Marking Scheme

This document was prepared for markers' reference. It should not be regarded as a set of model answers. Candidates and teachers who were not involved in the marking process are advised to interpret its contents with care.

General Marking Instructions

1. It is very important that all markers should adhere as closely as possible to the marking scheme. In many cases, however, candidates will have obtained a correct answer by an alternative method not specified in the marking scheme. In general, a correct answer merits ***all the marks*** allocated to that part, unless a particular method has been specified in the question. Markers should be patient in marking alternative solutions not specified in the marking scheme.

2. In the marking scheme, marks are classified into the following three categories:

'M' marks	awarded for correct methods being used;
'A' marks	awarded for the accuracy of the answers;
Marks without 'M' or 'A'	awarded for correctly completing a proof or arriving at an answer given in a question.

   In a question consisting of several parts each depending on the previous parts, 'M' marks should be awarded to steps or methods correctly deduced from previous answers, even if these answers are erroneous. However, 'A' marks for the corresponding answers should NOT be awarded (unless otherwise specified).

3. For the convenience of markers, the marking scheme was written as detailed as possible. However, it is still likely that candidates would not present their solution in the same explicit manner, e.g. some steps would either be omitted or stated implicitly. In such cases, markers should exercise their discretion in marking candidates' work. In general, marks for a certain step should be awarded if candidates' solution indicated that the relevant concept/technique had been used.

4. In marking candidates' work, the benefit of doubt should be given in the candidates' favour.

5. In the marking scheme, 'r.t.' stands for 'accepting answers which can be rounded off to' and 'f.t.' stands for 'follow through'. Steps which can be skipped are shaded whereas alternative answers are enclosed with rectangles. All fractional answers must be simplified.

Paper 1

Solution	Marks	Remarks
1. $\dfrac{2}{4h-7}-\dfrac{3}{6h-5}$		
$=\dfrac{2(6h-5)-3(4h-7)}{(4h-7)(6h-5)}$	1M	
$=\dfrac{12h-10-12h+21}{(4h-7)(6h-5)}$	1M	
$=\dfrac{11}{(4h-7)(6h-5)}$	1A	or equivalent
	----------(3)	
2. $\dfrac{Ax+C}{B}=3x$		
$Ax+C=3Bx$	1M	
$Ax-3Bx=-C$	1M	for putting x on one side
$x=\dfrac{C}{3B-A}$	1A	or equivalent
$\dfrac{Ax+C}{B}=3x$		
$\dfrac{Ax}{B}+\dfrac{C}{B}=3x$	1M	
$\dfrac{Ax}{B}-3x=\dfrac{-C}{B}$	1M	for putting x on one side
$x=\dfrac{C}{3B-A}$	1A	or equivalent
	----------(3)	
3. (a) $6r^2-13rs-28s^2$		
$=(2r-7s)(3r+4s)$	1A	or equivalent
(b) $4r-14s+6r^2-13rs-28s^2$		
$=4r-14s+(2r-7s)(3r+4s)$	1M	for using the result of (a)
$=2(2r-7s)+(2r-7s)(3r+4s)$		
$=(2r-7s)(2+3r+4s)$	1A	or equivalent
	----------(3)	
4. (a) $\dfrac{5x+7}{4}-1<2x$		
$5x+7-4<8x$		
$-3x<-3$	1M	for putting x on one side
$x>1$	1A	
$3x+9\geq 0$		
$x\geq -3$		
Thus, the required range is $x>1$.	1A	
(b) 2	1A	
	----------(4)	

Solution	Marks	Remarks
5. $a:c=6:5$	1M	either one
$\dfrac{2b+7c}{b+c}=4$ $2b+7c=4b+4c$ $2b=3c$ $b:c=3:2$ $b:c=15:10$ $a:c=12:10$		
So, we have $a:b:c=12:15:10$.	1M	
Let $a=12k$, $b=15k$ and $c=10k$, where k is a non-zero constant.		
$\dfrac{5a+8b}{2b+3c}$ $=\dfrac{5(12k)+8(15k)}{2(15k)+3(10k)}$	1M	
$=3$	1A	
	---------(4)	
6. Let $\$x$ be the marked price of the calculator. The cost of the calculator $=\dfrac{x}{(1+40\%)}$	1M	
$=\$\left(\dfrac{5x}{7}\right)$		
The selling price of the calculator $=(75\%)x$	1M	
$=\$\left(\dfrac{3x}{4}\right)$		
$\dfrac{3x}{4}-\dfrac{5x}{7}=13$	1M	
$x=364$ Thus, the marked price of the calculator is $\$364$.	1A	
Let $\$c$ be the cost of the calculator. The marked price of the calculator $=(1+40\%)c$	1M	
$=\$1.4c$		
The selling price of the calculator $=(75\%)(1.4c)$	1M	
$=\$1.05c$		
$1.05c-c=13$	1M	
$c=260$ Thus, the marked price of the calculator is $\$364$.	1A	
	---------(4)	

