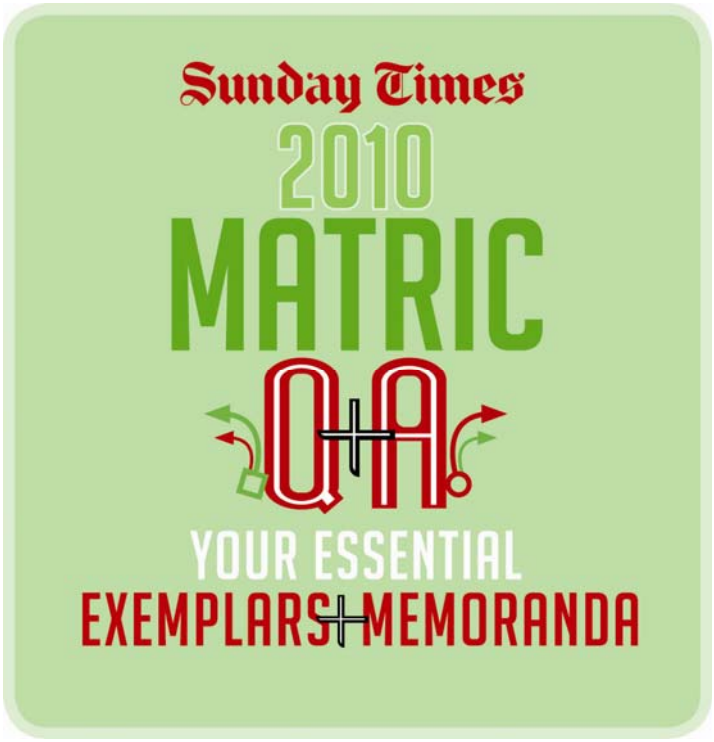
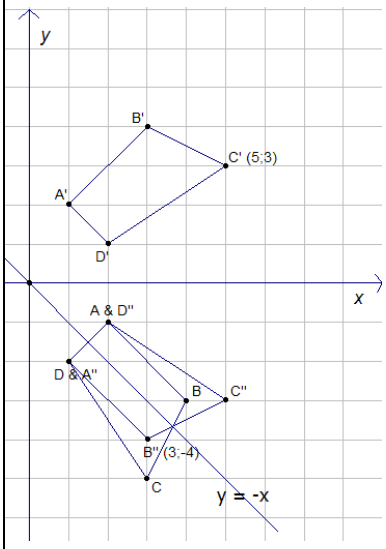
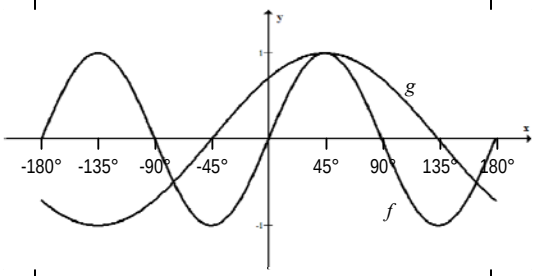
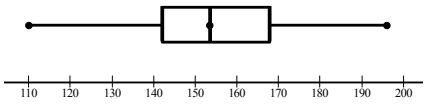
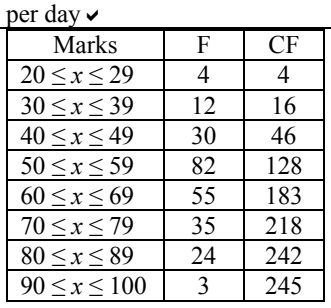


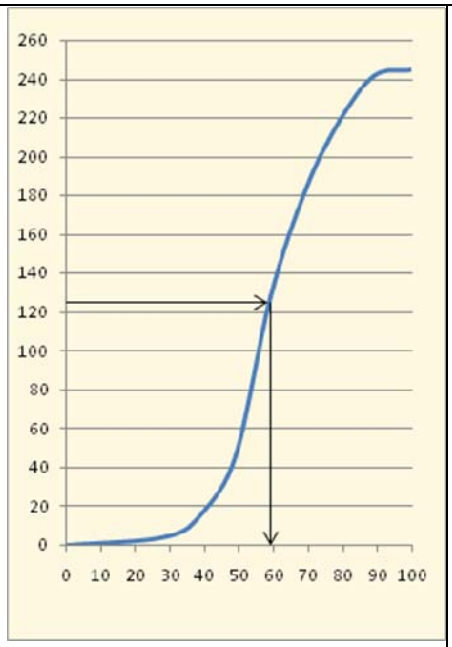
MATHEMATICS PAPER 2 MEMORANDUM

1.1	$M = (\frac{-1+3}{2}; \frac{3+(-1)}{2})$ ✔ $M = (1; 1)$ ✔	(2)
1.2	Midpoint $FH = (\frac{4+(-2)}{2}; \frac{4+(-2)}{2})$ ✔ $= (1; 1)$ ✔ ∴ midpoint FH = midpoint EG ∴ lines bisect each other.	(2)
1.3	$m_{EG} = \frac{3-(-1)}{-1-3} = \frac{4}{-4} = -1$ ✔ $m_{FH} = \frac{4-(-2)}{4-(-2)} = \frac{6}{6} = 1$ ✔ ∴ $m_{EG} \times m_{FH} = -1$ ⇒ EG ⊥ FH ✔ ∴ using 1.2, diagonals of EFGH bisect at 90° ✔ ∴ EFGH is a rhombus. OR $length_{EH} = \sqrt{(-1-(-2))^2 + (3-(-2))^2}$ $= \sqrt{1+25}$ $= \sqrt{26}$ ✔ $length_{EF} = \sqrt{(-1-4)^2 + (3-4)^2}$ $= \sqrt{25+1}$ ✔ $= \sqrt{26}$ ∴ using 1.2, EFGH is a parallelogram	(4)
	(diagonals bisect) ✔ But EH = EF ✔ ∴ EFGH is a rhombus.	
1.4	$m_{EG} = -1$ from above ✔ ∴ $y = -x + c$ Substitute (–1; 3): ✔ $3 = -(-1) + c$ $2 = c$ ∴ $y = -x + 2$ ✔	(3)
1.5	$y = -x + 2$ Let $x = \frac{5}{2}$. $y = -\frac{5}{2} + 2$ ✔ $y = -\frac{1}{2}$ ✔ ∴ $(\frac{5}{2}; \frac{-3}{4})$ does not lie on the line. ✔	(3)
1.6	$m_{FH} = \frac{4-(-1)}{4-3} = \frac{5}{1} = 5$ ✔ ∴ tan α = 5 A = $\tan^{-1}(5)$ ✔ = 78,69° ✔	(3)
1.7	$length_{EG} = \sqrt{(3-(-1))^2 + (-1-3)^2}$ ✔ $= \sqrt{32}$ $length_{HM} = \sqrt{(1-(-2))^2 + (1-(-2))^2}$ ✔ $= \sqrt{18}$ ∴ area ΔEGH = $\frac{1}{2}\sqrt{18} \times \sqrt{32}$ ✔	

	$= 12$ units^2 ✔	(4)
