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basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
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NASIONALE SENIOR
SERTIFIKAT

GRADE 12/GRAAD 12

MATHEMATICS P1/WISKUNDE VI

NOVEMBER 2017

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

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| DEPARTMENT OF BASIC EDUCATION |
| PRIVATE BAG 2855, PRETORIA 0001 |
| 2017 -11- 13 |
| APPROVED MARKING GUIDELINE PUBLIC EXAMINATION |

This memorandum consists of 19 pages.
Hierdie memorandum bestaan uit 19 bladsye.

[Signature]
10/11/2017
approved
W. van der Merwe

Approved: *[Signature]*
10/11/2017

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NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

LET WEL:

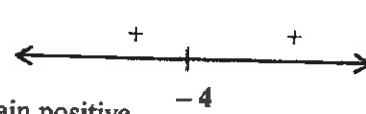
- Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

24

QUESTION/VRAAG 1

| | | | |
|-------|--|---|---|
| 1.1.1 | $x^2 + 9x + 14 = 0$ $(x+7)(x+2) = 0$ ✓ A $x = -7$ or $x = -2$ ✓ | • factors x 0/3 • an only 2/3 • f + sub = factors ✓ factors ✓ x = -7 ✓ x = -2 | 3 |
| 1.1.2 | $4x^2 + 9x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-9 \pm \sqrt{9^2 - 4(4)(-3)}}{2(4)}$ ✓ ✓ $= \frac{-9 \pm \sqrt{129}}{8}$ $x = 0,29$ or $x = -2,54$ ✓ ✓ OR/OF $x^2 + \frac{9}{4}x + \frac{81}{64} = \frac{3}{4} + \frac{81}{64}$ $(x + \frac{9}{8})^2 = \frac{129}{64}$ $x + \frac{9}{8} = \pm \frac{\sqrt{129}}{8}$ $x = \frac{-9 \pm \sqrt{129}}{8}$ $x = 0,29$ or $x = -2,54$ | • f x 0/4 • sub x correct answ 2/4 ✓ substitution ✓ simplification ✓ x = 0,29 ✓ x = -2,54 OR/OF ✓ for adding $\frac{81}{64}$ on both sides ✓ simplification LHS & RHS ✓ x = 0,29 ✓ x = -2,54 | 4 |
| 1.1.3 | $\sqrt{x^2 - 5} = 2\sqrt{x}$ $x^2 - 5 = 4x$ ✓ $x^2 - 4x - 5 = 0$ ✓ $(x-5)(x+1) = 0$ $x = 5$ or $x = -1$ ✓ $x = 5$ ✓ | $x^2 - 2x - 5 = 0$ ✓ CA $x = 3,45$ or $-1,45$ ✓ CA no soln ✓ CA 3/4 ✓ $x^2 - 5 = 4x$ ✓ standard form ✓ both answers ✓ select x = 5 | 4 |



| | | |
|--------------|---|---|
| <p>1.2</p> | <p> $3x - y = 4$ $y = 3x - 4$ ✓ $x^2 + 2xy - y^2 = -2$ $x^2 + 2x(3x - 4) - (3x - 4)^2 = -2$ ✓ $x^2 + 6x^2 - 8x - (9x^2 - 24x + 16) = -2$ $7x^2 - 8x - 9x^2 + 24x - 16 = -2$ $-2x^2 + 16x - 14 = 0$ } ✓ $x^2 - 8x + 7 = 0$ } ✓ $(x - 7)(x - 1) = 0$ ✓ <u>$x = 1$ or $x = 7$</u> $y = 3(1) - 4$ $y = 3(7) - 4$ <u>$y = -1$ or $y = 17$</u> </p> | <p> ✓ y subject of formula ✓ substitution ✓ correct standard form ✓ factors $f(1) = 0$ no solve ✓ x-values ✓ y-values </p> |
| | <p> OR/OF $3x - y = 4$ $x = \frac{y + 4}{3}$ $x^2 + 2xy - y^2 = -2$ $x^2 + 2xy - y^2 = -2$ $\left(\frac{y + 4}{3}\right)^2 + 2\left(\frac{y + 4}{3}\right)y - y^2 = -2$ $y^2 + 8y + 16 + 6y^2 + 24y - 9y^2 = -18$ $-2y^2 + 32y + 34 = 0$ $y^2 - 16y - 17 = 0$ $(y - 17)(y + 1) = 0$ $y = -1$ or $y = 17$ $x = \frac{-1 + 4}{3}$ $x = \frac{17 + 4}{3}$ $x = 1$ or $x = 7$ </p> | <p> OR/OF ✓ x subject of formula ✓ substitution ✓ correct standard form ✓ factors ✓ y-values ✓ x-values </p> |
| <p>1.3.1</p> | <p> $x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$ ✓ $x \in \mathbb{R}, x \neq -4$ or $x \in (-\infty; -4) \cup x \in (-4; \infty)$ or $x < -4$ or $x > -4$ $x \neq -4$ OR/OF $x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$  The function values remain positive $x \in \mathbb{R}, x \neq -4$ </p> | <p> ✓ $(x + 4)(x + 4)$ ✓ any one of the solutions ✓ and $x \neq -4$ OR/OF ✓ $(x + 4)(x + 4)$ ✓ any one of the solutions </p> |

