DEPARTMENT OF EDUCATION

UPPER SECONDARY SCHOOL CERTIFICATE EXAMINATIONS

ADVANCE MATHEMATICS

Paper 1

Monday

15th October 2012

Time allowed:

2 hours and 30 minutes

(8:00am – 10:30 am)

NO EXTRA TIME

(NO OTHER TIME)

Candidates are advised to fully utilise the allocated time.

MA1

INSTRUCTIONS TO CANDIDATES

To be read by the external invigilator to all candidates

1. The code for Advance Mathematics is **3.**
2. There are **7** printed pages in the question booklet.
3. An Electronic Answer Sheet, 2 pages Section B Answer Booklet and a 1 page formula sheet are also inserted in the centre.
4. There are two sections in this paper. Answer all questions.

   Section A: Multiple Choice Questions - 30 marks
   This section will be electronically marked.
   All answers to the Multiple Choice Section MUST be answered on the Electronic Answer Sheet.
   Carefully following the instructions, fill in your Candidate Information and Subject Information.

   Section B: Short Answer Questions - 20 marks
   Write down your name, your school name and your10 digit candidate number on the Section B Answer Sheet Provided.
5. You are required to only write the correct answer in the space provided.
6. Calculators may be used.
7. Answers written on the question paper will not be marked. Write answers neatly in spaces as allocated on the answer sheet. Answer **ALL** questions.
8. Correction Fluid is not allowed on the answer sheet. If you decide to change an answer, make sure it is absolutely clear to the marker what your final answer is.
9. 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.

SECTION A: (Questions 1 to 25) 25 marks

Answer each question by shading in with HB pencil, the circle directly under the correct alternative A, B, C or D. If you make a mistake, rub it out completely using an eraser and shade the correct answer on the Electronic Answer Sheet.

QUESTION 1

When the surd $\frac{1}{1-\sqrt{2}}$ is rationalized it may appear in the form $\frac{1+\sqrt{2}}{x}$. What is the value of x?

A. –2 B. –1

C. 1 D. 2

QUESTION 2

The expression $\sqrt{32a}-\sqrt{50a}+\sqrt{18a}$ in simplest surd form is

A. 0 B. $2\sqrt{a}$

C. $2\sqrt{2a}$ D. $4\sqrt{2a}$

QUESTION 3

The graph of the parabola $y = ax^2 + bx + c$ intersects the x-axis twice if:

A. $b^2 - 4ac = 0$ B. $b^2 - 4ac > 0$

C. $b^2 - 4ac < 0$ D. $b^2 + 4ac = 0$

QUESTION 4

The expression $\left(\frac{x^4-1}{x^2-1}\right)$ in its simplest form is

A. $\frac{x-1}{x+2}$ B. $x + 1$

C. $\frac{1}{x+1}$ D. $x^2 + 1$

QUESTION 5

The slope of the line 3y + 2x + 5 = 0, is

A. $-\frac{3}{2}$ B. $-\frac{2}{3}$

C. $\frac{2}{3}$ D. $\frac{3}{2}$

QUESTION 6

The following data are Maths test marks out of 10 for eleven students: 5, 6, 4, 10, 8, 7, 7, 9, 3, 6, and 4.

What is the median mark?

A. 6 B. 6.3

C. 7 D. 8

QUESTION 7

$\frac{(n+2)!}{n!}$ is equal to

A. 2! B. n!

C. $(n+2)$ D. $(n+2)(n+1)$

QUESTION 8

The circle $(x + 2)^2 + (y – 3)^2 = 5$ has centre and radius of

A. (2, -3), 5 B. (-2, 3), 5

C. $(–2,3),\sqrt{5}$ D. $(–2,–3),\sqrt{5}$

QUESTION 9

Consider the set **A** = {2, 4, 6, 8, 10}.

Which of the following is ***not*** a subset of **A**?

