GRADE : 11

SUBJECT : Mathematics

TITLE : Nov P 2

EXAMINER : ~~Mr A. Slaughter~~ DOE

TOTAL MARKS : 150

DATE : ____ / ____ / 20 ____

SOLUTIONS

TIME : 3 hour(s)

1.1. 100 143 150 155 164 (171) 171 180 182 188 190

↑ Q_1 ↑ M ↑ Q_3

I mm = 100 50

II Q_1 = 150 75

III M = 171 85,5

IV Q_3 = 182 91

V max = 190 95

Scale = mm ÷ 2

✓ ✓ ✓ ✓ ✓ **4**

1.2. $\bar{x}$ = 163,09 M = 171

$\bar{x} - M$ = 163,09 − 171

= −8

< 0

∴ skewed to left ✓ **1**

(OR)

$M - Q_1$ = 171 − 150 = 21

$Q_3 - M$ = 182 − 171 = 11

$M - Q_1 > Q_3 - M$

∴ skewed to left.

1.3. IQR = 182 − 150

= 32

• LF = $Q_1 - 1,5IQR$ = 150 − 1,5.32 = 102

• UF = $Q_3 + 1,5.IQR$ = 182 + 1,5.32 = 230

100 < LF nothing > 230

∴ outlier = 100 ✓ **1**

2.1. $\bar{x} = \frac{25+47+\cdots+x+\cdots+30}{10}$

$= \frac{324+x}{10}$ ✓ **1**

2.2. $36 = \frac{324+x}{10}$ ✓

LCD = 10 x-thru

360 = 324 + x

36 = x ✓ **2**

2.3. σ = 8,88 ✓✓ **2**

2.4. $\bar{x}$ = 36

σ = 8,88

$\bar{x} - \sigma$ $\quad$ $x + \sigma$

$= 36 - 8,88$ $\quad$ $= 36 + 8,88$

$= 27,12$ ✓ $\quad$ $= 44,88$

$< 27,12$ $\quad$ $> 44,88$

$= 25$ $\quad$ $= 47$ 55

$\therefore$ 3 people ✓ **2**

3.1. } D/sheet 1

3.2. }

3.3. $30\% = \frac{15}{50}$

(strictly speaking

cum freq $\leq$

so, $\leq \frac{14}{50}$ failed)

Loosely:

$< 15 = 4$

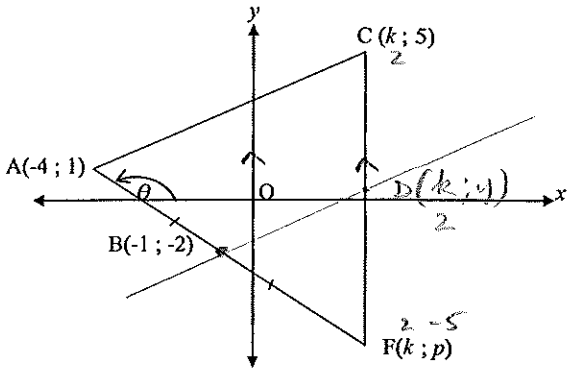
$\therefore \geq 15 = 40 - 4$

$= 36$ passed **2**

✓✓

34 35 36

4.



4.1. 1. A(-4;1) B(-1;-2) F(k ; p)

$-1 = \frac{-4+k}{2}$ ✓ $\quad -2 = \frac{1+p}{2}$

$2 = k$ ✓ $\quad -5 = p$ ✓ **3**

2. A(-4;1) F(2;-5)

$m_{AF} = \frac{-5-1}{2-(-4)} = -1$ **3**

✓f ✓sub ✓ans

3. B(-1;-2)

$m_{\perp} = 1$ ✓

$\therefore y = x + c$ ✓

sub B(-1;-2)

