DEPARTMENT OF EDUCATION

UPPER SECONDARY SCHOOL CERTIFICATE EXAMINATIONS

ADVANCE MATHEMATICS

PAPER 2

Friday

30th October 2015

Time allowed:

2 hours 30 minutes

(8:00am – 10:30 am)

NO EXTRA TIME

(NO OTHER TIME)

Candidates are advised to fully utilise the allocated time

MA_2

INSTRUCTIONS TO CANDIDATES

To be read by the external invigilator to all candidates

1. The code for Advance Mathematics is **3.**
2. There are **4** printed pages in the question booklet and **6 printed** pages in the answer booklet. A **1 page formula sheet** is also inserted in the question booklet.
3. The answer booklet is enclosed in the centre of this booklet. Take out the answer booklet now.
4. Check that you have the correct number of pages.
5. Write your 10 - digit candidate number, your name and your school name in the spaces provided in the answer booklet.
6. This paper contains 10 Short Answer Questions worth 5 marks each.

Total: 50 marks

Answer **ALL** questions.

7. Calculators, rulers and protractors are allowed.
8. Answer all questions on the answer sheet. Answers on any other paper including rough work paper and the question paper **will not be marked**
9. ALL working must be shown step by step to get full marks. Students may lose marks for writing down final answers only.
10. Enough space has been allocated for the answer to every question. Questions must be answered in spaces allocated on the Answer booklet. Answers written outside the space provided may not be marked.
11. Rubbers and Correctional Fluid are not allowed on the answer sheet. Where you have made an error, cross out all the working and start again on a new line.
12. Graphical Calculators are not permitted.

PENALTY FOR CHEATING OR ASSISTING TO CHEAT IN NATIONAL EXAMINATIONS IS NON-CERTIFICATION.

DO NOT TURN OVER THE PAGE AND DO NOT WRITE UNTIL YOU ARE TOLD TO START.

QUESTION 1

a) Fully factorize $x^2 + 6x + 8$.

(1 mark)

b) Where does the parabola $y = x^2 + 6x + 8$ cut the x-axis (x-intercepts) and the y-axis (y-intercept)?

(2 marks)

c) Determine the coordinate of the turning point of the parabola in (b).

(1 mark)

d) Use the information from section (b) and (c) to sketch the graph of the parabola $y = x^2 + 6x + 8$.

(1 mark)

QUESTION 2

Given the following data

Cars sold	2	3	5	7	8	10
Income (K' 000)	12	13	16	18	20	22

a) Plot a scatter diagram for the above information.

(3 marks)

b) State whether the two variables have is positive, negative or zero relationship.

(1 mark)

c) State whether, the variables have a linear, non-linear or no relationship.

(1 mark)

QUESTION 3

An arithmetic sequence has first term 11 and common difference of 5.

a) What will be the tenth term (T_{10})?

(1 mark)

b) What is the sum of the first ten terms (S_{10})?

(2 marks)

c) Find $S_{10} - T_{10}$.

(1 mark)

d) What is the value in (c) representing?

(1 mark)

QUESTION 4

The revenue of a shop on the verge of closing down reduces by 30% each year. If the revenue is K20, 000 in the first year, find the

a) revenue in the fifth year.

(1 mark)

b) **total revenue** after five years.

(2 marks)

c) total revenue if the decrease continued until there is no more revenue generated.

(2 marks)

QUESTION 5

Consider the circle with the equation $x^2 + y^2 + 2x - 8y = 7$. Using the completion of square method, find the centre and the radius of the circle.

(5 marks)

QUESTION 6

In an election for a particular electorate, two candidates, James and John contested. A total of 30, 245 people voted and John won by 3503 votes majority.

a) Create two linear equations to represent the above information, let x and y represent the appropriate variables.

(3 marks)

b) Solve the equations to find the number of people who voted for James.

(2 marks)

QUESTION 7

Given the quadratic equation $y = 7 - x - 3x^2$.

a) State whether it has a minimum or maximum value.

(1 mark)

b) What value in the given equation supports your answer in (a)?

(1 mark)

c) Use the derivative of the above equation to determine the x-value where this maximum or minimum occurs.

(2 marks)

d) What is this maximum or minimum value?

(1 mark)

QUESTION 8

a) Find the gradient m_1 of the line ℓ_1: $2x + y + 3 = 0$.

