basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

TECHNICAL MATHEMATICS

EXEMPLAR 2016

MEMORANDUM

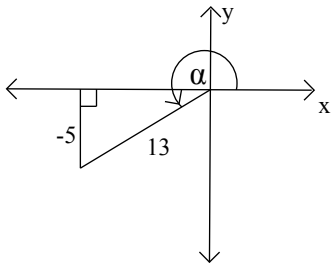
MARKS: 100

This memorandum consists of 8 pages.

QUESTION 1

1.1	$m_{AC} = \frac{-1-2}{2-0}$ *or* $= \frac{2+1}{0-2}$ $= -\frac{3}{2}$	✓answer (1)
1.2	$M\left(\frac{x_1+x_2}{2}; \frac{y_1+y_2}{2}\right)$ $M\left(\frac{-3+2}{2}; \frac{0-1}{2}\right)$ $M\left(-\frac{1}{2}; -\frac{1}{2}\right)$	✓formula ✓answer (2)
1.3	$m_{MD} = \frac{-\frac{1}{2}-2}{-\frac{1}{2}-0} = 5$ $y - y_1 = m(x - x_1)$ Answer only full marks $y - 2 = 5(x - 0)$ y = 5*x* + 2 $y = 5x + 2$	✓subst. into grad. formula ✓5 ✓subst. into str. line. formula ✓equation (4)
1.4	$AB = \sqrt{(x_2 - x_2)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-3-t)^2 + (0-(-3))^2}$ $\sqrt{(-3-t)^2 + 9} = \sqrt{13}$ $t^2 + 6t + 9 + 9 = 13$ $t^2 + 6t + 5 = 0$ $(t+5)(t+1) = 0$ $t = -1$	✓formula ✓substitution ✓factors ✓answer (4)
1.5	$AB = \sqrt{13}$ $DC = \sqrt{(0-2)^2 + (2-(-1))^2}$ $= \sqrt{13}$ $AD = \sqrt{(0-(-3))^2 + (2-0)^2}$ $= \sqrt{13}$ $BC = \sqrt{(-1-2)^2 + (-3-(-1))^2}$ $= \sqrt{13}$ All sides are equal and $A\widehat{D}C = 90°$ Hence ABCD is a square.	✓length of DC ✓length of AD ✓length of AB ✓conclusion (4)
		[15]

