

PATRONE, RYE EN REEKSE

Oplossings

Die DBE se eie nasienriglyne, in boekvolgorde

Elke oplossing hier is 'n uitknipsel van die amptelike DBE-nasienriglyn wat saam met die vraestel gepubliseer is waaruit die vraag kom. Die bewerking, die punt-merke en die aanvaarde alternatiewe is die DBE se eie. Niks is oorgeskryf of oor afgelei nie.

Die nommers pas by die vraeboek: oplossing 34 antwoord vraag 34, en die hoofstukke is in dieselfde volgorde.

Die DBE skryf een riglyn vir albei tale, so hierdie bladsye is tweetalig en hul nasienaantekeninge is grootliks in Engels. Dit is die DBE se eie bladsy, presies soos gedruk weergegee.

'n Nasienriglyn word vir nasieners geskryf, nie vir leerders nie. Dit wys die kortste pad na die punte, so waar 'n stap saamgepers lyk, is dit die riglyn wat bondig is eerder as 'n stap wat ontbreek.

1. 'n Kwadratiese patroon, 'n verskil van 33, dan m by elke term gevoeg

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QUESTION/VRAAG 3

3.1	$ \begin{array}{ccccccc} 14 & ; & 9 & ; & 6 & ; & 5 & ; & \dots \\ & \swarrow & & \searrow & \swarrow & & \searrow & & \\ & -5 & & -3 & & -1 & & & \\ & \swarrow & & \searrow & \swarrow & & \searrow & & \\ & 2 & & 2 & & & & & \end{array} $ $ \begin{array}{lcl} 2a = 2 & 3(1) + b = -5 & 1 - 8 + c = 14 \\ a = 1 & b = -8 & c = 21 \\ \therefore T_n = n^2 - 8n + 21 \end{array} $	$ \begin{array}{l} \checkmark 2a = 2 \\ \checkmark 3(1) + b = -5 \\ \checkmark 1 - 8 + c = 14 \end{array} $ (3)
3.2	$ \begin{array}{l} T_n = -5 + (n-1)(2) \\ T_n = 2n - 7 \\ 2n - 7 = 33 \\ \therefore n = 20 \\ \therefore T_{21} = (21)^2 - 8(21) + 21 \\ T_{21} = 294 \end{array} $ OR/OF $ \begin{array}{l} \therefore T_{n+1} - T_n = (n+1)^2 - 8(n+1) + 21 - n^2 + 8n - 21 \\ n^2 + 2n + 1 - 8n - 8 + 21 - n^2 + 8n - 21 = 33 \\ 2n - 7 = 33 \\ \therefore n = 20 \\ \therefore T_{21} = (21)^2 - 8(21) + 21 \\ T_{21} = 294 \end{array} $	$ \begin{array}{l} \checkmark \text{general term} \\ \checkmark \text{equating to 33} \\ \\ \checkmark \text{answer} \end{array} $ (3) OR/OF $ \begin{array}{l} \checkmark T_{n+1} - T_n \\ \checkmark \text{equating to 33} \\ \\ \checkmark \text{answer} \end{array} $ (3)
3.3	$ \begin{array}{l} T_7 = T_1 = 14 \\ \therefore 14 + m \geq 0 \\ m \geq -14 \\ \text{And } T_6 = T_2 \\ \therefore 9 + m < 0 \\ m < -9 \\ \therefore -14 \leq m < -9 \end{array} $	$ \begin{array}{l} \checkmark -14 \\ \\ \checkmark -9 \\ \checkmark -14 \leq m < -9 \end{array} $ (3)
		[9]

2. Vind b uit die eerste verskil, dan die 60ste term

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QUESTION 3/VRAAG 3

3.1	$3a + b = 7$ $3 + b = 7$ $b = 4$ OR/OF $T_2 - T_1 = 7$ $4 + 2b + 9 - (1 + b + 9) = 7$ $b = 4$	$\checkmark 3a + b = 7$ $\checkmark 3 + b = 7$ (2) OR/OF $\checkmark T_2 - T_1 = 7$ $\checkmark$ substitution (2)
3.2	$T_n = n^2 + 4n + 9$ $T_{60} = (60)^2 + 4(60) + 9$ $= 3849$ Answer only: full marks	$\checkmark$ substitution $\checkmark$ answer (2)
3.3	14 ; 21 ; 30 ; 41; First difference: 7 ; 9 ; 11 ; ... Common 2 nd difference: 2 $T_p = 2p + 5$ Answer only: full marks OR/OF First difference: 7 ; 9 ; 11 ; ... $T_n = a + (n-1)d$ $T_p = 7 + (p-1)(2)$ $T_p = 2p + 5$	$\checkmark$ first difference $\checkmark 2$ $\checkmark 2p + 5$ (3) OR/OF $\checkmark$ first difference $\checkmark 2$ $\checkmark 2p + 5$ (3)
3.4	$157 = 2p + 5$ $p = 76$ $\therefore$ Between T_{76} and T_{77} OR/OF $T_{n+1} - T_n = 157$ $(n+1)^2 + 4(n+1) + 9 - (n^2 + 4n + 9) = 157$ $n^2 + 2n + 1 + 4n + 4 + 9 - n^2 - 4n - 9 = 157$ $2n = 152$ $n = 76$ $\therefore$ Between T_{76} and T_{77}	$\checkmark 157 = 2p + 5$ $\checkmark p = 76$ $\checkmark T_{76}$ and T_{77} (3) OR/OF $\checkmark T_{n+1} - T_n = 157$ $\checkmark n = 76$ $\checkmark T_{76}$ and T_{77} (3)
		[10]

