higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second paper)
NQF LEVEL 4

23 November 2020

This marking guideline consists of 13 pages.

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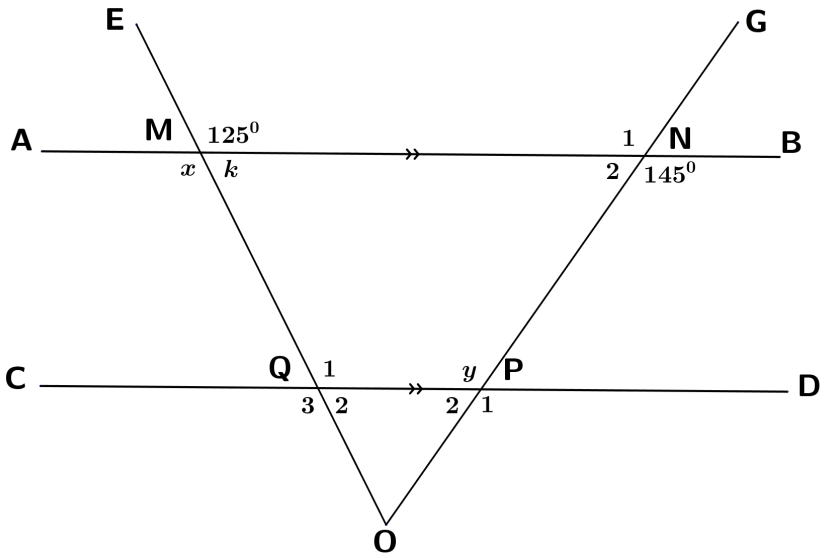
✓ = 1 mark √ = $\frac{1}{2}$ mark

- Accept all mathematically valid solutions.
- Continuous accuracy will apply as a general rule.
- If a candidate answers a question twice and does not delete either, mark the first attempt.
- If a candidate answers 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	Break down
S	Statement
R	Reason
S/R	Statement and reason

QUESTION 1

		SOLUTION	EXPLANATION
			
1.1	1.1.1	$x = 125°$✓	$x = 125°$ (1)
	1.1.2	$y = 145°$ ✓(alternate angles)✓	Answer (1) + R (1)
	1.1.3	$k = 55°$ and $\hat{N}_2 = 35°$✓ $k + \hat{N}_2 = 90°$ $\therefore O = 90°$ (angles of a Δ)✓ $\therefore EF \perp GH$	½ per angle 1 for reason (2)

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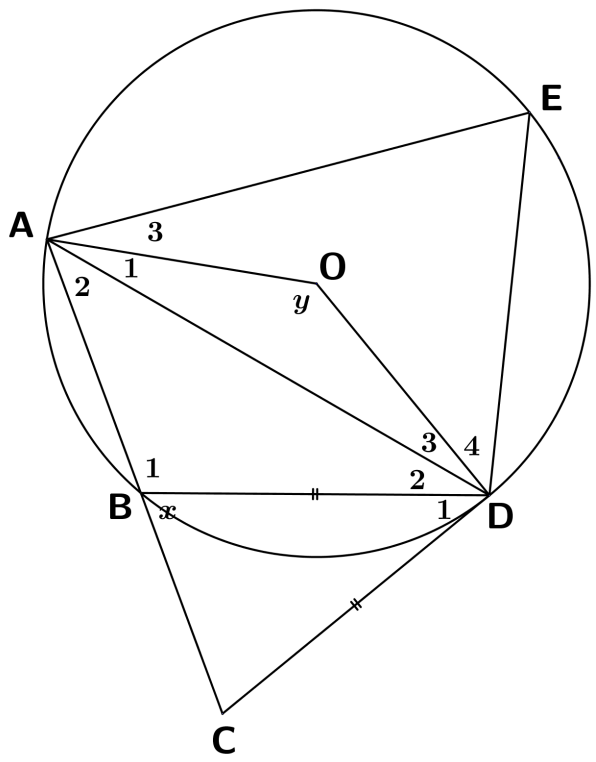
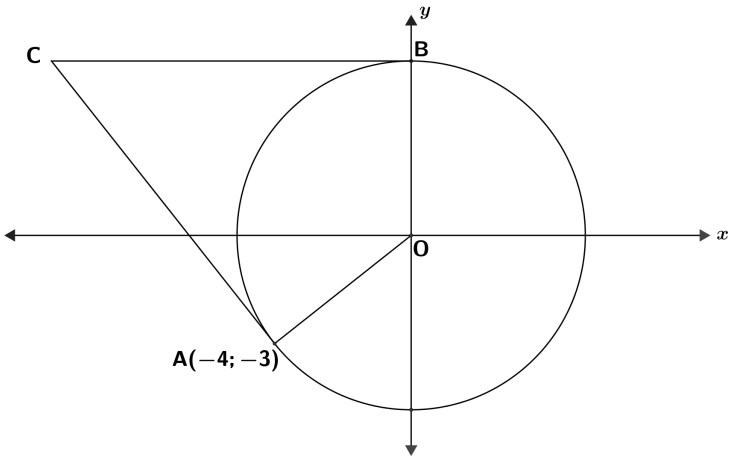
1.2	