Solution	Marks	Remarks
7. (a) $\angle POQ$ $=149^\circ-59^\circ$ $=90^\circ$	1A	
(b) $\angle POR$ $=239^\circ-59^\circ$ $=180^\circ$ Thus, P , O and R are collinear.	1A	f.t.
(c) The required perimeter $=PQ+QR+PR$	1M	
$=\sqrt{11^2+60^2}+\sqrt{60^2+144^2}+(11+144)$ $=372$	1A	
	---------(4)	
8. (a) $\angle ACB=\angle ADB=90^\circ$ (given) $BC=AD$ (given) $AB=AB$ (common side) $\Delta ABC\cong\Delta BAD$ (RHS)		
Marking Scheme:		
Case 1 Any correct proof with correct reasons.	2	
Case 2 Any correct proof without reasons.	1	
(b) AE $=\sqrt{AD^2+DE^2}$	1M	
$=15$ cm By (a), we have $\angle ABE=\angle BAE$. Hence, we have $AE=BE$.	1M	
So, we have $BE=15$ cm . Note that $CE=DE=9$ cm .		
The required area $=\dfrac{1}{2}(AD)(BD)+\dfrac{1}{2}(BC)(CE)$ $=\dfrac{1}{2}(12)(9+15)+\dfrac{1}{2}(12)(9)$ $=198\text{ cm}^2$	1A	
	---------(5)	
9. (a) $\dfrac{4+k}{10+9+4+3+4+k}=\dfrac{5}{18}$	1M	
$k=6$	1A	
(b) The mean $=5$	1A	
The mode $=3$	1A	
The median $=4$	1A	
	---------(5)	

Solution	Marks	Remarks
10. (a) Let $g(x)=a+bx$, where a and b are non-zero constants.	1A	
So, we have $a-3b=-21$ and $a+7b=9$.	1M	for either substitution
Solving, we have $a=-12$ and $b=3$.	1A	for both correct
Thus, we have $g(x)=3x-12$.		
	----------(3)	
(b) $h(x)=0$		
$xg(x)+k=0$		
$3x^2-12x+k=0$	1M	
Note that all the roots of the equation $h(x)=0$ are real numbers.		
$(-12)^2-4(3)(k)\geq 0$	1M	
$k\leq 12$	1A	
	----------(3)	
11. (a) $\frac{21+32+33+37+39+40+40+b+(20+28+29+30+34)(2)+(20+a)(3)}{20}=30$	1M	
Therefore, we have $3a+b=16$.		
Thus, we have $\begin{cases}a=3\\b=7\end{cases}$, $\begin{cases}a=4\\b=4\end{cases}$ or $\begin{cases}a=5\\b=1\end{cases}$.	1A+1A	1A for one pair + 1A for all
	----------(3)	
(b) 21	1A	
	----------(1)	
(c) When $a=3$, the inter-quartile range of the distribution is the greatest.	1M	
The greatest possible inter-quartile range of the distribution		
$=34-23$	1M	
$=11$	1A	f.t.
By (a), there are three cases.		
Case 1: $a=3$		
The inter-quartile range of the distribution		
$=34-23$	1M	any one
$=11$	1M	any one
Case 2: $a=4$		
The inter-quartile range of the distribution		
$=34-24$		
$=10$		
Case 3: $a=5$		
The inter-quartile range of the distribution		
$=34-25$		
$=9$		
Thus, the greatest possible inter-quartile range of the distribution is 11 .	1A	f.t.
	----------(3)	

Solution	Marks	Remarks
12. (a) Let $(b,0)$ be the coordinates of B .		
Then, the coordinates of A , C and D are $(mb+b,0)$, (b,mb) and $(mb+b,mb)$ respectively.	1M	for any one
The slope of OD		
$=\frac{mb-0}{mb+b-0}$	1M	
$=\frac{m}{m+1}$	1A	
Let k be the slope of OD .		
Denote the x-coordinate of A by a .		
Then, the coordinates of D are (a,ka) .	1M	either one
Therefore, the x-coordinate of B is $a-ka$.		
So, the coordinates of C are $(a-ka,ka)$.		
$ka=m(a-ka)$	1M	
$k=m-mk$		
$k=\frac{m}{m+1}$		
Thus, the slope of OD is $\frac{m}{m+1}$.	1A	
	----------(3)	
(b) The slope of OM		
$=\frac{5-0}{6-0}$		
$=\frac{5}{6}$		
The slope of OQ		
$=\frac{\frac{5}{6}}{\frac{5}{6}+1}$ (by (a))	1M	for using the result of (a)
$=\frac{5}{11}$		
So, the equation of the straight line passing through O and Q is $y=\frac{5x}{11}$.		
The equation of the straight line passing through M and N is		
$y-0=\frac{5-0}{6-10}(x-10)$	1M	
$y=\frac{-5x}{4}+\frac{25}{2}$		
Solving $y=\frac{5x}{11}$ and $y=\frac{-5x}{4}+\frac{25}{2}$, the coordinates of Q are $\left(\frac{22}{3},\frac{10}{3}\right)$.		
The x-coordinate of P		
$=\frac{22}{3}-\frac{10}{3}$	1M	
$=4$	1A	
	----------(4)	