$-2 = -1 + c$ ✓

$-1 = c$

$\therefore y = x - 1$ ✓ **4**

4.2. C(2;5) A(-4;1) F(2;-5)

$AC = \sqrt{(1-5)^2 + (-4-2)^2}$ ✓f ✓sub $= \sqrt{52}$ ✓

$CF = 10$ ✓

$FA = \sqrt{(-5-1)^2 + (2-(-4))^2}$ ✓ $= \sqrt{72}$

NAME: SLT

DIAGRAM SHEET 1

QUESTION 3.1

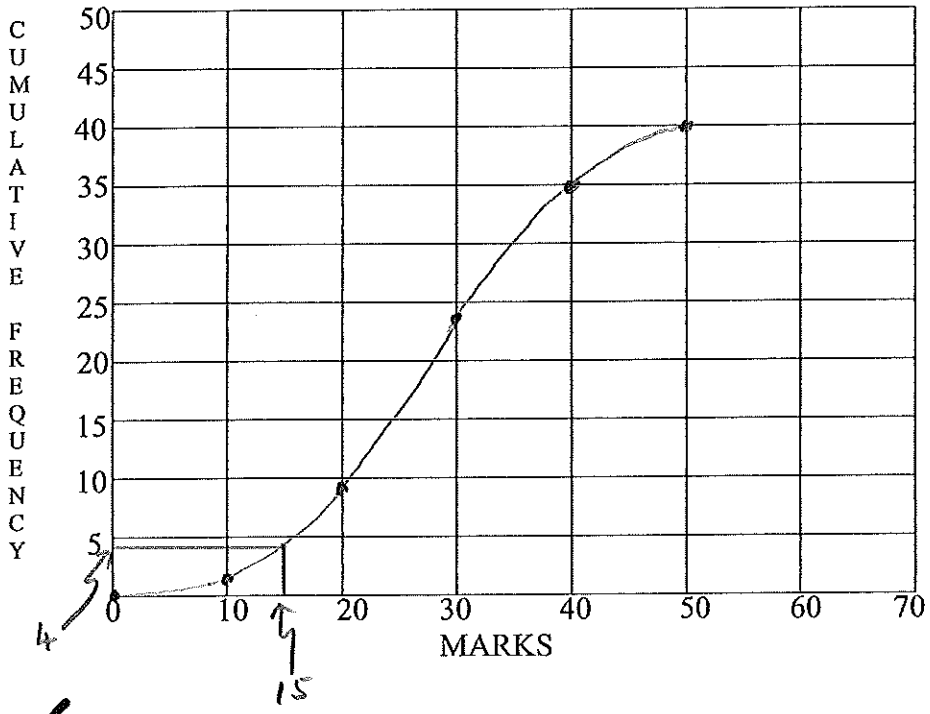
Grounding pt (0;0)

0 ——— 0

Interval	Frequency	Cumulative frequency
$0 \leq x < 10$	2	2
$10 \leq x < 20$	7	9 ✓
$20 \leq x < 30$	14	23
$30 \leq x < 40$	12	35 ✓
$40 \leq x < 50$	5	40

2

QUESTION 3.2:



✓

grounding pt (0;0)

✓ plotting

✓ smooth shape

3

All sides different lengths ∴ scalene ✓ 6

4.3. $m_{AF} = -1$ (4.1.2)

$\therefore \tan\theta = -1$ ✓

ref $\angle = 45°$

1 on − in

II: $\theta = 135°$ ✓

$135° = A\hat{F}C + 90°$ ✓ Ext $\angle$ $\triangle$

$\therefore A\hat{F}C = 45°$ ✓ 4

4.4. $AC \neq FC$ ✓✓ (4.1)

$\therefore \triangle ABC \neq \triangle FBC$

$\therefore A\hat{B}C \neq F\hat{B}C$

$\therefore A\hat{B}C \neq 90° \neq F\hat{B}C$ 2

(OR)

$m_{AF} = -1$ (4.1.2)

$B(-1;-2)$ $C(2;5)$

$m_{BC} = \frac{5-(-2)}{2-(-1)} = \frac{7}{3}$

$\therefore m_{AF} \cdot m_{BC} = -1 \cdot \frac{7}{3}$

$\neq -1$

$\therefore AF \not\perp BC$

(OR)

$\perp$ bis: $y = x - 1$

$C(2;5)$

LHS	RHS
$= y$	$= x - 1$
$= 5$	$= 2 - 1$
	$= 1$

$\therefore$ LHS ≠ RHS

$\therefore$ C does not lie on $\perp$ bisector of AF

4.5. $A(-4;1)$ $C(2;5)$

$m_{AC} = \frac{5-1}{2-(-4)} = \frac{2}{3}$

$B(-1;-2)$ $D(2;y)$

$m_{BD} = \frac{y-(-2)}{2-(-1)} = \frac{y+2}{3}$

$\therefore \frac{2}{3} = \frac{y+2}{3}$ ||

LCD = 3 x thm

$2 = y + 2$

$0 = y$ ✓✓ 2

(OR)