3. 'n Patroon wat draai, en waar sy terme begin daal

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QUESTION 3

3.1	-82	✓ answer (1)
3.2	-145 ; -122 ; -101 ; ... $2a = -2 \quad \therefore a = -1$ $3a + b = 23 \quad \therefore 3(-1) + b = 23 \quad \therefore b = 26$ $a + b + c = -145 \quad \therefore -1 + 26 + c = -145 \quad \therefore c = -170$ $\therefore T_n = -n^2 + 26n - 170$ OR/OF $2a = -2 \quad \therefore a = -1$ $c = -145 + (-2) - 23 = -170$ $\therefore T_n = -n^2 + bn - 170$ $-145 = -1 + b - 170$ $b = 26$ $\therefore T_n = -n^2 + 26n - 170$	$\checkmark 2a = -2$ $\checkmark 3(-1) + b = 23$ $\checkmark -1 + 26 + c = -145$ (3) OR/OF $\checkmark 2a = -2$ $\checkmark c = -145 + (-2) - 23$ $\checkmark -145 = -1 + b - 170$ (3)
3.3	$T_n = bn + c$ $T_n = -2n + 25$ $-2n + 25 = -121$ $-2n = -146$ $n = 73$ Between T_{73} and T_{74} OR/OF $T_{n+1} - T_n = -(n+1)^2 + 26(n+1) - 170 - (-n^2 + 26n - 170)$ $-121 = -2n + 25$ $n = 73$ Between T_{73} and T_{74} $T_n = a + (n-1)d$ $= 23 + (n-1)(-2)$ $= 25 - 2n$	$\checkmark T_n = -2n + 25$ $\checkmark T_n = -121$ $\checkmark n = 73$ $\checkmark$ answer (4) OR/OF $\checkmark T_n = -2n + 25$ $\checkmark T_n = -121$ $\checkmark n = 73$ $\checkmark$ answer (4)
3.4	$n = \frac{-b}{2a} = \frac{-26}{2(1)} = 13$ $T_{13} = -1$ $\therefore$ add 2 OR/OF $T'_n = -2n + 26 = 0$ $n = 13$ $T_{13} = -(13)^2 + 26(13) - 170 = -1$ $\therefore$ add 2	$\checkmark 13$ $\checkmark T_{13} = -1$ $\checkmark$ add 2 (3) OR/OF $\checkmark 13$ $\checkmark T_{13} = -1$ $\checkmark$ add 2 (3)

4. 3 ; 7 ; 12 ..., dan wat bygetel moet word om 13 527 te bereik

Amptelike DBE-nasienriglyn · Mei/Junie 2024 · V3 · 15 punte

QUESTION 3/VRAAG 3

3.1.1	$\begin{array}{c} 3 ; 7 ; 12 ; 18 \\ \quad \vee \quad \vee \quad \vee \\ \text{First diff: } 4 ; 5 ; 6 \\ \quad \quad \vee \quad \vee \\ \text{Second diff: } 1 ; 1 \\ 2a = 1 \\ a = \frac{1}{2} \\ 3a + b = 4 \\ 3\left(\frac{1}{2}\right) + b = 4 \\ b = \frac{5}{2} \\ a + b + c = 3 \\ \frac{1}{2} + \frac{5}{2} + c = 3 \\ c = 0 \\ T_n = \frac{1}{2}n^2 + \frac{5}{2}n \end{array}$	$\begin{array}{l} \checkmark 2a = 1 \\ \checkmark 3\left(\frac{1}{2}\right) + b = 4 \\ \checkmark \frac{1}{2} + \frac{5}{2} + c = 3 \end{array}$ (3)
3.1.2	$\begin{array}{l} 13\,527 = \frac{1}{2}n^2 + \frac{5}{2}n \\ n^2 + 5n - 27\,054 = 0 \\ (n - 162)(n + 167) = 0 \\ n = 162 \text{ or } n = -167 \\ T_{161} = 13\,363 \\ \therefore T_{161} + 164 = 13\,527 \\ 164 \text{ must be added.} \\ \textbf{OR/OF} \\ T_n = 3 + \text{sum of 1}^{\text{st}} \text{ differences} \\ 13\,527 = 3 + 4 + 5 + \dots + n \\ \frac{n - 3 + 1}{2}[3 + n] = 13\,527 \\ n^2 + n - 27\,060 = 0 \\ (n + 165)(n - 167) = 0 \\ n = 164 \end{array}$	$\begin{array}{l} \checkmark 13\,527 = \frac{1}{2}n^2 + \frac{5}{2}n \\ \checkmark \text{standard form} \\ \checkmark \text{answers for } n \\ \checkmark 164 \end{array}$ (4) OR/OF $\begin{array}{l} \checkmark 13\,527 = 3 + 4 + 5 + \dots + n \\ \checkmark n^2 + n - 27\,060 = 0 \\ \checkmark \text{answers for } n \\ \checkmark 164 \end{array}$ (4)