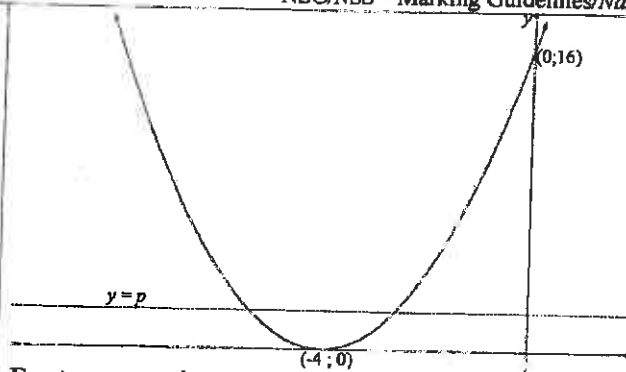
6

(6)

3

(3)

1.3.2



For two negative unequal roots:

$0 < p < 16$ ✓

neg ✓✓

OR/OF

$x^2 + 8x + 16 = p$

$x^2 + 8x + 16 - p = 0$

$0 < 16 - p < 16$

$-16 < -p < 0$

$0 < p < 16$

OR/OF

$x^2 + 8x + 16 - p = 0$

$x = \frac{-8 \pm \sqrt{64 - 4(16 - p)}}{2}$

$0 < 64 - 4(16 - p) < 64$

$0 < 4p < 64$

$0 < p < 16$

OR/OF

$x^2 + 8x + 16 = p$

$x^2 + 8x + 16 - p = 0$

Roots are real and unequal:

$8^2 - 4(16 - p) > 0$

$4p > 0$

$p > 0$

Roots are: $\frac{-8 \pm \sqrt{4p}}{2}$

For both roots to be negative:

$\sqrt{4p} < 8$

$4p < 64$

$p < 16$

$0 < p < 16$

✓ 0

✓ 16

✓ ✓ $0 < p < 16$

(4)

OR/OF

✓ 0

✓ 16

✓ ✓ $0 < p < 16$

(4)

✓ 0

✓ 16

✓ ✓ $0 < p < 16$

(4)

✓ 0

✓ 16

✓ ✓ $0 < p < 16$

(4)

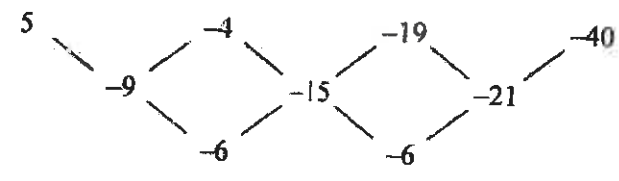
[24]

4

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18

QUESTION/VRAAG 2

| | | | |
|--------------|---|---|---------------------|
| <p>2.1.1</p> |  <p> \checkmark first differences: $-9; -15; -21$ \checkmark second difference $= -6$ </p> <p><i>ca</i> <i>an only</i> 2/2</p> | <p>diagram only ok</p> <p>\checkmark first differences $\checkmark -6$</p> | <p>2</p> |
| <p>2.1.2</p> | <p> $T_n = an^2 + bn + c$ $a = \frac{\text{second difference}}{2} = -3 \checkmark$ $3a + b = -9$ $3(-3) + b = -9$ $b = 0 \checkmark$ $a + b + c = 5$ $-3 + 0 + c = 5$ $c = 8 \checkmark$ $T_n = -3n^2 + 8$ </p> <p><i>x ok</i> <i>an only</i> 4/4</p> <p>OR/OF</p> <p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 5 + (n-1)(-9) + \frac{(n-1)(n-2)(-6)}{2}$ $= 5 - 9n + 9 - 3n^2 + 9n - 6$ $T_n = -3n^2 + 8$ </p> | <p>$\checkmark a = -3$</p> <p>$\checkmark b = 0$</p> <p>$\checkmark c = 8$</p> <p>$\checkmark T_n = -3n^2 + 8$</p> <p>OR/OF</p> <p> $\checkmark a = -3$ $\checkmark b = 0$ $\checkmark c = 8$ $\checkmark T_n = -3n^2 + 8$ </p> | <p>(2)</p> <p>4</p> |
| <p>2.1.3</p> | <p> $-3n^2 + 8 = -25\ 939 \checkmark$ $-3n^2 = -25947$ $n^2 = 8649 \checkmark$ $n = -93 \text{ or } n = 93$ </p> <p>The <u>93rd</u> term has a value of $-25\ 939$</p> <p><i>In quadratic</i> <i>n dec -25 939 not</i> <i>in sequence</i></p> <p><i>an only</i> <i>evident no working</i> 3/3 1/3</p> | <p>$\checkmark T_n = -25\ 939$</p> <p>$\checkmark n^2 = 8649$</p> <p>$\checkmark$ answer</p> | <p>(4)</p> <p>5</p> |

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|--------------|--|--|
| <p>2.2.1</p> | <p>$2k-7; k+8$ and $2k-1$ $k+8-(2k-7)=2k-1-(k+8)$ ✓ even if () missing method $-k+15=k-9$ $2k=24$ $k=12$ ✓ $2k-7; k+8$ and $2k-1$ ✓ $(17), 20; 23, \dots$ $d=3$ ✓ $T_{15} = 17+14(3)$ $= 59$ ✓ → ans only 1/5</p> | <p>✓ $k+8-(2k-7)=2k-1-(k+8)$ $k=12$ ✓17 ✓$d=3$ ✓$T_{15} = 59$</p> |
| <p>2.2.2</p> | <p>Sequence is $17; 20; 23; 26; 29; 32, \dots$ Every alternate term of the sequence will be even / Elke tweede term van die ry sal ewe wees $20+26+32+ \dots$ $S_{30} = \frac{30}{2}[2(20)+(29)(6)]$ ✓✓✓ (A) $= 15[40+174]$ $= 3210$ ✓ OR/OF $T_{30} = 20+29(6)$ $= 194$ $S_{30} = \frac{30}{2}(20+194)$ $= 3210$ • original o/e • odd o/e • $S_{60, orig} - S_{30, odd}$ • answer only 1/4</p> | <p>✓ $20+26+32+ \dots$ ✓ $a=20 d=6$ ✓ subst into correct formula ✓ answer (4) ✓ $a=20 d=6$ ✓ $T_{30} = 194$ ✓ $S_{30} = \frac{30}{2}(20+194)$ ✓ answer (4)</p> |

