Class	Index Number	Name

ANG MO KIO SECONDARY SCHOOL
FINAL EXAMINATION 2018
SECONDARY THREE EXPRESS

ADDITIONAL MATHEMATICS **4047/01**
Paper 1

Friday **05 October 2018** **1 hour 30 minutes**

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
Write your answers on the separate Answer Paper provided.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is **60**.

This document consists of **5** printed pages and **1** blank page.

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial expansion

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{n(n-1)\ldots(n-r+1)}{r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin 2A = 2\sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}ab\sin C$$

1 (a) (i) Factorise $8x^3+27$. [2]

(ii) Hence determine, showing all necessary working, the number of real roots of the equation $8x^3+27=0$. [3]

(b) The coefficient of x^3 of a cubic polynomial, f(x), is 4 and that the roots of the equation f(x) = 0 are -1, 3 and k. Given that f(x) has a remainder of 60 when divided by $x-2$, find the value of k. [3]

2 A curve has the equation $y=3x^2+4x+c$, where c is a constant.

(i) In the case where $c=-15$, find the range of values of x for $y>0$. [2]

(ii) Find the range of values of c such that the curve lies completely above the $x-$axis. [2]

(iii) Find the value of c for which the line $2y+x=1$ is a tangent to the curve. [4]

3 (a) Without using a calculator, find the exact value of $\cot\left(\frac{2\pi}{3}\right)$. [2]

(b) Given that $\sin A=-\frac{5}{13}$ and $\tan A>0$, find without using a calculator, the numerical value of

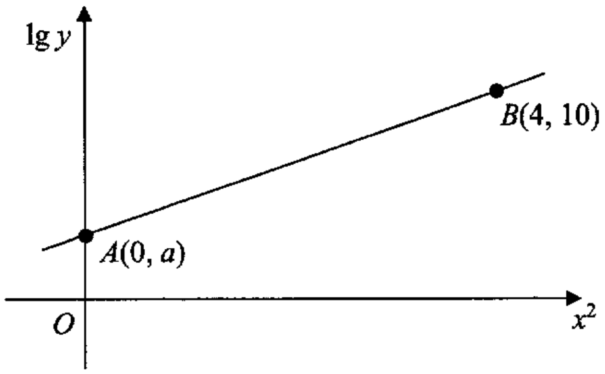
(i) $\sec A$, [2]

(ii) $\tan(-A)$. [1]

4 (i) Sketch the graphs of $y=2x^{\frac{1}{3}}$ and $y^2=2x$ on the same diagram for $x\geq 0$. [2]

(ii) The two graphs $y=2x^{\frac{1}{3}}$ and $y^2=2x$ intersect at (0, 0) and a point A. Find the coordinates of A. [3]

5 The variables x and y are related in such a way that, when $\lg y$ is plotted against x^2, a straight line passing through the point $A(0, a)$ and the point $B(4, 10)$ is obtained, as shown in the diagram.



Given that the line has a gradient of 2, find

(i) the value of a, [1]

(ii) the expression for y in terms of x, [1]

(iii) the values of x when $y = 1000$. [2]

6 The equation of a circle C is $x^2 + 6x + y^2 - 10y = 66$.

(i) Find the radius and the coordinates of the centre of the circle. [3]

(ii) Given that PQ is the diameter of the circle, where P is the point (5, 11), find the coordinates of the point Q. [2]

(iii) Find the equation of the circle C_1, which is a reflection of the circle C in the line $x = -1$. [2]

7 (i) Given that $u = 3^x$, express $3^{2x-1} = 3^x + 6$ as an equation in u. [1]

(ii) Hence find the value(s) of x for which $3^{2x-1} = 3^x + 6$. [2]

(iii) Explain why the equation $3^{2x-1} = 3^x - k$ has no solution if $k > 0.75$. [3]

8 **(a)** Solve $\log_4(x-2)-\log_4(x+2)=1+\log_4\frac{1}{9}$. [4]

(b) Solve the equation $\lg x=\log_x 1000$, giving your answer to 2 significant figures. [4]

9 **(a)** One root of the equation $8x^2-bx+1=0$ is twice the other root. Find the possible value(s) of b. [4]