	1.2.1	$\widehat{E} = x$✓ (Ext. ∠ of cq)✓ $\widehat{C}$✓ $= x$ … (Isosceles Δ)✓ $A\widehat{D}C = \widehat{D}_1 + \widehat{D}_2$✓ $= \widehat{E} = x$ … (tan chord✓)	$\widehat{E}$ answer (1) and R(1) $\widehat{C}$ answer (1) and R(1) Answer (1) and R(1) (3 × 2) (6)

	1.2.2	$y = 2E$ ✓ (∠ at centre)√ $y = 2x$ $y = 2(70°)$ $= 140°$√ $\hat{C} + y = x + y$ $= 70° + 140°$ $= 210°$✓ $\neq 180°$√ ∴ ACDO is not a a cyclic quadrilateral. √	$y = 2E$ (1) and R (½) ½ for 140° 1 for 210° ½ for ≠ 180° ½ for conclusion (4)

1.3	

	1.3.1	$r^2 = x^2 + y^2$ $r^2 = (-4)^2 + (-3)^2$ ✓ $r^2 = 25$ $x^2 + y^2 = 25$ ✓	1 for correct subs. 1 for answer (2)

	1.3.2	$m_{OA} = \frac{y_A - y_O}{x_A - x_O}$ $= \frac{-3-0}{-4-0}$ ✓ $= \frac{3}{4}$ ✓	1 for correct subs. 1 for answer (2)

	1.3.3	$m_{OA} \times m_{AC} = -1$ $\frac{3}{4} \times m_{AC} = -1$ $m_{AC} = -1 \times \frac{4}{3} = -\frac{4}{3}$ ✓ $y - y_A = m_{AC}(x - x_A)$ $y - (-3) = -\frac{4}{3}([x - (-4)]$ $y + 3 = -\frac{4}{3}x - \frac{16}{3}$ $y = -\frac{4}{3}x - \frac{25}{3}$ ✓	1 for correct gradient 1 for correct y int. (2)

	1.3.4	BO = r = 5 from 1.3.1 Y intercept of BC is 5 ✓ CB ⊥ OB … tan ⊥ to radius ∴ BC: $y = 5$✓	1 for y intercept 1 for equation (2)

	1.3.5	CA: $3y + 4x + 25 = 0$ ------ ① CB: $y = 5$ ----- ② ② in ① $3(5) + 4x + 25 = 0$ $x = -10$ ∴ C(−10; 5)	1 for y coordinate 1 for x coordinate (2)
			[25]

QUESTION 2

2.1	$1 - \sin^2\theta + 3 - \cos^2\theta$ $= \cos^2\theta + 3 - \cos^2\theta$ ✓ $= 3$ ✓ **Alternate** $1 - \sin^2\theta + 3 - \cos^2\theta$ $= (1 - \sin^2\theta) + 3 - (1 - \sin^2\theta)$ ✓ $= 3$ ✓	1 for substitution 1 for simplifying to 3 1 for substitution 1 for simplifying to 3 (2)

