DEPARTMENT OF EDUCATION

HIGHER SCHOOL CERTIFICATE EXAMINATIONS

MATHEMATICS A

PAPER 2

Monday

19 October 2009

Time allowed: 2 hours

(8:00 am – 10:00 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. There are **6** printed pages in the question booklet and **8 printed** pages in the answer booklet. The formula sheet is in pages 6 of the question booklet.
2. The answer booklet is enclosed in the centre of this booklet. Take out the answer booklet now.
3. Check that you have the correct number of pages.
4. Write your province, school and candidate number, your name and your school name in the space provided in the answer booklet.
5. This paper contains 7 questions worth a total of 50 marks

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

These questions are worth 1 mark each

QUESTION 1

Express $V = \frac{4}{3}\pi r^3$

QUESTION 2

Simplify $1 - \frac{3x+1}{1-x}$

QUESTION 3

2 + sinø can never be negative.

Is this true or false?

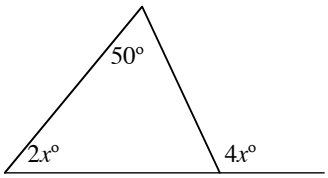
QUESTION 4

Find the number of terms in the sequence

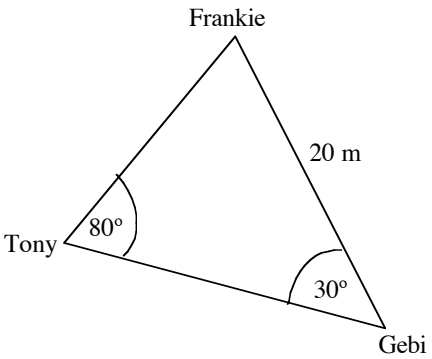
8, 11, 14, …, 128

QUESTION 5

Find the value of x in the diagram below.



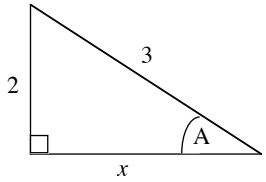
QUESTION 6



Calculate the distance between Tony and Frankie.

QUESTION 7

Below is a diagram of a right angled triangle.



Fina tan A and leave your answer in <u>exact</u> form.

QUESTION 8

$3^{x+2} = \frac{1}{27}$. Solve for x.

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SECTION B (QUESTIONS 9 TO 17)

These questions are worth 2 marks each

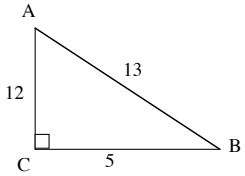
QUESTION 9

Total cost of a school excursion is given by the equation C = 3n + 4, where n is the number of students.

If three extra students go on the excursion, by how much does the total cost increase?

QUESTION 10

Below is a triangle with sides given. It is NOT DRAWN TO SCALE.

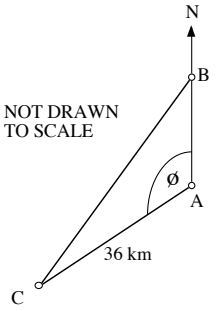


(i) Use Pythagoras theorem to prove that ΔABC is a right angled. *(1 mark)*

(ii) Calculate the size of <ABC to the nearest degree. *(1 mark)*

QUESTION 11

The bearing of C from A is 250º and the distance AC is 36 km.



(i) Find ø *(1 mark)*

(ii) If B is 15km north of A, calculate the distance BC correct to the nearest kilometre. *(1 mark)*

QUESTION 12

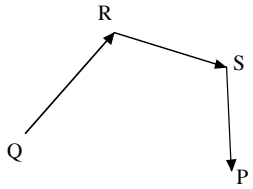
What number must be added to $\frac{1}{3}$ to get $\frac{7}{8}$?

QUESTION 13

Find the values of k for which this quadratic equation, $x^2 - x + k = 0$, has 2 distinct roots.

QUESTION 14

For points P, Q, R and S, simplify the following vector expressions.