3.2.1	$T_n = 8 + (n-1)(3)$ $T_n = 3n + 5$ $41 = 3n + 5$ $36 = 3n$ $n = 12$	✓ $T_n = 3n + 5$ ✓ $T_n = 41$ ✓ answer (3)
3.2.2a	$P_{41} = 12$	✓ answer (1)
3.2.2b	$P_8 = a + 7d = 1$ $P_{11} = a + 10d = 2$ $3d = 1$ $d = \frac{1}{3}$ $a + 7\left(\frac{1}{3}\right) = 1$ $a = -\frac{4}{3}$	✓ $a + 7d = 1$ ✓ $a + 10d = 2$ ✓ value of d ✓ value of a (4)
		[15]

5. Wanneer 'n term van die patroon gelyk is aan 'n term van sy eie verskille

Amptelike DBE-nasienriglyn · Mei/Junie 2021 · V2 · 17 punte

QUESTION/VRAAG 2

2.1.1	$2a = -8$ $a = -4$ $3a + b = 28$ $b = 40$ $a + b + c = 72$ $c = 36$ $T_n = -4n^2 + 40n + 36$	✓ second differences = -8 ✓ $a = -4$ ✓ $b = 40$ ✓ $c = 36$ (4)
2.1.2	$T_{12} = 36 - 8n = 36 - 8(12) = -60$ $-4n^2 + 40n + 36 = -60$ $n^2 - 10n - 24 = 0$ $(n - 12)(n + 2) = 0$ $\therefore n = 12$	✓ $36 - 8n$ ✓ -60 ✓ standard form ✓ factors ✓ $n = 12$ (5)
2.1.3	$T_n' = -8n + 40 = 0$ $n = 5$ $T_n = -4(5)^2 + 40(5) + 36 = 136$ OR/OF $\frac{-b}{2a} = \frac{40}{8} = 5$ $T_n = -4(5)^2 + 40(5) + 36$ $= 136$	✓ $-8n + 40$ ✓ $n = 5$ ✓ 136 (3) OR/OF ✓ substitution ✓ $n = 5$ ✓ 136 (3)
2.1.4	Maximum value = 41	✓ value (1)
2.2	$2\sin 3x - (-11) = 15 - 2\sin 3x$ $4\sin 3x = 4$ $\sin 3x = 1$ $3x = 90^\circ$ $\therefore x = 30^\circ$	✓ equating ✓ $4\sin 3x = 4$ ✓ $\sin 3x = 1$ ✓ answer (4)
		[17]

6. 'n Lineêre patroon, sy som, en 'n sigma-uitbreiding

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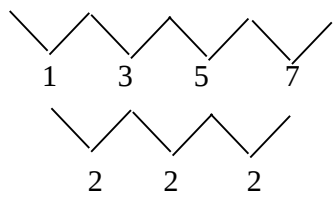
QUESTION/VRAAG 4

4.1	$a = 5$ and/en $d = 2$ $T_{51} = 5 + (51-1)(2)$ $= 105$	✓ a and d ✓ substitution into correct formula ✓ answer (3)
4.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{51} = \frac{51}{2}[2(5) + (51-1)2]$ or/of $S_{51} = \frac{51}{2}[5 + 105]$ $= 2\ 805$	✓ substitution into correct formula ✓ answer (2)
4.3	$\sum_{n=1}^{5\ 000} (2n+3) = 5 + 7 + 9 + \dots + 10\ 003$	✓ expansion (1)
4.4	$T_1 = -3$ $T_{4\ 999} = -2(4\ 999) - 1 = -9\ 999$ $\therefore \sum_{n=1}^{5\ 000} (2n+3) + \sum_{n=1}^{4\ 999} (-2n-1)$ $= (5 + 7 + 9 + \dots + 9\ 999 + 10\ 001 + 10\ 003) +$ $\quad \quad \quad (-3 - 5 - 7 - 9 - \dots - 9\ 999)$ $= 10\ 001 + 10\ 003 - 3$ $= 20\ 001$ OR/OF $S_{4\ 999} = \frac{4\ 999}{2}[2(-3) + (4\ 999-1)(-2)] = -24\ 999\ 999$ $S_{5\ 000} = \frac{5\ 000}{2}((2)(5) + (5\ 000-1)(2)) = 25\ 020\ 000$ $\sum_{n=1}^{5\ 000} (2n+3) + \sum_{n=1}^{4\ 999} (-2n-1) = 25\ 020\ 000 - 24\ 999\ 999$ $= 20\ 001$	✓ $T_1 = -3$ ✓ $T_{4\ 999} = -9\ 999$ ✓ both expansions ✓ answer (A) (4) OR/OF ✓ $T_1 = -3$ ✓ $S_{4\ 999} = -24\ 999\ 999$ ✓ $S_{5\ 000} = 25\ 020\ 000$ ✓ answer (A) (4)
		[10]