(b) Given that the roots of $2x^2-6x+3=0$ are α and β, find the quadratic equation whose roots are $\frac{3}{\alpha^2}$ and $\frac{3}{\beta^2}$. [5]

END OF PAPER

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Class	Index Number	Name

ANG MO KIO SECONDARY SCHOOL
FINAL EXAMINATION 2018
SECONDARY THREE EXPRESS

ADDITIONAL MATHEMATICS **4047/02**
Paper 2

Wednesday **03 October 2018** **2 hours**

Additional Materials: Answer Paper
Graph paper

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
Write your answers on the separate Answer Paper provided.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is **80**.

This document consists of **6** printed pages.

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial expansion

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{n(n-1)\ldots(n-r+1)}{r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

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Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} ab \sin C$$

1 A liquid is allowed to cool after being heated. The temperature, θ °C of the liquid, t seconds after being removed from the heat is given by $\theta = 25 + 80e^{-0.03t}$.

(i) Find the initial value of θ. [1]

(ii) Find the time taken for the liquid to cool to 60 °C. [2]

(iii) Explain why θ does not fall below 25 °C. [1]

2 Express $\dfrac{7x+4}{(x^2+5)(x-2)}$ in partial fractions. [5]

3 (i) The line $y - 2x + 9 = 0$ intersects the curve $x^2 + y^2 + xy + 3x = 46$ at the points R and Q. Find the coordinates of points R and Q. [4]

(ii) Find the equation of the perpendicular bisector of RQ. [3]

4 A right-angled triangle has base $(4 + 2\sqrt{3})$ cm and area $(6\sqrt{3} - 2)$ cm^2. Find the height of the triangle, giving your answer in the form $(a\sqrt{3} + b)$ cm where a and b are integers. [4]

5 (a) Find all the angles between 0° and 360° inclusive which satisfy the equation

(i) $\tan(2x + 60°) = 1.2$, [3]

(ii) $\tan y = 2 \sin y$. [4]

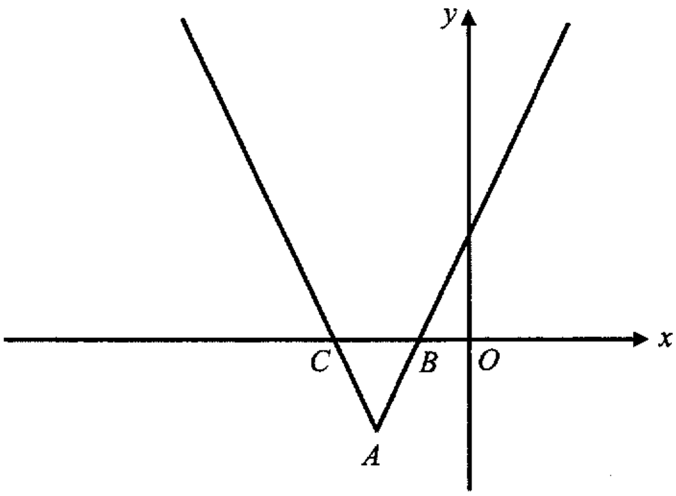
(b) Given that $0 \le x \le 2\pi$, find all the angles which satisfy the equation $2\cos^2 x = 1$. [3]

6 **(a)** Solve the simultaneous equations

$$25^x \div 5^{y+1} = 1,$$
$$\log_6 x = 1 - \log_6 y.$$ [6]

(b) Solve $3^x = e^{2x-5}$. [3]

7 The diagram shows part of the graph of $y = |3x+5| - 2$.



(i) Find the coordinates of the points A, B and C. [3]

(ii) Solve the equation $|3x+5| - 2 = x + 4$. [3]

(iii) State the number of solution(s) of the equation $|3x+5| - 2 = -3$. [1]

8 **(a)** Find the coefficient of x^2 in the binomial expansion of $\left(x - \frac{1}{3x}\right)^8$. [4]

(b) Find the first 3 terms in the expansion, in ascending powers of x, of

(i) $(1+3x)^7$,

(ii) $(2-x)^4$.

