



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(Second paper)

NQF LEVEL 4

25 February 2020

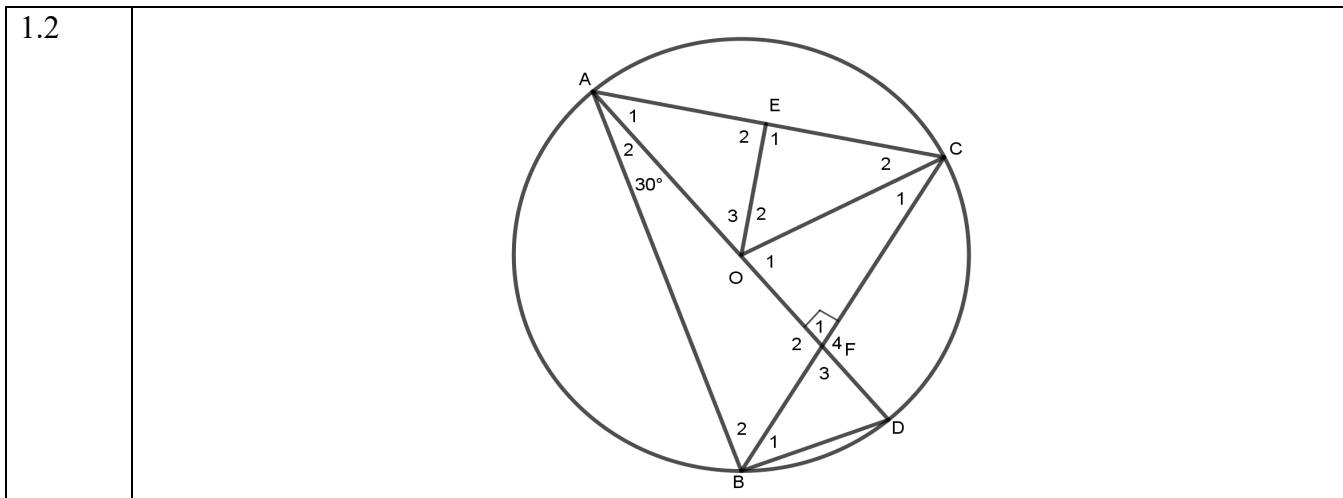
This marking guideline consists of 10 pages.

✓ = 1 mark √ = ½ mark

- Accept all mathematically valid solutions.
- Consistent accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the first attempt.
- If a candidate does a question, crosses it out and does not redo it, mark the deleted attempt.

MARKING LEGEND	
SYMBOL	EXPLANATION OF SYMBOL
A	Accuracy
M	Method
CA	Continuous accuracy (follow-up)
B/D	Breakdown
S	Statement
R	Reason
S/R	Statement and reason

QUESTION 1				
1.1	SOLUTION		EXPLANATION	
	1.1.1	$\widehat{ABC} = 180^\circ - 80^\circ - 20^\circ$ $= 80^\circ$ $x = 80^\circ - 50^\circ$ $= 30^\circ \checkmark$	1 for answer	(A) (1)
	1.1.2	$y = 50^\circ + 20^\circ \dots \text{ext. } \angle \text{ of } \triangle ABE$ $y = 70^\circ \checkmark$	1 for answer	(A) (1)
	1.1.3	Isosceles triangle ✓ ... $\widehat{ABC} = 80^\circ = \widehat{B} \checkmark$	1 for answer, 1 for reason	(A) (2)



1.2.1	(a)	$\widehat{B}_1 + \widehat{B}_2 = 90^\circ \checkmark$... subtended by dia. $\widehat{D} + 90^\circ + 30^\circ = 180^\circ$ $\widehat{D} = 60^\circ \checkmark$	1 for 90° (CA) 1 for answer (CA)	
	(b)	$\widehat{D} = \widehat{C}_1 + \widehat{C}_2 = 60^\circ \checkmark$... same segment $\widehat{A}_1 + 60^\circ + 90^\circ = 180^\circ$... angle sum ΔAFC $\widehat{A}_1 = 30^\circ \checkmark$	1 for S (A) 1 for answer (A)	
	(c)	$\widehat{O}_1 = 2\widehat{A}_1 = 60^\circ \checkmark$... angle at centre thm. $\widehat{C}_1 + 60^\circ + 90^\circ = 180^\circ$... ΔCOF $\widehat{C}_1 = 30^\circ \checkmark$	1 for S (A) 1 for answer (A)	
			(3 × 2)	(6)
1.2.2		$\widehat{B}_2 = 60^\circ$... ΔABF $\widehat{B}_2 = \widehat{D} \checkmark$... each = 60° AB is tangent ... conv. tan chord them \checkmark	1 for S (A) 1 for reason (A)	(2)
1.2.3		AE = CE ... given $\widehat{E}_1 = 90^\circ \checkmark$... mid pt of chord AC \checkmark $\widehat{F}_1 = 90^\circ$... given $\widehat{F}_1 + \widehat{E}_1 = 180^\circ \checkmark$ \therefore CEOF is a cyclic quad because opp. \angle 's of cyclic quad supplementary \checkmark	1 for S, 1 for R (A) 1 for S (A) 1 for reason (A)	(4)