Solution	Marks	Remarks
13. (a) The volume of X		
$=\frac{1}{3}(64^2)(24)\left(1-\left(\frac{18}{24}\right)^3\right)$	1M+1M	
$=18\,944\ \text{cm}^3$	1A	r.t. $18\,900\ \text{cm}^3$
	-----(3)	
(b) The area of each lateral face of X		
$=\frac{1}{2}\left(64+\frac{3}{4}(64)\right)\sqrt{6^2+8^2}$	1M	
$=560\ \text{cm}^2$		
The total surface area of X		
$=4(560)+64^2\left(1+\left(\frac{3}{4}\right)^2\right)$	1M	
$=8\,640\ \text{cm}^2$		
$\left(\frac{\text{The height of } X}{\text{The height of } Z}\right)^2=\left(\frac{6}{3}\right)^2=4$		
$\frac{\text{The total surface area of } X}{\text{The total surface area of } Z}=\frac{8\,640}{960}=9$		
$\frac{\text{The total surface area of } X}{\text{The total surface area of } Z}\neq\left(\frac{\text{The height of } X}{\text{The height of } Z}\right)^2$	1M	
Thus, X and Z are not similar.	1A	f.t.
	-----(4)	
14. (a) -4	1A	
	-----(1)	
(b) (i) By (a), we have $F(x)=(6x^2+x-4)(qx^2+rx-10)$.		
Note that $F(-1)=-12$ and $F(2)=0$.	1M+1M	
Hence, we have $(6(-1)^2+(-1)-4)(q(-1)^2+r(-1)-10)=-12$		
and $(6(2)^2+(2)-4)(q(2)^2+r(2)-10)=0$.		
So, we have $q-r=-2$ and $2q+r=5$.		
Solving, we have $q=1$ and $r=3$.	1A	for both correct
(ii) $F(x)=0$		
$(6x^2+x-4)(x^2+3x-10)=0$		
$(6x^2+x-4)(x-2)(x+5)=0$	1M	
$6x^2+x-4=0$, $x-2=0$ or $x+5=0$	1M	
$x=\frac{-1\pm\sqrt{97}}{12}$, $x=2$ or $x=-5$	1M	
Note that $\frac{-1-\sqrt{97}}{12}$ and $\frac{-1+\sqrt{97}}{12}$ are irrational numbers.		
Also note that 2 and -5 are not irrational numbers.		
Thus, the equation $F(x)=0$ has 2 irrational roots.	1A	f.t.
	-----(7)	

Solution	Marks	Remarks
15. $\log_9 y-22=4(\log_3 x-5)$	1M	
$\log_9 y=\log_3 x^4+2$	1M	any one
$\log_9 y=\log_3 9x^4$		
$\frac{\log_3 y}{\log_3 9}=\log_3 9x^4$		
$\log_3 y=2\log_3 9x^4$		
$y=81x^8$	1A	
	-----(3)	
16. (a) The required probability		
$=\frac{C_4^{16}C_1^4}{C_5^{20}}$	1M	for numerator
$=\frac{455}{969}$	1A	r.t. 0.470
The required probability		
$=5\left(\frac{16}{20}\right)\left(\frac{15}{19}\right)\left(\frac{14}{18}\right)\left(\frac{13}{17}\right)\left(\frac{4}{16}\right)$	1M	for numerator
$=\frac{455}{969}$	1A	r.t. 0.470
	-----(2)	
(b) The required probability		
$=1-\frac{C_5^{16}}{C_5^{20}}-\frac{455}{969}$	1M	for $1-p_1-(a)$
$=1-\frac{91}{323}-\frac{455}{969}$		
$=\frac{241}{969}$	1A	r.t. 0.249
The required probability		
$=\frac{C_3^{16}C_2^4}{C_5^{20}}+\frac{C_2^{16}C_3^4}{C_5^{20}}+\frac{C_1^{16}C_4^4}{C_5^{20}}$	1M	for $p_2+p_3+p_4$
$=\frac{70}{323}+\frac{10}{323}+\frac{1}{969}$		
$=\frac{241}{969}$	1A	r.t. 0.249
	-----(2)	