Hence, find the coefficient of x^2 in the expansion of $(1+3x)^7(2-x)^4$. [6]

9 The function f is defined by $f(x) = 3\cos 2x + 1$ for $0° \le x \le 180°$.

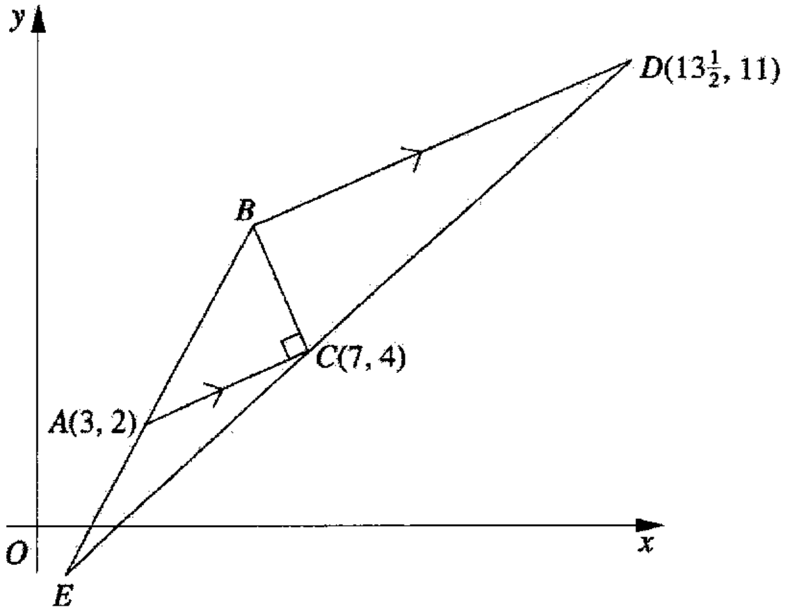
(i) State the amplitude of f. [1]

(ii) State the period of f. [1]

(iii) Find the x-coordinates of the points where the curve meets the x-axis. [3]

(iv) Sketch the graph of $y = 3\cos 2x + 1$ for $0° \le x \le 180°$. [2]

10 **Solutions to this question by accurate drawing will not be accepted.**



The diagram shows a triangle ABC in which the coordinates of the points A and C are (3, 2) and (7, 4) respectively. $\angle ACB = 90°$. The line BD is parallel to AC and D is the point $\left(13\frac{1}{2}, 11\right)$. The lines BA and DC are extended to meet at E.

Find

(i) the equation of line BD, [2]

(ii) the coordinates of B, [4]

(iii) the ratio of the area of the quadrilateral $ABDC$ to the area of the triangle BCD. [3]

11 The table below shows experimental values of two variables, x and y, which are connected by an equation of the form $ay = x + \frac{b}{x}$, where a and b are constants.

x	2	4	6	8
y	0.6	0.95	1.3	1.7

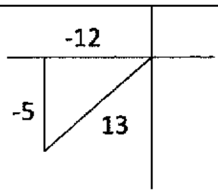
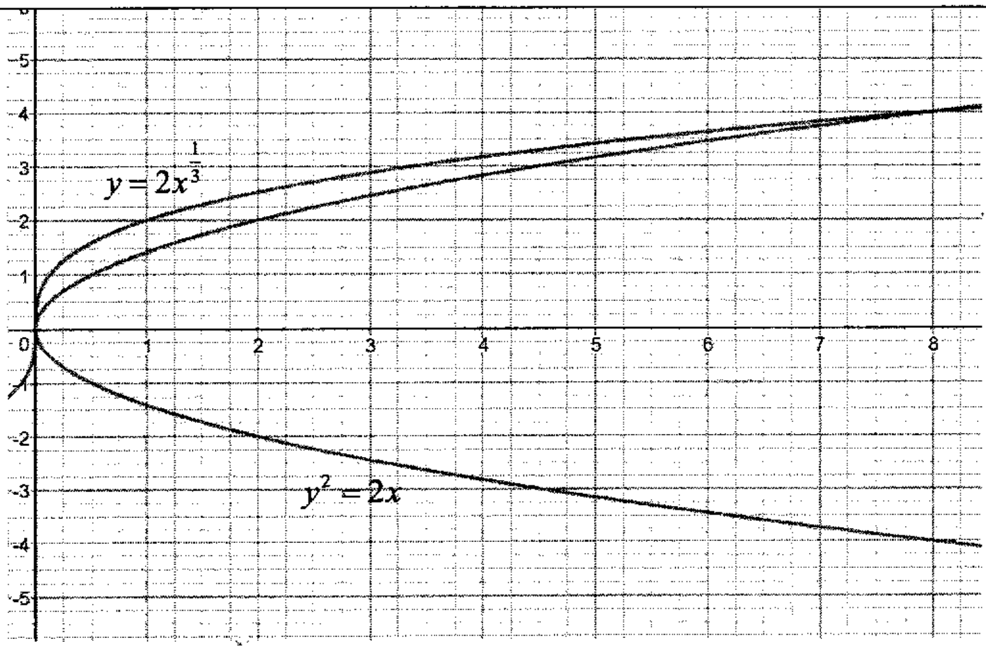
(i) Plot xy against x^2 and draw a straight line graph. Use your graph to estimate the value of each of the constants a and b. [6]