7. Twintig terme, dan vyf-en-sewentig, en die term wat moes verander

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QUESTION/VRAAG 2

2.1.1	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{20} = \frac{20}{2}[2(7) + (20-1)(5)]$ $S_{20} = 1\,090$	✓ substitution ✓ answer (2)
2.1.2	$T_n = 7 + (n-1)(5)$ $T_n = 5n + 2$ $S_{75} - S_{20} = 14\,400 - 1\,090 = 13\,310$ $\sum_{n=1}^{75} (5n+2) - \sum_{n=1}^{20} (5n+2) = 13\,310$ $\therefore \sum_{n=21}^{75} (5n+2) = 13\,310$ OR/OF $T_{21} + T_{22} + T_{23} + \dots + T_{75} = 14\,400 - 1\,090$ $107 + 112 + 117 + \dots = 13\,310$ $T_n = 102 + 5n$ $\therefore \sum_1^{55} (5n+102) = 13\,310$	✓ general term ✓ $S_{75} - S_{20}$ ✓ $\sum_{n=21}^{75} \checkmark = 13\,310$ (4) OR/OF ✓ $S_{75} - S_{20}$ ✓ general term ✓ $\sum_{n=1}^{55} \checkmark = 13\,310$ (4)
2.2.1	$T_n = 2n - 1$ 98 th first difference = $2(98) - 1$ = 195 Quadratic: $T_{98} = 9\,632 - 195$ = 9\,437	✓ answer ✓ method ✓ answer (3)
2.2.2	28 ; 29 ; 32  $\begin{array}{lll} 3a + b = 1 & 9a + 3b + c = 32 & \\ 2a = 2 & 3(1) + b = 1 & T_3 = 1(3)^2 - 2(3) + c = 32 \\ a = 1 & b = -2 & c = 29 \end{array}$ OR/OF $1 - 2 + c = 28$ $c = 29$ $\therefore T_n = n^2 - 2n + 29$	✓ second difference ✓ $a = 1$ ✓ $b = -2$ ✓ method to calculate c ✓ $c = 29$ (5)
		[14]

8. Van die 7de term na die aantal terme, dan die eerste veertig

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QUESTION/VRAAG 2

2.1.1	$a + 6d = 35$ $-1 + 6d = 35$ $6d = 36$ $d = 6$ OR/OF $\frac{35 - (-1)}{7 - 1} = 6$ ANSWER ONLY: FULL MARKS	✓ substitution ✓ answer (2) OR/OF ✓ substitution ✓ answer (2)
2.1.2	$T_n = a + (n-1)d$ $473 = -1 + (n-1)(6)$ $79 = n - 1$ $\therefore n = 80$ ANSWER ONLY: FULL MARKS	✓ substitution into the correct formula ✓ equating to 473 ✓ answer (3)
2.1.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{40} = \frac{40}{2}[2(-1) + (40-1)(6)]$ $\therefore S_{40} = 4640$ OR/OF $T_{40} = 6(40) - 7$ $= 233$ $S_n = \frac{n}{2}(a + l)$ $= \frac{40}{2}(-1 + 233)$ $= 4640$	✓ substitution ✓ answer (2) OR/OF ✓ substitution ✓ answer (2)
2.2.1	$\begin{array}{ccccccc} 75 & & 53 & & 35 & & 21 \\ & \backslash & / & \backslash & / & \backslash & / \\ & -22 & & -18 & & -14 & \\ & & / & \backslash & / & \backslash & \\ & & 4 & & 4 & & \end{array}$ $T_5 = 11$	✓ answer (A) (1)
2.2.2	$T_n = an^2 + bn + c$ $2a = 4$ $a = 2$ $3a + b = -22$ $6 + b = -22$ $b = -28$ $a + b + c = 75$ $2 - 28 + c = 75$ $c = 101$ $\therefore T_n = 2n^2 - 28n + 101$	✓ $T_n = an^2 + bn + c$ ✓ $a = 2$ ✓ $b = -28$ ✓ $c = 101$ (4)

2.2.3

Minimum value of T_n

$$n = -\frac{b}{2a} = -\frac{(-28)}{2(2)}$$

$$n = 7$$

$$\text{Minimum value of } T_n = 2(7)^2 - 28(7) + 101 = 3$$

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern.

$$\text{Maximum value of new pattern} = -\frac{3}{5}$$

OR/OF

$$T'_n = 4n - 28$$

$$4n - 28 = 0$$

$$4n = 28$$

$$n = 7$$

$$\text{Minimum value of } T_n = 2(7)^2 - 28(7) + 101 = 3$$

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern.