A. {2, 4} B. {6, 8, 10}

C. {1, 2, 4} D. {2, 4, 6, 8, 10}

QUESTION 10

The sum of the first 50 terms of an arithmetic series with first term 1 and common difference 2 is

A. 2, 500 B. 25, 000

C. 250, 000 D. 250

QUESTION 11

Given that sin ø = $\frac{4}{5}$, when ø is an acute angle, the exact value of sec ø is

A. $\frac{3}{5}$ B. $\frac{3}{4}$

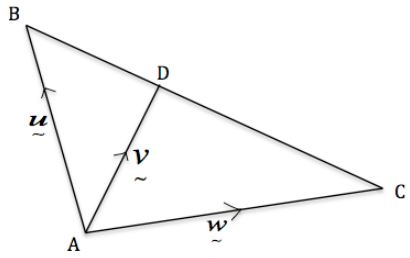
C. $\frac{5}{9}$ D. $\frac{5}{3}$

QUESTION 12

In the diagram below

$\overrightarrow{AB} = \underset{\sim}{u}$, $\overrightarrow{AD} = \underset{\sim}{v}$ and $\overrightarrow{AC} = \underset{\sim}{w}$

Express $\overrightarrow{BD}$ in terms of $\underset{\sim}{u}, \underset{\sim}{v}$ and $\underset{\sim}{w}$.



A. $\underset{\sim}{w} - \underset{\sim}{u}$ B. $\underset{\sim}{v} - \underset{\sim}{u}$

C. $\underset{\sim}{u} + \underset{\sim}{w}$ D. $\underset{\sim}{v} + \underset{\sim}{u}$

QUESTION 13

The derivative of $3x^2 - 1$ is

A. $6x$ B. $3x$

C. $3x - 1$ D. $6x - 1$

QUESTION 14

Given that $f(x) = \sin x$. The exact value of $f'\left(\frac{\pi}{3}\right)$ is

A. $\frac{1}{\sqrt{2}}$ B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{2}$ D. $\sqrt{3}$

QUESTION 15

If displacement is a function of time, the first derivative would represent

A. acceleration B. distance

C. time D. velocity

QUESTION 16

The solution to the quadratic equation

$2x^2 - x - 6 = 0$ is

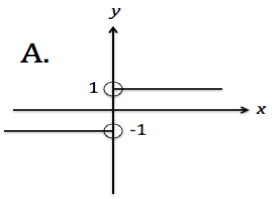
A. $x = -\frac{3}{2}$ or $x = -2$ B. $x = \frac{3}{2}$ or $x = -2$

C. $x = -\frac{3}{2}$ or $x = 2$ D. $x = \frac{3}{2}$ or $x = 2$

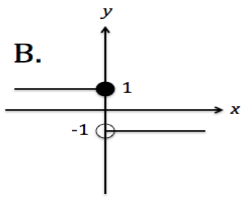
QUESTION 17

The graph of $\frac{|x|}{x}$ is

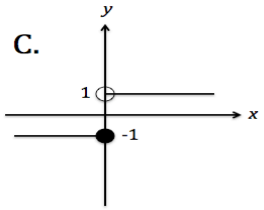
A.



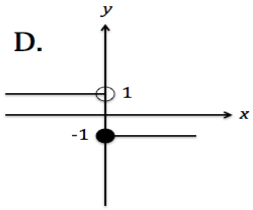
B.



C.

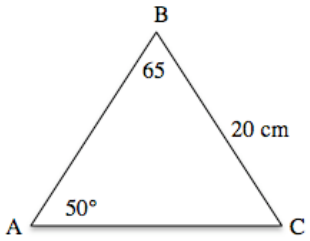


D.



QUESTION 18

In the ΔABC below, the length AC to the nearest centimetre is



A. 23 cm B. 24 cm

C. 25 cm D. 30 cm

QUESTION 19

An alloy consists of copper, zinc and tin in the ratio 1: 3: 4. If the weight of copper in the alloy is 10 g, then the weight of zinc and tin are respectively

A. 40 g and 50 g B. 40 g and 30 g

C. 30 g and 40 g D. 30 g and 50 g

QUESTION 20

The solution to the linear inequality

$2x-5 \geq 4x-6$ is

A. $x \leq -\frac{1}{2}$ B. $x \geq -\frac{1}{2}$

C. $x \leq \frac{1}{2}$ D. $x \geq \frac{1}{2}$

QUESTION 21

A marble is selected at random from a bag containing four red, three blue and two green marbles. What is the probability that it is red or blue?