Solution	Marks	Remarks
17. (a) (i) Γ is the perpendicular bisector of QR .	1M	
(ii) The coordinates of the mid-point of QR are $(3,-5)$.		
The slope of QR $=\dfrac{-9-(-1)}{-4-10}$ $=\dfrac{4}{7}$		
The equation of Γ is		
$y-(-5)=\dfrac{-7}{4}(x-3)$	1M	
$7x+4y-1=0$	1A	or equivalent
	----------(3)	
(b) (i) Denote the point $(4,3)$ by S .		
The coordinates of the mid-point of RS are $(0,-3)$.		
The slope of RS $=\dfrac{3-(-9)}{4-(-4)}$ $=\dfrac{3}{2}$		
The equation of the perpendicular bisector of RS is		
$y-(-3)=\dfrac{-2}{3}(x-0)$		
$2x+3y+9=0$		
Solving $7x+4y-1=0$ and $2x+3y+9=0$, the coordinates of the centre of C are $(3,-5)$.	1M	
The radius of C $=\sqrt{(4-3)^2+(3+5)^2}$	1M	
$=\sqrt{65}$		
Thus, the equation of C is $(x-3)^2+(y+5)^2=65$.	1A	$x^2+y^2-6x+10y-31=0$
(ii) Denote the centre of C by G .		
Note that G lies on the circumcircle of ΔUVW .		
Also note that GU is a diameter of the circumcircle of ΔUVW .		
GU $=\sqrt{(10-3)^2+(4+5)^2}$ $=\sqrt{130}$		
The area of the circumcircle of ΔUVW		
$=\pi\left(\dfrac{\sqrt{130}}{2}\right)^2$	1M	
≈ 102.1017612		
>100		
Thus, the area of the circumcircle of ΔUVW is greater than 100 .	1A	f.t.
	----------(5)	

Solution	Marks	Remarks
18. (a) (i) By cosine formula, we have		
$QS^2=PQ^2+PS^2-2(PQ)(PS)\cos\angle QPS$	1M	
$QS^2=12^2+10^2-2(12)(10)\cos 82°$		
$QS\approx 14.51201074$		
$QS\approx 14.5\text{ cm}$	1A	r.t. 14.5 cm
Thus, the length of QS is 14.5 cm .		
(ii) By sine formula, we have		
$\dfrac{\sin\angle QSR}{QR}=\dfrac{\sin\angle QRS}{QS}$	1M	
$\sin\angle QSR\approx\dfrac{13\sin 65°}{14.51201074}$		
$\angle QSR\approx 54.27995332°$ or $\angle QSR\approx 125.7200468°$ (rejected)		
$\angle RQS$		
$\approx 180°-65°-54.27995332°$		
$\approx 60.72004668°$		
$\approx 60.7°$	1A	r.t. 60.7°
	----------(4)	
(b) (i) Denote the foot of the perpendicular from R to QS by T .		
Then, we have $RT=13\sin\angle RQS$.		
Let h cm be the shortest distance from R to the plane PQS .		
$h=RT\sin 80°$	1M	
$h=(13\sin\angle RQS)\sin 80°$		
By (a)(ii), we have $h\approx 11.16685898$.		
Thus, the required distance is 11.2 cm .	1A	r.t. 11.2 cm
(ii) Denote the shortest distance from P to the plane QRS by d cm .		
$\dfrac{1}{3}(\text{the area of }\Delta PQS)h=\dfrac{1}{3}(\text{the area of }\Delta QRS)d$	1M	
$\dfrac{d}{h}=\dfrac{\frac{1}{2}(PQ)(PS)\sin\angle QPS}{\frac{1}{2}(QR)(QS)\sin\angle RQS}$		
$\dfrac{d}{11.16685898}\approx\dfrac{(12)(10)(\sin 82°)}{(13)(14.51201074)\sin 60.72004668°}$		
$d\approx 8.064136851$		
Since $PX\geq d$, the distance between P and X exceeds 8 cm .		
Thus, the claim is correct.	1A	f.t.
	----------(4)	

