^{\frac{1}{2}} b^{\frac{1}{3}} + b^{\frac{1}{3} + \frac{1}{3}} \\
 &= a^1 + 2a^{\frac{1}{2}} b^{\frac{1}{3}} + b^{\frac{2}{3}}
 \end{aligned}$$

$$\begin{aligned}
7. & \quad (2x^{\frac{1}{4}} - y^{\frac{3}{4}})(2x^{\frac{1}{4}} + y^{\frac{3}{4}}) \\
& = (2x^{\frac{1}{4}})(2x^{\frac{1}{4}}) - (y^{\frac{3}{4}})(y^{\frac{3}{4}}) \\
& = 4x^{\frac{1}{4}+\frac{1}{4}} - y^{\frac{3}{4}+\frac{3}{4}} \\
& = 4x^{\frac{1}{2}} - y^{\frac{3}{2}}
\end{aligned}$$

$$\begin{aligned}
9. & \quad (32)^{-0.2} \\
& = \left(2^{\frac{5}{1}}\right)^{-\frac{2}{10}} \\
& = \left(2^{\frac{5}{1}}\right)^{-\frac{1}{5}} \\
& = 2^{-1} \\
& = \frac{1}{2}
\end{aligned}$$

$$\begin{aligned}
11. & \quad \left(3\frac{3}{8}\right)^{-\frac{1}{3}} \\
& = \left(\frac{27}{8}\right)^{-\frac{1}{3}} \\
& = \left(\frac{3^{\frac{3}{1}}}{2^{\frac{3}{1}}}\right)^{-\frac{1}{3}} \\
& = \frac{3^{-1}}{2^{-1}} \\
& = \frac{2}{3}
\end{aligned}$$

$$\begin{aligned}
13. & \quad \left(32^{\frac{2}{5}} + 2^{-2}\right)^{-1} \\
& = \left(\left(2^{\frac{5}{1}}\right)^{\frac{2}{5}} + \frac{1}{2^2}\right)^{-1} \\
& = \left(2^2 + \frac{1}{4}\right)^{-1} \\
& = \left(4 + \frac{1}{4}\right)^{-1} \\
& = \left(\frac{17}{4}\right)^{-1} \\
& = \frac{4}{17}
\end{aligned}$$

$$\begin{aligned}
8. & \quad 125^{\frac{1}{3}} \\
& = \left(5^{\frac{3}{1}}\right)^{\frac{1}{3}} \\
& = 5^1 \\
& = 5
\end{aligned}$$

$$\begin{aligned}
10. & \quad (0,008)^{\frac{1}{3}} \\
& = \left(\frac{1}{125}\right)^{\frac{1}{3}} \\
& = \left(\frac{1}{5^{\frac{3}{1}}}\right)^{\frac{1}{3}} \\
& = \frac{1}{5}
\end{aligned}$$

$$\begin{aligned}
12. & \quad \left(\frac{81}{625}\right) \\
& = \left(\frac{3^{\frac{4}{1}}}{5^{\frac{4}{1}}}\right)^{-\frac{3}{4}} \\
& = \frac{3^{\frac{4}{1} \times -\frac{3}{4}}}{5^{\frac{4}{1} \times -\frac{3}{4}}} \\
& = \frac{3^{-3}}{5^{-3}} \\
& = \frac{5^3}{3^3} \\
& = \frac{125}{27}
\end{aligned}$$

$$\begin{aligned}
14. & \quad \left(16^{\frac{1}{4}} + 32^{-\frac{2}{5}}\right)^{\frac{1}{2}} \\
& = \left(\left(2^{\frac{4}{1}}\right)^{\frac{1}{4}} + \left(2^{\frac{5}{1}}\right)^{-\frac{2}{5}}\right)^{\frac{1}{2}} \\
& = (2^1 + 2^{-2})^{\frac{1}{2}} \\
& = \left(2 + \frac{1}{2^2}\right)^{\frac{1}{2}} \\
& = \left(2 + \frac{1}{4}\right)^{\frac{1}{2}} \\
& = \left(\frac{9}{4}\right)^{\frac{1}{2}} \\
& = \left(\frac{3^{\frac{2}{1}}}{2^{\frac{2}{1}}}\right)^{\frac{1}{2}} \\
& = \frac{3}{2}
\end{aligned}$$

$$15. \quad 8^{\frac{2}{3}} \times 27^{-\frac{1}{3}} \times 81^{\frac{1}{2}}$$

$$\begin{aligned} &= \left(2^{\frac{3}{1}}\right)^{\frac{2}{3}} \times \left(3^{\frac{3}{1}}\right)^{-\frac{1}{3}} \times \left(3^{\frac{4}{1}}\right)^{\frac{1}{2}} \\ &= 2^2 \times 3^{-1} \times 3^2 \\ &= \frac{4}{1} \times \frac{1}{3} \times \frac{9}{1} = 12 \end{aligned}$$

$$17. \quad \frac{8^{-\frac{1}{3}} \times 18^{-\frac{1}{2}}}{3 \times 2^{-\frac{1}{2}}}$$

$$\begin{aligned} &= \frac{\left(2^{\frac{3}{1}}\right)^{-\frac{1}{3}} \times \left(2^1 \times 3^{\frac{2}{1}}\right)^{-\frac{1}{2}}}{3^1 \times 2^{-\frac{1}{2}}} \\ &= \frac{2^{-1} \times 2^{-\frac{1}{2}} \times 3^{-1}}{3^1 \times 2^{-\frac{1}{2}}} \\ &= 2^{-1} \times 2^{-\frac{1}{2}} \times 3^{-1} \times 3^{-1} \times 2^{\frac{1}{2}} \\ &= 2^{-1-\frac{1}{2}+\frac{1}{2}} \cdot 3^{-1-1} \\ &= 2^{-1} \cdot 3^{-2} \\ &= \frac{1}{2 \cdot 3^2} \\ &= \frac{1}{18} \end{aligned}$$

$$16. \quad \frac{32^{\frac{2}{5}} \times 8^{-\frac{5}{3}}}{4^{-\frac{3}{2}}}$$

$$= \frac{\left(2^{\frac{5}{1}}\right)^{\frac{2}{5}} \times \left(2^{\frac{3}{1}}\right)^{-\frac{5}{3}}}{\left(2^{\frac{2}{1}}\right)^{-\frac{3}{2}}}$$

$$= \frac{2^2 \times 2^{-5}}{2^{-3}}$$

$$= 2^2 \times 2^{-5} \times 2^3$$

$$= 2^0$$

$$= 1$$

$$18. \quad (32)^{\frac{3}{5}} \times \left(\frac{2}{3}\right)^2 \div \left(\frac{81}{16}\right)^{-\frac{1}{2}}$$

$$= \left(2^{\frac{5}{1}}\right)^{\frac{3}{5}} \times \left(\frac{2}{3}\right)^2 \div \left(\frac{3^{\frac{4}{1}}}{2^{\frac{4}{1}}}\right)^{-\frac{1}{2}}$$