(ii) Using your graph, find the value of y when $x = 7$. [2]

END OF PAPER

Solutions for AMKSS FE 2018 AM P1

Qn	Solutions	
1ai [2]	$8x^3+27=(2x)^3+3^3$ $=(2x+3)\left[(2x)^2-(2x)(3)+3^2\right]$ $=(2x+3)(4x^2-6x+9)$	M1 A1
aii [3]	$8x^3+27=0$ $(2x+3)(4x^2-6x+9)=0$ $x=-1.5$ or $4x^2-6x+9=0$ $D=(-6)^2-4(4)(9)$ $=-108<0$ hence no real roots $\therefore$ No of real roots = 1 (i.e $x=-1.5$)	 M1 M1 A1
(b) [3]	$f(x)=4(x+1)(x-3)(x-k)$ $f(2)=60$ $4(2+1)(2-3)(2-k)=60$ $-12(2-k)=60$ $2-k=-5$ $k=7$	M1 M1 A1
2(i) [2]	$y=3x^2+4x-15>0$ $(3x-5)(x+3)>0$ $x<-3$ or $x>\frac{5}{3}$	M1 A1
(ii) [2]	Curve lies above x-axis i.e. $b^2-4ac<0$ $(4)^2-4(3)c<0$ $16-12c<0$ $c>1\frac{1}{3}$	M1 (D<0) A1
(iii) [4]	$2y+x=1\Rightarrow y=\frac{1-x}{2}$ Subt into $y=3x^2+4x+c$ $\frac{1-x}{2}=3x^2+4x+c$ $1-x=6x^2+8x+2c$ $6x^2+9x+2c-1=0$ line is a tangent to curve, D = 0 $9^2-4(6)(2c-1)=0$ $81-48c+24=0$ $-48c=-105$ $c=\frac{35}{16}=2\frac{3}{16}$	 M1 (eliminates y) M1 (correct quad) M1 (any use of D=0) A1

3(a) [2]	$\cot\left(\frac{2\pi}{3}\right)=\frac{1}{\tan\left(\frac{2\pi}{3}\right)}$	M1
	$=-\frac{1}{\sqrt{3}}$ or $-\frac{\sqrt{3}}{3}$	A1
b(i) [2]	$\sec A=\frac{1}{\cos A}$ 	
	$=\frac{1}{-\frac{12}{13}}$	M1
	$=-\frac{13}{12}$ or $-1\frac{1}{12}$	A1
(ii) [1]	$\tan(-A)=-\tan A=-\frac{5}{12}$	B1
4(i) [2]	 B1 – Graph of $y=2x^{\frac{1}{3}}$ B1 – Graph of $y^2=2x$	

