

**Mathematics I**

**010**

**09 Nov. 2016 08.30am - 11.30am**



**ORDINARY LEVEL NATIONAL EXAMINATIONS, 2016**

**SUBJECT: MATHEMATICS I**

**DURATION: 3 HOURS**

**INSTRUCTIONS:**

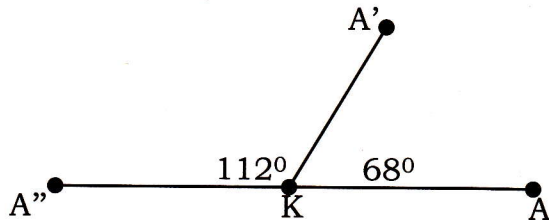
- 1) Write your name and index number on the answer booklet as they appear on your registration form and **DO NOT** write your names and index number on additional answer sheets of paper if provided.
- 2) Do not open this paper until you are told to do so.
- 3) This paper has **TWO** sections: **A** and **B**.
  - **SECTION A:** Attempt **ALL** questions. **(55marks)**
  - **SECTION B:** Attempt **ONLY** any **THREE** questions. **(45marks)**
- 4) You may use mathematical instruments and calculators **where necessary**.
- 5) Use a **blue or black pen only** to write your answers and a pencil to draw diagrams.
- 6) Show clearly all the working. **Marks will not be awarded for the answer without all working steps.**

**SECTION A: ATTEMPT ALL QUESTIONS.****(55 MARKS)**

- 1) Simplify and express the answer in standard form:  $\frac{0.085 \times 0.0084}{1.7 \times 0.007}$ . **(4marks)**
- 2) (a) Find the next two missing terms: 1, 2, 4, 7, ....., ....., ..... **(3marks)**  
(b) What is the 10<sup>th</sup> term in 2(a) above? **(2marks)**
- 3) Using a ruler, a pencil and a pair of compasses only, construct a triangle ABC such that lengths AB = 8.7cm, AC = 10.6cm and angle BAC = 60°. Find the length of BC. [You must show all your construction lines.] **(4marks)**
- 4) Given the function  $f(x) = \frac{x+4}{-x+4}$ ,  
(a) evaluate  $f(-\frac{1}{4})$ . **(2marks)**  
(b) calculate the value of x for which f(x) is not defined. **(2marks)**
- 5) Solve for x, over the set of real numbers, IR:  $\frac{x+1}{2} - \frac{x-7}{3} = \frac{x}{3}$ . **(3marks)**
- 6) Solve for x, over IR:  $x^2 - x - 90 = 0$ . **(3marks)**
- 7) Line A is parallel to line B. Line B passes through points (4,5) and (1,-4). Find the equation of line A if it passes through (0,-1). **(4marks)**
- 8) Given that m is directly proportional to the cube of t and t = 4 when m = 8, find the value of t when m = 27. **(4marks)**
- 9) Use vectors to prove that the points M(-7,-6), N(1,-10) and O(3,-11) lie on a straight line. **(4marks)**
- 10) Given that  $f(x) = 2x + 1$  and  $g(x) = x^2 - 9$ , find the value of x if  $gf(x) = 0$ . **(4marks)**
- 11) The longest side of a triangle is twice the length of the shortest side. The third side is 7cm less than the longest side and the perimeter of the triangle is 78cm. Find the lengths of the sides of the triangle. **(3marks)**
- 12) A man pays for the following items as follows: a pair of shoes 6,000Frw, a pair of trousers 5,000Frw, a shirt 4,000Frw and a pair of socks 3,000Frw. Draw an accurate pie chart for this information. **(4marks)**
- 13) If  $\frac{5}{\sqrt{5}} + \sqrt{20} = a\sqrt{5}$ , find the value of a. **(4marks)**

- 14) Given that  $\vec{a} = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$  and  $\vec{b} = \begin{pmatrix} 21 \\ r \end{pmatrix}$  are parallel vectors, find the value of r. (3marks)

- 15) Point A is rotated  $68^\circ$  about K and then by  $112^\circ$  about K.