1.8	G → H back 5 down 1 ∴ E → P is the same ✔ ∴ P(–6; 2) ✔ (or equivalent)	(2)
2.1	ΔEDC is right angled at C (tangent, radius) $ED^2 = EC^2 + DC^2$ ✔ $13^2 = 12^2 + DC^2$ $25 = DC^2$ $5 = DC$ ✔	(2)
2.2	$DC^2 = (a-1)^2 + (2-(-1))^2$ ✔ $25 = a^2 - 2a + 1 + 9$ ✔ $0 = a^2 - 2a - 15$ ✔ $a = -3$; $a = 5$ ✔ By inspection, for this sketch $a = 5$. ✔	(5)
2.3	$m_{DC} = \frac{2-(-1)}{5-1} = \frac{3}{4}$ ✔ $m_{tangent} = \frac{-4}{3}$ ✔ $y = \frac{-4}{3}x + c$ Substitute (1; –1): $-1 = \frac{-4}{3}x + c$ ✔ $\frac{1}{3} = c$ ✔ $y = \frac{-4}{3}x + \frac{1}{3}$	(4)
2.4	y-axis is tangent to circle at A. ∴ AD is horizontal ∴ A(0; 2) ✔ ✔ (inspection)	(2)
2.5	$(x-a)^2 + (y-b)^2 = c^2$ ✔ Substitute (1; –1) and (0; 2): $(0-1)^2 + (2-(-1))^2 = c^2$ ✔ ✔ $10 = c^2$ ✔ $(x-1)^2 + (y+1)^2 = 10$ ✔	(5)
3.1 and 3.2		(10)
3.3	P(x; y) → P′($-x$; $-y$) → final image $(-\frac{4}{5}x; -\frac{4}{5}y)$ ✔ ✔	(2)
3.4	Linear factor $\frac{4}{5}$ ⇒ area factor $\frac{16}{25}$ ✔ ∴ area $= \frac{16}{25}p$ units^2 ✔	(2)
4.1	$(x\cos\theta - y\sin\theta;\ x\sin\theta + y\cos\theta)$ ✔ $= (6\cos 60° - 3\sin 60°;\ 6\sin 60° + 3\cos 60°)$ ✔ ✔ $= \left(\frac{6-3\sqrt{3}}{2}; \frac{3+6\sqrt{3}}{2}\right)$ ✔ ✔ OR $= \left(3 - \frac{3\sqrt{3}}{2}; 3\sqrt{3} + \frac{3}{2}\right)$	(5)
4.2	(6; 3) → (3; 6) → (3; –6) ✔ ✔	(2)
5.1.1	$\tan\theta = \frac{y}{x} = \frac{b}{a}$ ✔	(1)
5.1.2	$\cos(-\theta) = \cos\theta = \frac{x}{r}$ ✔ ✔ $r = \sqrt{a^2 + b^2}$ (Pythagoras) ✔ ∴ $\cos(-\theta) = \frac{a}{\sqrt{a^2+b^2}}$ ✔	(4)
5.2.1	$\cos 53°$ $= \sin(90° - 53°)$ $= \sin 37°$ ✔ $= k$ ✔	(2)