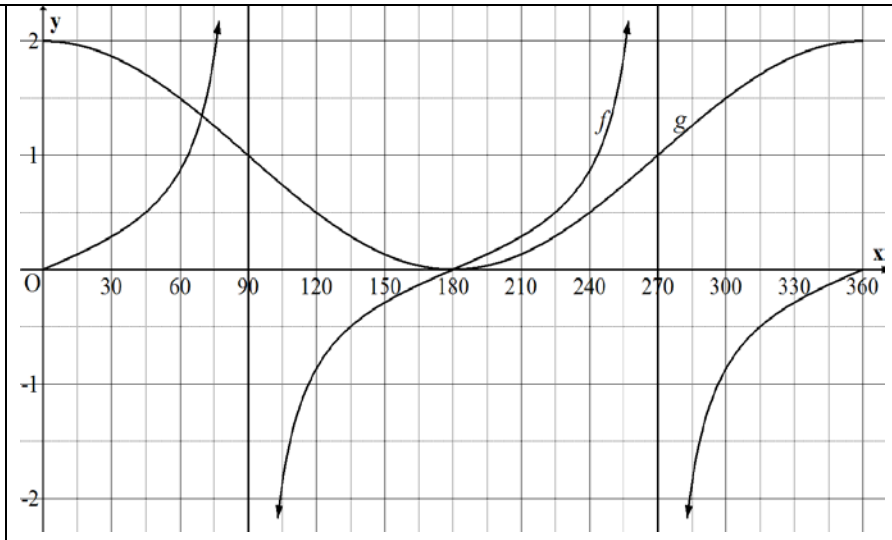
QUESTION 2

2.1.1	$\sin(x+y) = \sin(43+32,5)$ $= 0,97$	answer only full marks.	✓substitution ✓answer (2)
2.1.2	$\sec\left(\frac{x-y}{2}\right) = \sec\left(\frac{43-32,5}{2}\right)$ $= \frac{1}{\cos\left(\frac{21}{4}\right)}$ $= 1,00$	answer only full marks.	✓changing to cos ✓answer (2)
2.2.1	$13\sin\alpha + 5 = 0$ and $90^0 < \alpha < 270^0$ $\sin\alpha = \frac{-5}{13}$ $x^2 + (-5)^2 = 13^2$ $\therefore x = -12$ $\therefore \cot\alpha = \frac{-12}{-5} = \frac{12}{5}$		✓correct diagram ✓$\frac{-5}{13}$ ✓ $x = -12$ ✓answer (4)
2.2.2	$\cos\alpha + \tan\alpha = \frac{-12}{13} + \frac{5}{12}$ $= \frac{-144+65}{156}$ $= \frac{-79}{156}$		✓$\frac{-12}{13}$ ✓$\frac{5}{12}$ ✓answer (3)
2.3	$\cot x = \tan 53^0 + \sin 233^0$ $\frac{1}{\tan x} = \tan 53^0 + \sin 233^0$ $\tan x = \frac{1}{\tan 53^0 + \sin 233^0}$ $x = \tan^{-1}\left(\frac{1}{\tan 53^0 + \sin 233^0}\right)$ $= 62,15^0$ *Answer* 62.12^0 *two marks*		✓$\frac{1}{\tan x}$ ✓ $\tan^{-1}$ ✓ answer (3)
			[14]

QUESTION 3

3.1.1	$SQ = 5m - 1{,}5m = 3{,}5m$	✓ answer (1)
3.1.2	$\sin 63° = \frac{SQ}{SR}$ $\sin 63° = \frac{3{,}5}{SR}$ $\therefore SR = 3{,}93m$	✓ $\sin 63° = \frac{3{,}5}{SR}$ ✓ answer (2)
3.1.3	$\cos 15^0 = \frac{PQ}{PR}$ $PR = \frac{PQ}{\cos 15^0}$ $PR = \frac{5m}{\cos 15^0}$ $= 5{,}18m$ Or $\sin 75^0 = \frac{PQ}{PR}$ $PR = \frac{PQ}{\sin 75^0}$ $= \frac{5m}{\sin 75^0}$ $= 5{,}18m$	✓$\cos 15^0$ ✓ making PR the subject of the formula ✓ substitution ✓answer OR ✓$\sin 75^0$ ✓ making PR the subject of the formula ✓ substitution ✓answer (4)
3.2.1	$\frac{AB}{BC} = \tan 52°$ $\therefore \frac{45}{BC} = \tan 52°$ $BC = \frac{45}{\tan 52^0}$ $\therefore$ BC = 35,16 *m*	✓$\frac{AB}{BC} = \tan 52°$ ✓ $BC = \frac{45}{\tan 52^0}$ ✓answer (3)
3.2.2	$\frac{AB}{BD} = \tan 38° \therefore \frac{45}{BD} = \tan 38°$ $\therefore$ BD = 57,60*m* CD = 35,16*m* + 57,60*m* CD = 92,76*m*	✓$\frac{45}{BD} = \tan 38°$ ✓length of BD ✓answer (3)
		[13]

QUESTION 4

4.1		✓y-int of g ✓shape of g ✓x intercepts of f ✓y intercept of f ✓shape of f (5)
4.2	$x = 90^o$ and $x = 270^o$	✓ answer (1)
4.3	$y \in [0; 2]$ OR $0 \leq y \leq 2$	✓✓ answer with correct notation (2)
4.4	$(180^o; 0)$	✓180^0 ✓0 (2)
4.5	$180^o < x < 270^o$ OR $x \in (180°; 270°)$	✓✓ answer with correct notation (2)
		[12]