(i) $\overrightarrow{QR} - \overrightarrow{SR}$

(ii) $\overrightarrow{QR} - \overrightarrow{SR} - \overrightarrow{PS}$

QUESTION 15

A polynomial is given by

$f(x) = x^3 + 2x^2 - x - 2$

(i) Fully factorise $f(x)$ by the grouping method and abstraction of the highest common multiple.

(ii) Hence solve the polynomial equation

$f(x) = x^3 + 2x^2 - x - 2 = 0$

QUESTION 16

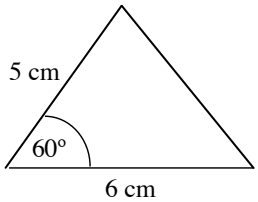
$k + 5, -1$ and $2k - 1$ are consecutive terms of an arithmetic sequence.

(i) Find k.

(ii) Find the terms.

QUESTION 17

Find the area of the triangle below.



Leave your answer in <u>exact</u> form.

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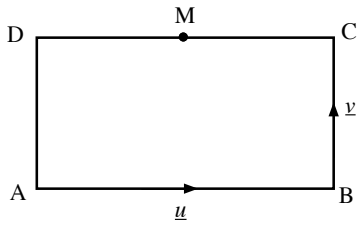
SECTION C (QUESTIONS 18 TO 25)

These questions are worth 3 marks each

QUESTION 18

ABCD is a rectangle. M is the midpoint of CD.



Find the following in terms of $\underline{u}$ and $\underline{v}$.

(i) $\overrightarrow{AC}$

(ii) $\overrightarrow{BD}$

(iii) $\overrightarrow{AM}$

QUESTION 19

Find the coordinates of the point on the curve $y = 2x^2 - 12x + 1$, where the gradient of the tangent is parallel to the x axis.

QUESTION 20

From first principle find the derivative of

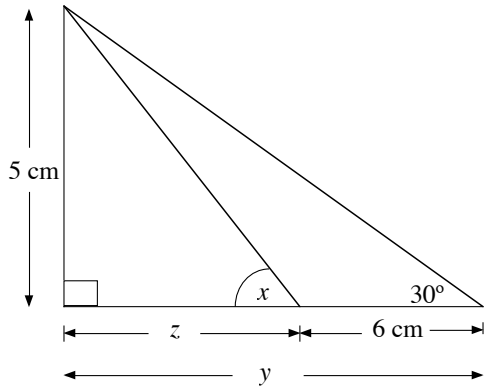
$$f(x) = \frac{1}{x^2}$$

QUESTION 21

From the sum of the numbers that are divisible by 3 from 9 to 210 inclusive.

QUESTION 22

Study the diagram below.



Show that $\tan x = \dfrac{5\left(5\sqrt{3}+6\right)}{39}$

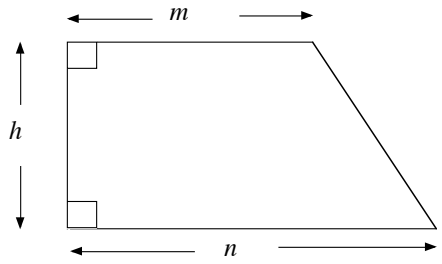
QUESTION 23

Fully simplify the algebraic fractions below.

$$\frac{x^2+3x-xy-3y}{2x^2+2x-4} \div \frac{3y-3x+xy-x^2}{x^2+x-2}$$

QUESTION 24

Study the diagram below.



Find the expression for its area.

QUESTION 25

A parabola has the form $y = ax^2 + bx + 1$ where a and b are constants.

The parabola passes through the points A (1, 2) and B (–2, 11).

Find a, b and hence its equation.

END OF EXAMINATION

HIGHER SCHOOL CERTIFICATE EXAMINATIONS, 2009

FORMULAE SHEET FOR MATHEMATICS A

MENSURATION

Arc Length	$L = \frac{\theta}{360}\ 2\pi r$
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	$V = \frac{4}{3}\ \pi r^3$
Interior Angles of Polygon	$S_n = (n - 2) \times 180^\circ$

INTEREST

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

TRIGONOMETRY

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

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	$\frac{y_2 - y_1}{x_2 - x_1} = m = \tan \theta$