(ii) [3]	$\left(2x^{\frac{1}{3}}\right)^2 = 2x$ $4x^{\frac{2}{3}} = 2x$ $x^{\frac{2}{3}} = \frac{1}{2}x$ $x^2 = \left(\frac{1}{2}x\right)^3$ $x^2 - \frac{1}{8}x^3 = 0$ $x^2\left(1 - \frac{1}{8}x\right) = 0$ $x = 0$ (NA) or 8 $y = 4$ Coordinates of $A = (8,\ 4)$	M1 M1 A1
5(i) [1]	$A(0,a), B(4,10)$ $grad = \frac{10-a}{4-0} = 2$ $10 - a = 8$ $a = 2$	B1
(ii) [1]	$\lg y = 2x^2 + 2$ $y = 10^{2x^2+2}$	B1
(iii) [2]	$\lg 1000 = 2x^2 + 2$ $3 = 2x^2 + 2$ $x^2 = \frac{1}{2}$ $x = \pm 0.707$	B2
6(i) [3]	$x^2 + 6x + y^2 - 10y = 66$ Centre = (-3, 5), $radius\ = \sqrt{9 + 25 - (-66)}$ $= 10 units$	B1 M1 A1
(ii) [2]	Midpoint of PQ = centre of circle $\left(\frac{5+a}{2}, \frac{11+b}{2}\right) = (-3,5)$ $\therefore \frac{5+a}{2} = -3 \Rightarrow a = -11$ $\frac{11+b}{2} = 5 \Rightarrow b = -1$ $Q(-11,-1)$	M1 A1
(iii) [2]	New centre = (1, 5), $r = 10$ $(x-1)^2 + (y-5)^2 = 100$.	M1 A1

7(i) [1]	$3^{2x-1} = 3^x + 6$ $\frac{(3^x)^2}{3} = 3^x + 6$ $\frac{u^2}{3} = u + 6$ or $u^2 - 3u - 18 = 0$	B1(any appropriate eqn in u)
(ii) [2]	$u^2 - 3u - 18 = 0$ $(u-6)(u+3) = 0$ $u = 6$ or $u = -3$(Rej) $3^x = 6$ $x \lg 3 = \lg 6$ $x = 1.63$ (3sf)	M1 A1
(iii) [3]	$3^{2x-1} = 3^x - k$ $\frac{u^2}{3} = u - k$ $u^2 - 3u + 3k = 0$ No solutions $\Rightarrow D < 0$ $(-3)^2 - 4(1)(3k) < 0$ $9 - 12k < 0$ $-12k < 9$ $k > 0.75$	M1 M1 M1
8(a) [4]	$\log_4(x-2) - \log_4(x+2) = 1 + \log_4 \frac{1}{9}$ $\log_4 \frac{x-2}{x+2} = \log_4 4 + \log_4 \frac{1}{9}$ $\log_4 \frac{x-2}{x+2} = \log_4 \frac{4}{9}$ $\therefore \frac{x-2}{x+2} = \frac{4}{9}$ $9x - 18 = 4x + 8$ $5x = 26$ $x = 5.2$	M1(division law) M1(get rid of log) M1 A1
(b) [4]	$\lg x = \log_x 1000$ $\lg x = \frac{\lg 10^3}{\lg x}$ $(\lg x)^2 = 3$ $\lg x = \sqrt{3}$ or $-\sqrt{3}$ $x = 10^{\sqrt{3}}$ or $10^{-\sqrt{3}}$ $x = 54$ or 0.019 (2sf)	M1 M1 A2(2 sig fig)

9(a) [4]	$8x^2 - bx + 1 = 0$ Let roots be α and 2α. sum of roots: $\alpha + 2\alpha = -\frac{-b}{8}$ $3\alpha = \frac{b}{8}$ $b = 24\alpha$ product of roots: $\alpha(2\alpha) = \frac{1}{8}$ $\alpha^2 = \frac{1}{16}$ $\alpha = \pm\frac{1}{4}$ $\therefore b = 24\alpha = \pm 6$	M1 M1 M1 A1
(b) [5]	$2x^2 - 6x + 3 = 0$ $\alpha + \beta = 3 \qquad \alpha\beta = \frac{3}{2} = 1.5$ Sum of roots $= \frac{3}{\alpha^2} + \frac{3}{\beta^2}$ $= \frac{3(\alpha^2 + \beta^2)}{(\alpha\beta)^2}$ $= \frac{3\left[(\alpha+\beta)^2 - 2\alpha\beta\right]}{(\alpha\beta)^2}$ $= \frac{3\left[(3)^2 - 2(1.5)\right]}{(1.5)^2}$ $= 8$ Product of roots $= \left(\frac{3}{\beta^2}\right)\left(\frac{3}{\alpha^2}\right)$ $= \frac{9}{(1.5)^2} = 4$ $\therefore$ Equation is $x^2 - 8x + 4 = 0$	M1 M1-sum of roots formula A1 M1 A1