Find a single rotation that has the same effect as this. (2marks)

**SECTION B: ATTEMPT ONLY ANY THREE QUESTIONS. (45 MARKS)**

- 16) (a) At a factory, a worker's wages for a 40-hour week is 120,000Frw. She is paid 10% of her weekly wages for every 2 hours that she works overtime. At the end of a certain week she received 216,000Frw. Calculate the number of hours of overtime that she worked. (5marks)

- (b) A laptop costs 257,000Frw. A student takes the laptop on hire purchase. The student has to pay a deposit of 15,000Frw and 25 monthly instalments of 12,400Frw.

Calculate:

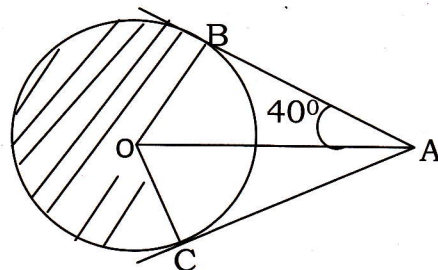
- (i) the total amount paid for the laptop under the hire purchase agreement. (3marks)

- (ii) the difference between the amount paid under hire purchase and the cost price. (2marks)

- (c) A car was bought for 33,000,000Frw. The value of the car depreciated each year by 15% of its value at the beginning of the year.

Calculate the value of the car after three years. (5marks)

- 17) The diagram below is a circle with centre O.  $\overline{OB}$  and  $\overline{OC}$  are radii,  $\overline{AB}$  and  $\overline{AC}$  are tangents to the circle.



- (a) Show that triangle ABO is congruent to triangle ACO. (4marks)

(b) Find:

- (i) the size of angle AOB. (2marks)

- (ii) the size of angle CAO. (2marks)

(c) Given that  $\overline{AO} = 13\text{cm}$  and  $\overline{OC} = 5\text{cm}$ .

Calculate:

(i) the area of triangle ACO. (3marks)

(ii) the area of the shaded region. [Express your answer to the nearest tenth, use  $\pi = 3.14$ ] (4marks)

18) (a) If  $\vec{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$  and  $\vec{b} = \begin{pmatrix} -12 \\ 6 \end{pmatrix}$ , calculate  $2\vec{a} - 0.5\vec{b}$ . (3marks)

(b) The points a(-3,2), b(2,-3) and c(6,1) are in a Cartesian plane.

(i) Determine the column vectors of  $\vec{ab}$ ,  $\vec{ac}$  and  $\vec{bc}$ . (6marks)

(ii) Calculate the length of  $\vec{ac}$ ,  $\vec{ab}$  and  $\vec{bc}$ . (3marks)

(iii) Hence show that triangle abc is right angled triangle at b. (3marks)

19) (a) Given that  $p(x) = 6x^3 + 35x^2 + 19x - 30$ .

(i) Prove that -5 is a zero of  $p(x)$  and hence factorize it completely. (7marks)

(ii) Find the values of  $x$  for which  $p(x) = 0$ . (1mark)

(b) Solve for  $x$ , over the set of real numbers:  $\frac{x+2}{x-2} + \frac{x-2}{x+2} = \frac{8-4x}{x^2-4}$  (7marks)

20) A teacher found that students were taking too long to answer a statistics question in every mathematics examination. She asked students to answer a statistics question and she recorded how long it took each student. Below are the times in minutes the teacher recorded.

35	39	31	32	35	32	31	29	26	35	31
39	29	39	34	29	39	39	26	27	32	39
32	39	26	35	34	26	32	35	32	34	

(a) Draw a frequency table for this data and calculate the mean time (correct to the nearest whole number). (10marks)

(b) The statistics question is worth 15% of the total marks in a three hour mathematics examination paper.

(i) How long should each student spend on the statistics question? (1mark)

(ii) What is the percentage of students who were spending too long on the statistics question? (2marks)

(c) How many students spent :

(i) the longest time? (1mark)

(ii) the shortest time? (1mark)