2.2	$2^{2\sin 210°} \times 2^{3\tan 225°}$ $= 2^{2(-\sin 30°)+3(\tan 45°)}$ ✓ $= 2^{2\left(-\frac{1}{2}\right)+3(1)}$ ✓ $= 2^2$ $= 4$✓	½ per reduction ½ per special angle ratio 1 for answer (3)

2.3	$2p\tan(\theta) = \sin(4\theta)$ Given $\theta = 41°$ $2p\tan(41°) = \sin(4 \times 41°)$ ✓ $2p\tan 41° = \sin 164°$ $\therefore p = \dfrac{\sin 164°}{2\tan 41°}$ $p = 0{,}16$ ✓	1 for substitution 1 for answer (2)

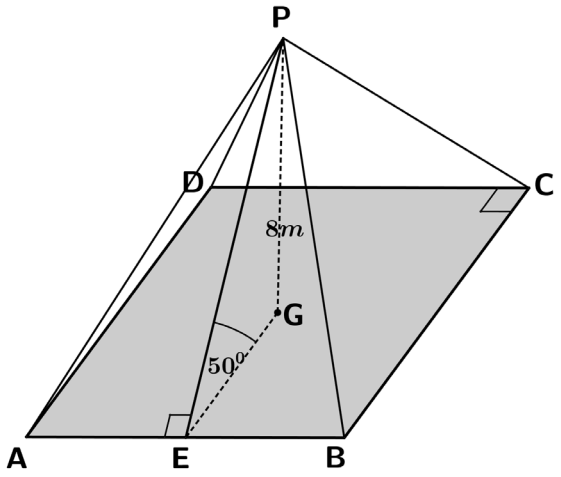
2.4.1	$\cos(x+y) = \cos x \cos y - \sin x \sin y$ ✓ $\cos(x-y) = \cos x \cos y + \sin x \sin y$ ✓	1 for answer 1 for answer (2)

2.4.2	From 2.4.1 $\cos x \cos y - \sin x \sin y = \cos(x+y)$ $\cos x \cos y + \sin x \sin y = \cos(x-y)$ Adding the two equations: $2\cos x \cos y = \cos(x+y) + \cos(x-y)$	1 for adding equations 1 for simplifying to answer (2)

2.5	$\frac{\cos 160°.\tan 200°}{-2\sin 10°} = \frac{-\cos 20°\sqrt{}\tan\ 20°\sqrt{}}{-2\sin 10°}$ $= \frac{-\cos 20° . \frac{\sin 20°}{\cos 20°}\sqrt{}}{-2\sin 10°}$ $= \frac{\sin 20°}{2\sin 10°}\sqrt{}$ $= \frac{2\sin 10° \cos 10°\sqrt{}}{2\sin 10°}$ $= \cos 10°\sqrt{}$	½ per reduction ½ for tan substitution ½ for simplifying ½ for double angle expand ½ for logical conclusion (3)

2.6.1	$\text{LHS} = \frac{2\sin\theta\cos\theta}{2\cos^2\theta - 1}$ $= \frac{\sin 2\theta\ ✓}{\cos 2\theta\ ✓}$ $= \tan 2\theta = \text{RHS}$	1 for each substitution (-1) for no conclusion (2)

2.6.2	$\frac{2\sin\theta\cos\theta}{2\cos^2\theta - 1} = \sqrt{3}$ $\tan 2\theta = \sqrt{3}\sqrt{}$ $2\theta = 60^0\sqrt{}; 240^0$ $\theta = 30; 120^0$✓ ✓	½ for substitution ½ for reference angle 1 for each correct answer (3)