$y = \frac{5+(-5)}{2}$ midpt thm

$= 0$

5.1. $x + 2y - 6 = 0$

$2y = -x + 6$ ✓

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

$y = -\frac{1}{2}x + c$ ✓ //

Sub $(-2;5)$

$5 = -\frac{1}{2}(2) + c$ ✓

$4 = c$

$\therefore y = -\frac{1}{2}x + 4$ ✓ ✓ **4**

5.2. $k(-3;5)\ L(2;-3)\ N(5;-9)$

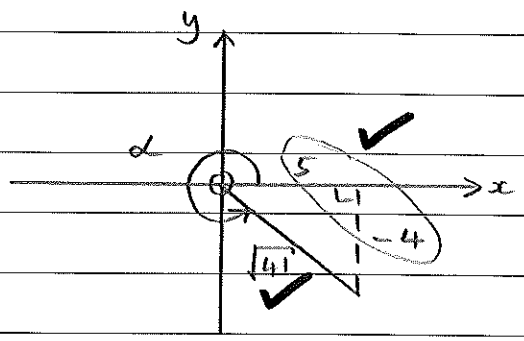
$m_{KL} = \frac{-3-5}{2-(-3)} = -\frac{8}{5}$ ✓

$m_{LN} = \frac{-9-(-3)}{5-2} = -2$ ✓

$\therefore m_{KL} \neq m_{LN}$ ✓R

$\therefore$ points not collinear ✓ **4**

6.1. 1. $\tan\alpha = -\frac{4}{5}$ $\frac{y}{x}$ $\frac{-4}{5}$



$\tan -$ $\therefore$ II (IV)

$\alpha \in [180°;360°]$ $\therefore$ III (IV)

$(-4)^2 + (5)^2 = r^2$

$41 = r^2$

$\sqrt{41} = r$

$2\cos(180° - \alpha)$

$= 2[-\cos\alpha]$

$= -2\cos\alpha$ ✓ $\frac{x}{r}$

$= -2\left(\frac{5}{\sqrt{41}}\right)$

$= -\frac{10}{\sqrt{41}}$ ✓ **4**

6.1. 2. $\sin(\alpha - 90°)$

$= \sin(\alpha + 270°)$

$= \sin(270° + \alpha)$

$= -\cos\alpha$

$\therefore [-\cos\alpha]^2 - \sin^2\alpha$

$= \cos^2\alpha - \sin^2\alpha$

$= (\cos\alpha)^2 - (\sin\alpha)^2$

$\frac{x}{r}$ ✓ $\left(\frac{5}{\sqrt{41}}\right)^2 - \left(\frac{-4}{\sqrt{41}}\right)^2$ $\frac{y}{r}$