Solution	Marks	Remarks
19. (a) $f(x)$		
$= 2x^2+4mx+8x+2m^2+8m+n$		
$= 2(x^2+2mx+4x)+2m^2+8m+n$		
$= 2(x^2+2(m+2)x+(m+2)^2-(m+2)^2)+2m^2+8m+n$	1M	
$= 2(x+m+2)^2+n-8$		
Thus, the coordinates of P are $(-m-2, n-8)$.	1A	
	---------(2)	
(b) Transforming $f(x)$ to $f\left(\frac{x}{5}\right)+7$ represents the enlargement of 5 times of the original along the x-axis and the upward translation of 7 units.	1A+1A	
	---------(2)	
(c) (i) The coordinates of Q are $(-5m-10, n-1)$.	1M	
Note that $1+n-(-m-2)=-5m-10-(1+n)$ and $\frac{4-m}{n-8}=\frac{n-1}{4-m}$.	1M+1M	
So, we have $n=-3m-7$ and $8m^2+77m+104=0$.	1M	for $\alpha u^2+\beta u+\gamma=0$
Since $mn<0$, we have $m=-8$ and $n=17$.		
Thus, the coordinates of P and Q are $(6,9)$ and $(30,16)$ respectively.	1A	for both correct
(ii) For $PQ // SR$, the slope of PQ is equal to the slope of RS .		
Therefore, we have $\frac{t-(2t-3)}{3t+27-(3t+3)}=\frac{16-9}{30-6}$.	1M	
Solving, we have $t=-4$.		
The coordinates of R and S are $(15,-4)$ and $(-9,-11)$ respectively.		
$PQ=\sqrt{(30-6)^2+(16-9)^2}=25$	1M	any one
$RS=\sqrt{(15-(-9))^2+(-4-(-11))^2}=25$		
$QR=\sqrt{(30-15)^2+(16-(-4))^2}=25$		
When $t=-4$, we have $PQ=QR=RS$ and $PQ // SR$.		
Thus, it is possible that $PQRS$ is a rhombus.	1A	f.t.
For $PQ=RS$, we have		
$\sqrt{(30-6)^2+(16-9)^2}=\sqrt{((3t+27)-(3t+3))^2+(t-(2t-3))^2}$.	1M	
Simplifying, we have $t^2-6t-40=0$.		
Solving, we have $t=10$ or $t=-4$.		
Case 1: $t=10$		
The coordinates of R and S are $(57,10)$ and $(33,17)$ respectively.		
$QR=\sqrt{(57-30)^2+(10-16)^2}=\sqrt{765}\neq 25=PQ$	1M	any one
Hence, $PQRS$ is not a rhombus.		
Case 2: $t=-4$		
The coordinates of R and S are $(15,-4)$ and $(-9,-11)$ respectively.		
$QR=\sqrt{(30-15)^2+(16-(-4))^2}=25$		
$PS=\sqrt{(6-(-9))^2+(9-(-11))^2}=25$		
When $t=-4$, we have $PQ=QR=RS=PS$.		
Thus, it is possible that $PQRS$ is a rhombus.	1A	f.t.

Solution	Marks	Remarks
For $PQ=QR$, we have		
$\sqrt{(30-6)^2+(16-9)^2}=\sqrt{(3t+27-30)^2+(t-16)^2}$.	1M	
Simplifying, we have $t^2-5t-36=0$.		
Solving, we have $t=9$ or $t=-4$.		
Case 1: $t=9$		
The coordinates of R and S are $(54,9)$ and $(30,15)$ respectively.		
$RS=\sqrt{(54-30)^2+(9-15)^2}=\sqrt{612}\neq 25=PQ$	1M	any one
Hence, $PQRS$ is not a rhombus.		
Case 2: $t=-4$		
The coordinates of R and S are $(15,-4)$ and $(-9,-11)$ respectively.		
$RS=\sqrt{(15-(-9))^2+(-4-(-11))^2}=25$		
$PS=\sqrt{(6-(-9))^2+(9-(-11))^2}=25$		
When $t=-4$, we have $PQ=QR=RS=PS$.		
Thus, it is possible that $PQRS$ is a rhombus.	1A	f.t.
For $QR=RS$, we have		
$\sqrt{(3t+27-30)^2+(t-16)^2}=\sqrt{(3t+27-3t-3)^2+(t-2t+3)^2}$.	1M	
Simplifying, we have $9t^2-44t-320=0$.		
Solving, we have $t=\frac{80}{9}$ or $t=-4$.		
Case 1: $t=\frac{80}{9}$		
The coordinates of R and S are $\left(\frac{161}{3},\frac{80}{9}\right)$ and $\left(\frac{89}{3},\frac{133}{9}\right)$ respectively.		
$PS=\sqrt{\left(6-\frac{89}{3}\right)^2+\left(9-\frac{133}{9}\right)^2}=\sqrt{\frac{48\,073}{81}}\neq 25=PQ$	1M	any one
Hence, $PQRS$ is not a rhombus.		
Case 2: $t=-4$		
The coordinates of R and S are $(15,-4)$ and $(-9,-11)$ respectively.		
$RS=\sqrt{(15-(-9))^2+(-4-(-11))^2}=25$		
$PS=\sqrt{(6-(-9))^2+(9-(-11))^2}=25$		
When $t=-4$, we have $PQ=QR=RS=PS$.		
Thus, it is possible that $PQRS$ is a rhombus.	1A	f.t.
	---------(8)	