QUESTION/VRAAG 3

| | | |
|------------|---|---|
| <p>3.1</p> | <p>$a+ar=2$ ✓ $a(1+r)=2$ $a = \frac{2}{1+r}$ ✓ OR/OF → $\frac{a}{1-r} - 2 = \frac{1}{4}$ $4a-8(1-r)=1-r$ $4a-8+8r=1-r$ $4a=9-9r$ $a = \frac{9-9r}{4}$</p> | <p>✓ $a+ar=2$ ✓ $a = \frac{2}{1+r}$ ✓ $\frac{a}{1-r} - 2 = \frac{1}{4}$ ✓ $a = \frac{9-9r}{4}$</p> |
|------------|---|---|

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08

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[18]

2

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| | <p>OR/OF</p> $S_n = \frac{a(r^n - 1)}{r - 1}$ $2 = \frac{a(r^2 - 1)}{r - 1}$ $2 = \frac{a(r - 1)(r + 1)}{r - 1}$ $2 = a(r + 1)$ $a = \frac{2}{r + 1}$ <p>OR/OF</p> $\frac{ar^2}{1 - r} = \frac{1}{4}$ $a = \frac{1 - r}{4r^2}$ <p style="text-align: center;"><i>S_∞ = $\frac{T_2}{1 - r}$ → "a"</i></p> | <p>OR/OF</p> $\checkmark 2 = \frac{a(r^2 - 1)}{r - 1}$ $\checkmark a = \frac{2}{1 + r}$ <p style="text-align: right;">(2)</p> <p>OR/OF</p> $\checkmark \frac{ar^2}{1 - r} = \frac{1}{4}$ $\checkmark a = \frac{1 - r}{4r^2}$ <p style="text-align: right;">(2)</p> |
|--|--|--|

| | | |
|------------|---|---|
| <p>3.2</p> | <p>$S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = \frac{1}{4}$ b/d o/b</p> $S_{\infty} = 2 + \frac{1}{4} \checkmark$ $\frac{a}{1 - r} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1 - r} = \frac{9}{4}$ $\checkmark \left(\frac{2}{1 + r}\right) \times \left(\frac{1}{1 - r}\right) = \frac{9}{4}$ $\frac{2}{1 - r^2} = \frac{9}{4}$ $8 = 9 - 9r^2$ $9r^2 = 1 \checkmark \quad a, r^2 - 1 = 0$ $r = \frac{1}{3} \checkmark \quad r \neq -\frac{1}{3}$ $a = \frac{3}{2} \checkmark$ <p style="text-align: center;">→</p> <p>OR/OF</p> | $\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1 - r} = \frac{9}{4} \quad \frac{2}{4}$ <p>✓ substitution of a into the correct formula</p> $\checkmark 9r^2 = 1$ $\checkmark r = \frac{1}{3}$ $\checkmark a = \frac{3}{2}$ <p style="text-align: right;">(6)</p> <p>OR/OF</p> |
|------------|---|---|

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|---|---|
| $S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $4a = 9 - 9r$ $r = \frac{9-4a}{9}$ $a + a\left(\frac{9-4a}{9}\right) = 2$ $9a + 9a - 4a^2 = 18$ $2a^2 - 9a + 9 = 0$ $(a-3)(2a-3) = 0$ $a = \frac{3}{2} \text{ or } a = 3$ $r = \frac{1}{3} \text{ or } r = -\frac{1}{3}$ <p style="text-align: center;">N/A</p> | $\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ $\checkmark r = \frac{9-4a}{9}$ <p>\checkmark substitution of a into the correct formula</p> $\checkmark a = \frac{3}{2}$ $\checkmark r = \frac{1}{3}$ <p style="text-align: right;">(6)</p> |
| <p>OR/OF</p> $r = \frac{2-a}{a}$ <p>T_3 "a"</p> $\frac{ar^2}{1-r} = \frac{1}{4}$ $4ar^2 = 1-r$ $4a\left(\frac{2-a}{a}\right)^2 = 1 - \frac{2-a}{a}$ $16 - 16a + 4a^2 = 2a + 2$ $2a^2 - 9a + 9 = 0$ $(2a-3)(a-3) = 0$ $a = \frac{3}{2} \quad a \neq 3$ $r = \frac{1}{3} \quad r \neq -\frac{1}{3}$ | <p>OR/OF</p> $\checkmark r = \frac{2-a}{a}$ $\checkmark \frac{ar^2}{1-r} = \frac{1}{4}$ <p>\checkmark substitution of a</p> $\checkmark (2a-3)(a-3) = 0$ $\checkmark a = \frac{3}{2}$ $\checkmark r = \frac{1}{3}$ <p style="text-align: right;">(6)</p> |
| <p>OR/OF</p> | <p>OR/OF</p> |

| | |
|---|---|
| $S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $\left(\frac{1-r}{4r^2}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$ $\frac{1}{4r^2} = \frac{9}{4}$ $4 = 36r^2$ $9r^2 = 1$ $r = \frac{1}{3}$ $a = \frac{3}{2}$ | $\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ $\checkmark \text{substitution of } a$ $\checkmark 9r^2 = 1$ $\checkmark r = \frac{1}{3}$ $\checkmark a = \frac{3}{2}$ |
| | (6) |
| | [8] |