2.7		

	2.7.1	$\sin 50° = \frac{8}{PE}$ √ $PE = 10{,}4$ m√	½ for correct ratio ½ for answer (1)
	2.7.2	$\tan 50° = \frac{8}{EG}$ √ $EG = 6{,}7$ m√ $BC = 2EG = 13.4$ m ✓	½ for correct ratio ½ for answer 1 for BC (2)
	2.7.3	$PB = PC = 12{,}4$ …Δ PBC isosceles ✓ $BC^2 = PB^2 + PC^2 - 2PB.PC\cos B\hat{P}C$ ✓ $\cos B\hat{P}C = \frac{12{,}4^2 + 12{,}4^2 - 13{,}4^2}{2(12{,}4)(12{,}4)}$ $B\hat{P}C = 65{,}411^0$ ✓	1 for isosceles Δ 1 for subs in cosine rule 1 for answer (3)
			[25]

QUESTION 3

3.1.1 Option 1

Number of Saturdays absent (x)	Final marks in % (y)	$x.y$	x^2
0	96	0	0
1	91	91	1
2	78	156	4
2	83	166	4
3	75	225	9
3	62	186	9
5	70	350	25
6	68	408	36
7	56	392	49
$\sum x = 29$ √	$\sum y = 679$√	$\sum x.y = 1\,974$√	$\sum x^2 = 137$√
$\bar{x} = 3{,}22$ √	$\bar{y} = 75{,}44$√		

Accuracy ½ marks as indicated on the table.

$$b = \frac{n\sum x.y - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$= \frac{9 \times 1\,974 - (29)(679)}{9 \times 137 - (29)^2} \checkmark$$

1 Substitution (CA)

$$= \frac{17\,766 - 19\,691}{1\,233 - 841}$$

$$= \frac{-1\,925}{392}$$

$$= -4{,}91\surd$$

½ Answer (CA)

$a = \bar{y} - b\bar{x}$
$a = 75{,}44 - (-4{,}91)(3{,}22)\checkmark$
$a = 91{,}25$

1 Substitution (CA)

$\therefore y = a + bx$
$y = 91{,}25 - 4{,}91x\surd$

½ Answer

(6)

3.1.1 Option 2

Number of Saturdays absent (x)	Final marks in % (y)	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$
0	96	-66.20	10.37
1	91	-34.54	4.93
2	78	-3.12	1.49
2	83	-9.22	1.49
3	75	0.10	0.05
3	62	2.96	0.05
5	70	-9.68	3.17
6	68	-20.68	7.73
7	56	-73.48	14.29
$\sum x = 29\surd$	$\sum y = 679\surd$	$\sum(x-\bar{x})(y-\bar{y})$	$(\sum x-\bar{x})^2$
$\bar{x} = 3.22\surd$	$\bar{y} = 75{,}44\surd$	$= -213.88\surd$	$= 43.57\surd$

Accuracy ½ marks as indicated on the table.

$$b = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2}$$

$$= \frac{-213.88}{43.57}\checkmark$$ — 1 Substitution (CA)

$$= -4{,}91\surd$$ — ½ Answer (CA)