$$= 2^3 \times \frac{2^2}{3^2} \div \frac{3^{-2}}{2^{-2}}$$

$$= 2^3 \times \frac{2^2}{3^2} \times \frac{2^{-2}}{3^{-2}}$$

$$= \frac{2^3}{1} \times \frac{2^2}{3^2} \times \frac{3^2}{2^2}$$

$$= 8$$



# Hoofstuk 2

## Ekspone

### Antwoorde 4: Wortels

$$\begin{aligned} 1.1 \quad & \sqrt{2} \times \sqrt{2} \\ & = (\sqrt{2})^2 \\ & = 2 \end{aligned}$$

$$\begin{aligned} 1.3 \quad & \sqrt{a} \times \sqrt{a} \\ & = (\sqrt{a})^2 \\ & = a \end{aligned}$$

$$\begin{aligned} 1.5 \quad & \sqrt{\frac{4}{9}} \\ & = \frac{\sqrt{4}}{\sqrt{9}} \\ & = \frac{2}{3} \end{aligned}$$

$$1.7 \quad \sqrt{a^2 - b^2}$$

Dit bly net so. Daar is TERME onder die wortel - jy mag nie die wortel uitwerk oor terme nie

$$\begin{aligned} 1.9 \quad & \sqrt{144 + 25} - \sqrt[3]{-125} + \sqrt{\frac{162}{2}} \\ & = \sqrt{169} - \sqrt[3]{-125} + \sqrt{81} \\ & = 13 - (-5) + 9 \\ & = 13 + 5 + 9 \\ & = 27 \end{aligned}$$

$$\begin{aligned} 1.10 \quad & \sqrt{16a^{10}b^{18}} \\ & = \sqrt{4^2 a^{10} b^{18}} \\ & = 4^{\frac{2}{2}} \cdot a^{\frac{10}{2}} \cdot b^{\frac{18}{2}} \\ & = 4a^5b^9 \end{aligned}$$

$$\begin{aligned} 1.2 \quad & \sqrt{81} \times \sqrt{81} \\ & = (\sqrt{81})^2 \\ & = 81 \end{aligned}$$

$$\begin{aligned} 1.4 \quad & \sqrt{16^3} \\ & = \sqrt{(2^4)^3} \\ & = \sqrt{2^{12}} \\ & = 2^{\frac{12}{2}} \\ & = 2^6 \\ & = 64 \end{aligned}$$

$$\begin{aligned} 1.6 \quad & \sqrt{\frac{5}{20}} \\ & = \sqrt{\frac{1}{4}} \\ & = \frac{\sqrt{1}}{\sqrt{4}} \\ & = \frac{1}{2} \end{aligned}$$

$$\begin{aligned} 1.8 \quad & \sqrt{9 + 16} \\ & = \sqrt{25} \\ & = 5 \end{aligned}$$

$$\begin{aligned} 1.11 \quad & \sqrt[3]{27x^{12}y^{21}} \\ & = \sqrt[3]{3^3 x^{12} y^{21}} \\ & = 3^{\frac{3}{3}} \cdot x^{\frac{12}{3}} \cdot y^{\frac{21}{3}} \\ & = 3x^4y^7 \end{aligned}$$

$$\begin{aligned}
1.12 \quad & \sqrt[5]{3^{10}} + \sqrt[3]{3^6} - \sqrt[4]{3^8} \\
&= 3^{\frac{10}{5}} + 3^{\frac{6}{3}} - 3^{\frac{8}{4}} \\
&= 3^2 + 3^2 - 3^2 \\
&= 3^2 \\
&= 9
\end{aligned}$$

$$\begin{aligned}
1.13 \quad & \sqrt[3]{\frac{(2^{-6})^2}{(2^3)^{-1}}} \\
&= \sqrt[3]{\frac{2^{-12}}{2^{-3}}} \\
&= \frac{2^{-12}}{2^{-3}} \\
&= \frac{2^{-4}}{2^{-1}} \\
&= \frac{2^1}{2^4} \\
&= \frac{1}{2^3} = \frac{1}{8}
\end{aligned}$$

$$\begin{aligned}
1.14 \quad & \sqrt{25-16} + (\sqrt{17})^2 - \sqrt{2^2 \cdot 3^2} + \sqrt{3} \sqrt{3} \\
&= \sqrt{9} + 17 - 2^{\frac{2}{2}} \cdot 3^{\frac{2}{2}} + (\sqrt{3})^2 \\
&= \sqrt{3^2} + 17 - 2 \cdot 3 + 3 \\
&= 3 + 17 - 6 + 3 \\
&= 17
\end{aligned}$$

$$\begin{aligned}
1.15 \quad & \frac{\sqrt{5^6 \cdot (5 \cdot 3^2)^2}}{\sqrt[3]{5^9 3^{-6}}} \\
&= \frac{\sqrt{5^6 \cdot 5^2 \cdot 3^4}}{\sqrt[3]{5^9 3^{-6}}} \\
&= \frac{\sqrt{5^8 \cdot 3^4}}{\sqrt[3]{5^9 3^{-6}}} \\
&= \frac{5^{\frac{8}{2}} \cdot 3^{\frac{4}{2}}}{5^{\frac{9}{3}} \cdot 3^{\frac{-6}{3}}} \\
&= \frac{5^4 \cdot 3^2}{5^3 \cdot 3^{-2}} \\
&= \frac{5^4 \cdot 3^2 \cdot 3^2}{5^3} \\
&= 5 \cdot 3^4 \\
&= 5 \cdot 81 \\
&= 405
\end{aligned}$$

$$\begin{aligned}
1.16 \quad & \sqrt{\sqrt[3]{a^{30}} \cdot \sqrt[5]{a^{40}}} \\
&= \sqrt{a^{\frac{30}{3}} \cdot a^{\frac{40}{5}}} \\
&= \sqrt{a^{10} \cdot a^8} \\
&= \sqrt{a^{18}} \\
&= a^{\frac{18}{2}} \\
&= a^9
\end{aligned}$$

$$\begin{aligned}
1.17 \quad & \sqrt{\sqrt{\sqrt{\sqrt{3^{80} \cdot y^{48}}}}} \\
&= \sqrt{\sqrt{\sqrt{3^{40} \cdot y^{24}}}} \\
&= \sqrt{\sqrt{3^{20} \cdot y^{12}}} \\
&= \sqrt{3^{10} \cdot y^6} \\
&= 3^5 y^3
\end{aligned}$$

$$\begin{aligned}
1.18 \quad & \sqrt{3^{10m+4}} \\
&= 3^{\frac{10m+4}{2}} \\
&= 3^{5m+2}
\end{aligned}$$

$$\begin{aligned}
1.19 \quad & \sqrt[3]{\frac{(2^{-x})^2}{(2^x)^4}} \\
&= \sqrt[3]{\frac{2^{-2x}}{2^{4x}}} \\
&= \sqrt[3]{2^{-2x} \cdot 2^{-4x}} \\
&= \sqrt[3]{2^{-6x}} \\
&= 2^{-\frac{6x}{3}} \\
&= 2^{-2x} \\
&= \frac{1}{2^{2x}}
\end{aligned}$$

$$\begin{aligned}
2.1 \quad & \sqrt{27} \\
&= \sqrt{3 \times 9} \\
&= \sqrt{3} \times \sqrt{9} \\
&= \sqrt{3} \times 3 \\
&= 3\sqrt{3}
\end{aligned}$$