$$\text{Maximum value of new pattern} = -\frac{3}{5}$$

OR/OF

$$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$$

$$n = -\frac{b}{2a} = \frac{-\frac{28}{5}}{2\left(-\frac{2}{5}\right)}$$

$$= 7$$

$$T_7 = -\frac{3}{5}$$

OR/OF

$$\checkmark n = 7$$

$$\checkmark \text{ min value} = 3$$

$$\checkmark -\frac{1}{5} \text{ value of term of old pattern}$$

$$\checkmark \text{ max value} = -\frac{3}{5} \quad (4)$$

OR/OF

$$\checkmark n = 7$$

$$\checkmark \text{ min value} = 3$$

$$\checkmark -\frac{1}{5} \text{ value of term of old pattern}$$

$$\checkmark \text{ max value} = -\frac{3}{5} \quad (4)$$

OR/OF

$$\checkmark \checkmark T_n \div (-5)$$

$$\checkmark n = 7$$

$$\checkmark \text{ max value} = -\frac{3}{5} \quad (4)$$

OR/OF

$$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$$

$$T'_n = -\frac{4}{5}n + \frac{28}{5}$$

$$\checkmark\checkmark T_n \div (-5)$$

$$-\frac{4}{5}n + \frac{28}{5} = 0$$

$$-4n = -28$$

$$n = 7$$

$$\text{Minimum value of } T_n = 2(7)^2 - 28(7) + 101 = 3$$

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern.

$$\checkmark n = 7$$

$$\text{Maximum value of new pattern} = -\frac{3}{5}$$

$$\checkmark \text{ max value} = -\frac{3}{5}$$

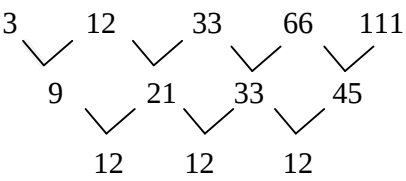
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[16]

9. T91 en S91, dan 'n kwadratiese patroon uit drie verskille

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QUESTION 2/VRAAG 2

2.1.1	$7 + 12 + 17 + \dots$ $T_n = a + (n-1)d$ $T_{91} = 7 + (91-1)(5)$ $T_{91} = 457$ OR/OF $d = 5$ $T_n = 5n + 2$ $T_{91} = 5(91) + 2$ $T_{91} = 457$	$\checkmark d = 5$ $\checkmark$ substitution into correct formula $\checkmark$ answer (3) OR/OF $\checkmark d = 5$ $\checkmark$ substitution $n = 91$ $\checkmark$ answer (3)
2.1.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{91} = \frac{91}{2}[2 \times 7 + (91-1)(5)]$ $S_9 = 21\ 112$ OR/OF $S_n = \frac{n}{2}(a + l)$ $S_{91} = \frac{91}{2}(7 + 457)$ $S_{91} = 21\ 112$	$\checkmark$ substitution into correct formula $\checkmark$ answer (2) OR/OF $\checkmark$ substitution into correct formula $\checkmark$ answer (2)
2.1.3	$T_n = 7 + (n-1)(5)$ $5n + 2 = 517$ $5n = 515$ $n = 103$	$\checkmark$ substitution into correct formula $\checkmark$ equate $\checkmark$ answer (3)
2.2.1	$T_1 = 3; T_2 - T_1 = 9$ and $T_3 - T_2 = 21$  $\therefore T_5 = 3 + 9 + 21 + 33 + 45 = 111$ OR/OF $2a = 12$ $a = 6$ $3(6) + b = 9$ $b = -9$ $6 - 9 + c = 3$ $T_5 = 6(5)^2 - 9(5) + 6 = 111$	$\checkmark$ constant second diff = 12 $\checkmark$ first differences : 33 and 45 (2) OR/OF $\checkmark$ constant second diff = 12 $\checkmark$ substitute 5 (2)

2.2.2	$2a = 12$ $a = 6$ $3(6) + b = 9 \quad \text{or} \quad 5 \times 6 + b = 21$ $b = -9$ $6 - 9 + c = 3$ $c = 6$ $T_n = 6n^2 - 9n + 6$	$\checkmark 2a = 12$ $\checkmark 3(6) + b = 9 / 5 \times 6 + b = 21$ $\checkmark 6 - 9 + c = 3 \quad (3)$
2.2.3	$T_n' = 12n - 9 > 0$ $n > \frac{3}{4}$ $\therefore T_n$ is increasing for $n \in N$ OR/OF $n = -\frac{b}{2a} = -\frac{-9}{2(6)}$ $n = \frac{3}{4}$ $\therefore \text{min at } n = 1 \text{ for } n \in N$ $\therefore T_n$ is increasing for $n \in N$	$\checkmark T_n' = 12n - 9$ $\checkmark n > \frac{3}{4}$ $\checkmark \text{increasing for } n \in N \quad (3)$ OR/OF $\checkmark n = -\frac{b}{2a} = \frac{9}{2(6)}$ $\checkmark n = \frac{3}{4}$ $\checkmark \text{increasing for } n \in N \quad (3)$
		[16]

