DEPARTMENT OF EDUCATION

UPPER SECONDARY SCHOOL CERTIFICATE EXAMINATIONS

ADVANCE MATHEMATICS

PAPER 2

Friday

25th October 2013

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

M_{A_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 **3** 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 all over the answer booklet 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) A ship has sufficient food to feed 600 people in four (4) weeks. How long would the food last for 800 people? (Assume consumption rate is constant)

(b) (i) Make y the subject of the equation

$$2^a = \sqrt{\frac{x^2}{y}}$$

(ii) Use your result from (i) to find y, when $a = 3$ and $x = 4$

QUESTION 2

Solve the equation $\frac{\sqrt{3x}}{2-\sqrt{3}} = \frac{1+\sqrt{3}}{3+\sqrt{3}}$, for x.

Express the solution with a rational denominator.

QUESTION 3

The radioactive decay of an unknown substance is given by $A(t) = A_0 e^{-kt}$ where $A(t)$ is the amount of substance (in grams) remaining at any time (t) in hours. A_0 is the initial amount of the substance before it started decaying and k is a proportionality constant. *(Leave your answers correct to 2 decimal places).*

(a) If after two hours, $0.9\,A_0$ remains, find k.

(2 marks)

(b) Find the time needed for the initial value to reduce to half its initial value.

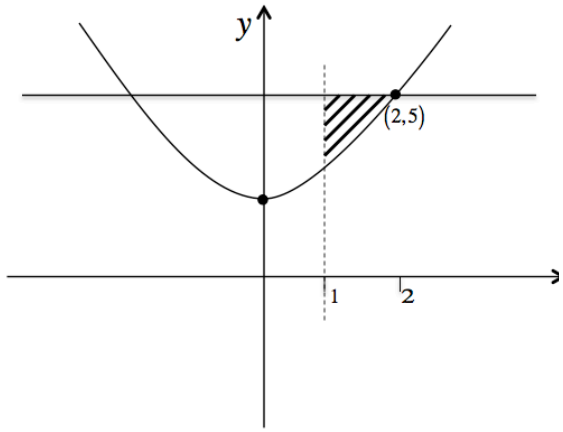
(2 marks)

(c) If A_0 =200 grams, what will remain after 20 hours?

(1 mark)

QUESTION 4

(a) Write the inequalities that identify the shaded region below.



(3 marks)

(b) If the shaded region represents coordinates, (x, y) that gives possible values for the function $P = 2x + y$.

What coordinate gives the maximum value for function *P*?

(2 marks)

QUESTION 5

Maxwell has three blue and two red shirts. On each day of the three days, Monday, Tuesday and Wednesday, he selects one shirt at random to wear. Maxwell wears each shirt that he selects only once.

(i) What is the probability that Maxwell will wear a blue shirt on Monday?

(1 mark)

(ii) What is the probability that Maxwell will wear a shirt of the same colour on all three days?

(1 mark)

(iii) What is the probability that Maxwell will not wear a shirt of the same colour on consecutive days?

(3 marks)

QUESTION 6

Determine the points of intersection of the circle $x^2 + y^2 = 9$ and the straight line $y = x + 1$. *(Leave your answer in surd form)*

QUESTION 7

The sum of the 3rd term to the 7th term in a geometric series is 3267. Find the 1st term if the common ratio is 3.

QUESTION 8

Tossing a coin gives results that obey a binomial expansion. If a coin is tossed 5 times, what is the probability of getting 3 heads and 2 tails? *(Hint: Let **x** be heads and **y** be tails and **n** be the number of tosses)*.

QUESTION 9

(a) Find the scalar product of the two vectors;
u = 5**i** +3**j** and **v** = 5**i** + 0**j**

(1 mark)

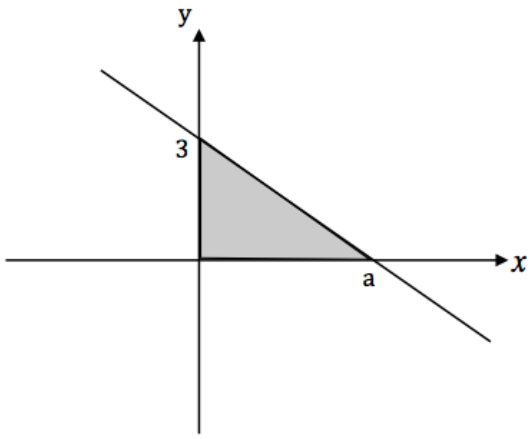
(b) Determine the acute angle (*in radians*) between **u** and **v** provided their initial points coincide. (*Give your answer to 2 decimal places*)

(4 marks)

QUESTION 10

(a) Find the area of triangle shaded on the diagram.

(1 mark)



(b) Evaluate $\int_0^a \left(3 - \frac{3}{a}x\right)dx$

(4 marks)

END OF EXAMINATION

Advance Mathematics '13
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 No		
1	3								

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		**QUESTION 2**
total for this question ☐ Marker 1 Marker 2		total for this question ☐ Marker 1 Marker 2

QUESTION 3		**QUESTION 4**
total for this question ☐ Marker 1 Marker 2		total for this question ☐ Marker 1 Marker 2

QUESTION 5

total for this question Marker 1 Marker 2

QUESTION 6

total for this question Marker 1 Marker 2

QUESTION 7

Marker 1 Marker 2

QUESTION 8

Marker 1 Marker 2

QUESTION 9		**QUESTION 10**
Marker 1 Marker 2		Marker 1 Marker 2

HIGHER SCHOOL CERTIFICATE EXAMINATIONS 2013
FORMULAE SHEET FOR ADVANCE MATHEMATICS

MENSURATION

Arc Length	$L = \frac{\theta}{360} = 2\pi r$
Area of Sector	$A = \frac{\theta}{360} 2\pi r^2$
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	$V = \frac{4}{3}\pi r^3$
Interior Angles of Polygon	$s_n = (n-2)$x 180^o

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	$\pi^c = 180^o$
Arc Length	$L = r\theta^c$
Area of Sector	$A = \frac{1}{2}r^2\theta$
Area of Minor Segment	$A = \frac{1}{2}r^2(\theta^c - \sin\theta^c)$

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

SERIES

Arithmetic Progression	$T_n = a + (n-1)d$
	$S_n = \frac{n}{2}(a + T_n)$
	$S_n = \frac{n}{2}(2a + [n-1]d)$
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

Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
First Derivative	$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{\Delta x\to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x}$

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	$\frac{y_2-y_1}{x_2-x_1} = m = tan\,\theta$
ABSOLUTE VALUE	$\lvert x\rvert = \begin{cases} -x, & \text{if } x < 0 \\ x, & \text{if } x \geq 0 \end{cases}$

BINOMIAL EXPANSION

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