$$\begin{aligned}
2.3 \quad & \sqrt{98} \\
&= \sqrt{2 \times 49} \\
&= \sqrt{2} \times \sqrt{49} \\
&= \sqrt{2} \times 7 \\
&= 7\sqrt{2}
\end{aligned}$$

$$\begin{aligned}
2.5 \quad & \sqrt{20} \\
&= \sqrt{5 \times 4} \\
&= \sqrt{5} \times \sqrt{4} \\
&= \sqrt{5} \times 2 \\
&= 2\sqrt{5}
\end{aligned}$$

$$\begin{aligned}
2.7 \quad & 5\sqrt{8} - 2\sqrt{2} \\
&= 5\sqrt{4 \cdot 2} - 2\sqrt{2} \\
&= 5\sqrt{4} \cdot \sqrt{2} - 2\sqrt{2} \\
&= 5 \cdot 2 \cdot \sqrt{2} - 2\sqrt{2} \\
&= 10\sqrt{2} - 2\sqrt{2} \\
&= 8\sqrt{2}
\end{aligned}$$

$$\begin{aligned}
1.20 \quad & \frac{\sqrt{m^6(m \cdot 3^2)^2}}{\sqrt[3]{m^9 \cdot 3^{-6}}} \\
&= \frac{\sqrt{m^6 \cdot m^2 \cdot 3^4}}{\sqrt[3]{m^9 \cdot 3^{-6}}} \\
&= \frac{\sqrt{m^8 \cdot 3^4}}{\sqrt[3]{m^9 \cdot 3^{-6}}} \\
&= \frac{m^{\frac{8}{2}} \cdot 3^{\frac{4}{2}}}{m^{\frac{9}{3}} \cdot 3^{\frac{-6}{3}}} \\
&= \frac{m^4 \cdot 3^2}{m^3 \cdot 3^{-2}} \\
&= m^4 \cdot 3^2 \cdot m^{-3} \cdot 3^2 \\
&= m^1 \cdot 3^4 \\
&= 81m
\end{aligned}$$

$$\begin{aligned}
2.2 \quad & \sqrt{18} \\
&= \sqrt{2 \times 9} \\
&= \sqrt{2} \times \sqrt{9} \\
&= \sqrt{2} \times 3 \\
&= 3\sqrt{2}
\end{aligned}$$

$$\begin{aligned}
2.4 \quad & \sqrt{75} \\
&= \sqrt{3 \times 25} \\
&= \sqrt{3} \times \sqrt{25} \\
&= \sqrt{3} \times 5 \\
&= 5\sqrt{3}
\end{aligned}$$

$$\begin{aligned}
2.6 \quad & \sqrt{63} \\
&= \sqrt{7 \times 9} \\
&= \sqrt{7} \times \sqrt{9} \\
&= \sqrt{7} \times 3 \\
&= 3\sqrt{7}
\end{aligned}$$

$$\begin{aligned}
2.8 \quad & \frac{\sqrt{32}}{\sqrt{50}} \\
&= \frac{\sqrt{2 \times 16}}{\sqrt{2 \times 25}} \\
&= \frac{\sqrt{2} \times \sqrt{16}}{\sqrt{2} \times \sqrt{25}} \\
&= \frac{\sqrt{2} \times 4}{\sqrt{2} \times 5} \\
&= \frac{4\sqrt{2}}{5\sqrt{2}} \\
&= \frac{4}{5}
\end{aligned}$$

$$\begin{aligned}
2.9 \quad & \sqrt{147} - \sqrt{12} \\
&= \sqrt{49 \cdot 3} - \sqrt{4 \cdot 3} \\
&= \sqrt{49} \cdot \sqrt{3} - \sqrt{4} \cdot \sqrt{3} \\
&= 7\sqrt{3} - 2\sqrt{3} \\
&= 5\sqrt{3}
\end{aligned}$$

$$\begin{aligned}
2.11 \quad & \sqrt{27} + \sqrt{36 \times 3 \times 16} \\
&= \sqrt{9 \cdot 3} + \sqrt{36} \cdot \sqrt{3} \cdot \sqrt{16} \\
&= \sqrt{9} \cdot \sqrt{3} + 6 \cdot \sqrt{3} \cdot 4 \\
&= 3\sqrt{3} + 24\sqrt{3} \\
&= 27\sqrt{3}
\end{aligned}$$

$$\begin{aligned}
2.13 \quad & (\sqrt{19})^2 \sqrt{2} - \sqrt{50} (\sqrt{8})^2 \\
&= 19\sqrt{2} - \sqrt{25 \cdot 2} \cdot 8 \\
&= 19\sqrt{2} - \sqrt{25} \sqrt{2} \cdot 8 \\
&= 19\sqrt{2} - 5 \cdot \sqrt{2} \cdot 8 \\
&= 19\sqrt{2} - 40\sqrt{2} \\
&= -21\sqrt{2}
\end{aligned}$$

$$\begin{aligned}
2.15 \quad & \sqrt{18b^4} - 121\sqrt{2b^4} \\
&= \sqrt{9 \cdot 2 \cdot b^4} - 121\sqrt{2 \cdot b^4} \\
&= \sqrt{9} \cdot \sqrt{2} \cdot \sqrt{b^4} - 121\sqrt{2} \cdot \sqrt{b^4} \\
&= 3\sqrt{2} b^2 - 121\sqrt{2} b^2 \\
&= -118\sqrt{2} b^2
\end{aligned}$$

$$\begin{aligned}
3.1.1 \quad & \sqrt{a^3} \\
&= a^{\frac{3}{2}}
\end{aligned}$$

$$\begin{aligned}
3.1.3 \quad & \sqrt[3]{b^2} \\
&= b^{\frac{2}{3}}
\end{aligned}$$

$$\begin{aligned}
3.1.5 \quad & p^2 \sqrt{p^3} \\
&= p^2 \times p^{\frac{3}{2}} \\
&= p^{\frac{2}{1} + \frac{3}{2}} \\
&= p^{\frac{7}{2}}
\end{aligned}$$

$$\begin{aligned}
2.10 \quad & 4\sqrt{18} - 3\sqrt{2} + 5\sqrt{2} \\
&= 4\sqrt{9 \cdot 2} - 3\sqrt{2} + 5\sqrt{2} \\
&= 4\sqrt{9} \cdot \sqrt{2} - 3\sqrt{2} + 5\sqrt{2} \\
&= 4 \cdot 3 \cdot \sqrt{2} - 3\sqrt{2} + 5\sqrt{2} \\
&= 12\sqrt{2} - 3\sqrt{2} + 5\sqrt{2} \\
&= 14\sqrt{2}
\end{aligned}$$

$$\begin{aligned}
2.12 \quad & -\sqrt{9k^2} \sqrt{48k^2} - \sqrt{75} k^2 \\
&= -3k^{\frac{2}{2}} \cdot \sqrt{16 \cdot 3} k^{\frac{2}{2}} - \sqrt{25 \cdot 3} k^2 \\
&= -3k \cdot \sqrt{16} \cdot \sqrt{3} k - \sqrt{25} \cdot \sqrt{3} \cdot k^2 \\
&= -3k \cdot 4 \cdot \sqrt{3} k - 5 \cdot \sqrt{3} \cdot k^2 \\
&= -12\sqrt{3} k^2 - 5\sqrt{3} k^2 \\
&= -17\sqrt{3} k^2
\end{aligned}$$