AMKSS Final Exam A.Math Paper 2

Answer Scheme

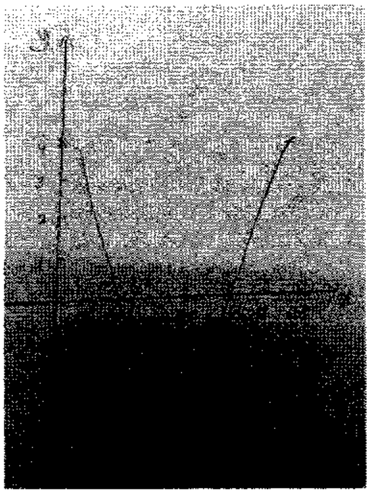
Qn	Answer	Mark Allocation
1(i)	When $t=0$, $\theta = 25+80e^0$ $\theta = 105^\circ C$	B1
1(ii)	$60 = 25+80e^{-0.03t}$ $e^{-0.03t} = \frac{35}{80}$ $-0.03t = \ln\left(\frac{35}{80}\right)$ $t \approx 27.6s$	M1 A1
1(iii)	Since $e^{-0.03t} > 0$ $80e^{-0.03t} > 0$ $25+80e^{-0.03t} > 25$ θ does not fall below $25^\circ C$	B1
2.	$\frac{7x+4}{(x^2+5)(x-2)} = \frac{Ax+B}{x^2+5} + \frac{C}{x-2}$ $7x+4 = (Ax+B)(x-2)+C(x^2+5)$ When $x=2; 18=9C$ $C=2$ When $x=0$; $4=-2B+2(5)$ $B=3$ When $x=1$; $11=(A+3)(-1)+2(6)$ $A=-2$ $\frac{7x+4}{(x^2+5)(x-2)} = \frac{-2x+3}{x^2+5} + \frac{2}{x-2}$	M1 A1 A1 A1 A1

3(i)	$x^2+y^2+xy+3x=46-(1)$ $y-2x+9=0-(2)$ Subst (1) into (2) $x^2+(2x-9)^2+x(2x-9)+3x=46$ $x^2+4x^2-36x+81+2x^2-9x+3x-46=0$ $7x^2-42x+35=0$ $x^2-6x+5=0$ $(x-5)(x-1)=0$ $x=5$ or $x=1$ $y=1$ or $y=-7$ $R(5,1)$ and $Q(1,-7)$	 M1 M1 M1 A1
3(ii)	$M_{RQ}=2$ M of perpendicular bisector $=-\frac{1}{2}$ Midpoint $(3,-3)$ $y=-\frac{1}{2}x+c$ At$(3,-3)$ $-3=-\frac{1}{2}x+c$ $c=-\frac{3}{2}$ $y=-\frac{1}{2}x-\frac{3}{2}$	 M1 M1 A1
4	$\frac{1}{2}\times(4+2\sqrt{3})\times h=6\sqrt{3}-2$ $h=\frac{6\sqrt{3}-2}{2+\sqrt{3}}\times\frac{2-\sqrt{3}}{2-\sqrt{3}}$ $h=\frac{12\sqrt{3}-6\times3-4+2\sqrt{3}}{4-3}$ $h=14\sqrt{3}-22$	M1 M1 M1 A1
5(a)(i)	$\tan(2x+60°)=1.2$ Acute$\angle=50.19443$ $2x+60°=50.19443(NA),230.19443,$ $410.19443,590.19443,770.19443$ $x=85.1°,175.1°,265.1°,355.1°$	 M1 M1 A1

