DEPARTMENT OF EDUCATION

HIGHER SCHOOL CERTIFICATE EXAMINATIONS

MATHEMATICS A

PAPER 2

Monday

19 October 2010

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

MA_2

INSTRUCTIONS TO CANDIDATES

To be read by the external invigilator to all candidates

1. There are **3** printed pages in the question booklet and **8 printed** pages in the answer booklet. There is a one-page formula sheet included as an insert.
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.

QUESTION 1 **(7 MARKS)**

Consider the function $f(x) = \sqrt{9-4x}$.

a) Find $f(x+h)$ *(1)*

b) Evaluate and rationalize the numerator of the expression $\dfrac{f(x+h)-f(x)}{h}$ *(2)*

c) Evaluate the limit,

$$\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$ *(1)*

d) What does the answer in (c) represent? *(1)*

e) Find the equation of the tangent line to the graph of $f(x)$ at the point where $x = 0$. *(2)*

QUESTION 2 **(7 MARKS)**

Profit (in kina) for a manufacturing firm made from producing and selling x units of a product on a daily basis is given by the profit function :

$$P(x) = -0.003x^2 + 120x - 500000$$

a) Calculate the profit obtained from producing and selling:

i. 0 units.

ii. 30 000 units. *(2)*

b) Determine the number of units that must be produced and sold daily to maximize profit. *(2)*

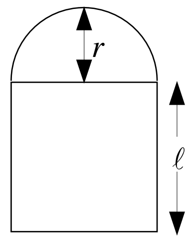
c) What is the maximum profit? *(1)*

d) The company's current practice is to manufacture and sell 30 000 units daily. Would you recommend to the manager to change or maintain this norm? Explain your answer. *(2)*

QUESTION 3 **(7 MARKS)**

A church window consisting of a rectangle topped by a semicircle is to have perimeter p and area A.

If the radius of the semicircle is r and length of the rectangle is ℓ, do the following. (*See diagram*)



a) Write an expression for p in terms of r and ℓ . *(1)*

b) Write an expression for A , the area of the church window, in terms of r and ℓ . *(1)*

c) Write an expression for A, the area of the church window, in terms of p and r. *(3)*

d) Determine the area of the church window if $p = 10$ and $r = 1$.

Leave your answer in exact form. *(2)*

QUESTION 4 **(7 MARKS)**

An observer at ground level is at a distance d from a building. The angles of elevation to the bottoms of the windows on the second and third floors are α and β , respectively. If x is the distance from the base of the building to the bottom of the second floor and h the distance between the bottom of the second floor and the bottom of the third floor windows, do the following.

a) Draw a diagram to represent this information. (1)

b) Find Tan α and Tan β . *(2)*

c) Express x in terms of d and α . *(1)*

d) Find the distance h . *(3)*

QUESTION 5 **(7 MARKS)**

The general term of a geometric sequence is given by $a_n = (-1)^{n-1} 2\left(\frac{3}{4}\right)^{n-1}, n = 1,2,3,....$

a) Write down the first 4 terms of the sequence. (2)

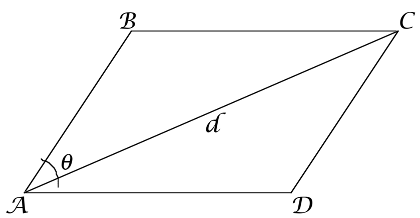
b) What is the common ratio r? (1)

c) Write down the geometric series of the sequence in part (a) and find the sum of the first 12 terms to 2 decimal places. (2)

d) Find the infinite sum of the geometric series. (2)

QUESTION 6 **(7 MARKS)**

Consider the parallelogram $ABCD$ as shown below.



$AD = a, AB = b$ and angle $B\hat{A}D = \theta$ radians. Diagonal AC has length d and bisects angles $B\hat{A}D$ and $B\hat{C}D$.

a) Determine angles $C\hat{A}D$ and $A\hat{C}D$. Your answer must be in radians. (2)

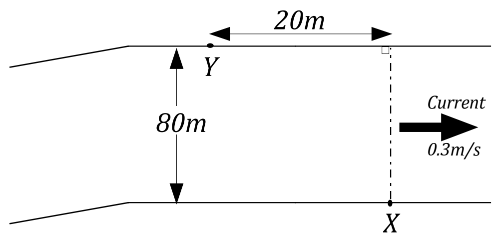
b) Find angle $A\hat{D}C$. (1)

c) Apply the cosine rule to triangle ACD and show that:

$d = \sqrt{a^2 + b^2 - 2abCos\theta}$ (4)

QUESTION 7 **(8 MARKS)**

As part of an endurance race, Nathaniel needs to swim from X to Y across a fairly straight section of a river as shown below. Nathaniel swims at $1.8ms^{-1}$ in still water.



If the river flows with a consistent current of $0.3ms^{-1}$, find:

a) the distance from X to Y correct to 2 decimal places. (1)

b) the direction in which Nathaniel must swim so as to get to Y. (4)

c) the time Nathaniel will need to get from X to Y. (3)

END OF EXAMINATION