$= \frac{25}{41} - \frac{16}{41}$

$= \frac{9}{41}$ ✓ **3**

6.2. $\tan 45^\circ = 1$ ✓

$\therefore 4\cos^2 x - 1 = 0$

$\cos^2 x = \frac{1}{4}$

$\cos x = \pm\sqrt{\frac{1}{4}}$

$\therefore \cos x = \pm\frac{1}{2}$ ✓

$\text{Ref}^\angle = 60^\circ$

$\cos$ + in' $(k \in \mathbb{Z})$

I: $x = 60^\circ + k360^\circ$

II: $x = 120^\circ + k360^\circ$

III: $x = 240^\circ + k360^\circ$

IV: $x = 300^\circ + k360^\circ$

but $x \in [0^\circ; 360^\circ]$

$\therefore x = 60^\circ; 120^\circ; 240^\circ$ or 300° ▷ **4**

✓ ✓
two ∠'s two ∠'s

7.1. • $\sin 117^\circ = \sin(90^\circ + 27^\circ)$

$= +\cos 27^\circ$ ✓

• $\cos 27^\circ$

• $\cos(-x) = +\cos x$ ✓

• $\tan(180^\circ - x) = -\tan x$ ✓

• $\sin(360^\circ + x) = \sin x$ ✓

$\therefore \frac{\cos 27^\circ}{\cos 27^\circ} + (\cos x)(-\tan x)(\sin x)$

$= 1 + (\cos x)(-\frac{\sin x}{\cos x})(\sin x)$

$= 1 - \sin^2 x$ ✓

$= \cos^2 x$ ✓ ▷ **6**

7.2.1. $\frac{\cos x}{1-\sin x} - \frac{\cos x}{1+\sin x} = 2\tan x$

LHS

$= \frac{\cos x(1+\sin x) - \cos x(1-\sin x)}{(1-\sin x)(1+\sin x)}$ ✓

$= \frac{\cos x + \sin x\cos x - \cos x + \sin x\cos x}{1-\sin^2 x}$ ✓

$= \frac{2\sin x\cos x}{\cos^2 x}$ ✓

$= \frac{2\sin x}{\cos x}$ ✓

$= 2\tan x$

$=$ RHS ▷ **5**

7.2.2. ID is UD when

• $\tan x$: UD

$\frac{\sin x}{\cos x}$: UD

$\cos x = 0$

$\therefore x = 90^\circ + k180^\circ \quad (k \in \mathbb{Z})$

$\therefore \quad -90^\circ; 90^\circ$

• $1 - \sin x = 0$

$\sin x = 1$

$\therefore x = 90^\circ + k360^\circ$

$\therefore \quad 90^\circ$

• $1 + \sin x = 0$

$\sin x = -1$

$x = 270^\circ + k360^\circ$

$\therefore \quad -90^\circ$

So, $x = \pm 90^\circ$ ▷ **2**

✓✓

7.3 $\left(\sqrt{\tan\theta}\right)^2 = \left(x + \frac{1}{x}\right)^2$ ✓

$\tan\theta = x^2 + 2 + \frac{1}{x^2}$

$= x^2 + \frac{1}{x^2} + 2$ ✓

$= 1 + 2$

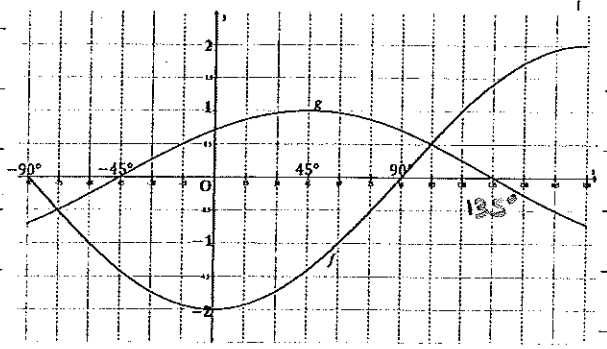
$= 3$ ✓

ref $\angle = 71{,}56\ldots°$ ✓

tan + in (k ∈ Z) ✓

$\therefore \theta = 71{,}57° + k180°$ ✓ ✓ 6

8.1.



$f: y = a\cos bx$

$-2\cos$ $\quad np = \frac{360°}{b}$

$360° = \frac{360°}{b}$

$b = 1$

$\therefore y = -2\cos x$

$a = -2$ ✓ $\quad b = 1$ ✓

$g: y = p\sin(x + r)$

$-45°$

$1\sin \quad x = -45°$

$x + 45° = 0$

$\therefore y = \sin(x + 45°)$

$p = 1$ ✓ $\quad r = 45°$ ✓ 4

OR

135°

$-1\sin \quad x = 135°$

$x - 135° = 0$

$\therefore y = -\sin(x - 135°)$

$p = -1$ ✓ $\quad r = -135°$ ✓

8.2. $f(x) - g(x) = 0$

$y_f - y_g = 0$

$y_f = y_g$

$\therefore x = -75°$ or $105°$ ✓ ✓ 2

8.3. $360°$ ✓ 1

8.4. $g: y = p\sin(x + r)$

$45° \rightarrow$

$\therefore y = p\sin(x + r - 45°)$ ✓

double period ✓

$\therefore y = p\sin\frac{1}{2}(x + r - 45°)$ 2

OR

$g: y = \sin(x + 45°)$

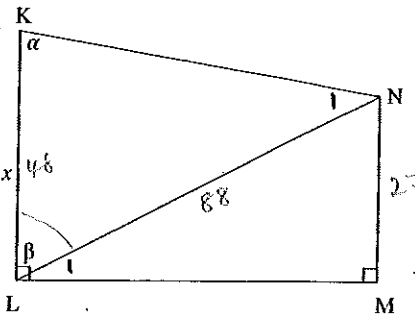
$45° \rightarrow$

$y = \sin x$ ✓

double period

$y = \sin(\frac{1}{2}x)$ ✓

9.