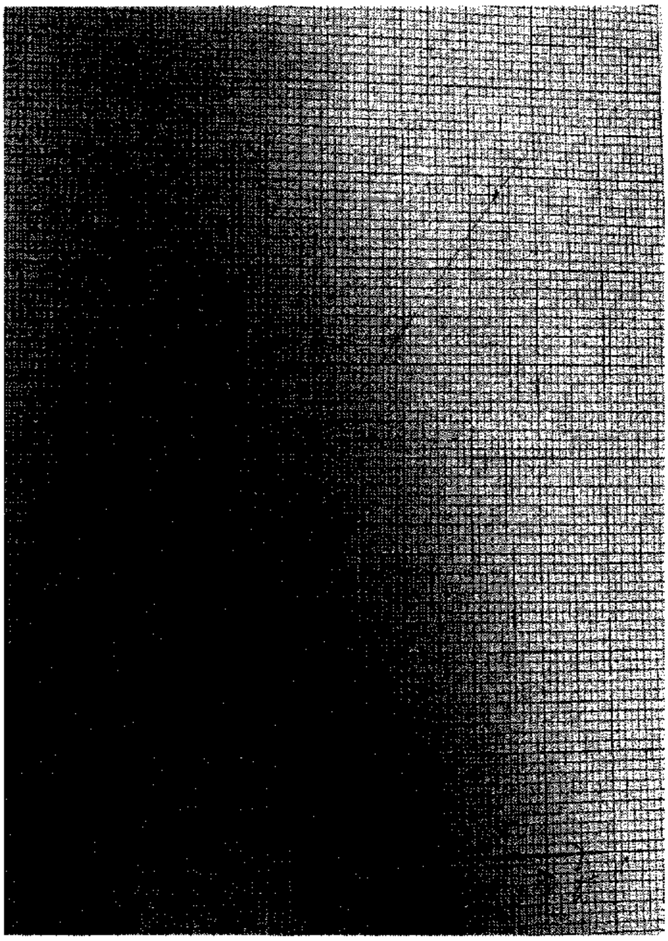
5(a)(ii)	$\frac{\sin y}{\cos y} = 2\sin y$ $\sin y - 2\sin y\cos y = 0$ $\sin y(1-2\cos y) = 0$ $\sin y = 0$ or $\cos y = \frac{1}{2}$ Acute$\angle = 0$ Acute$\angle = 60°$ $y = 0°, 180°, 360°$ $y = 60°, 300°$	M1 M1 M1 A1
5(b)	$2\cos^2 x = 1$ $\cos^2 x = \frac{1}{2}$ $\cos x = \pm\sqrt{\frac{1}{2}}$ Acute$\angle = 0.785398$ $x = 0.785, 2.36, 3.93, 5.50$	 M1 M1 A1
6(a)	$25^x \div 5^{y+1} = 1$ $5^{2x} \div 5^{y+1} = 5^0$ $2x - y - 1 = 0$ $2x - y = 1 - (1)$ $\log_6 x = 1 - \log_6 y$ $\log_6 x + \log_6 y = 1$ $\log_6 (xy) = 1$ $xy = 6$ $y = \frac{6}{x} - (2)$ Subst (2) into (1) $2x - \frac{6}{x} = 1$ $2x^2 - x - 6 = 0$ $(2x+3)(x-2) = 0$ $x = -1\frac{1}{2}$ or $x = 2$ $y = -4$(NA) $y = 3$	 M1 M1 M1 M1 M1 A1

6(b)	$3^x = e^{2x-5}$ $\ln 3^x = \ln e^{2x-5}$ $x\ln 3 = 2x-5$ $x(\ln 3-2) = -5$ $x = \frac{-5}{\ln 3-2}$ $x = 5.55$	M1 M1 A1
7(i)	$\|3x+5\|-2=0$ $\|3x+5\|=2$ $3x+5=2$ or $3x+5=-2$ $x=-1$ $\quad x=-\frac{7}{3}$ $B(-1,0)$, $C\left(-2\frac{1}{3},0\right)$ $3x+5=0$ $x=-\frac{5}{3}$ $A\left(-1\frac{2}{3},-2\right)$	 B1, B1 B1
7(ii)	$\|3x+5\|-2=x+4$ $\|3x+5\|=x+6$ $3x+5=x+6$ or $3x+5=-x-6$ $x=\frac{1}{2}$ $\quad x=-2\frac{3}{4}$	M1 M1 A1
7(iii)	0	B1