10. 'n Atleet se weeklikse kilometers as 'n rekenkundige reeks

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QUESTION/VRAAG 2

2.1.1	$T_n = 2n + 3$	✓ $2n$ ✓ 3 (2)
2.1.2	$93 = 2n + 3$ $90 = 2n$ $45 = n$	✓equating ✓answer (2)
2.1.3	$50 + 70 + 90 + \dots + 930$ $S_{45} = \frac{45}{2}[2(50) + (45 - 1)(20)]$ $S_{45} = R22\ 050$ Total raised = R22 050 OR/OF $50 + 70 + 90 + \dots + 930$ $S_{45} = \frac{45}{2}[50 + 930]$ $S_{45} = R22\ 050$ Total raised = R22 050 OR/OF $5 + 7 + 9 + \dots + 93$ $S_{45} = \frac{45}{2}[2(5) + (45 - 1)(2)]$ $S_{45} = 2\ 205\text{km}$ $S_{45} = R22\ 050$ Total raised = R22 050 OR/OF $5 + 7 + 9 + \dots + 93$ $S_{45} = \frac{45}{2}[5 + 93]$ $S_{45} = 2\ 205\text{km}$ $S_{45} = R22\ 050$ Total raised = R22 050	✓convert to money ✓substitution ✓answer (3) OR/OF ✓convert to money ✓substitution ✓answer (3) OR/OF ✓substitution ✓answer ✓convert to money (3) OR/OF ✓substitution ✓answer ✓convert to money (3)
2.2.1 a)	$T_1 = (2)^{1+2}$ $T_1 = 8$	✓ $a = 8$ (1)
2.2.1 b)	$r = 2$	✓ $r = 2$ (1)
2.2.2	$T_{20} = (2)^{20+2}$ $T_{20} = 2^{22} = (2^2)^{11}$ $= 4^{11}$	✓substitution ✓answer (2)

2.2.3	$\frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \dots$ $S_{\infty} = \frac{a}{1-r}$ $= \frac{\frac{1}{8}}{1 - \frac{1}{2}}$ $\therefore S_{\infty} = \frac{1}{4}$	✓ series ✓ substitution ✓ answer (3)
2.2.4	$8 + 4^2 + 32 + 4^3 + \dots + 4^{11} + \dots$ $S_{21} - S_{10} = \frac{8(2^{21} - 1)}{2 - 1} - \frac{16(4^{10} - 1)}{4 - 1}$ $= 16\,777\,208 - 5\,592\,400$ $= 11\,184\,808$ OR/OF $8 + 32 + 128 + \dots$ $S_{11} = \frac{8(4^{11} - 1)}{4 - 1}$ $\therefore S_{11} = 11\,184\,808$	✓ $\frac{8(2^{21} - 1)}{2 - 1}$ ✓ $n = 10$ ✓ $\frac{16(4^{10} - 1)}{4 - 1}$ ✓ $11\,184\,808$ OR/OF ✓ $n = 11$ ✓ $r = 4$ ✓ $\frac{8(4^{11} - 1)}{4 - 1}$ ✓ $11\,184\,808$ (4)
		[18]

11. Vind x, toon die somformule, dan die som tot oneindigheid

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QUESTION/VRAAG 2

2.1	$\frac{90}{x} = \frac{81}{90}$ $81x = 8100$ $x = 100$ OR/OF $x = 90 \times \frac{10}{9}$ $x = 100$	$\checkmark \frac{90}{x} = \frac{81}{90}$ $\checkmark \text{ answer} \quad (2)$ OR/OF $\checkmark \frac{10}{9}$ $\checkmark \text{ answer} \quad (2)$
2.2	$S_n = \frac{a(1-r^n)}{1-r}$ $S_n = \frac{100(1-(0,9)^n)}{1-0,9}$ $S_n = \frac{100(1-(0,9)^n)}{0,1}$ $\therefore S_n = 1\,000(1-(0,9)^n)$	$\checkmark r = 0,9$ $\checkmark \text{substitution into correct formula} \quad (2)$
2.3	$S_\infty = \frac{a}{1-r}$ $S_\infty = \frac{100}{1-\frac{9}{10}}$ $S_\infty = 1000$ OR/OF $S_\infty = \lim_{n \rightarrow \infty} [1\,000(1-(0,9)^n)]$ $S_\infty = 1000$	$\checkmark \text{ substitution}$ $\checkmark \text{ answer} \quad (2)$ OR/OF $\checkmark S_\infty = \lim_{n \rightarrow \infty} [1\,000(1-(0,9)^n)]$ $\checkmark \text{ answer} \quad (2)$
		[6]

12. Die algemene term, dan watter term van die reeks 15 625 is

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QUESTION/VRAAG 5

3.1.1	$T_n = ar^{n-1} = 2000\left(\frac{1}{5}\right)^{n-1}$	✓ $2000\left(\frac{1}{5}\right)^{n-1}$ (1)
3.1.2	$T_7 = 2000\left(\frac{1}{5}\right)^{7-1} = \frac{16}{125}$	✓ $\frac{16}{125}$ (1)
3.1.3	$\frac{16}{15625} = 2000\left(\frac{1}{5}\right)^{n-1}$ $\frac{1}{1953125} = \left(\frac{1}{5}\right)^{n-1}$ $\left(\frac{1}{5}\right)^9 = \left(\frac{1}{5}\right)^{n-1}$ OR $n-1 = \log_{\frac{1}{5}} \frac{1}{1953125}$ $n-1 = 9$ $n = 10$	✓ equating ✓ same base / use of log ✓ answer (3)
3.2	$S_\infty = 27 = \frac{a}{1-r}$ $S_3 = \frac{a(1-r^3)}{1-r} = 26$ $27(1-r^3) = 26$ $1-r^3 = \frac{26}{27}$ $r^3 = \frac{1}{27}$ $\therefore r = \frac{1}{3}$ OR/OF $S_\infty = 27 = \frac{a}{1-r}$ $a = 27(1-r)$ But $a + ar + ar^2 = 26$ $a(1+r+r^2) = 26$ $27(1-r)(1+r+r^2) = 26$ $(1-r)(1+r+r^2) = \frac{26}{27}$ $r^2 + r + 1 - r^3 - r^2 - r = \frac{26}{27}$ $-r^3 + 1 = \frac{26}{27}$ $r^3 = \frac{1}{27}$ $\therefore r = \frac{1}{3}$	✓ $S_\infty = 27 = \frac{a}{1-r}$ ✓ $S_3 = \frac{a(1-r^3)}{1-r} = 26$ ✓ substitution ✓ $r = \frac{1}{3}$ OR/OF ✓ $a = 27(1-r)$ ✓ $a + ar + ar^2 = 26$ ✓ substitution ✓ $r = \frac{1}{3}$ (4)
		[9]