9.1. $\hat{N}_1 = 180° - (\alpha + \beta)$ ∠'s $\Delta = 180°$

$\frac{LN}{\sin\alpha} = \frac{x}{\sin(180° - (\alpha+\beta))}$ ✓

$\therefore LN = \frac{x \sin\alpha}{\sin(\alpha+\beta)}$ ✓

$\hat{L}_1 = 90° - \beta$

$\sin(90° - \beta) = \frac{MN}{LN}$ ✓

$\therefore \cos\beta = \frac{MN}{LN}$ ✓

$\therefore MN = LN \cos\beta$ ✓

sub LN ✓ $= \frac{x \sin\alpha}{\sin(\alpha+\beta)} \cdot \cos\beta$

$= \frac{x \sin\alpha \cos\beta}{\sin(\alpha+\beta)}$ ▷ **6**

(OR)

$\frac{MN}{\sin(90° - \beta)} = \frac{LN}{\sin 90°}$

$\frac{MN}{\cos\beta} = \frac{LN}{1}$

$\therefore MN = LN \cdot \cos\beta$

$= \frac{x \sin\alpha}{\sin(\alpha+\beta)} \cdot \cos\beta$

$= \frac{x \sin\alpha \cos\beta}{\sin(\alpha+\beta)}$

9.2. 1. $MN = \frac{x \sin\alpha \cos\beta}{\sin(\alpha+\beta)}$

$= \frac{48 \sin 76° \cos 72°}{\sin(76° + 72°)}$ ✓

$= 27{,}16$ m ✓ ▷ **2**

9.2. 2. area ΔKLN

$= \frac{1}{2}(x)(LN)\sin\beta$ ✓f

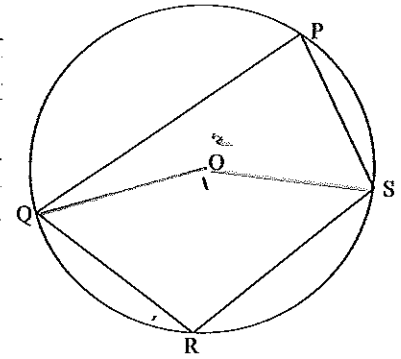
$= \frac{1}{2}(48)(88)\sin(72°)$ ✓sub

$= 2\,008{,}63\ m^2$ ✓ ▷ **3**

10.1. 1. equal to the angle in the alternate circle segment ✓ **1**

10.1. 2. the opposite interior angle. ✓ **1**

10.2.



Constr: QO, OS ✓ or on diagram

$\hat{O}_1 = 2\hat{P}$ ✓S ∠ @ centre ✓R

$\hat{O}_2 = 2\hat{R}$ ✓S ∠ @ centre

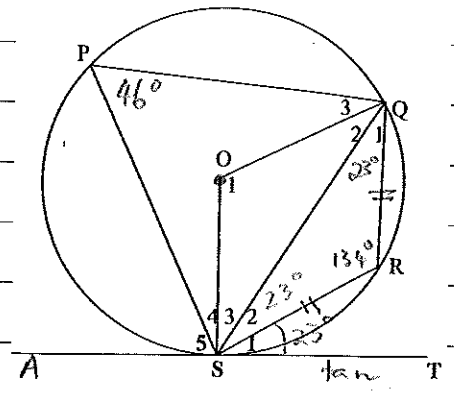
$\hat{O}_1 + \hat{O}_2 = 360°$ 1 rev = 360°

$2\hat{P} + 2\hat{R} = 360°$ ✓S

$2(\hat{P} + \hat{R}) = 360°$

$\hat{P} + \hat{R} = 180°$ ▷ **5**

10.3.