$$a = \bar{y} - b\bar{x}$$

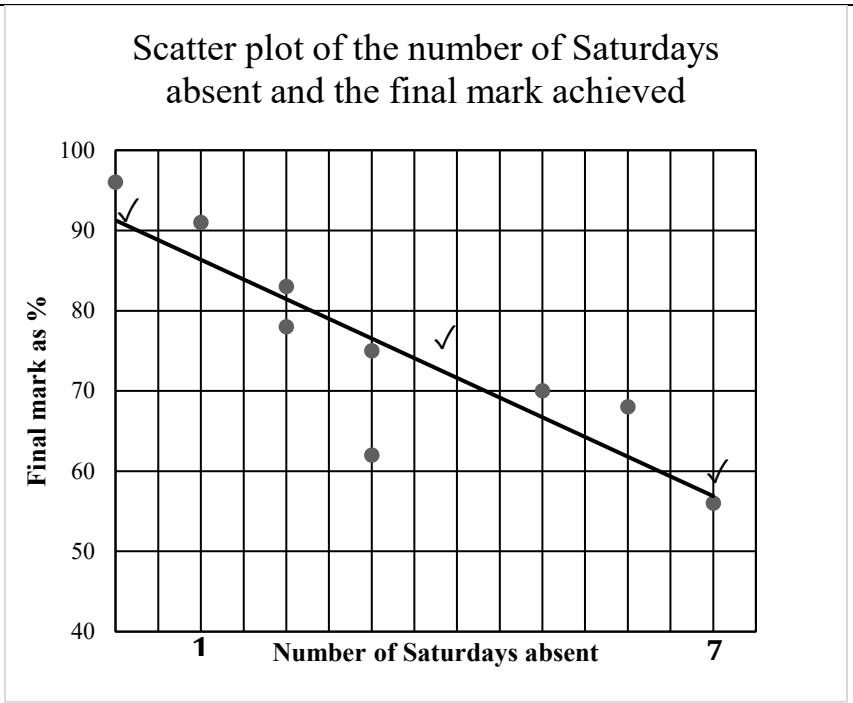
$$a = 75{,}44 - (-4{,}91)(3{,}22)\checkmark$$ — 1 Substitution (CA)

$$a = 91{,}25$$

$$\therefore y = a + bx$$

$$y = 91{,}25 - 4{,}91x\surd$$ — ½ Answer

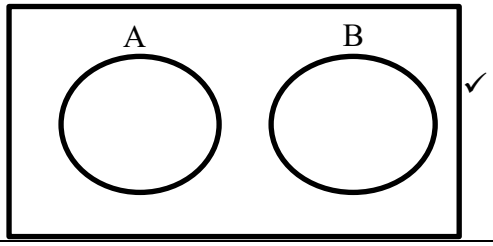
(6)

3.1.2		
		1 each for plotting any two calculated points on the line $y = 91{,}25 - 4{,}91x$ For example the end points $(0; 91{,}25)$ and $(7; 57)$ 1 for drawing the line. (3)

3.1.3	Negative✓	(1)
3.1.4	The greater the number of days absent, the lower the mark.✓	(1)
3.1.5	$\therefore y = a + bx$ $y = 91{,}25 - 4{,}91(4)$✓ $= 72\%$✓	1 for substitution 1 for answer (2)

3.2	Set B ✓ has the greater standard deviation because range of B (73) is greater than the range of A(37). ✓ OR Set B ✓ because the spread of data is greater ✓ .	1 for answer 1 for reason (2)
		[15]

QUESTION 4

4.1	Two sets are mutually exclusive (disjoint) if they do not have any elements in common. ✓ **OR** If two events A and B are mutually exclusive either event can occur without the other event occurring. ✓  	1 for explanation 1 for diagram (2)

4.2	4.2.1	$P(\text{female}) = \frac{1}{2} = 0{,}5$✓	1 for answer (A) (1)

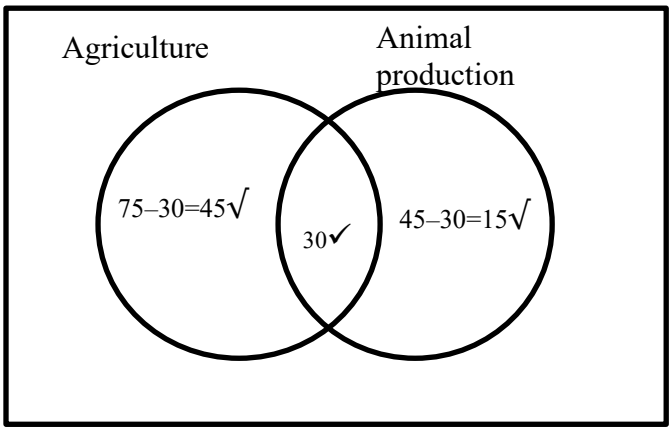
	4.2.2	$P(\text{female female}) = \frac{1}{2} \times \frac{3}{5}$✓ $= \frac{3}{10} = 0{,}3$✓	1 for working 1 for answer Full marks answer only (2)