Paper 2

Question No.	Key	Question No.	Key
1.	C (86)	26.	B (55)
2.	D (78)	27.	D (45)
3.	A (88)	28.	C (60)
4.	A (91)	29.	B (87)
5.	B (93)	30.	D (55)
6.	A (77)	31.	B (70)
7.	B (46)	32.	A (63)
8.	D (55)	33.	B (49)
9.	C (67)	34.	D (54)
10.	B (70)	35.	A (34)
11.	C (58)	36.	C (46)
12.	A (73)	37.	C (41)
13.	C (74)	38.	B (47)
14.	A (67)	39.	A (49)
15.	D (68)	40.	C (46)
16.	D (55)	41.	A (27)
17.	C (36)	42.	C (66)
18.	C (82)	43.	D (59)
19.	D (51)	44.	D (72)
20.	D (46)	45.	B (53)
21.	B (36)		
22.	B (64)		
23.	A (56)		
24.	A (59)		
25.	C (40)		

Note: Figures in brackets indicate the percentages of candidates choosing the correct answers.

Candidates' Performance

Paper 1

In this year, 44 943 candidates sat the examination. The mean score was 56 marks. Candidates generally performed better in Section A than in Section B.

Section A(1)

Question Number	Performance in General
1	Very good. About 80% of the candidates were able to simplify the given expression.
2	Very good. About 85% of the candidates were able to make x the subject of the given formula.
3	Very good. About 80% of the candidates were able to factorize the given expressions.
4 (a)	Very good. Most candidates were able to solve the given compound inequality.
(b)	Good. About 65% of the candidates were able to write down the least integer satisfying the given compound inequality.
5	Very good. Most candidates were able to find the value of the given expression. A small number of the candidates wrongly thought that $a:c=5:6$.
6	Very good. About 75% of the candidates were able to find the marked price of the calculator. A small number of candidates confused the marked price with the selling price of the calculator.
7 (a)	Very good. Over 80% of the candidates were able to find $\angle POQ$.
(b)	Good. About half of the candidates were able to conclude that P , O and R are collinear with reasonable explanation.
(c)	Good. Many candidates were able to find the perimeter of ΔPQR . Some candidates wrongly gave the area of ΔPQR as the answer.
8 (a)	Good. Many candidates were able to give a complete proof. Some candidates were not aware that AB is the common side of ΔABC and ΔBAD .
(b)	Very good. Most candidates were able to find the area of the pentagon $ABCED$.
9 (a)	Very good. About 80% of the candidates were able to find the value of k .
(b)	Very good. Most candidates were able to write down the mean, the mode and the median of the distribution. A small number of candidates wrongly thought that the mode of the distribution was 10 .

Section A(2)

Question Number	Performance in General
10 (a)	Very good. About 85% of the candidates were able to find $g(x)$.
(b)	Good. Many candidates were able to find the range of values of k. Some candidates wrongly thought that the discriminant of the equation $h(x)=0$ was equal to zero.
11 (a)	Very good. Most candidates were able to use the mean of the distribution to find the values of a and b.
(b)	Good. About 65% of the candidates were able to write down the least possible range of the distribution.
(c)	Good. Many candidates were able to find the greatest possible inter-quartile range of the distribution. Some candidates wrongly gave the least possible inter-quartile range of the distribution as the answer.
12 (a)	Poor. Most candidates wrongly thought that OD was perpendicular to OC, and hence they were unable to express correctly the slope of OD in terms of m.
(b)	Poor. Most candidates wrongly thought that P was the mid-point of OM, and hence they were unable to find correctly the x-coordinate of P.
13 (a)	Good. Many candidates were able to find the volume of X. Some candidates confused the volume of a pyramid with the volume of a prism.
(b)	Fair. Many candidates found difficulty in calculating the total surface area of X, and hence they were unable to explain correctly why X and Z are not similar.
14 (a)	Good. Over 60% of the candidates were able to write down the value of p. Some candidates were not aware that $-10p=40$.
(b) (i)	Good. Many candidates were able to find the values of q and r. Some candidates overlooked that $F(-1)=-12$ and $F(2)=0$.
(ii)	Fair. Many candidates confused irrational roots with imaginary roots.