13. Konvergeer dit? Dan k uit 'n sigma wat op 29 520 uitkom

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QUESTION 2/VRAAG 2

2.1.1	$r = \frac{1}{2}$ Yes, because $-1 < \frac{1}{2} < 1$	$\checkmark r = \frac{1}{2}$ $\checkmark$ answer with reason (2)
2.1.2	$S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{4}{1-\frac{1}{2}}$ $\therefore S_{\infty} = 8$	$\checkmark$ substitution $\checkmark$ answer (2)
2.2	$\sum_{p=k}^{10} 3^{p-1} = 3^{k-1} + 3^{k+1-1} + 3^{k+2-1} + \dots + 3^9$ $= 3^{k-1} + 3^k + 3^{k+1} + \dots + 3^9$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $29\,520 = \frac{3^{k-1}(3^{11-k} - 1)}{3 - 1}$ $3^{10} - 3^{k-1} = 59\,040$ $3^{k-1} = 9$ $k - 1 = 2$ $\therefore k = 3$	$\checkmark a = 3^{k-1}$ $\checkmark r = 3$ $\checkmark n = 11 - k$ $\checkmark$ substitution $\checkmark$ answer (5)
		[9]

14. k uit 'n som van 98 301, dan 'n meetkundige en 'n rekenkundige saam

Amptelike DBE-nasienriglyn · November 2023 · V3 · 10 punte

QUESTION 3/VRAAG 3

3.1.1	$T_n = ar^{n-1}$ $T_n = 3(2)^{n-1}$	$\checkmark T_n = 3(2)^{n-1}$ (1)
3.1.2	$\sum_{p=1}^k \frac{3}{2} \cdot 2^p = 98\,301$ $\sum_{p=1}^k \frac{3}{2} \cdot 2^p = 3 + 6 + 12 + \dots$ $n = k$ $\frac{3[(2)^k - 1]}{2 - 1} = 98\,301$ $(2)^k = 32\,768$ $2^k = 2^{15}$ OR/OF $k = \log_2 32\,768$ $\therefore k = 15$	$\checkmark$ expansion $\checkmark n = k$ $\checkmark$ substitution into correct formula $\checkmark k = 15$ (4)
3.2	$S_{22} = \frac{22}{2}[2a + 21(3)]$ $S_{22} = 22a + 693$ $S_{\infty} = \frac{a}{1 - \frac{1}{3}}$ $= \frac{3a}{2}$ $\therefore 22a + 693 = \frac{3a}{2} + 734$ $44a + 1386 = 3a + 1468$ $41a = 82$ $a = 2$	$\checkmark$ substitution into S_n $\checkmark S_{22} = 22a + 693$ $\checkmark$ substitution into S_{∞} $\checkmark S_{22} = S_{\infty} + 734$ $\checkmark$ answer (5)
		[10]

15. Sirkels binne sirkels, en die reeks wat hulle radiusse maak

Amptelike DBE-nasienriglyn · November 2024 · V3 · 10 punte

QUESTION/VRAAG 3

3.1	2nd circle: $\frac{6}{2} = 3 \text{ cm}$ 3rd circle: $\frac{3}{2} = 1,5 \text{ cm}$ OR/OF 3rd circle = $6\left(\frac{1}{2}\right)^2 = 1,5$	✓✓ radius 3rd circle (2) OR/OF ✓✓ radius 3rd circle (2)
3.2	$36\pi ; 9\pi ; \frac{9}{4}\pi ; \dots$ $r = \frac{1}{4} ; a = 36\pi$ $S_{10} = \frac{36\pi \left(\left(\frac{1}{4} \right)^{10} - 1 \right)}{\frac{1}{4} - 1}$ $S_{10} = 150,80$	✓ a ✓ r ✓ substitution ✓ answer (4)
3.3	$6 ; 3 ; \frac{3}{2} \dots$ radius = $\frac{1}{2} \left(\frac{3}{128} \right) = \frac{3}{256}$ $\frac{3}{256} = 6 \left(\frac{1}{2} \right)^{n-1}$ $\frac{1}{512} = \left(\frac{1}{2} \right)^{n-1}$ $\left(\frac{1}{2} \right)^9 = \left(\frac{1}{2} \right)^{n-1} \quad \text{or/of} \quad n-1 = \log_{\left(\frac{1}{2} \right)} \left(\frac{1}{512} \right)$ $\therefore n-1=9$ $\therefore n=10$ $\therefore n-1=9$ $\therefore n=10$	✓ $\frac{3}{256}$ ✓ equating to radius general term ✓ simplification ✓ answer (4)

