**JETS OF ZAMBIA**

**NORTHERN REGION**

**2012 MATHEMATICS JUNIOR OLYMPIAD**

INSTRUCTIONS

1. There are twelve (12) questions in this paper. You are required to attempt all the questions.

2. All your working must be shown. Omission of essential working will result in loss of marks.

1. Given that E=$\left\{Natural numbers less than 6\right\}$ and A$ ∩B$=$\left\{\right\}$, A=$\left\{1,2\right\}$ ,(A $∪B)'=\left\{5\right\}$
2. Illustrate this information on a Venn diagram (1 mark)
3. Find n(B)’ (1 mark)
4. Find n(A$∩B)'$ (1 mark)
5. Find n(B) (1 mark)
6. State whether the statement below is true or false about sets A and B.

“Set A is equal to set B” (1 mark)

1. (a) Solve for x in $9^{2x-3}=\frac{1}{27} \left(1 mark\right)$

(b) Express as a single number in scientific notation $\frac{9.3 X 10^{2}}{1.2 X10^{-2}+3.5 X 10^{-3}} $ (1 mark)

(c) Find the value of $16^{\frac{-1}{2}} ($ 1 mark)

(d) Find the value of $\frac{2^{2n+3}}{2^{n+1}}$ =32 (2 marks)

3.

$$^{}$$

In the diagram given above, O is the centre of the circle. Angle AOB =$140^{0}$ and angle OAC=$30^{0}$.

Find (a) (i) angle ACB (1 mark)

(ii) angle OCA (1 mark)

(iii) angle OCB (1 mark)

 (iv) angle OBC (1 mark)

 (b) Find the size of the reflex angle AOB (1 mark)

4. (a) Using a rule and a pair of campuses only, construct ∆ABC where AB=7.2cm,BC=4.6cm and angle ABC=$45^{0}$. (2 marks)

(b) Measure and write down the length AC (1 mark)

(c) Construct a locus of points equidistant from A and B. (1 mark)

(d) Circumscribe the triangle with a circle. (1 mark)

5. If A=$\left(\begin{matrix}3&8&1\\4&-6&-3\end{matrix}\right)$ and B=$\left(\begin{matrix}-2&-8&7\\-3&-2&-4\end{matrix}\right)$ .Find the value of A $– B. \left(5 marks\right)$

6. A bag contains 3 red balls and 2 green balls. One ball is picked at random and then replaced. Another ball is picked.

1. Draw a tree diagram (3 marks)
2. Find the probability that both balls picked are green. (2 marks)

7. Express as a single fraction.

 $\frac{x-5}{2x-6}-\frac{x-7}{4x-12}$ (5 marks)

8.

 B

 C

 15

 $55^{0}$ 11

 A 8 D

In the diagram above AB is a vertical wall of a tall building. A beam CD of length 11 meters rests with one end. D is on the horizontal ground. It is held in place by two cables BC and BD. Given that AD=8m, BD=15m and angle BDC =$55^{0}$

Calculate (i) the length AB ($\frac{1}{2} marks)$

(ii) the length of cable BC (2 marks)

(iii) the angle between the beam CD and the ground (2 marks)

(iv) the area of $∆$BCD ($\frac{1}{2} marks)$

9. (a) For the function f(x)=$\frac{x-5}{10}$, find ;

(i) f(2) (1 mark)

(ii) $f^{-1}\left(3\right) \left(2 marks\right)$

(iii) Find x if f(x) = 20 (2 marks)

10.

 C

 x-1 x

 A x – 2 B

The diagram ABC is a right angled triangle in which AB=x-2 ,AC=x-1 and BC=x.

1. Using the information given above, form an equation in x and show that it reduces

to $x^{2}- 6x+5=0 \left(3 marks\right)$

1. Hence solve the equation. (2 marks)

11. A car moved from point A to point B due East. It then covered the same distance from point B to C at bearing of $120^{0}$.

1. Illustrate this information on a sketch map (3 marks)
2. Calculate the bearing of C from A. (3 marks)

2.

 125cm

The diagram above shows a cylindrical water tank of radius 24cm and height 125cm.It is open on top and full of water. Taking $π to be 3.142,$calculate

1. The volume in liters of water in the tank. (2 marks)
2. The total surface area of the tank in metres per square. (3 marks)

13.

 150cm

 20cm

The diagram above show a rectangular trough of length 150cm and width 20cm.The trough was completely filled with 48000$cm^{3} of water $from the tank.

1. Calculate the depth of the tank (2 marks)
2. After the trough had been filled, water started to leak out of the tank. Calculate the rate at which the level of water in the tank was falling (3 marks).