Section B

Question Number	Performance in General
15	Fair. Many candidates wrongly applied the properties of logarithm, and hence they were unable to express y in terms of x.
16 (a)	Very good. Most candidates were able to find the probability that exactly 1 white cup is drawn.
(b)	Good. Many candidates were able to find the probability that at most 3 red cups are drawn. Some candidates wrongly applied the concept of complementary events, and hence they were unable to find the required probability.
17 (a) (i)	Very good. Most candidates were able to describe the geometric relationship between Γ and QR. A small number of the candidates wrongly thought that Γ was the angle bisector of QR.
(ii)	Good. Many candidates were able to use the result of (a)(i) to find the equation of Γ .
(b) (i)	Fair. Many candidates were not aware that the centre of C is the point of intersection of Γ and the perpendicular bisector of RS, and hence they were unable to find the equation of C.
(ii)	Poor. Most candidates were not aware that GU is a diameter of the circumcircle of ΔUVW, and hence they were unable to conclude that the area of the circumcircle of ΔUVW is greater than 100.
18 (a) (i)	Good. Over half of the candidates were able to find the length of QS.
(ii)	Good. Many candidates were able to find $\angle RQS$. Some candidates confused $\angle RQS$ with $\angle QSR$.
(b) (i)	Fair. Many candidates wrongly thought that PR was perpendicular to the plane PQS, and hence they were unable to find the shortest distance from R to the plane PQS.
(ii)	Poor. Most candidates were not aware that the distance between P and X is at least the shortest distance from P to the plane QRS, and hence they were unable to conclude that the distance between P and X exceeds 8 cm .
19 (a)	Fair. Over half of the candidates were unable to use the method of completing the square to express the coordinates of P in terms of m and n.
(b)	Fair. Many candidates wrongly thought that transforming $f(x)$ to $f\left(\frac{x}{5}\right)+7$ represented the enlargement of 5 times of the original along the y-axis and the downward translation of 7 units.
(c) (i)	Poor. Most candidates were unable to express the coordinates of Q in terms of m and n, and hence they were unable to find the coordinates of P and Q.
(ii)	Poor. Most candidates were unable to find the coordinates of P and Q, and hence they were unable to explain correctly why it is possible that $PQRS$ is a rhombus.

General recommendations

Candidates should:

1. grasp fundamental mathematics topics like change of subject, factorization, ratios, percentages, inequalities and mensuration;
2. show all working and explain clearly how to get the conclusion;
3. have a better understanding of statistical terms and their applications;
4. develop a better spatial sense, such as distinguishing right-angled triangles from non-right-angled triangles in 3-D figures;
5. make use of the memory space in calculators for carrying more significant figures throughout the working in solving trigonometric problems; and
6. explore the relationship between different parts of a question.

Paper 2

In this year, 44 886 candidates sat the examination. The paper consisted of 45 multiple-choice items. The mean score was 27. Post-examination analysis revealed the following:

1. Candidates' performance on Items 1, 2, 3, 4, 5, 6, 12, 13, 18, 29 and 44 was good. Over 70% of the candidates answered them correctly.