10.3. 1. $\hat{Q}_1 = 23°$ ✓ ∠ tan chord ✓

$\therefore \hat{S}_2 = 23°$ ✓ ISOS Δ, ✓

sides = 4

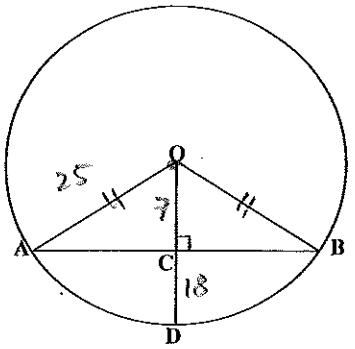
2. $\hat{R} = 134°$ ✓ ∠'s Δ = 180° ✓ 2

3. $\hat{P} = 46°$ ✓ opp ∠'s cyclic ✓

quad = 180° 2

4. $\hat{O}_1 = 92°$ ✓ ∠ @ centre ✓ 2

11.1.

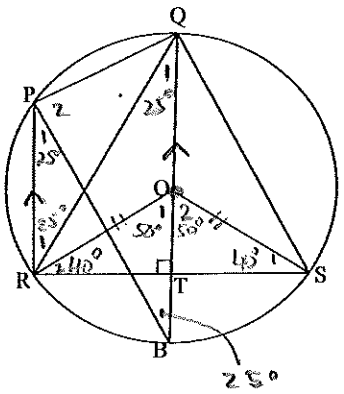


OC = 7 ✓ radii

$\therefore$ AC = 24 ✓ Pythag ✓

$\therefore$ AB = 48 cm ✓ line from centre @ ⊥ to chord bisects chord 5

11.2.



11.2. 1. $\hat{P}_1 = 25°$ ✓ alt ∠'s =, ||lines ✓

$\hat{R}_1 = 25°$ ✓ ∠'s same @ segm = ✓

$\hat{Q}_1 = 25°$ ✓ ∠'s same @ segm = 6

11.2. 2a. $\hat{O}_1 = 50°$ ✓ ∠ @ centre ✓ 2

11.2. 2b. $\hat{R}_2 = 40°$ ✓ ∠'s ✓ $\Delta = 180°$ **2**

11.2. 2c. $\hat{S}_1 = 40°$ ✓R radii, isos Δ, sides = ∠'s Δ = 180°

$\hat{O}_{1+2} = 100°$ ✓S **2**

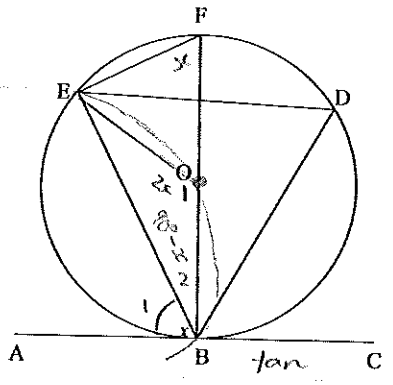
11.2. 2d. $\hat{P}_2 = 90°$ ✓R ∠ in semi ⊙ = 90°

$\therefore \hat{P}_{1+2}$

$= 90° + 25°$

$= 115°$ ✓S **2**

12.1.



12.1. 1a. $\hat{B}_2 = 90° - x$ ✓S tan ⊥ rad

12.1. 1b $\hat{F} = x$ ✓S ∠ tan chord

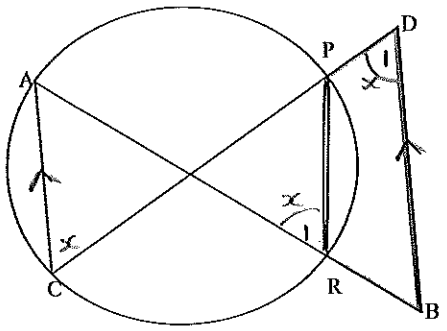
12.1. 2. Constr OE

$\hat{O}_1 = 2x$ ∠ @ centre ✓

$\therefore \hat{B}_1 \neq \hat{O}_1$ ✓

$\therefore$ AB is not a tang to ⊙ OBE ✓ conv ∠ tan chord. **3**

12.2.



Let $\hat{D}_1 = x$

$\therefore \hat{C} = x$ ✓ alt ∠'s = ✓, ∥ lines

$\therefore \hat{R}_1 = x$ ✓ ∠'s same ⊙ segm ✓

$\therefore \hat{D}_1 = \hat{R}_1$ ✓S $= x$

$\therefore$ PDBR is cyclic quad ✓ conv ext ∠ ✓R cyclic quad **7**