1.3	1.3.1	$r^2 = (-2)^2 + 3^2 = 13 \checkmark$ $\therefore x^2 + y^2 = 13 \checkmark$	$\frac{1}{2}$ for S (A) $\frac{1}{2}$ for answer (A)	(1)
	1.3.2	C(-3; -4) $r^2 = (-3 - 0)^2 + (0 - 4)^2 = 25 \checkmark$ C lies outside the \odot because $25 > 13 \checkmark$	1 for S (A) 1 for R (A)	(2)

1.3.3	$AB = 2r \dots \text{diameter} \checkmark$ $AB = 2\sqrt{13} = \sqrt{52} \checkmark$	1 for S/distance formula (A) 1 for either answer (A)	(2)
1.3.4	$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 0}{-2 - 0} = -\frac{3}{2} \checkmark$	1 for answer (A)	(1)
1.3.5	$m_{TANGENT} = -1 \times -\frac{2}{3} = \frac{2}{3} \checkmark$ $(-2; 3): y - 3 = \frac{2}{3}(x + 2) \checkmark$ $y = \frac{2}{3}x + \frac{4}{3} + 3$ $y = \frac{2}{3}x + \frac{13}{3} \checkmark$	1 for answer (CA) 1 for subst. in formula (CA) 1 for answer (CA)	(3)
			[25]