5.2.2	$\sin(-74°)$ $= -\sin 74°$ $= -2\sin 37°\cos 37°$ ✔ ✔ $= -2k\sqrt{1-k^2}$ ✔	(4)
5.3.1	LHS $= \frac{\sin\alpha\sin 2\alpha}{\cos\alpha} + \cos 2\alpha$ ✔ $= \frac{\sin\alpha 2\sin\alpha\cos\alpha}{\cos\alpha} + 1 - 2\sin^2\alpha$ ✔ ✔ $= 1$ ✔ = RHS	(4)
5.3.2	LHS $= \frac{\sin 234°}{\cos 36°} - \frac{\sin(x-90°)\cos(90°-2x)}{\sin(x-360°)}$ $= \frac{-\sin 54°}{\cos 36°} - \frac{(-\cos x)\sin 2x}{\sin x}$ ✔ ✔ ✔ ✔ $= \frac{-\sin 54°}{\sin 54°} - \frac{\cos x . 2\sin x\cos x}{\sin x}$ ✔ ✔ $= -1 + 2\cos^2 x$ ✔ $= \cos 2x$ = RHS	(8)
5.4	$3\cos^2 x + 5\sin x = 3$ $3(1 - \sin^2 x) + 5\sin x = 3$ ✔ $3 - 3\sin^2 x + 5\sin x = 3$ $0 = 3\sin^2 x - 5\sin x$ $0 = \sin x(3\sin x - 5)$ ✔ $\sin x = 0$ or $\sin x = \frac{5}{3}$ ✔ ✔ ∴ $x = 0° + n180°$ or x is undefined	(6)

	$(n \in Z)$ ✔ ✔	
6.1	$A\hat{C}B = 110° - 50°$ $= 60°$ ✔ $\therefore AB^2 = 150^2 + 260^2 - (2.150.260)\cos 60°$ ✔ $AB^2 = 51\ 100$ ✔ $\therefore AB = 226{,}05$ ✔ AB = 226 km ✔	(5)
6.2.1	$C\hat{D}B = 180° - (\theta + 30°)$ ✔	(1)
6.2.2	In ΔABC: $\tan\theta = \frac{p}{CB}$ $CB \tan\theta = p$ ……(i) ✔ In ΔCBD: $\frac{CB}{\sin[180° - (\theta + 30°)]} = \frac{8}{\sin\theta}$ ✔ $\frac{CB}{\sin(\theta + 30°)} = \frac{8}{\sin\theta}$ ✔ $CB = \frac{8\sin(\theta + 30°)}{\sin\theta}$ ……(ii) ✔ Combining (i) and (ii): $p = \frac{8\sin(\theta + 30°)}{\sin\theta} . \tan\theta$ $p = \frac{8\sin(\theta + 30°)}{\sin\theta} \cdot \frac{\sin\theta}{\cos\theta}$ ✔ $p = \frac{8\sin(\theta + 30°)}{\cos\theta}$ ✔	(6)