QUESTION 5

5.1	If they are equiangular OR Their corresponding sides are proportional	✓answer (1)
5.2.1	*in* ΔABC and ΔEDC $A\hat{C}B = E\hat{C}B = 76^0$.....vert opp angles $\hat{A} = \hat{E} = \frac{180^0 - 76^0}{2} = 52^0$.....alt angles, $AB \parallel DE$ $\hat{B} = \hat{D} = 52^0$...alt angles, $AB \parallel DE$ $\therefore \Delta ABC \ \|\|\| \ \Delta EDC(A.A.A)$	✓statement and reason ✓ statement and reason ✓ statement and reason ✓ statement and reason (4)
5.2.2	If at least one pair of corresponding sides is equal.	✓✓reason (2)
5.3.1	$x = 38mm$....midpoint theorem	✓value of x ✓reason (2)
5.3.2	$\alpha = 46^o$.....alt ∠s; YZ // DE	✓value of α ✓reason (2)
5.3.3	$D\hat{F}E + 46^0 + 40^0 = 180^0$ ∠sum in Δ $D\hat{F}E = 180^0 - 86^0 = 94^0$ $Y\hat{F}Z = D\hat{E}F$ vert.opp∠s $Y\hat{F}Z = 94^0$ *Or* $D\hat{F}Y = 46^0 + 40^0$ *Or* $E\hat{F}Z = 46^0 + 40^0$ ext.∠ of ΔDFE $Y\hat{F}Z = 180^0 - 86^0$ ∠s on a str line DFZ or EFY $\therefore \ Y\hat{F}Z = 94^0$ OR $Y\hat{F}Z = 180^0 - (\alpha + \beta)$ sum of ∠s *of* ΔFYZ $= 180^0 - (46^0 + 40^0)$ alt. ∠s =; DE // YZ $= 94^0$	✓ two statements and reasons ✓answer OR ✓ two statements and reasons ✓answer OR ✓ two statements and reasons ✓answer (2)
		[13]

QUESTION 6

6.1.1	Both opposites sides are parallel	✓answer (1)
6.1.2	$2x + 20 = 5x - 40$....*opp* ∠s *of* //m $3x = 60^o$ $x = 20^o$	✓statement ✓reason ✓simplification ✓answer (4)
6.2.1	$8x + 2^0 + 4x + 2^0 + x - 2^0 + 5x - 2^0 = 360^0$ (sum of ∠*s* in quad) $18x = 360^0$ $x = 20^0$	✓statement ✓reason ✓simplification ✓answer (4)
6.2.2	$\hat{A} = 8x + 2 = 8(20°) + 2° = 162°$ $\hat{B} = 4x + 2 = 4(20°) + 2° = 82°$ $\hat{C} = 5x - 2 = 5(20°) - 2° = 98°$ $\hat{D} = x - 2 = 20° - 2° = 18°$ $\hat{A} + \hat{D} = 162° + 18° = 180°$ Hence AB // DC co-int ∠*s* supp Therefore ABCD is a trapezium. Or $\hat{B} + \hat{C} = 82^0 + 92^0 = 180^0$ Hence AB // DC co-int ∠*s* supp Therefore ABCD is a trapezium.	✓value of A ✓value of D ✓$\hat{A} + \hat{D} = 180°$ ✓reason OR ✓value of $\hat{B}$ ✓value of $\hat{C}$ ✓$\hat{B} + \hat{C} = 180^0$ ✓reason (4)
		[13]

QUESTION 7

7.1	$CP^2 = PA^2 + AC^2$ (Pythagoras) $10^2 = 6^2 + AC^2$ AC = 8 *m*	✓statement ✓reason ✓substitution ✓answer (4)
7.2	Let the new point be R such that AR = 5 *m* $CR^2 = RA^2 + AC^2$ (Pythagoras) $CR^2 = 5^2 + 8^2$ CR = $\sqrt{89}$ *m*	✓statement ✓substitution ✓answer (3)
		[7]

QUESTION 8

8.1.1	$122^0 + 0,46 \times 60^0$ $= 122^0 + 27,6'$ $= 122^0 + 27' + 0,6 \times 60^0$ $= 122^0 27' 36''$ answer only full marks	✓ $\times 60^0$ ✓+ $27.6'$ ✓ answer (3)
8.1.2	$83^0 59' 13'' = \left(83 + \frac{59}{60} + \frac{13}{60 \times 60}\right)$ $= 83,99^0$ answer only full marks	✓ $\frac{59}{60}$ ✓ $\frac{13}{60^2}$ ✓ answer (3)
8.2	$\theta = \frac{s}{r} = \frac{4}{6}$ $= \frac{2}{3}$ $\theta = \frac{2}{3} \times \frac{180^0}{\pi}$ $= 38,39^0$	✓formula ✓$\frac{2}{3}$ ✓conversion ✓answer (4)
8.3	$6\pi - 15^0 + \frac{4\pi}{3}$ $= \frac{3 \times 6\pi + 4\pi}{3} - 15^0$ $= \frac{22\pi}{3} - 15^0$ $= \left(\frac{22}{3} \times 180^0\right) - 15^0$ $= 1305^0$	✓$\frac{22\pi}{3}$ ✓conversion ✓answer (3)
		[13]
		TOTAL: 100