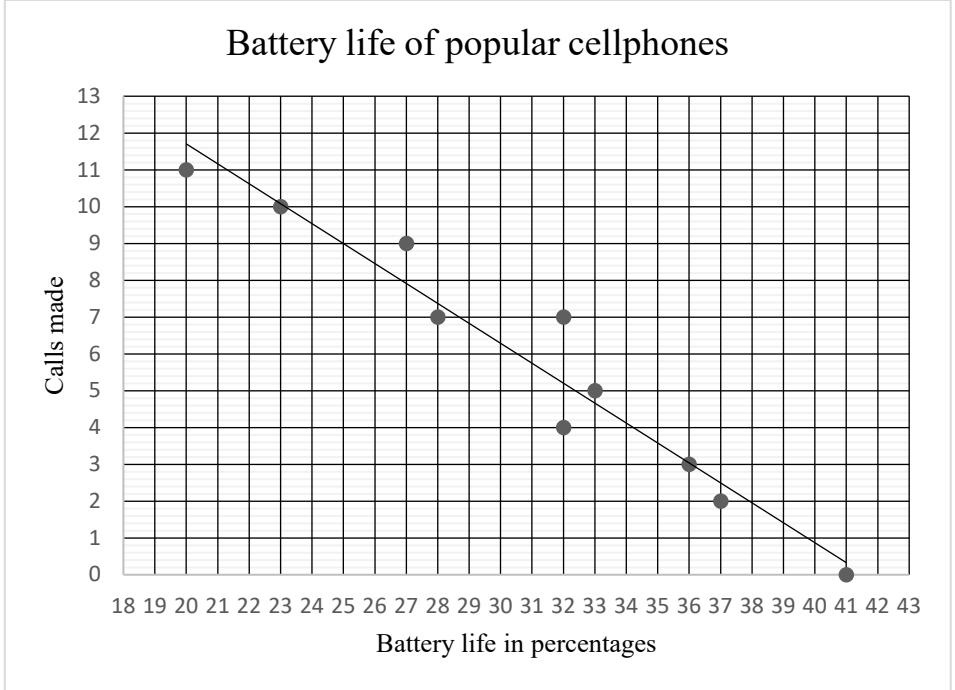
QUESTION 2

2.1	$\cos \theta = 0,726$ $\text{Ref } \angle: \theta = \cos^{-1} 0,726 = 43,4^\circ \checkmark$ $\therefore \theta = 360^\circ - 43,4^\circ = 316,6^\circ \checkmark$	1 for ref angle (A) 1 for answer (A)	(2)
2.2	$\frac{\sin^2 \theta}{\sin(180^\circ - \theta) \times \cos(90^\circ + \theta) + \tan 45^\circ}$ $= \frac{\sin^2 \theta}{\sin \theta \sqrt{\times} (-\sin \theta) \sqrt{\times} + 1 \sqrt{\times}}$ $= \frac{-\sin^2 \theta + 1 \sqrt{\times}}{\sin^2 \theta}$ $= \frac{1 - \sin^2 \theta}{\sin^2 \theta}$ $= \frac{\cos^2 \theta}{\sin^2 \theta} \checkmark$ $= \tan^2 \theta \checkmark$	$\frac{1}{2}$ for each term (A) $\frac{1}{2}$ for simplifying (A) 1 for denominator (A) 1 for answer (A)	(4)
2.3	$2\cos^2 2x - 1 = -\frac{1}{2}$ $\cos 4x \checkmark = -0,5$ $4x = \pm 120^\circ \checkmark + 360^\circ k \checkmark ; k \in \mathbb{Z}$ $x = \pm 30^\circ + 90^\circ k ; k \in \mathbb{Z} \checkmark$ OR $x = 30^\circ + 90^\circ k ; 60^\circ + 90^\circ k ; k \in \mathbb{Z}$	1 for double angle (A) 1 for angle, 1 for 360k (CA) 1 for answer (CA)	(4)

2.4	$\frac{\sin A}{\sin B} - \frac{\cos A}{\cos B} = \frac{2 \sin(A - B)}{\sin 2B}$ $\text{LHS} = \frac{\sin A}{\sin B} - \frac{\cos A}{\cos B}$ $= \frac{\sin A \cos B - \cos A \sin B}{\sin B \cos B} \checkmark$ $= \frac{\sin(A - B)}{\sin B \cos B} \checkmark$ $= \frac{\sin(A - B)}{\sin B \cos B} \times \frac{2}{2}$ $= \frac{2 \sin(A - B)}{2 \sin B \cos B} \checkmark$ $= \frac{2 \sin(A - B)}{\sin 2B} \checkmark = \text{RHS}$	<p>1 for numerator (A) 1 for denominator (A)</p> <p>1 for compound angle (A)</p> <p>1 for setup (A)</p> <p>1 for answer (A)</p>	(5)
2.5	$\frac{\cos(45^\circ - \theta)}{\cos 45^\circ \times \cos \theta} - \tan \theta$ $= \frac{\cos 45^\circ \cos \theta + \sin 45^\circ \sin \theta}{\cos 45^\circ \times \cos \theta} - \frac{\sin \theta}{\cos \theta} \checkmark$ $= \frac{\cos 45^\circ \cos \theta + \sin 45^\circ \sin \theta - \cos 45^\circ \sin \theta}{\cos 45^\circ \times \cos \theta}$ $= \frac{\frac{1}{\sqrt{2}} \cos \theta + \frac{1}{\sqrt{2}} \sin \theta - \frac{1}{\sqrt{2}} \sin \theta}{\frac{1}{\sqrt{2}} \times \cos \theta} \checkmark$ $= \frac{\frac{1}{\sqrt{2}} \cos \theta + \frac{1}{\sqrt{2}} \sin \theta - \frac{1}{\sqrt{2}} \sin \theta}{\frac{1}{\sqrt{2}} \times \cos \theta} \checkmark$ $= \frac{\frac{1}{\sqrt{2}} \cos \theta}{\frac{1}{\sqrt{2}} \times \cos \theta}$ $= 1 \checkmark$	<p>Allocate as indicated All accuracy marks</p>	(5)
2.6	$BC^2 = AC^2 + AB^2 - 2AC \cdot AB \cos 20^\circ$ $BC^2 = 20^2 + 16^2 - 2 \times 20 \times 16 \times \cos 20^\circ \checkmark$ $BC = \sqrt{54,6} = 7,39 \text{m} \checkmark$ $\widehat{DCB} = 70^\circ \checkmark \dots \text{alt. angles}$ $\frac{DB}{BC} = \tan 70^\circ \checkmark$ $DB = 7,39 \tan 70^\circ$ $= 20,3 \text{m} \checkmark$	<p>1 for substitution (A)</p> <p>1 for answer (A)</p> <p>1 for answer (A)</p> <p>1 for ratio (A)</p> <p>1 for answer (CA)</p>	(5)
			[25]