23

QUESTION/VRAAG 4

| | |
|--|--|
| <p>4.1</p> $f(x) = -ax^2 + bx + 6$ $f'(x) = -2ax + b \checkmark$ $-2ax + b = 3$ <p>at $x = -1$</p> $2a + b = 3 \checkmark \checkmark \text{A [1]}$ $f(-1) = \frac{7}{2}$ $-a - b + 6 = \frac{7}{2}$ $-2a - 2b + 12 = 7$ $2a + 2b = 5 \quad [2]$ $[2] - [1]$ $b = 2$ $2a + 2 = 3$ $a = \frac{1}{2}$ <p>OR/OF</p> | $\checkmark -2ax + b$ $\checkmark 2a + b = 3$ $\checkmark -a - b + 6 = \frac{7}{2}$ $\checkmark \text{solve simultaneously}$ |
| | (5) |

5

| | | |
|------------|--|---|
| | $f'(x) = -2ax + b$ $3 = 2a + b$ $b = 3 - 2a$ $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ $a + 3 = \frac{7}{2}$ $a = \frac{1}{2}$ $b = 2$ | $\checkmark -2ax + b$ $\checkmark \checkmark 2a + b = 3$ \checkmark $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ $\checkmark \text{ solve simultaneously}$ <p style="text-align: right;">(5)</p> |
| <p>4.2</p> | $f(x) = -\frac{1}{2}x^2 + 2x + 6$ <p>x-intercepts:</p> $-\frac{1}{2}x^2 + 2x + 6 = 0 \checkmark$ $-x^2 + 4x + 12 = 0$ $x^2 - 4x - 12 = 0$ $(x - 6)(x + 2) = 0$ <p style="text-align: center;"> $(-2; 0)$ $(6; 0)$ </p> | $\checkmark -\frac{1}{2}x^2 + 2x + 6 = 0$ $\checkmark (-2; 0)$ $\checkmark (6; 0)$ <p style="text-align: right;">(3)</p> |

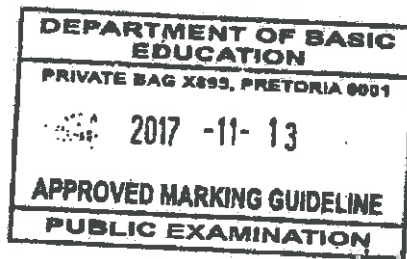
3

$x = -2$ or 6
 must use given a and b

$$\frac{1}{2}x^2 + 2x + 6 = 0 \checkmark$$

no soln \checkmark

2/3 max



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| | | |
|--------------------|--|---|
| <p>4.3</p> | <p>$f(x) = -\frac{1}{2}x^2 + 2x + 6$ (CA incorrect a + b)</p> <p>$f'(x) = 0$ or $x = -\frac{b}{2a}$ or $x = \frac{-2+6}{2}$</p> <p>$-x+2=0$ $x = -\frac{2}{2 \cdot (-\frac{1}{2})}$ $x = 2$</p> <p>$x = 2$ ✓✓ $x = 2$</p> <p>$y = -\frac{1}{2}(2)^2 + 2(2) + 6$ $= -2 + 4 + 6$ $= 8$ ✓ <u>TP (2; 8)</u> →</p> <p>OR/OF</p> <p>$y = -\frac{1}{2}(x^2 - 4x - 12)$ $= -\frac{1}{2}[(x-2)^2 - 4 - 12]$ $= -\frac{1}{2}(x-2)^2 + 8$ <u>TP (2; 8)</u></p> <p>(2; 8)</p> | <p>✓ $-x+2 / -\frac{2}{2 \cdot (-\frac{1}{2})} /$ $\frac{-2+6}{2}$</p> <p>✓ $x = 2$</p> <p>✓ $y = 8$</p> <p>OR/OF</p> <p>✓ $-\frac{1}{2}(x-2)^2 + 8$</p> <p>✓ $x = 2$ ✓ $y = 8$</p> <p>(3)</p> |
| <p>4.4 4.6</p> | <p>(2; 8)</p> <p>(0; 6)</p> <p>(-2; 0)</p> <p>(-1; 0)</p> <p>(0; -1)</p> <p>(6; 0)</p> <p>shape ✓ x ✓ y ✓ bp ✓</p> <p>x int ✓ y int ✓</p> | <p>4.4: f: ✓ shape ✓ x- intercepts ✓ y- intercept ✓ (2; 8)</p> <p>(4)</p> <p>4.6: g: ✓ x- intercept • must be str line ✓ y- intercept</p> <p>(2)</p> |
| <p>4.5</p> | <p><u>$0 < x < 4$ or (0; 4)</u> ✓✓</p> <p>$x < 4 \frac{1}{2}$ $x > 0 \frac{2}{3}$</p> | <p>✓ 4 A ✓✓ $0 < x < 4$ (3)</p> |
| <p>4.7</p> | <p><u>$x \leq -2$ or $-1 \leq x \leq 6$</u> ✓✓</p> <p>OR/OF</p> <p>$(-\infty; -2]$ or $[-1; 6]$</p> <p>• CA from their graph • $< \frac{2}{3}$ • no penalty for and</p> | <p>A ✓ $x \leq -2$ A ✓ $-1 \leq x \leq 6$</p> <p>(3) [23]</p> |