A. $\frac{1}{9}$ B. $\frac{3}{9}$

C. $\frac{4}{9}$ D. $\frac{7}{9}$

QUESTION 22

The frequency distribution shows the scores of a Math course.

Score	Frequency
0 - 10	10
11 - 20	12
21 - 30	25
31 - 40	20
41 - 50	15
51 - 60	8
61 - 70	2

What is the mean score?

A. 13.14 B. 14

C. 30.43 D. 35

QUESTION 23

The circle $x^2+6x+y^2+4y+9=0$, expressed in the form; $(x-x_o)^2+(y-y_o)^2=r^2$ is

A. $(x+2)^2+(y-3)^2=5$
B. $x^2+y^2=5$
C. $(x-2)^2+(y+3)^2=5$
D. $(x+3)^2+(y+2)^2=4$

QUESTION 24

Provided $x>0$, the sum

$1+\frac{1}{x}+\frac{1}{x^2}+\frac{1}{x^3}+\ldots\ldots$ is approximately equal to

A. 1 B. $\frac{1}{x}$

C. $\frac{1}{x+1}$ D. $\frac{x}{x-1}$

QUESTION 25

Given that

$$(x+y)^n = x^n + \binom{n}{1}x^{n-1}y + \binom{n}{2}x^{n-2}y^2 + \ldots\ldots + y^n,$$

where $\binom{n}{r} = \frac{n!}{r!(n-r)!}$

$(x-y)^4$ is equal to;

A. $x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$

B. $x^4 - 4x^3y - 6x^2y^2 - 4xy^3 - y^4$

C. $x^4 + 4x^3y - 6x^2y^2 + 4xy^3 - y^4$

D. $x^4 - 4x^3y + 6x^2y^2 - 4xy^3 + y^4$

QUESTION 26

Given that $\boldsymbol{u} = -3\boldsymbol{i} + \boldsymbol{j} - 2\boldsymbol{k}$ and $\boldsymbol{v} = 9\boldsymbol{i} - 2\boldsymbol{j} + \boldsymbol{k}$,

vector $\boldsymbol{u} - \boldsymbol{v}$ is

A. $12\boldsymbol{i} - 3\boldsymbol{j} + 3\boldsymbol{k}$ B. $6\boldsymbol{i} - \boldsymbol{j} - \boldsymbol{k}$

C. $-12\boldsymbol{i} + 3\boldsymbol{j} - 3\boldsymbol{k}$ D. $-6\boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k}$

QUESTION 27

The motion of a projected particle is given by the equation $s(t) = 6 + t - t^2$, where ***s*** is in metres and ***t*** is in seconds. The velocity of the particle is zero at

A. t = 0 seconds B. t = $\frac{1}{2}$ second

C. t = 1 second D. t = 3 seconds

QUESTION 28

The parabola $y = -x^2 + x + 6$ has a maximum value of

A. 6.25 B. 6

C. 6.5 D. 7

QUESTION 29

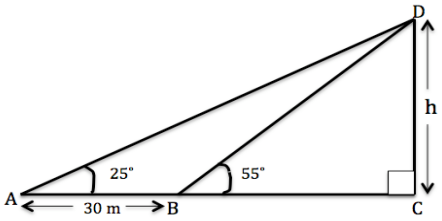
Provided $x \neq 0$, a geometric progression with 50th term being $\frac{1}{x^{49}}$ and 10th term $\frac{1}{x^9}$ has a common ratio of

A. $\frac{1}{x}$ B. x

C. $\frac{1}{x^2}$ D. $\frac{1}{x^3}$

QUESTION 30

In the diagram below, ***h*** to the nearest metre is



A. 21 m B. 25 m

C. 30 m D. 40 m

SECTION B: 20 SHORT ANSWER QUESTIONS.

Each question is worth 1 mark.

QUESTION 31

Express $\log_2 x - \log_2 x^2 + \log_2 x^3$ as a single logarithm.

QUESTION 32

Rationalize $\frac{1}{\sqrt{2}}$

QUESTION 33

Factorize $-2x^2 + 8x - 6$

QUESTION 34

Solve the linear inequality $2 - x < x + 3$

QUESTION 35

State the domain of function $f(x) = \log_{10} x$

QUESTION 36

Express the equation $y = \log_b x$ in index notation.