	OR/OF 12 ; 6 ; 3 ; ... diameter = $\frac{3}{128}$ $\frac{3}{128} = 12 \left(\frac{1}{2}\right)^{n-1}$ $\frac{1}{512} = \left(\frac{1}{2}\right)^{n-1}$ $\left(\frac{1}{2}\right)^9 = \left(\frac{1}{2}\right)^{n-1}$ or/of $n-1 = \log_{\left(\frac{1}{2}\right)}\left(\frac{1}{512}\right)$ $\therefore n-1=9$ $\therefore n-1=9$ $\therefore n=10$ $\therefore n=10$	OR/OF ✓ $12\left(\frac{1}{2}\right)^{n-1}$ ✓ equating general term of diameter to $\frac{3}{128}$ ✓ simplification ✓ answer (4)
		[10]

16. Die 10de term, dan die waardes van t wat dit laat konvergeer

Amptelike DBE-nasienriglyn · Mei/Junie 2022 · V3 · 11 punte

QUESTION/VRAAG 3

3.1.1	$T_n = ar^{n-1}$ $T_{10} = 1024 \left(\frac{1}{4}\right)^{10-1}$ $\therefore T_{10} = \frac{1}{256}$ ANSWER ONLY: FULL MARKS	✓ substitution into the correct formula ✓ answer (2)
3.1.2	$\sum_{p=0}^8 256(4^{1-p}) = 1024 + 256 + 64 + \dots$ $S_n = \frac{a[1-r^n]}{1-r}$ $S_9 = \frac{1024 \left[1 - \left(\frac{1}{4}\right)^9\right]}{1 - \frac{1}{4}}$ $S_9 = \frac{87381}{64}$ $= 1365,33$ OR/OF $\sum_{p=0}^8 256(4^{1-p})$ $= 1024 + 256 + 64 + 16 + 4 + 1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64}$ $S_9 = \frac{87381}{64}$ $= 1365,33$	✓ 1024 ✓ $n = 9$ ✓ substitution into the correct formula ✓ answer (4) OR/OF ✓ 1024 ✓ rest of expansion ✓ $n = 9$ terms ✓ answer (4)
3.2	$-t^2 - 6t - 9; \frac{t^3 + 9t^2 + 27t + 27}{2}$ $-(t^2 + 6t + 9); \frac{1}{2}(t+3)(t^2 + 6t + 9)$ $-(t+3)^2; \frac{1}{2}(t+3)^3$ $r = \frac{-(t+3)}{2}$ $-1 < \frac{-t-3}{2} < 1$ $-2 < -t-3 < 2$ $1 < -t < 5$ $-5 < t < -1$	$\frac{t^3 + 9t^2 + 27t + 27}{-t^2 - 6t - 9}$ ✓ $r = \frac{2}{-t^2 - 6t - 9}$ ✓ $-(t^2 + 6t + 9)$ ✓ $\frac{1}{2}(t+3)(t^2 + 6t + 9)$ ✓ $-1 < \frac{-t-3}{2} < 1$ ✓ answer (5)
		[11]

17. r uit die 6de term, dan hoeveel terme 114 674 bereik

Amtelike DBE-nasienriglyn · November 2022 · V2 · 14 punte

QUESTION 2/VRAAG 2

2.1.1	$a = 14$ $T_6 = 14r^5 = 448$ $r^5 = 32$ $\therefore r = 2$ Answer only: full marks	$\checkmark T_6 = 14r^5 = 448$ $\checkmark r = 2$ (2)
2.1.2	$T_n = 14(2)^{n-1}$ $S_n = \frac{14(2^6 - 1)}{2 - 1}$ $S_6 = 882$ $114\,674 - 882 = 113\,792$ $113\,792 = 896(2^n - 1)$ $128 = 2^n$ $n = 7$ OR/OF $S_n = \frac{a(r^n - 1)}{r - 1}$ $114\,674 = \frac{14(2^n - 1)}{2 - 1}$ $8\,191 = 2^n - 1$ $2^n = 8\,192$ $n = \log_2 8\,192$ $n = 13$ $\therefore 7$ more terms must be added to the first 6 terms.	$\checkmark$ substitution into correct formula $\checkmark S_6 = 882$ $\checkmark 128 = 2^n$ $\checkmark 7$ (4) OR/OF $\checkmark$ substitution into correct formula $\checkmark 2^n = 8\,192$ $\checkmark n = 13$ $\checkmark 7$ (4)
2.1.3	$r = \frac{1}{2}$ OR $448r^5 = 14$ $\therefore r = \frac{1}{2}$ $S_\infty = \frac{a}{1 - r}$ $S_\infty = \frac{448}{1 - \frac{1}{2}}$ $S_\infty = 896$	$\checkmark r = \frac{1}{2}$ $\checkmark$ substitution $\checkmark$ answer (3)