QUESTION 3

3.1
 and
 3.3



Plotting points:

All 10 points correct: 4 marks

7 – 9 points correct: 3 marks

4 – 6 points correct: 2 mark

2 – 3 points correct: 1 mark

(4)

3.3 Line of best fit ✓

(1)

3.2

Internal examinations (x)	Final examinations (y)	x.y	x ²
32	7	224	1 024
20	11	220	400
27	9	243	729
37	2	74	1 369
32	4	128	1 024
28	7	196	784
41	0	0	1 681
23	10	230	529
33	5	165	1 089
36	3	108	1 296
$\Sigma x = 309\checkmark$	$\Sigma y = 58\checkmark$	$\Sigma x.y = 1 588\checkmark$	$\Sigma x^2 = 9 925\checkmark$
$\bar{x} = 30,9\checkmark$	$\bar{y} = 5,8\checkmark$		

Allocate marks as indicated.

$b = \frac{n \sum x \cdot y - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$ $= \frac{10 \times 1\,588 - (309)(58)}{10 \times 9\,925 - (309)^2} \sqrt{}$ $= \frac{15\,880 - 17\,922}{99\,250 - 95\,481}$ $= \frac{-2\,042}{3\,769}$ $b = -0,542\sqrt{}$ $a = \bar{y} - b\bar{x}$ $a = 5,8 - (-0,542)(30,9)$ $a = 22,54\sqrt{}$ $\therefore y = a + bx$ $y = 22,486 + (-0,542)x\sqrt{}$	<p>½ for substitution (A)</p> <p>½ for b-value (A)</p> <p>½ for a-value (A)</p> <p>½ for equation (A)</p>	(5)
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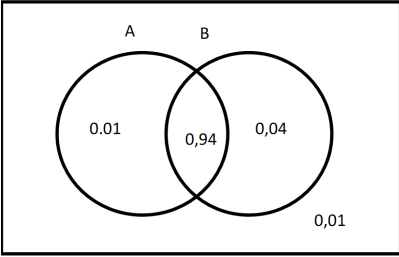
Alternative:

Internal examinations (x)	Final examinations (y)	$(x - \bar{x})(y - \bar{y})$	$(x - \bar{x})^2$
32	7	1,32	1,21
20	11	-56,68	118,81
27	9	-12,48	15,21
37	2	-23,18	37,21
32	4	-1,98	1,21
28	7	-3,48	8,41
41	0	-58,58	102,01
23	10	-33,18	62,41
33	5	-1,68	4,41
36	3	-14,28	26,01
$\sum x = 309$	$\sum y = 58$	$\Sigma(x - \bar{x})(y - \bar{y}) = -204,2\sqrt{}$	$\Sigma(x - \bar{x})^2 = 376,9\sqrt{}$
$\bar{x} = 30,9\sqrt{}$	$\bar{y} = 5,8\sqrt{}$		

Allocate marks as indicated.

	$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$ $b = \frac{-204,12}{376,9} \checkmark$ $= 0,54 \checkmark$ $a = \bar{y} + b\bar{x}$ $a = 5,8 - (-0,542)(30,9)$ $a = 22,54 \checkmark$ $y = a + bx$ $y = 22,54 + (-0,542)x \checkmark$	<p>½ for substitution (A)</p> <p>½ for b-value (A)</p> <p>½ for a-value (A)</p> <p>½ for equation (A)</p>	
3.4	The fewer the calls made, the longer the battery life.	1 for answer (A)	(2)
3.5	$y = 22,54 + (-0,542)x \checkmark$ $y = 22,54 + (-0,542)(31) \checkmark$ $y = 5,738 \checkmark$	Allocate marks as indicated.	(3)
			[15]