3

4
2

3

3

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QUESTION/VRAAG 5

| | | |
|------------|---|--|
| <p>5.1</p> | <p>$y \in \mathbb{R}; y \neq -1$ ✓✓ OR/OF $y < -1$ or $y > -1$ OR/OF $y \in (-\infty; -1)$ or $y \in (-1; \infty)$ OR/OF $\mathbb{R} - \{-1\}$</p> <p><i>Handwritten:</i> $y \neq -1$ ✓✓ 2/2 $y \in \mathbb{R}$ ✓ 1/2 and ; x 1/2 $y \in \mathbb{R}; \dots$ 0/2</p> | <p>✓✓ answer (2)</p> |
| <p>5.2</p> | <p>$D(2; -1)$ $g(x) = \frac{2}{x-2} - 1$ ✓✓</p> | <p>✓ $D(2; -1)$ $\frac{2}{x-2} - 1$ (2)</p> |
| <p>5.3</p> | <p>$f(x) = \log_3 x$ $\log_3 t = 1$ ✓ $t = 3$ ✓ <i>ans only</i> 3/3 $x = 3$ 3/3</p> <p>OR/OF</p> <p>$A(t; 1)$ $g(x) = \frac{2}{x-2} - 1$ $1 = \frac{2}{t-2} - 1$ $2 = \frac{2}{t-2}$ $2t - 4 = 2$ $t = 3$</p> | <p>✓ correct substitution of A ✓✓ $t = 3$ (3)</p> |
| <p>5.4</p> | <p>$x = \log_3 y$ ✓ $y = 3^x$ ✓ <i>answ only</i> 2/2</p> | <p>✓ interchange x and y $y = 3^x$ (2)</p> |
| <p>5.5</p> | <p>$3^x < 3^1$ ✓ $x < 1$ ✓ OR/OF $3^x < 3^1$ $x \in (-\infty; 1)$</p> <p><i>answ only</i> 2/2</p> | <p>✓ $3^x < 3^1$ $x < 1$ (2) ✓ $3^x < 3^1$ $x \in (-\infty; 1)$ (2)</p> |
| <p>5.6</p> | <p>Equation of the axis of symmetry: $y = -x + 1$ ✓✓ x-intercept of the axis of symmetry is at $x = 1$ f has an x-intercept at B(1 ; 0) which is the same as the x-intercept of the axis of symmetry Point of intersection: $B(1; 0)$ ✓ <i>loads or B</i> OR/OF <i>answ only</i> 1/3 Since BE = ED = 1 and D lies on the axis of symmetry and the gradient of the axis of symmetry is -1, B will also lie on the axis of symmetry. But B also lies on f. Therefore B(1 ; 0) is the point of intersection between f and the axis of symmetry with a negative gradient. <i>Omdat BE = ED = 1 en D op die simmetrie-as lê en die simmetrie-as se gradiënt -1 is, sal B ook op die simmetrie-as lê. Maar B lê ook op f. Dus is B(1 ; 0) die snypunt van f en die simmetrie-as met negatiewe gradiënt.</i></p> | <p>✓✓ equation of axis of symmetry ✓ B or (1 ; 0) OR/OF ✓✓ BE = ED = 1 A ✓ B or (1 ; 0) (3) [14]</p> |

14

2
2
3
2
3

Handwritten signatures

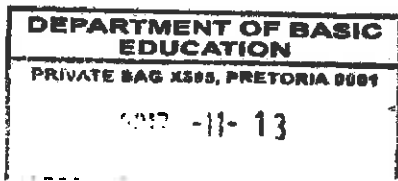
| | | |
|--|---|--|
| | <p>Total amount paid in first year = $R\ 5\ 536,95 \times 12$ $= R\ 66\ 443,40$ ✓ <i>CA</i></p> <p>Balance on loan after 1 year = P of remaining installments</p> $P = \frac{x \left[1 - (1+i)^{-n} \right]}{i}$ <p>✓ <i>Sub</i> $5\ 536,95 \left[1 - \left(1 + \frac{0,11}{12} \right)^{-42} \right]$ ✓</p> $= \frac{0,11}{12}$ <p>$= R\ 192\ 296,20$ ✓</p> <p>Amount paid off in the first year: $R\ 235\ 000 - R\ 192\ 296,20 = R\ 42\ 703,80$ ✓</p> <p>Amount of interest = $R\ 66\ 443,40 - R\ 42\ 703,80$ $= R\ 23\ 739,60$ ✓</p> <p>OR/OF</p> $P = \frac{5536,95 \left[1 - \left(1 + \frac{0,11}{12} \right)^{-12} \right]}{\frac{0,11}{12}}$ <p>$= R\ 62\ 648,18$</p> <p>$235\ 000 - 62\ 648,18 = R\ 172\ 351,82$</p> <p>After 12 months, money owed on house is</p> $172\ 351,82 \left(1 + \frac{0,11}{12} \right)^{12}$ <p>$= 192\ 296,17$</p> <p>Amount paid after 12 months is $5\ 536,95 \times 12 = R\ 66\ 443,40$</p> <p>Amount of interest paid: $R\ 66\ 443,40 - (235\ 000 - 192\ 296,17)$ $= R\ 23\ 739,57$</p> | <p>✓ R 66 443,40</p> <p>✓ $n = -42$</p> <p>✓ substitution into correct formula</p> <p>✓ R 192 296,20</p> <p>✓ R 42 703,80</p> <p>✓ R 23 739,60</p> <p>OR/OF</p> <p>(6)</p> <p>6</p> <p>✓ R 62 648,18</p> <p>✓ R 172 351,82</p> <p>✓ R 192 296,17</p> <p>✓ R 66 443,40</p> <p>✓ 235 000 – 192 296,17</p> <p>✓ R 23 739,57</p> <p>(6) [15]</p> |
|--|---|--|