(1 mark)

b) What is the gradient m_2 of another line ℓ_2 that is perpendicular to line ℓ_1?

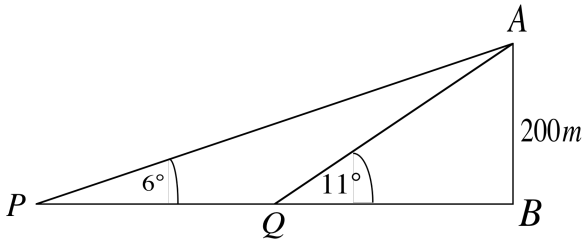
(1 mark)

c) If the line ℓ_2 passes through the point (1,2), find its equation.

(3 marks)

QUESTION 9

In the diagram below, a ship sails from P to Q towards a cliff AB of height 200 metres. At P the angle of elevation of the cliff is 6 degrees.



a) Find the distance of the ship from the base of the cliff to the nearest metre.

(1 mark)

b) In 6 minutes the ship travels to position Q where the angle of elevation is 11 degrees. Find to the nearest whole number the

i) distance QB.

(1 mark)

ii) distance PQ.

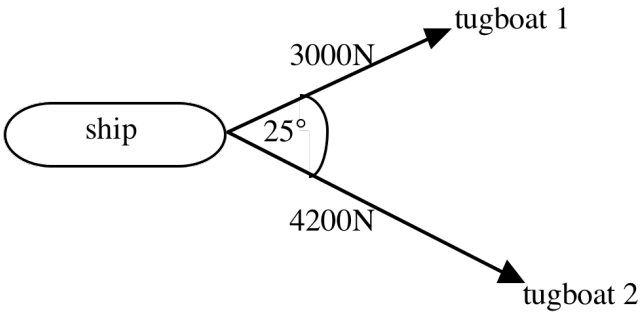
(1 mark)

iii) speed of the ship in kilometres per hour.

(2 marks)

QUESTION 10

Two tugboats are manoeuvring a ship as shown in the diagram below.



a) Reconstruct a vector diagram to help solve this problem.

(1 mark)

b) Calculate the resultant force on the ship.

(2 marks)

c) Calculate the angle this resultant makes with the smaller tug force.

(2 marks)

END OF EXAMINATION

Advance Mathematics '15
Paper 2 - Answer Booklet

Write your province, school and candidate number, your name and your school name in the space provided below.

Year		Province		School			Candidate		
1	5								

Candidate Name: _____

School Name: _____

All answers must be written in this booklet and in the appropriate spaces provided.

	SCORE	Marker 1	Marker 2
Question 1			
Question 2			
Question 3			
Question 4			
Question 5			
Question 6			
Question 7			
Question 8			
Question 9			
Question 10			
TOTAL			

QUESTION 1

a)

(1 mark)

b)

(2 marks)

c)

(1 mark)

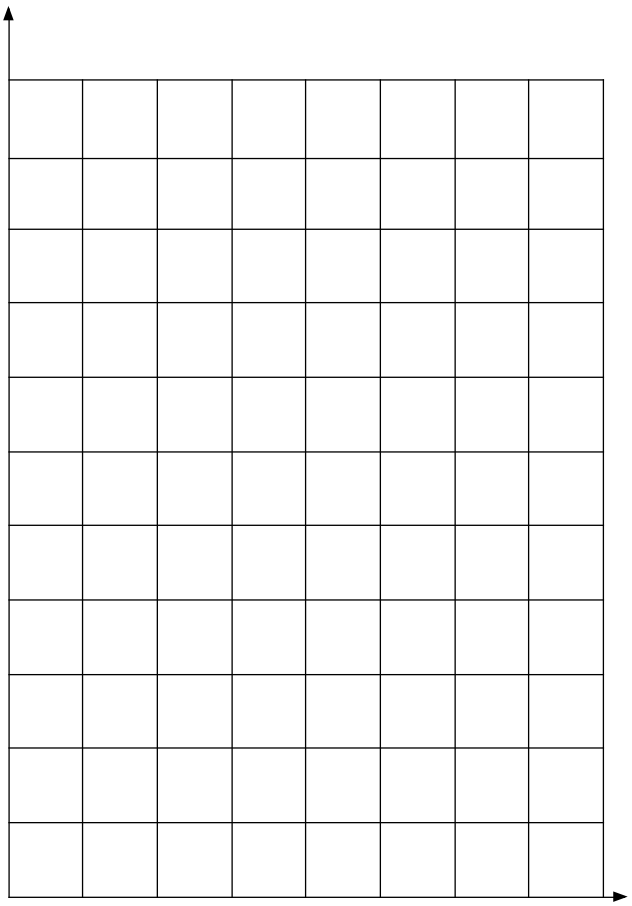
d)