QUESTION 4					
4.1	4.1.1	(a)	$P(\text{male}) = \frac{120}{236} \checkmark = 0,51$	As allocated (A)	(1)
		(b)	$P(\text{female and not sterilised}) = \frac{67}{236} \checkmark$ $= 0,28$	As allocated (A)	(1)
	4.1.2		$P(\text{male and sterilised}) = \frac{51}{236}$ $= 0,22 \checkmark$ $\neq 0$ <p>Not mutually exclusive ✓</p>	<p>1 for correct calculation (A)</p> <p>1 for answer (A)</p>	(2)
	4.1.3		$P(\text{male}) \times P(\text{sterilised})$ $= \frac{120}{236} \times \frac{100}{236} \checkmark$ $= 0,22$ $P(\text{male and sterilised}) = \frac{51}{236} \checkmark$ $= 0,22$ <p>∴ P(male) × P(sterilised) = P(male and sterilised) ✓ ∴ independent events correct to 2 decimal places ✓</p>	All accuracy marks as indicated	(3)

4.2	4.2.1		✓✓	2 for Venn diagram	
		$P(A \cup B) = 0,01 + 0,94 + 0,04 \checkmark = 0,99 \checkmark$ <p style="text-align: center;">OR</p> $P(A \cup B) = P(A) + P(B) - P(A \cap B) \checkmark$ $= 0,95 + 0,98 - 0,94 = 0,99 \checkmark$		2 accuracy marks as indicated	(4)
	4.2.2	$P(A \cup B)' \checkmark = 0,01 \text{ or } 1\% \checkmark$ <p style="text-align: center;">OR</p> $P(A \cup B)' = 1 - P(A \cup B) \checkmark = 1 - 0,$ $= 0,01 \checkmark$		2 for correct answer from Venn diagram	(2)
	4.2.3	$P(\text{device B only}) = 0,04 \checkmark \checkmark$		2 for correct answer from Venn diagram	(2)
					[15]

QUESTION 5

5.1	$\text{Price in 2023} = P(1 + i)^4 \checkmark$ $= 22,50(1 + 0,07)^4 \checkmark$ $= R29,493 \checkmark$		(2)	
5.2	<p>Refilwe:</p> $A = P(1 + i \times n) \checkmark$ $= R6\,000(1 + 0,085 \times 5) \checkmark$ $= 6\,000(1,425)$ $= R8\,550 \checkmark$ <p>Johnny:</p> $A = P(1 + i)^n \checkmark$ $A = R6\,000(1 + 0,02)^{20} \checkmark$ $= R8\,915,68 \checkmark$ <p>∴ John will receive a bigger amount. ✓</p>	$\frac{1}{2}$ for formula (A) 1 for substitution (A) 1 for answer (CA)	$\frac{1}{2}$ for formula (A) 1 for substitution (A) 1 for answer (CA) 1 for answer (CA) (6)	
5.3	5.3.1	$A = P(1 - i)^n \checkmark$ $A = 120\,000(1 - 0,09)^5 \checkmark$ $= R74\,883,86 \checkmark$	Allocate according to ticks.	(3)
	5.3.2	$A = P(1 + i)^n \checkmark$ $A = 120\,000(1 + 0,07)^5 \checkmark$ $= R168\,306,21 \checkmark$	Allocate according to ticks.	(3)

5.4	5.4.1	<p>Gross income Income from salary = $R36\ 000 \times 12$ = R432 000 Yearly bonus = R 45 000 One-off incentive bonus = R26 000 TOTAL = R503 000✓</p> <p>Deductions Pension = $R2\ 500 \times 12 = R30\ 000$ UIF = $R360 \times 12 = R4\ 320$ TOTAL = R34 320✓</p> <p>∴ Annual taxable income = Gross income – (pension + UIF) = $R503\ 000 - (R30\ 000 + R4\ 320)$ = R46 8680✓</p>		(2)
	5.4.2	<p>Normal tax = $R100\ 263 + \frac{36}{100}(R468\ 680 - R423\ 300)$ = R116 599,80✓</p> <p>Less rebates and tax credits Primary: $R14\ 067 + R7\ 713 = R21\ 780$✓</p> <p>Medical aid tax credit: $R310 \times 12 = R3\ 720$✓</p> <p>Total tax due = payable tax – (rebates + tax credits) = $R116\ 599,80 - R25\ 500$ = R91 099,80✓</p> <p>Total tax already paid = R 95 000 Due to Barry = tax paid – payable tax = $R95\ 000 - R91\ 099,80$ = R3900,20✓</p>		(4)
				[20]
				TOTAL: 100