	4.2.3	$P(\text{female female male male}) = \frac{1}{2} \times \frac{3}{5}$✓ $\times \left(1 - \frac{3}{5}\right) \times \frac{3}{5}$✓ $= \frac{1}{2} \times \frac{3}{5} \times \frac{2}{5} \times \frac{3}{5}$ $= \frac{9}{125}$✓	2 for working 1 for answer (3)

4.3.1	Number of learners studying agriculture $= \frac{1}{2} \times 150 = 75$✓	Answer (1)

4.3.2	Number of learners studying animal production $= \frac{30}{100} \times 150 = 45$✓	Answer (1)

4.3.3	Number of learners studying animal production and agriculture $= \frac{40}{100} \times 75 = 30$✓	Answer (1)

4.3.4		Allocate according to ticks (2)
4.3.5	Number not studying Agriculture and Animal Production $= 150 - (45 + 30 + 15) = 60$ ✓ Probability $= \frac{60}{150} = 0,4$ or 40% ✓	1 for number 1 for probability (2)
		[15]

QUESTION 5	

5.1	Amount borrowed $= 850\ 000 \times \frac{12}{100}$ $= \text{R}102\ 000$ ✓ $\therefore$ Amount $= 850\ 000 - 102\ 000$ $= \text{R}748\ 000$ ✓ **OR** Amount borrowed $= 850\ 000 \times \frac{88}{100}$✓ $= \text{R}748\ 000$ ✓	1 for R102 000 1 for answer (2)

5.2	$\text{A} = \text{P}(1+i)^n$✓ $\therefore \quad 1\ 711{,}41 = 1\ 430{,}77\left(1+\frac{i}{12}\right)^{18}$ ✓ $\therefore \left(1+\frac{i}{12}\right)^{18} = \frac{1\ 711{,}41}{1\ 430{,}77}$ $\left(1+\frac{i}{12}\right) = \left(\frac{1\ 711{,}41}{1\ 430{,}77}\right)^{\frac{1}{18}}$ ✓ $\frac{i}{12} = 1{,}009999937 - 1$ $i = 0{,}1199$ $= 12\%$ p.a. month compounded✓	formula substitution simplify answer (4)

5.3	$A = P(1-i)^n$✓ $\therefore 15\,000 = P(1-0{,}25)^4$✓ $15\,000 = P(0{,}75)^4$✓ $P = R47\,407{,}41$✓	formula substitution simplify answer (4)

5.4	Let $P = x$. Then $A = 3x$✓ $A = P(1+in)$✓ $3x = x(1+0{,}16n)$✓ $3 = 1 + 0{,}16n$ $2 = 0{,}16n$ $\therefore n = 12{,}5$ years✓	1 for $A = 3x$ 1 for correct SI formula 1 for substitute 1 for answer (4)

5.5.1	**Gross income:** Income from salary = R46 000 × 12 = R552 000 13th cheque = R45 000 TOTAL = R597 000√ **Deductions**: Pension = R1 500 × 12 = R18 000 UIF = R148,72 × 12 = R1784,64 TOTAL = R19 784,64√ Taxable Income = R597 000 − (R18 000 + R1 784,64) = R577 215,00✓	 ½ for R597 000 ½ for R23 520 1 for answer (2)

5.5.2	Tax = R147 891 + $\frac{39}{100}$(R577 215 − R555 600) = R156 320,85√ Less rebates and tax credits: Primary R14 067 = R14 067√ Medical aid tax credit R310 × 12 × 2 = R7 440√ Medical aid tax credit R209 × 12 × 1 = R2 508√ TOTAL = R24 015√ Total tax due = payable tax – (rebates + tax credits) = R156 320,85 − R24 015 = R132 305,85√ Total tax already paid = R195 000 Due to Ricardo = R195 000-R132 305,85 = R62 694,15 ✓	 ½ for R154 863,81 ½ for R14 067 ½ for R7 440 ½ for R2 508 ½ forR24 015 ½ for R130 848,81 1 for correct answer (4)
		[20]

TOTAL: 100

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