(1 mark)

total for this question Marker 1 Marker 2

QUESTION 2

a)



(3 marks)

b)

(1 mark)

c)

(1 mark)

total for this question Marker 1 Marker 2

QUESTION 3

a)

(1 mark)

b)

(2 marks)

c)

(1 mark)

d)

(1 mark)

total for this question Marker 1 Marker 2

QUESTION 4

a)

(1 mark)

b)

(2 marks)

c)

(2 marks)

total for this question Marker 1 Marker 2

QUESTION 5

total for this question [ ] Marker 1 Marker 2

QUESTION 6

a)

(3 marks)

b)

(2 marks)

total for this question [ ] Marker 1 Marker 2

QUESTION 7

a)

(1 mark)

b)

(1 mark)

c)

(2 marks)

d)

(1 mark)

Marker 1 Marker 2

QUESTION 8

a)

(1 mark)

b)

(1 mark)

c)

(3 marks)

Marker 1 Marker 2

QUESTION 9

a)

(1 mark)

b)

i)

(1 mark)

ii)

(1 mark)

iii)

(2 marks)

Marker 1 Marker 2

QUESTION 10

a)

(1 mark)

b)

(2 marks)

c)

(2 marks)

Marker 1 Marker 2

HIGHER SCHOOL CERTIFICATE EXAMINATIONS 2015
FORMULAE SHEET FOR ADVANCE MATHEMATICS

MENSURATION

Arc Length $L = \frac{\theta}{360} 2\pi r = \frac{\theta}{360} \pi d$

Area of Sector $A = \frac{\theta}{360} \pi r^2$

Surface Area of Cylinder $A = 2\pi r^2 + 2\pi rh$

Surface Area of Sphere $A = 4\pi r^2$

Curved Surface Area of Cone $A = \pi rL$

Volume of Sphere $A = \frac{4}{3} \pi r^3$

Interior Angle Sum of Polygon $S_n = (n-2) \times 180$

INTEREST

Compound Interest $A = P\left(1 + \frac{r}{100}\right)^n$

TRIGONOMETRY

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

Cosine Rule $c^2 = a^2 + b^2 - 2ab\cos C$

Area of Triangle $A = \frac{1}{2} ab \sin C$

Conversion $\pi^c = 180°$

Arc Length $L = r\theta^c$

Area of Sector $A = r^2\theta^c$

Area of Minor Segment $A = \frac{1}{2} r^2 (\theta^c - \sin\theta^\circ)$

PERMUTATION AND COMBINATION

PERMUTATION ${}^nP_r = \frac{n!}{(n-r)!}$

COMBINATION ${}^nC_r = \frac{n!}{r!(n-r)!}$

SERIES

Arithmetic Progression $T_n = a + (n-1)d$

$S_n = \frac{n}{2}(a+l)$ or $S_n = \frac{n}{2}(2a + [n-1]d)$

Geometric progression $T_n = ar^{n-1}$

$S_n = \frac{a(r^n - 1)}{r-1} = \frac{a(1-r^n)}{1-r}$, *for* $r \neq 1$

$S_\infty = \frac{a}{1-r}$, *for* $-1 < r < 1$

ALGEBRA AND CALCULUS

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

First Derivative $f'(x) = \lim_{h \to \infty} \frac{f(x+h) - f(x)}{h} = \lim_{\Delta x \to \infty} \frac{f(x+\Delta x) - f(x)}{\Delta x}$

ANALYTIC GEOMETRY

Distance between two points $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Mid-point of Interval $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Gradient of a Line $m = \frac{y_2 - y_1}{x_2 - x_1} = \tan\theta$

ABSOLUTE VALUE $|x| = \begin{cases} -x, \text{ if } x < 0 \\ x, \text{ if } x \geq 0 \end{cases}$

BINOMIAL EXPANSION

$(x+y)^n = x^n + \binom{n}{1} x^{n-1}y + \binom{n}{2} x^{n-2}y^2 + \ldots + y^n$ *where* $\binom{n}{r} = \frac{n!}{r!(n-r)!}$