$$\begin{aligned}
2.14 \quad & 3\sqrt{8} + 4\sqrt{32} - \sqrt{200} \\
&= 3\sqrt{4 \cdot 2} + 4\sqrt{16 \cdot 2} - \sqrt{100 \cdot 2} \\
&= 3 \cdot \sqrt{4} \cdot \sqrt{2} + 4 \cdot \sqrt{16} \sqrt{2} - \sqrt{100} \sqrt{2} \\
&= 3 \cdot 2 \cdot \sqrt{2} + 4 \cdot 4 \cdot \sqrt{2} - 10 \cdot \sqrt{2} \\
&= 6\sqrt{2} + 16\sqrt{2} - 10\sqrt{2} \\
&= 12\sqrt{2}
\end{aligned}$$

$$\begin{aligned}
2.16 \quad & \sqrt{108a} - \sqrt{121a} \cdot \sqrt{3} \\
&= \sqrt{108a} - \sqrt{121a} \cdot \sqrt{3} \\
&= \sqrt{36 \cdot 3 \cdot a} - \sqrt{121 \cdot a} \cdot \sqrt{3} \\
&= \sqrt{36} \cdot \sqrt{3} \cdot \sqrt{a} - \sqrt{121} \cdot \sqrt{a} \cdot \sqrt{3} \\
&= 6\sqrt{3} \sqrt{a} - 11\sqrt{3} \sqrt{a} \\
&= -5\sqrt{3} \sqrt{a}
\end{aligned}$$

$$\begin{aligned}
3.1.2 \quad & \sqrt{x} \\
&= x^{\frac{1}{2}}
\end{aligned}$$

$$\begin{aligned}
3.1.4 \quad & \sqrt[3]{y^4} \\
&= y^{\frac{4}{3}}
\end{aligned}$$

$$\begin{aligned}
3.1.6 \quad & x^{\frac{1}{2}} \sqrt{x^{-5}} \\
&= x^{\frac{1}{2}} \times x^{-\frac{5}{2}} \\
&= x^{\frac{1}{2} - \frac{5}{2}} \\
&= x^{-2} \\
&= \frac{1}{x^2}
\end{aligned}$$

$$3.2.1 \quad x^{\frac{1}{3}} \\ = \sqrt[3]{x}$$

$$3.2.3 \quad a^{\frac{2}{5}} \\ = \sqrt[5]{a^2}$$

$$3.2.5 \quad b^{-\frac{3}{4}} \\ = \frac{1}{b^{\frac{3}{4}}} \\ = \frac{1}{\sqrt[4]{b^3}}$$

$$3.2.2 \quad 2^{\frac{1}{2}} \\ = \sqrt{2}$$

$$3.2.4 \quad y^{\frac{2}{5}} \\ = \sqrt[5]{y^2}$$

$$3.2.6 \quad 3^{-\frac{1}{5}} \\ = \frac{1}{3^{\frac{1}{5}}} \\ = \frac{1}{\sqrt[5]{3}}$$

# Hoofstuk 2

## Eksponente

### Antwoorde 5: Vergelykings wat magte bevat

1.  $3^x = 27$

$$3^x = 3^3$$

$$x = 3$$

3.  $4 \cdot 3^{2x} = 36$

$$\frac{4 \cdot 3^{2x}}{4} = \frac{36}{4}$$

$$3^{2x} = 9$$

$$3^{2x} = 3^2$$

$$2x = 2$$

$$x = 1$$

5.  $4^{-2x} = 8$

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

$$2^{-4x} = 2^3$$

$$-4x = 3$$

$$x = -\frac{3}{4}$$

7.  $9^x = 27^{3x+5}$

$$(3^2)^x = (3^3)^{3x+5}$$

$$3^{2x} = 3^{9x+15}$$

$$2x = 9x + 15$$

$$-15 = 7x$$

$$-\frac{15}{7} = x$$

9.  $\left(\frac{1}{2^1}\right)^{x-5} = 64$

$$(2^{-1})^{x-5} = 64$$

$$(2)^{-x+5} = 2^6$$

$$-x + 5 = 6$$

$$-1 = x$$

2.  $\frac{1}{3^x} = 27^2$

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

$$3^{-x} = 3^6$$

$$-x = 6$$

$$-6 = x$$

4.  $4^{5x} = 8^{3x-4}$

$$(2^2)^{5x} = (2^3)^{3x-4}$$

$$2^{10x} = 2^{9x-12}$$

$$10x = 9x - 12$$

$$x = -12$$

6.  $7^{x+2} = 1$

$$7^{x+2} = 7^0$$

$$x + 2 = 0$$

$$x = -2$$

8.  $4 \cdot 8^{x-1} = 16^x$

$$(2^2) \cdot (2^3)^{x-1} = (2^4)^x$$

$$2^2 \cdot 2^{3x-3} = 2^{4x}$$

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

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

$$-1 = x$$

10.  $2^{\frac{x}{2}} = \frac{1}{8}$

$$2^{\frac{x}{2}} = \frac{1}{2^3}$$

$$2^{\frac{x}{2}} = 2^{-3}$$

$$\frac{x}{2} = \frac{-3}{1}$$

$$x = -6$$

$$11. (3^x - 9)(3^x + 9) = 0$$

$$3^x - 9 = 0 \text{ of } 3^x + 9 = 0$$

$$3^x = 9 \quad 3^x = -9$$

$$3^x = 3^2 \quad \text{geen oplossing}$$

$$x = 2$$

$$13. \frac{8^x}{4^{x-1}} = \frac{1}{32}$$

$$\frac{(2^3)^x}{(2^2)^{x-1}} = \frac{1}{2^5}$$

$$\frac{2^{3x}}{2^{2x-2}} = 2^{-5}$$

$$2^{3x} \cdot 2^{-2x+2} = 2^{-5}$$

$$2^{3x-2x+2} = 2^{-5}$$

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

$$x = -7$$

$$15. 2^x = 7$$

$$4 < 7 < 8$$

$$2^2 < 7 < 2^3$$

$$2 < x < 3$$

$$2^{2,5} = 5,656\dots$$

$$2^{2,8} = 6,964\dots$$

$$2^{2,9} = 7,464\dots$$

Verfyn verder

$$2^{2,85} = 7,21\dots$$

$$2^{2,84} = 7,16\dots$$

$$2^{2,83} = 7,11\dots$$

$$2^{2,82} = 7,06\dots$$

$$2^{2,81} = 7,01\dots$$

$$x \simeq 2,81$$

$$12. \frac{27^{x-1}}{9^{x+1} \cdot \left(\frac{1}{3}\right)^{-2x}} = 81^{-1}$$

$$\frac{(3^3)^{x-1}}{(3^2)^{x+1} \cdot 3^{2x}} = (3^4)^{-1}$$

$$\frac{3^{3x-3}}{3^{2x+2} \cdot 3^{2x}} = 3^{-4}$$

$$3^{3x-3} \cdot 3^{-2x-2} \cdot 3^{-2x} = 3^{-4}$$

$$3^{3x-3-2x-2-2x} = 3^{-4}$$

$$3x - 3 - 2x - 2 - 2x = -4$$

$$-x - 5 = -4$$

$$-1 = x$$

$$14. 4 \times 3^{2x} = 9 \times 2^{2x}$$

$$\frac{4 \times 3^{2x}}{4 \cdot 2^{2x}} = \frac{9 \times 2^{2x}}{4 \cdot 2^{2x}}$$