DEPARTMENT OF BASIC EDUCATION
 PRIVATE BAG X895, PRETORIA 0001
 2017 -11- 13
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

[Handwritten signature]

QUESTION/VRAAG 6

| | | |
|--------------|--|---|
| <p>6.1</p> | $A = P(1+i)^n$ $12\ 146,72 = 10\ 000 \left(1 + \frac{r}{12}\right)^{36}$ $\left(1 + \frac{r}{12}\right)^{36} = 1,214672$ $1 + \frac{r}{12} = \sqrt[36]{1,214672}$ $= 1,005416$ $\frac{r}{12} = 0,005416$ $r = 0,06500$ $r = 6,5\%$ | <p>✓ $\frac{r}{12} \rightarrow$ or $\frac{r}{1200}$ x by 12/12 each</p> <p>✓ $n = 36$</p> <p>✓ correct substitution into formula</p> <p>✓ $1 + \frac{r}{12} = \sqrt[36]{1,214672}$</p> <p>✓ 6,5%</p> |
| <p>6.2.1</p> | $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $235\ 000 = \frac{x \left[1 - \left(1 + \frac{0,11}{12}\right)^{-54}\right]}{\frac{0,11}{12}}$ $x = \frac{235\ 000 \times \frac{0,11}{12}}{\left[1 - \left(1 + \frac{0,11}{12}\right)^{-54}\right]}$ $= R5\ 536,95$ <p>His monthly instalment is R 5 536,95</p> | <p>✓ $i = \frac{0,11}{12}$</p> <p>✓ $n = 54$</p> <p>✓ correct substitution in P</p> <p>✓ answer</p> |
| <p>6.2.2</p> | <p>Amount paid for the year : $(5\ 536,95 \times 12) = R66\ 443,40$</p> $\text{Balance} = 235\ 000 \left(1 + \frac{0,11}{12}\right)^{12} - \frac{5\ 536,95 \left[\left(1 + \frac{0,11}{12}\right)^{12} - 1\right]}{\frac{0,11}{12}}$ $= 192\ 296,17$ $\text{Interest} = (5\ 536,95 \times 12) - (235\ 000 - 192\ 296,17)$ $= 66\ 443,40 - 42\ 703,83$ $= 23\ 739,57$ <p>OR/OF</p> | <p>✓ R66 443,40</p> <p>✓ $235\ 000 \left(1 + \frac{0,11}{12}\right)^{12}$</p> <p>✓ $\frac{5\ 536,95 \left[\left(1 + \frac{0,11}{12}\right)^{12} - 1\right]}{\frac{0,11}{12}}$</p> <p>✓ R192 296,17</p> <p>✓ R42 703,83</p> <p>✓ R23 739,57</p> <p>OR/OF</p> |



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15

5

4

OB 7 235 000
b/d

12

QUESTION/VRAAG 7

lim (x+2) - 1
 h → 0
 no penalty
 -x - x ok
 num has term
 h, bd

multiple
 answer only
 0/6

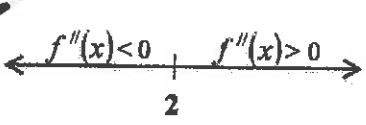
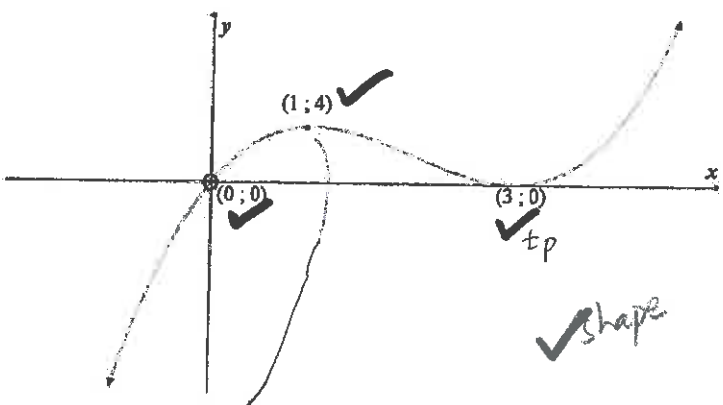
CA were 1/2
 linear
 Dx (6x-4)
 xN