7.1	$\sin 2x = \cos(x - 45°)$ $\sin 2x = \sin[90° - (x - 45°)]$ $\sin 2x = \sin(135° - x)$ ✔ $\therefore 2x = 135° - x + n360° (n \in Z)$ ✔ $3x = 135° + n360°$ $x = 45° + n120°$ ✔ or $2x = 180° - (135° - x) + n360° (n \in Z)$ ✔ $2x = 45° + x + n360°$ $x = 45° + n360°$ ✔ $\therefore$ for $x \in [-180°; 180°]$ $x = 45°; 165°; -75°$ ✔ ✔ ✔	(8)
7.2	 ✔ ✔ ✔ for g ✔ ✔ ✔ for f	(6)
7.3.1	$g(x) \leq f(x)$ for $[-180°; 90°]$ $\Rightarrow -180° \leq x \leq -75°$ ✔ ✔ ✔	(3)
7.3.2	$\frac{f(x)}{g(x)}$ undefined $\Rightarrow g(x) = 0$ ✔ $\therefore x = -45°$ only for $[-180°; 90°]$ ✔	(2)
8.1.1	$\bar{x} = 65{,}27$ ✔ ✔ ✔ Using stats mode on calculator or manually	(3)
8.1.2	$SD = 8{,}71$ ✔ ✔	(2)
8.1.3	Upper boundary = 65,27 + 8,71 = 73,98 ✔ Lower boundary = 65,27 – 8,71 = 56,56 ✔ $\therefore$ reject 50; 45; 80 i.e. 3 bags would be rejected ✔	(3)
8.2.1	Ordered list 11 000 12 600 14 200 Q_1 = 14 200 14 500 15 300 Median = 15 350 15 400 16 500 16 800 Q_3 = 16 800 18 600 19 600 $\therefore$ Minimum = 11 000 ✔ Lower quartile = 14 200 ✔ Median = 15 350 ✔ Upper quartile = 16 800 ✔ Maximum = 19 600 ✔	(5)
8.2.2	Scale in 100s  ✔ ✔ ✔ ✔	(3)
8.2.3	Maximum per day $= \frac{19\ 600}{28} = 700$ patients per day ✔ Minimum per day $= \frac{11000}{28} = 392$ patients per day ✔	(2)
9.1	 ✔ ✔	(2)

Marks	F	CF
$20 \leq x \leq 29$	4	4
$30 \leq x \leq 39$	12	16
$40 \leq x \leq 49$	30	46
$50 \leq x \leq 59$	82	128
$60 \leq x \leq 69$	55	183
$70 \leq x \leq 79$	35	218
$80 \leq x \leq 89$	24	242
$90 \leq x \leq 100$	3	245

9.2	 ✔ ✔ ✔ ✔	(4)
9.3	Median at $\frac{245+1}{2} = 123$ Median approximately 59 ✔ ✔	(2)
9.4	Data is grouped, so original raw data is lost. ∴ mean or median will be approximate. ✔ ✔	(2)