$$\frac{3^{2x}}{2^{2x}} = \frac{9}{4}$$

$$\left(\frac{3}{2}\right)^{2x} = \frac{3^2}{2^2}$$

$$\left(\frac{3}{2}\right)^{2x} = \left(\frac{3}{2}\right)^2$$

$$2x = 2$$

$$x = 1$$

$$16. 5^x = 140$$

$$125 < 140 < 625$$

$$5^3 < 140 < 5^4$$

$$3 < x < 4$$

$$5^{3,5} = 279,508\dots$$

$$5^{3,2} = 172,466\dots$$

$$5^{3,1} = 146,827\dots$$

$$5^{3,0} = 125$$

Verfyn verder

$$5^{3,05} = 135,47\dots\dots$$

$$5^{3,07} = 139,906\dots\dots$$

$$5^{3,08} = 142,17\dots\dots$$

$$x \simeq 3,07$$

$$17. 5^{x+1} + 5^x = 6$$

$$5^x \cdot 5^1 + 5^x = 6$$

$$5^x(5 + 1) = 6$$

$$5^x(6) = 6$$

$$\frac{5^x(6)}{6} = \frac{6}{6}$$

$$5^x = 1$$

$$5^x = 5^0$$

$$x = 0$$

$$19. 2 \cdot 3^x + 3^x \cdot 2^{-1} = 7\frac{1}{2}$$

$$3^x(2 + 2^{-1}) = \frac{15}{2}$$

$$3^x\left(2 + \frac{1}{2}\right) = \frac{15}{2}$$

$$3^x\left(\frac{5}{2}\right) = \frac{15}{2}$$

$$\frac{3^x\left(\frac{5}{2}\right)}{\frac{5}{2}} = \frac{15}{\frac{5}{2}}$$

$$3^x = 3^1$$

$$x = 1$$

$$23. x^{-2} = 49$$

$$\frac{1}{x^2} = \frac{49}{1}$$

$$49x^2 = 1$$

$$x^2 = \frac{1}{49}$$

$$\sqrt{x^2} = \pm \sqrt{\frac{1}{49}}$$

$$x = \pm \frac{1}{7}$$

$$21. 2^{x+2} + 5 \cdot 2^x + 2^x = 40$$

$$2^x \cdot 2^2 + 5 \cdot 2^x + 2^x = 40$$

$$2^x(2^2 + 5 + 1) = 40$$

$$2^x(10) = 40$$

$$\frac{2^x(10)}{10} = \frac{40}{10}$$

$$2^x = 4$$

$$2^x = 2^2$$

$$x = 2$$

$$18. 3^{x+1} + 3^{x-1} = \frac{10}{9}$$

$$3^x \cdot 3^1 + 3^x \cdot 3^{-1} = \frac{10}{9}$$

$$3^x(3 + 3^{-1}) = \frac{10}{9}$$

$$3^x\left(3 + \frac{1}{3}\right) = \frac{10}{9}$$

$$3^x\left(\frac{10}{3}\right) = \frac{10}{9}$$

$$\frac{3^x\left(\frac{10}{3}\right)}{\frac{10}{3}} = \frac{\frac{10}{9}}{\frac{10}{3}}$$

$$3^x = \frac{1}{3}$$

$$3^x = 3^{-1}$$

$$x = -1$$

$$20. 2 \cdot 3^x = 63 - 3^{x-1}$$

$$2 \cdot 3^x + 3^{x-1} = 63$$

$$2 \cdot 3^x + 3^x \cdot 3^{-1} = 63$$

$$3^x(2 + 3^{-1}) = 63$$

$$3^x\left(2 + \frac{1}{3}\right) = 63$$

$$3^x\left(\frac{7}{3}\right) = 63$$

$$\frac{3^x\left(\frac{7}{3}\right)}{\frac{7}{3}} = \frac{63}{\frac{7}{3}}$$

$$3^x = 27$$

$$3^x = 3^3$$

$$x = 3$$

$$24. 2x^4 + 1 = 33$$

$$\frac{2x^4}{2} = \frac{32}{2}$$

$$x^4 = 16$$

$$\sqrt[4]{x^4} = \pm \sqrt[4]{2^4}$$

$$x = \pm 2$$

$$22. x^{\frac{1}{2}} = 5$$

$$\sqrt{x} = 5$$

$$(\sqrt{x})^2 = 5^2$$

$$x = 25$$



$$25. \quad x^{\frac{3}{2}} = 27$$

$$\sqrt{x^3} = 3^3$$

$$\left(\sqrt{x^3}\right)^2 = (3^3)^2$$

$$x^3 = 3^6$$

$$\sqrt[3]{x^3} = \sqrt[3]{3^6}$$

$$x = 3^2$$

$$x = 9$$

$$27. \quad 4x^{\frac{2}{3}} - 9 = 0$$

$$4x^{\frac{2}{3}} = 9$$

$$\frac{4x^{\frac{2}{3}}}{4} = \frac{9}{4}$$

$$x^{\frac{2}{3}} = \frac{9}{4}$$

$$\sqrt[3]{x^2} = \frac{3^2}{2^2}$$

$$\left(\sqrt[3]{x^2}\right)^3 = \left(\frac{3^2}{2^2}\right)^3$$

$$x^2 = \frac{3^6}{2^6}$$

$$\sqrt{x^2} = \pm \sqrt{\frac{3^6}{2^6}}$$

$$x = \pm \frac{3^3}{2^3}$$

$$x = \pm \frac{27}{8}$$

$$26. \quad x^{\frac{1}{2}} + 3 = 0$$

$$\sqrt{x} = -3$$

geen  $\mathbb{R}$  oplossing

(’n positiewe  $\sqrt{\quad}$  kan nie gelyk

wees aan ’n negatiewe getal nie)

$$28. \quad 2x^{-\frac{3}{2}} - 16 = 0$$

$$2x^{-\frac{3}{2}} = 16$$

$$\frac{2x^{-\frac{3}{2}}}{2} = \frac{16}{2}$$

$$x^{-\frac{3}{2}} = 8$$

$$\frac{1}{x^{\frac{3}{2}}} = \frac{8}{1}$$

$$x^{\frac{3}{2}} = \frac{1}{8}$$

$$\sqrt{x^3} = \frac{1}{2^3}$$

$$\left(\sqrt{x^3}\right)^2 = \left(\frac{1}{2^3}\right)^2$$

$$x^3 = \frac{1}{2^6}$$

$$\sqrt[3]{x^3} = \sqrt[3]{\frac{1}{2^6}}$$

$$x = \frac{1}{2^2}$$

$$x = \frac{1}{4}$$

# Hoofstuk 2

## Eksponente

### Antwoorde 6: Gemeng

$$\begin{aligned}
 1.1 \quad & 2a^{-\frac{1}{2}} \times 4a^{-\frac{1}{2}} \\
 &= 8a^{-\frac{1}{2}-\frac{1}{2}} \\
 &= 8a^{-1} \\
 &= \frac{8}{a}
 \end{aligned}$$