QUESTION 37

The vertical asymptote of the graph of $y = \frac{1}{x+4}$ is

QUESTION 38

A bag contains 4 yellow, 3 red and 7 white marbles. A single marble is drawn at random from the bag. What is the probability that it is not red?

QUESTION 39

Calculate the 31st percentile of the following data set: 23, 31, 25, 18, 33, 42, 29, 33, 30, 28, 19, 25, and 18.

QUESTION 40

Given that set A = {1, 3, 4, 6, 9, 10} and

set B = {2, 4, 6, 8, 10, 12}. Find A ∪ B.

QUESTION 41

Fully expand $(x + xy)^2$

QUESTION 42

Compute the sum to infinity of the geometric series

$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + ...$

QUESTION 43

The exact value of $\sin\left(\frac{-\pi}{4}\right) + \cos\left(\frac{-\pi}{3}\right)$ is

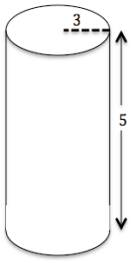
QUESTION 44

How many distinct 4- digit numbers can be formed using the digits 3, 4, 5, 6, 7 without repetition?

QUESTION 45

Solve $\frac{7x}{x+1} - 1 = 0$

QUESTION 46

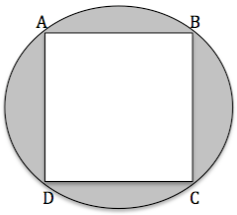


What would be the height of a rectangular solid with square base of area 25 square units and having volume equal to this cylinder?

QUESTION 47

If one PNG Kina buys 0.4380 Australian dollars on a particular day, how much would K200.00 be equivalent to in Australian dollars?

QUESTION 48

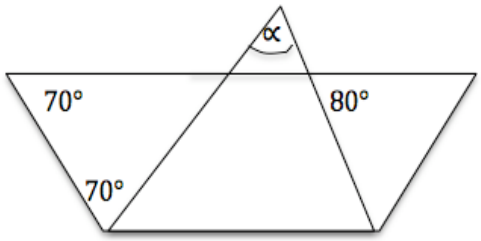


The square ABCD has area $4cm^2$ and touches the circle at 4 points. Find the area of the shaded region, correct to the nearest cm^2.

QUESTION 49

Find the slope of the tangent line to the parabola $y = 2x^2 + 1$ at the point where $x = -1$.

QUESTION 50



What is the value of α in the diagram?

END OF EXAMINATION

ADVANCE MATHEMATICS - PAPER 1
SECTION B ANSWER BOOKLET

Write your 10-digit candidate number, your name and your school name in the spaces provided below.

Year		Province		School			Candidate No		
1	2								

Candidate Name: _____

School Name: _____

This answer booklet is for you to write the answers to section B only.

All Multiple Choice Answers should be on the Electronic Mark Sheet.

All answers must be written neatly in the appropriate spaces in this booklet. **Answers written elsewhere on the question paper (or any other paper) will not be marked.**

TOTAL SCORE

Recorded by: _____

Checked by: _____

SECTION B– ANSWERS TO SECTION B ONLY

Question 31			**Question 41**	
Question 32			**Question 42**	
Question 33			**Question 43**	
Question 34			**Question 44**	
Question 35			**Question 45**	

Question 36			**Question 46**	
Question 37			**Question 47**	
Question 38			**Question 48**	
Question 39			**Question 49**	
Question 40			**Question 50**	

HIGHER SCHOOL CERTIFICATE EXAMINATIONS 2012
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	$s_n = (n-2)\text{x } 180^o$

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	$T_n = a + (n-1)d$
	$S_n = \frac{n}{2}(a + T_a)$
	$S_n = \frac{n}{2}(2a + [n-1]d)$
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	$\frac{y_2-y_1}{x_2-x_1} = m = tan\ \theta \frac{y_2-y_1}{x_2-x_1} = m = tan\ \theta$
ABSOLUTE VALUE	$\lvert x\rvert = \begin{cases} -x, \text{ if } x < 0 \\ x, \text{ if } x \geq 0 \end{cases}$

BINOMIAL EXPANSION

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