2. Candidates' performance on Item 41 was unsatisfactory. Less than 30% of the candidates gave the correct answers.

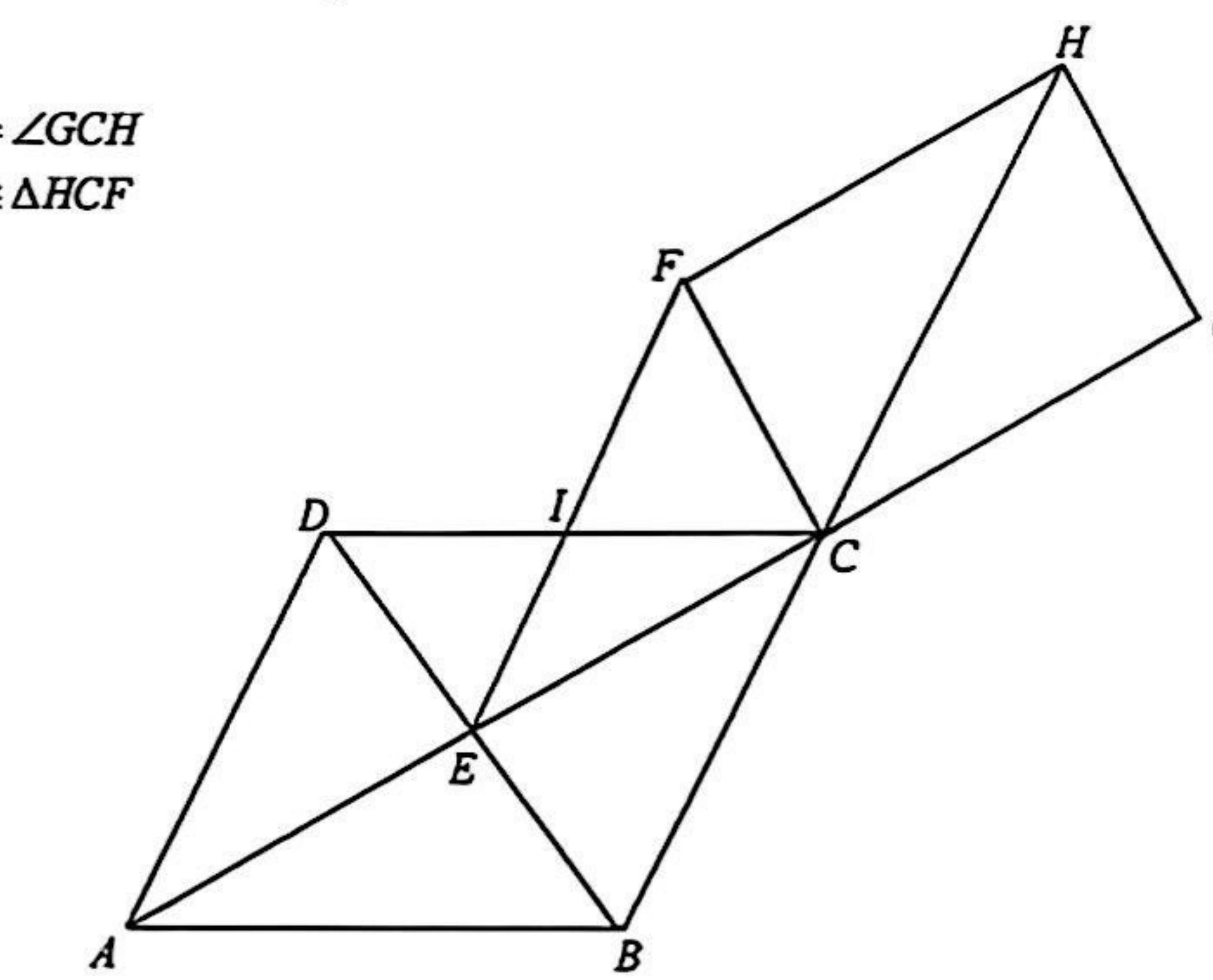
3. In Item 21, many candidates were not aware that $\angle ABE$ and $\angle GCH$ are complementary angles. Many candidates wrongly thought that $\angle ABE = \angle GCH$, and hence wrongly gave Option D as the answer.

Q.21 In the figure, $ABCD$ is a rhombus. Denote the point of intersection of AC and BD by E. Let F be a point such that $BH // EF$ and $CFHG$ is a rectangle, where G and H are points lying on AC produced and BC produced respectively. Denote the point of intersection of CD and EF by I. Which of the following must be true?

I. $CI = FI$

II. $\angle ABE = \angle GCH$

III. $\Delta ADE \cong \Delta HCF$



A.	I and II only	(14%)
* B.	I and III only	(36%)
C.	II and III only	(23%)
D.	I, II and III	(27%)

4. In Item 25, many candidates wrongly thought that P was the mid-point of AB, and hence wrongly gave Option B as the answer.

Q.25 The coordinates of the points A and B are $(-3, 1)$ and $(-7, -5)$ respectively. If P is a point lying on the straight line $x - y + 13 = 0$ such that $AP = PB$, then the y-coordinate of P is

A.	-11 .	(10%)
B.	-2 .	(31%)
* C.	2 .	(40%)
D.	11 .	(19%)

5. In Item 35, many candidates were unable to find the correct value of a, and hence gave wrong answers.

Q.35 Let $z=(a-5)i+\frac{(a+2)i}{2+i}$. If a and z are real numbers, then $a-z=$

* A.	2.	(34%)
B.	3.	(17%)
C.	4.	(27%)
D.	5.	(22%)

6. In Item 37, many candidates confused the least value with the greatest value of $5x-2y+c$, and hence wrongly gave Option A as the answer.

Q.37 Consider the following system of inequalities:

$$\begin{cases} x-2y\leq 1 \\ x+4y\leq 13 \\ 2x-y\geq -1 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. Find the constant c such that the least value of $5x-2y+c$ is 22, where (x, y) is a point lying in R.

A.	1	(23%)
B.	23	(19%)
* C.	25	(41%)
D.	29	(17%)

7. In Item 41, many candidates were not aware that I, J and P are collinear. Many candidates wrongly thought that I, J and Q were collinear, and hence wrongly gave Option D as the answer.

Q.41 Let G, H, I and J be the centroid, the orthocentre, the in-centre and the circumcentre of ΔPQR respectively. If $\angle PQR=\angle PRQ=22°$, which of the following are true?

I. G lies inside ΔPQR.
II. H lies outside ΔPQR.
III. I, J and Q are collinear.

* A.	I and II only	(27%)
B.	I and III only	(22%)
C.	II and III only	(22%)
D.	I, II and III	(29%)