$$\begin{aligned}
 1.3 \quad & (27a^{-3})^{-\frac{2}{3}} \\
 &= (3^3 a^{-3})^{-\frac{2}{3}} \\
 &= 3^{\frac{3}{1} \times -\frac{2}{3}} a^{\frac{-3}{1} \times -\frac{2}{3}} \\
 &= 3^{-2} a^2 \\
 &= \frac{a^2}{3^2} \\
 &= \frac{a^2}{9}
 \end{aligned}$$

$$\begin{aligned}
 1.5 \quad & \left(16^{\frac{1}{4}} + 32^{\frac{2}{5}}\right)^{\frac{1}{2}} \\
 &= \left(2^{\frac{4}{1} \times \frac{1}{4}} + 2^{\frac{5}{1} \times \frac{2}{5}}\right)^{\frac{1}{2}} \\
 &= (2^1 + 2^2)^{\frac{1}{2}} \\
 &= (6)^{\frac{1}{2}} \\
 &= \sqrt{6}
 \end{aligned}$$

$$\begin{aligned}
 2.1 \quad & 3 \times 5^x - \sqrt{25^x} \\
 &= 3 \times 5^x - \sqrt{(5^2)^x} \\
 &= 3 \times 5^x - \sqrt{5^{2x}} \\
 &= 3 \times 5^x - 5^{\frac{2x}{2}} \\
 &= 3 \times 5^x - 5^x \\
 &= 5^x(3 - 1) = 5^x(2) = 2 \times 5^x
 \end{aligned}$$

$$\begin{aligned}
 1.2 \quad & (64x^{-18})^{\frac{1}{6}} \\
 &= (2^6 x^{-18})^{\frac{1}{6}} \\
 &= 2^{\frac{6}{1} \times \frac{1}{6}} x^{\frac{-18}{1} \times \frac{1}{6}} \\
 &= 2^1 x^{-3} \\
 &= \frac{2}{x^3}
 \end{aligned}$$

$$\begin{aligned}
 1.4 \quad & \left(\frac{25}{16}\right)^{-\frac{1}{2}} \\
 &= \left(\frac{5^2}{2^4}\right)^{-\frac{1}{2}} \\
 &= \frac{5^{\frac{2}{1} \times -\frac{1}{2}}}{2^{\frac{4}{1} \times -\frac{1}{2}}} \\
 &= \frac{5^{-1}}{2^{-2}} \\
 &= \frac{2^2}{5^1} \\
 &= \frac{4}{5}
 \end{aligned}$$

$$\begin{aligned}
 1.6 \quad & \frac{100^{-\frac{n}{4}} \cdot 15^{\frac{n}{2}+2} \cdot 24^{\frac{n}{6}}}{9^{\frac{n}{3}+1}} \\
 &= \frac{100^{-\frac{n}{4}} \cdot 15^{\frac{n}{2}+2} \cdot 24^{\frac{n}{6}}}{9^{\frac{n}{3}+1}} \\
 &= \frac{(2^2 \cdot 5^2)^{-\frac{n}{4}} \cdot (3 \cdot 5)^{\frac{n}{2}+2} \cdot (3 \cdot 2^3)^{\frac{n}{6}}}{(3^2)^{\frac{n}{3}+1}} \\
 &= \frac{2^{\frac{2}{1} \times -\frac{n}{4}} \cdot 5^{\frac{2}{1} \times -\frac{n}{4}} \cdot 3^{\frac{n}{2}+2} \cdot 5^{\frac{n}{2}+2} \cdot 3^{\frac{n}{6} \cdot 2} \cdot 2^{\frac{3}{1} \times \frac{n}{6}}}{3^{\frac{2}{1} \times \frac{n}{3}+1}} \\
 &= \frac{2^{-\frac{1n}{2}} \cdot 5^{-\frac{1n}{2}} \cdot 3^{\frac{n}{2}+2} \cdot 5^{\frac{n}{2}+2} \cdot 3^{\frac{n}{6} \cdot 2} \cdot 2^{\frac{1n}{2}}}{3^{\frac{2}{1} \times (\frac{n}{3}+1)}} \\
 &= \frac{2^{-\frac{1n}{2}} \cdot 5^{-\frac{1n}{2}} \cdot 3^{\frac{n}{2}+2} \cdot 5^{\frac{n}{2}+2} \cdot 3^{\frac{n}{6} \cdot 2} \cdot 2^{\frac{1n}{2}}}{3^{\frac{2n}{3}+2}} \\
 &= 2^{-\frac{1n}{2}} \cdot 5^{-\frac{1n}{2}} \cdot 3^{\frac{n}{2}+2} \cdot 5^{\frac{n}{2}+2} \cdot 3^{\frac{n}{6} \cdot 2} \cdot 2^{\frac{1n}{2}} \cdot 3^{-\frac{2n}{3}-2} \\
 &= 2^{-\frac{1n}{2}+\frac{1n}{2}} \cdot 5^{-\frac{1n}{2}+\frac{n}{2}+2} \cdot 3^{\frac{n}{2}+2+\frac{n}{6}-\frac{2n}{3}-2} \\
 &= 2^0 \cdot 5^2 \cdot 3^0 \\
 &= 1 \cdot 25 \cdot 1 \\
 &= 25
 \end{aligned}$$

$$\begin{aligned}
2.2 \quad \sqrt[3]{\sqrt{64}} &= \sqrt[3]{\sqrt{2^6}} \\
&= \sqrt[3]{2^3} \\
&= 2^{\frac{3}{3}} \\
&= 2
\end{aligned}$$

$$\begin{aligned}
2.3 \quad \sqrt{9^3} + 8^{-\frac{2}{3}} \\
&= \sqrt{(3^2)^3} + (2^3)^{-\frac{2}{3}} \\
&= \sqrt{3^6} + 2^{\frac{3}{1} \times -\frac{2}{3}} \\
&= 3^{\frac{6}{2}} + 2^{-2} \\
&= 3^3 + \frac{1}{2^2} \\
&= 27 + \frac{1}{4} \\
&= 27\frac{1}{4}
\end{aligned}$$

$$\begin{aligned}
2.4 \quad 4^0 + \sqrt{2^4} - \sqrt[3]{8^2} + (0,5)^{-2} \\
&= 1 + 2^{\frac{4}{2}} - \sqrt[3]{(2^3)^2} + \left(\frac{1}{2}\right)^{-2} \\
&= 1 + 2^2 - \sqrt[3]{2^6} + \frac{1^{-2}}{2^{-2}} \\
&= 1 + 4 - 2^{\frac{6}{3}} + \frac{2^2}{1} \\
&= 1 + 4 - 2^2 + \frac{4}{1} \\
&= 1 + 4 - 4 + 4 \\
&= 5
\end{aligned}$$

$$\begin{aligned}
2.5 \quad \frac{\sqrt{8} + \sqrt{8}}{\sqrt{2} \cdot \sqrt{8}} \\
&= \frac{\sqrt{2 \times 4} + \sqrt{2 \times 4}}{\sqrt{2} \cdot \sqrt{2 \times 4}} \\
&= \frac{\sqrt{2} \times \sqrt{4} + \sqrt{2} \times \sqrt{4}}{\sqrt{2} \cdot \sqrt{2} \times \sqrt{4}} \\
&= \frac{\sqrt{2} \times 2 + \sqrt{2} \times 2}{\sqrt{2} \cdot \sqrt{2} \times 2} \\
&= \frac{2\sqrt{2} + 2\sqrt{2}}{2 \times 2} \\
&= \frac{4\sqrt{2}}{4} \\
&= \sqrt{2}
\end{aligned}$$