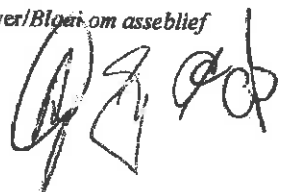
| | | |
|--------------|--|---|
| <p>7.1</p> | $f(x+h) = 2(x+h)^2 - (x+h)$ $= 2(x^2 + 2xh + h^2) - x - h$ $= 2x^2 + 4xh + 2h^2 - x - h \checkmark$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x$ $= 4xh + 2h^2 - h \checkmark$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \checkmark$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - h}{h} \checkmark$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 1)}{h} \checkmark$ $= \lim_{h \rightarrow 0} (4x + 2h - 1) \checkmark$ $= 4x - 1 \checkmark$ <p>OR/OF</p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \checkmark$ $= \lim_{h \rightarrow 0} \frac{2(x+h)^2 - (x+h) - (2x^2 - x)}{h} \checkmark$ $= \lim_{h \rightarrow 0} \frac{2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x}{h} \checkmark$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - h}{h} \checkmark$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 1)}{h} \checkmark$ $= \lim_{h \rightarrow 0} (4x + 2h - 1) \checkmark$ $= 4x - 1 \checkmark$ <p>sub ok them f mark implied Sub</p> | $\checkmark 2x^2 + 4xh + 2h^2 - x - h$ $\checkmark 4xh + 2h^2 - h$ $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \text{subst. into formula}$ $\checkmark \lim_{h \rightarrow 0} (4x + 2h - 1)$ $\checkmark 4x - 1$ <p>OR/OF</p> $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \text{subst. into formula}$ $\checkmark 2x^2 + 4xh + 2h^2 - x - h$ $\checkmark 4xh + 2h^2 - h$ $\checkmark \lim_{h \rightarrow 0} (4x + 2h - 1)$ <p>if () missing no penalty</p> $\checkmark 4x - 1$ |
| <p>7.2.1</p> | $D_x[(x+1)(3x-7)]$ $= D_x(3x^2 - 4x - 7) \checkmark$ $= 6x - 4 \checkmark$ <p>• answer only 2/2 • Dx = 6x - 4 ok • N if not in 7.1</p> | $\checkmark 3x^2 - 4x - 7$ $\checkmark 6x - 4$ |
| <p>7.2.2</p> | $y = \sqrt{x^3} - \frac{5}{x} + \frac{1}{2}\pi$ $y = x^{\frac{3}{2}} - 5x^{-1} + \frac{1}{2}\pi$ $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 5x^{-2}$ <p>fraction for CA negative for CA -5 x (-1) CA</p> | $\checkmark x^{\frac{3}{2}} - 5x^{-1}$ $\checkmark \frac{3}{2}x^{\frac{1}{2}}$ $\checkmark + 5x^{-2}$ <p>derivative of $\frac{1}{2}\pi$ is 0</p> |

6
 formula
 x out f(x+h)
 sub ... - (...)
 simplify by
 2x^2 + x
 con factor and
 cancel h's
 answer

15

QUESTION/VRAAG 8

| | | | |
|--------------|---|--|----------|
| <p>8.1</p> | <p> $f(x) = x^3 - 6x^2 + 9x$ ✓ $f'(x) = 3x^2 - 12x + 9$ ✓ $f''(x) = 6x - 12 = 0$ ✓✓ $x = 2$ $f''(0) = 6(0) - 12 = -12$ ✓ $f''(3) = 6(3) - 12 = 6$ Point of inflection at $x = 2$ </p>  | <p> $x^3 - 6x^2 + 9x$ ✓ $3x^2 - 12x + 9$ ✓ $6x - 12$ ✓ $6x - 12 = 0$ ✓ ✓ explanation (5) </p> | <p>5</p> |
| <p>8.2</p> |  | <p> PTO spec cases + marks ✓ shape at ✓ (0; 0) fn must be increasing through origin ✓ (3; 0) as TP ✓ (1; 4) </p> | <p>4</p> |
| <p>8.3</p> | <p> f concave up for $x > 2$ $y = -f(x)$ will be concave down for $x > 2$ ✓✓ </p> | <p> $x \in (2; \infty)$ $x > 2$ ✓✓ </p> | <p>2</p> |
| <p>8.4.1</p> | <p> $(3; 7)$ ✓ CA $x + 2$ $y + 3$ ✓ </p> | <p> $\checkmark 3$ $\checkmark 7$ </p> | <p>2</p> |
| <p>8.4.2</p> | <p> Do not agree with Claire as her statement is incorrect. Between $x = 1$ and $x = 3$ the graph of f is decreasing. Therefore at $x = 2$ the gradient will have a negative value. Stem nie saam met Claire nie, want haar stelling in verkeerd. Die grafiek van f is dalend/afnemend tussen $x = 1$ en $x = 3$. By $x = 2$ moet die gradiënt dus 'n negatiewe waarde hê. OR/OF $f'(2) = 3(2)^2 - 12(2) + 9 = -3$ $\neq 1$ ← not required ✓ NO ✓ R "NO" only 1/2 </p> | <p> \checkmark no ✓ justification $f'(2) = -3$ ✓ No or $\neq 1$ ✓ (2) </p> | <p>2</p> |