8(a)	General Term $= {}^8C_r (x)^{8-r}\left(-\frac{1}{3x}\right)^r$ $= {}^8C_r x^{8-r}(x)^{-r}\left(-\frac{1}{3}\right)^r$ $= {}^8C_r x^{8-2r}\left(-\frac{1}{3}\right)^r$ $8-2r=0$ $r=3$ ${}^8C_3 x^{8-2(3)}\left(-\frac{1}{3}\right)^3$ $=-\frac{56}{27}x^2$ Coefficient of $x^2 = -\frac{56}{27}$	 M1 M1 M1 A1
8(b)(i)	$(1+3x)^7$ $= {}^7C_0(1)^7(3x)^0 + {}^7C_1(1)^6(3x)^1 + {}^7C_2(1)^5(3x)^2$ $=1+21x+189x^2$	 M1 A1
8(b)(ii)	$(2-x)^4$ $= {}^4C_0(2)^4(-x)^0 + {}^4C_1(2)^3(-x)^1 + {}^4C_2(2)^2(-x)^2$ $=16-32x+24x^2$ $(1+21x+189x^2)(16-32x+24x^2)$ $=21x(-32x)+16(189x^2)+24x^2$ $=-672x^2+3024x^2+24x^2$ $=2376x^2$ Coefficient of $x^2 = 2376$	 M1 A1 M1 A1
9(i)	3	B1
9(ii)	180°	B1

9(iii)	$y=0$ $3\cos 2x+1=0$ $\cos 2x=-\frac{1}{3}$ Acute$\angle=70.52877937$ $2x=109.5°,250.5°$ $x=54.7°,125.3°$	M1 M1 A1
9(iv)	 Correct shape, turning point Correct x, y intercepts	B1 B1
10(i)	$M_{AC}=\frac{1}{2}$ $M_{BD}=\frac{1}{2}$ Equation of BD: $y=\frac{1}{2}x+c$ At $\left(13\frac{1}{2},11\right)$ $11=\frac{1}{2}\left(13\frac{1}{2}\right)+c$ $c=\frac{17}{4}$ $y=\frac{1}{2}x+\frac{17}{4}$	M1 A1

10(ii)	$M_{BC} = -2$ Equation of BC: $y = 2x + c$ At $(7,4)$ $4 = -2(7) + c$ $c = 18$ $y = -2x + 18$ $-2x + 18 = \frac{1}{2}x + \frac{17}{4}$ $x = 5\frac{1}{2}$ $y = 7$ $B\left(5\frac{1}{2}, 7\right)$	M1 M1 M1 A1
10(iii)	Area of $ABDC$ $= \frac{1}{2}\begin{vmatrix} 3 & 7 & 13\frac{1}{2} & 5\frac{1}{2} & 3 \\ 2 & 4 & 11 & 7 & 2 \end{vmatrix}$ $= 22.5$units Area of BCD $= \frac{1}{2}\begin{vmatrix} 5\frac{1}{2} & 7 & 13\frac{1}{2} & 5\frac{1}{2} \\ 7 & 4 & 11 & 7 \end{vmatrix}$ $= 15$units Ratio $= 3 : 2$	 M1 M1 A1

11(i)	$ay = x + \frac{b}{a}$	
	$xy = \frac{x^2}{a} + \frac{b}{a}$	
	Plot xy against x^2	M1
	Straight line	M1
	Gradient $= \frac{1}{a}$	
	Intercept $= \frac{b}{a}$	
	$\frac{b}{a} = 0.4$	M1
	$b = 1.94 \pm 0.2$	A1
	$\frac{1}{a} = \frac{14-0.4}{66-0}$	M1
	$\frac{1}{a} = 0.206060606$	
	$a = 4.85 \pm 0.2$	A1
		

11(ii)	$x^2 = 49$ $xy = 10.45$ $y = \frac{10.45}{7}$ $y = 1.49 \pm 0.2$	M1 A1