$$\begin{aligned}
3. \quad \frac{2 \cdot 3^n - 3^{n+2}}{3^{n+1}} \\
&= \frac{2 \cdot 3^n - 3^n \cdot 3^2}{3^n \cdot 3^1} \\
&= \frac{3^n(2 - 3^2)}{3^n \cdot 3^1} \\
&= \frac{2 - 3^2}{3^1} \\
&= \frac{-7}{3}
\end{aligned}$$

$$\begin{aligned}
4. \quad \frac{6^{n+1} \cdot 9^{n+2}}{2^n \cdot 27^n} \\
&= \frac{(2 \cdot 3)^{n+1} \cdot (3^2)^{n+2}}{2^n \cdot (3^3)^n} \\
&= \frac{2^{n+1} \cdot 3^{n+1} \cdot 3^{2n+4}}{2^n \cdot 3^{3n}} \\
&= 2^{n+1} \cdot 3^{n+1} \cdot 3^{2n+4} \cdot 2^{-n} \cdot 3^{-3n} \\
&= 2^{n+1-n} \cdot 3^{n+1+2n+4-3n} \\
&= 2^1 \cdot 3^5 = 2(243) = 486
\end{aligned}$$

$$\begin{aligned}
5. \quad \frac{3^{n-4} \cdot 81^{1+n}}{27^{-n+1} \cdot 9^{4n+1}} \\
&= \frac{3^{n-4} \cdot (3^4)^{1+n}}{(3^3)^{-n+1} \cdot (3^2)^{4n+1}} \\
&= \frac{3^{n-4} \cdot 3^{4+4n}}{3^{-3n+3} \cdot 3^{8n+2}} \\
&= 3^{n-4} \cdot 3^{4+4n} \cdot 3^{3n-3} \cdot 3^{-8n-2} \\
&= 3^{n-4+4+4n+3n-3-8n-2} \\
&= 3^{-5} = \frac{1}{3^5} = \frac{1}{243}
\end{aligned}$$

$$\begin{aligned}
6. \quad \frac{2 \cdot 2^x + 6 \cdot 2^{x-1}}{5 \cdot 2^x} \\
&= \frac{2 \cdot 2^x + 6 \cdot 2^{x-1}}{5 \cdot 2^x} \\
&= \frac{2^x(2 + 6 \cdot 2^{-1})}{5 \cdot 2^x} \\
&= \frac{2 + 6 \cdot 2^{-1}}{5} \\
&= \frac{2 + \frac{6}{2}}{5} \\
&= \frac{2+3}{5} \\
&= \frac{5}{5} = 1
\end{aligned}$$

$$7. \frac{6(3^{m+1})}{(3^m)^{m-1}} \div \frac{2 \times 9^{m+1}}{(3^{m-1})^{m+1}}$$

$$= \frac{6(3^{m+1})}{3^{m^2-m}} \div \frac{2 \times (3^2)^{m+1}}{3^{(m-1)(m+1)}}$$

$$= \frac{6 \cdot 3^{m+1}}{3^{m^2-m}} \div \frac{2 \times 3^{2m+2}}{3^{m^2-1}}$$

$$= \frac{2^1 \cdot 3^1 \cdot 3^{m+1}}{3^{m^2-m}} \times \frac{3^{m^2-1}}{2^1 \times 3^{2m+2}}$$

$$= 2^1 \cdot 3^1 \cdot 3^{m+1} \cdot 3^{m^2-1} \cdot 3^{-m^2+m} \cdot 2^{-1} \times 3^{-2m-2}$$