07

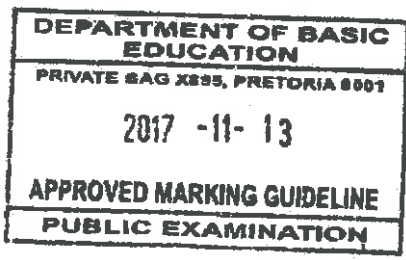
QUESTION/VRAAG 9

| | |
|--|--|
| <p> $y = x^2 + 2$ $P(x; x^2 + 2)$ $B(0; 3)$ $PB^2 = (x-0)^2 + (x^2 + 2 - 3)^2$ ✓ $x^2 + (x^2 - 1)^2$ $= x^2 + x^4 - 2x^2 + 1$ $= x^4 - x^2 + 1$ ✓ PB will be a minimum if PB^2 is a minimum $\frac{d(PB^2)}{dx} = 4x^3 - 2x$ $4x^3 - 2x = 0$ ✓ $x(2x^2 - 1) = 0$ $x = 0$ or $x^2 = \frac{1}{2}$ $x = \frac{1}{\sqrt{2}}$ ✓ <hr style="border: 1px dashed red; width: 10%; margin: 5px auto;"/> $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ ✓ $= \frac{1}{4} - \frac{1}{2} + 1$ $= \frac{3}{4}$ $PB = \frac{\sqrt{3}}{2} = 0,87$ ✓ <i>only CA 46</i> \uparrow <i>PB < 1</i> OK </p> | <p> $\checkmark (x-0)^2 + (x^2 + 2 - 3)^2$ $\checkmark x^4 - x^2 + 1$ $\checkmark 4x^3 - 2x$ $\checkmark \frac{d(PB^2)}{dx} = 0$ $\checkmark x = \frac{1}{\sqrt{2}}$ $\checkmark PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ \checkmark answer </p> |
| <p>OR/OF</p> | <p>OR/OF</p> |

7

$y' = 2x$
 $y = -\frac{1}{2}x + 3$
 \equiv
 $-\frac{1}{2}x$

• trial and error $x = 0,70$
 2 below } 2 above 4/7
 0,87
 (d)



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| | | |
|--|---|--|
| <p>$\frac{x^2-1}{x} = -1$</p> | <p>Gradient of tangent to curve = $2x$ ✓</p> <p>Gradient of line joining B and the curve = $\frac{x^2+2-3}{x-0}$ $= \frac{x^2-1}{x}$ ✓</p> <p>Shortest distance will be where tangent to curve is perpendicular to the line joining P and the curve.</p> $\frac{x^2-1}{x} = -\frac{1}{2x}$ $2x(x^2-1) = -x$ $2x^3 - 2x = 0$ $x(2x^2 - 1) = 0$ $x = 0 \text{ or } x^2 = \frac{1}{2}$ $x = \frac{1}{\sqrt{2}}$ $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $= \frac{1}{4} - \frac{1}{2} + 1$ $= \frac{3}{4}$ $PB = \frac{\sqrt{3}}{2} = 0,87$ <p>OR/OF</p> <p>$P(k; k^2 + 2)$ and $B(0; 3)$</p> <p>BP ⊥ tangent passing through $y = x^2 + 2$ at P.</p> $m_{\text{tangent at P}} = 2k$ $m_{BP} = -\frac{1}{2k}$ <p>Equation of BP: $y = \left(-\frac{1}{2k}\right)x + 3$</p> $y_P = \left(-\frac{1}{2k}\right)(k) + 3 = 2,5$ $\Rightarrow k^2 + 2 = 2,5 \text{ and so } k = \sqrt{0,5} \text{ and } P(\sqrt{0,5}; 2,5)$ $BP = \sqrt{(\sqrt{0,5} - 0)^2 + (2,5 - 3)^2} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2} = 0,87$ | <p>✓ = $2x$</p> <p>$(x, x^2 + 2)$ $(0, 3)$</p> <p>✓ = $\frac{x^2-1}{x}$</p> <p>✓ $\frac{x^2-1}{x} = -\frac{1}{2x}$</p> <p>✓ $2x^3 - 2x = 0$</p> <p>✓ $x = \frac{1}{\sqrt{2}}$</p> <p>✓ $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$</p> <p>✓ answer</p> <p>OR/OF</p> <p>✓ $P(k; k^2 + 2)$</p> <p>✓ $m_{\text{tangent at P}} = 2k$</p> <p>✓ $m_{BP} = -\frac{1}{2k}$</p> <p>✓ $y = \left(-\frac{1}{2k}\right)x + 3$</p> <p>✓ value of y at P</p> <p>✓ value of k</p> <p>✓ answer</p> <p style="text-align: right;">17</p> |
|--|---|--|

08

QUESTION/VRAAG 10

10.1

$n(S) = 100$

8 values need to be placed in correct position:
 2 or 3 correct: 1 mark
 4 or 5 correct: 2 marks
 6 or 7 correct: 3 marks
 8 correct: 4 marks

10.2 $(49 - x) + x + 8 + 4 + 5 + 2 + (60 - x) + 14 = 100$
 $-x + 142 = 100$
 $x = 42$

10.3 P (use only one application) $= \frac{7+2+18}{100}$
 $= \frac{27}{100}$ or 27%

4

2

2

06

QUESTION/VRAAG 11

11.1 $5 \times 5 \times 10 \times 9 = 2250$

11.2

| No of digits used | Letters | Digits | Total |
|-------------------|--------------|--|---------|
| 1 | 5×5 | 10 | 250 |
| 2 | 5×5 | 10×9 | 2 250 |
| 3 | 5×5 | $10 \times 9 \times 8$ | 18 000 |
| 4 | 5×5 | $10 \times 9 \times 8 \times 7$ | 126 000 |
| 5 | 5×5 | $10 \times 9 \times 8 \times 7 \times 6$ | 756 000 |

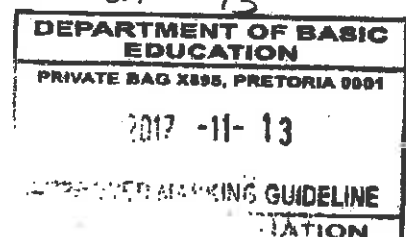
Codes of two letters and five digits will ensure unique numbers for 700 000 clients.

700 000
 25
 = 28 000

$5,5 \times 9,8,7,6,5,4 = 1\,512\,000$

TOTAL/TOTAAL: 150

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ignore 25 b/d

378 000 (5)

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