$$= 2^{1-1} \cdot 3^{1+m+1+m^2-1-m^2+m-2m-2}$$

$$= 2^0 \cdot 3^{-1} = 1 \cdot 3^{-1} = \frac{1}{3}$$

$$8. \frac{4^n \cdot 2^{n+2} - 8^n}{2^2 \cdot 3^0 \cdot 2^{3n}}$$

$$= \frac{(2^2)^n \cdot 2^{n+2} - (2^3)^n}{2^2 \cdot 1 \cdot 2^{3n}}$$

$$= \frac{2^{2n} \cdot 2^{n+2} - 2^{3n}}{2^2 \cdot 2^{3n}}$$

$$= \frac{2^{3n+2} - 2^{3n}}{2^2 \cdot 2^{3n}}$$

$$= \frac{2^{3n} \cdot 2^2 - 2^{3n}}{2^2 \cdot 2^{3n}}$$

$$= \frac{2^{3n}(2^2-1)}{2^2 \cdot 2^{3n}}$$

$$= \frac{2^2-1}{2^2} = \frac{3}{4}$$

$$9. \sqrt{\frac{3^{n+2}-3^n}{3^{n-1}} + 1}$$

$$= \sqrt{\frac{3^n \cdot 3^2 - 3^n}{3^n \cdot 3^{-1}} + 1}$$

$$= \sqrt{\frac{3^n(3^2-1)}{3^n \cdot 3^{-1}} + 1}$$

$$= \sqrt{\frac{3^n(8)}{3^n \cdot \frac{1}{3}} + 1}$$

$$= \sqrt{\frac{8}{\frac{1}{3}} + 1}$$

$$= \sqrt{25}$$

$$= 5$$

$$10. \frac{2^{2a+1}-4^a}{4^a+2^{2a-1}}$$

$$= \frac{2^{2a} \cdot 2^1 - 2^{2a}}{2^{2a} + 2^{2a-1}}$$

$$= \frac{2^{2a}(2^1-1)}{2^{2a}(1+2^{-1})}$$

$$= \frac{2-1}{1+\frac{1}{2}}$$

$$= \frac{2}{3}$$

$$11.1 \quad 3^{\frac{2}{x}} = \frac{1}{81}$$

$$3^{\frac{2}{x}} = \frac{1}{3^4}$$

$$3^{\frac{2}{x}} = 3^{-4}$$

$$\frac{2}{x} = \frac{-4}{1}$$

$$-4x = 2$$

$$x = -\frac{2}{4} = -\frac{1}{2}$$

$$11.2 \quad 2^{x+2} + 5 \cdot 2^x + 2^x = 40$$

$$2^x \cdot 2^2 + 5 \cdot 2^x + 2^x = 40$$

$$2^x(2^2 + 5 + 1) = 40$$

$$2^x(10) = 40$$

$$\frac{2^x(10)}{10} = \frac{40}{10}$$

$$2^x = 4$$

$$2^x = 2^2$$

$$x = 2$$

$$11.3 \quad 8x^{-3} - 27 = 0$$

$$8x^{-3} = 27$$

$$\frac{8x^{-3}}{8} = \frac{27}{8}$$

$$x^{-3} = \frac{27}{8}$$

$$\frac{1}{x^3} = \frac{3^3}{2^3}$$

$$x^3 = \frac{2^3}{3^3} \quad \text{vat omgekeerde aan beide kante}$$

$$\sqrt[3]{x^3} = \sqrt[3]{\frac{2^3}{3^3}}$$

$$x = \frac{2}{3}$$

$$11.4 \quad 2x^{\frac{2}{3}} = 32$$

$$\frac{2x^{\frac{2}{3}}}{2} = \frac{32}{2}$$

$$x^{\frac{2}{3}} = 16$$

$$\sqrt[3]{x^2} = 2^4$$

$$\left(\sqrt[3]{x^2}\right)^3 = (2^4)^3$$

$$x^2 = 2^{12}$$

$$\sqrt{x^2} = \pm \sqrt{2^{12}}$$

$$x = \pm 2^6$$

$$x = \pm 64$$

### INSIG VRAE

$$12. \quad \frac{2^{22}}{2} = 2^{22} \cdot 2^{-1} = 2^{21}$$

$$13. \quad 5^x + 5^x + 5^x + 5^x + 5^x = 5^5$$

$$5 \cdot 5^x = 5^5$$

$$5^{x+1} = 5^5$$

$$x + 1 = 5$$

$$x = 4$$

$$14. \quad 4^6 + 8^4 + 16^3 + 64^2$$

$$= (2^2)^6 + (2^3)^4 + (2^4)^3 + (2^6)^2$$

$$= 2^{12} + 2^{12} + 2^{12} + 2^{12}$$

$$= 4 \cdot 2^{12}$$

$$= 2^2 \cdot 2^{12}$$

$$= 2^{14}$$

$$15. \quad \text{NB: Onthou } 1^{\text{enige eksponent}} = 1$$

$$T_1 + T_2 + T_3 + \dots + T_{12}$$

$$\therefore 1^4 + 1^{44} + 1^{444} + \dots + 1^{444444444444} = 1 + 1 + 1 + \dots + 1 = 12$$

$$16.1 \quad (\sqrt{2})^3$$

$$= \sqrt{2} \cdot \sqrt{2} \cdot \sqrt{2}$$

$$= \sqrt{2} \cdot (\sqrt{2})^2$$

$$= \sqrt{2} \cdot 2$$

$$= 2\sqrt{2}$$

$$16.2 \quad \frac{(\sqrt{2})^3 \cdot 2^{18}}{(2^8)^2 \cdot \sqrt{2}}$$

$$= \frac{2 \cdot \sqrt{2} \cdot 2^{18}}{2^{16} \cdot \sqrt{2}}$$

$$= \frac{2^{19}}{2^{16}}$$

$$= 2^3$$

$$= 8$$

$$17. \quad \frac{18^x}{2^{-x}}$$

$$= \frac{(2 \cdot 3^2)^x}{2^{-x}}$$

$$= \frac{2^x \cdot 3^{2x}}{2^{-x}}$$

$$= 2^x \cdot 3^{2x} \cdot 2^x$$

$$= 2^{2x} \cdot 3^{2x}$$

$$= (2 \cdot 3)^{2x}$$

$$= 6^{2x}$$

$$= 6^x \cdot 6^x$$

$$= 5.5$$

$$= 25$$

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

$$\begin{aligned}
19. \quad & \frac{2^{2010}+15 \cdot 2^{2010}}{2^{2020}} \\
&= \frac{2^{2010}+15 \cdot 2^{2010}}{2^{2010+10}} \\
&= \frac{2^{2010}(1+15)}{2^{2010} \cdot 2^{10}} \\
&= \frac{16}{2^{10}} \\
&= \frac{2^4}{2^{10}} \\
&= \frac{1}{2^6} \\
&= \frac{1}{64}
\end{aligned}$$

$$\begin{aligned}
21.1 \quad & x^2 - 5x + 6 = 0 \\
&(x-2)(x-3) = 0 \\
&x-2 = 0 \text{ of } x-3 = 0 \\
&x = 2 \text{ of } x = 3
\end{aligned}$$

$$\begin{aligned}
18.2 \quad & \frac{9^x-4}{3^{x+2}} = \sqrt{400+225} \\
&3^x - 2 = \sqrt{625} \quad \text{uit 18.1} \\
&3^x - 2 = 25 \\
&3^x = 27 \\
&3^x = 3^3 \\
&x = 3
\end{aligned}$$

$$\begin{aligned}
20. \quad & \left( \frac{1}{x^{-1}+y^{-1}} \right) + (x+y)^{-1} \\
&= \frac{1}{\frac{1}{x}+\frac{1}{y}} + \frac{1}{(x+y)} \\
&= \frac{1}{\frac{y+x}{xy}} + \frac{1}{(x+y)} \\
&= 1 \times \frac{xy}{y+x} + \frac{1}{(x+y)} \\
&= \frac{xy}{(x+y)} + \frac{1}{(x+y)} \\
&= \frac{xy+1}{(x+y)}
\end{aligned}$$

$$\begin{aligned}
21.2 \quad & x - 5x^{\frac{1}{2}} + 6 = 0 \\
&\left(x^{\frac{1}{2}} - 3\right)\left(x^{\frac{1}{2}} - 2\right) = 0 \\
&x^{\frac{1}{2}} - 3 = 0 \text{ of } x^{\frac{1}{2}} - 2 = 0 \\
&x^{\frac{1}{2}} = 3 \quad x^{\frac{1}{2}} = 2 \\
&\left(x^{\frac{1}{2}}\right)^2 = 3^2 \quad \left(x^{\frac{1}{2}}\right)^2 = 2^2 \\
&x = 9 \quad x = 4
\end{aligned}$$

## Meer oor “Wiskunde Anibrand Antwoordboek Graad 10” en die outeur.

Ek is reeds vir 28 jaar betrokke by Wiskunde-onderrig vir graad 8 tot graad 12 leerders. Die afgelope 10 jaar is ek verbonde aan Hoërskool Die Wilgers in Pretoria, waar ek ‘n Wiskunde Akademie bedryf met een groep in elke graad.

Met die aanvang van die nuwe KABV sillabus in 2007 het ek begin om al my notas vir my Wiskunde-onderrig elektronies saam te stel met behulp van innoverende sagteware sodat dit alle onderwerpe met grafika en voorbeelde volledig verduidelik. Die graad 10 Wiskunde Anibrand Antwoordboek bied volledig uitgewerkte, verduidelikende antwoorde vir al die huiswerk probleme in die graad 10 “Wiskunde Anibrand Notaboek”.

Leerders wat hierdie boek gebruik om hulle huiswerk probleme te merk, kan uit die antwoorde self sien waar hulle gefouteer het en dan hulle foute korrigeer.

Ek gebruik hierdie antwoorde die afgelope 5 jaar in my klasaanbieding vir die graad 10 leerders. Dit stel my in staat om die antwoorde konstant te verbeter, soos wat ek dit in die klassituasie as nodig ervaar.

Die volledige antwoorde op huiswerkprobleme help leerders om selfvertroue in die vak te kry want hulle kan hulle probleme identifiseer wanneer hulle huiswerk doen, dit uitsorteer en dan voortgaan met die res van die huiswerk probleme.

Hierdie boek, saam met die Notaboek, is die antwoord vir alle graad 10 leerders wat wil presteer in Wiskunde en ook vir alle Wiskunde onderwysers wat sonder moeite ‘n kwaliteit Wiskunde klasaanbieding vir leerders wil bied.

**[www.wiskundeanibrand.com](http://www.wiskundeanibrand.com)**

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