

# STAREHE BOYS HIGH SCHOOL MOCK 2015

## MATHEMATICS PAPER 1

### Section I (50 marks)

Answer all the questions in this section in the spaces provided

1. Without using calculators evaluate  $\frac{1}{3}$  of  $(2\frac{3}{4} - 5\frac{1}{2}) \times 3\frac{6}{7} \div \frac{9}{4}$  {2 marks}

2. Use the method of completing the square to solve the quadratic equation  
 $2x^2 - 13x + 15 = 0$  {3 marks}

3. Solve for  $\theta$  in the equation  $6 \cos^2 \theta - \sin \theta - 4 = 0$  in the range  $0^\circ \leq \theta \leq 180^\circ$ . {3 marks}

4. The sides of a rectangle are  $x$  cm and  $(x + 1)$  cm. A circle has radius of  $(x + 2)$  cm. If the sum of the area of the rectangle and the circle is  $184 \text{ cm}^2$ . Using  $\pi$  as  $\frac{22}{7}$  find the value of  $x$ . {4 marks}

5. Use binomial expansion to evaluate  $\left(2 + \frac{1}{\sqrt{2}}\right)^5 + \left(2 - \frac{1}{\sqrt{2}}\right)^5$  {3 marks}

6. A line  $L_1$  passes through point (1, 2) and has a gradient of 5. Another line  $L_2$  is perpendicular to  $L_1$  and meets it at a point where  $x = 4$ . Find the equation for  $L_2$  in the form  $y = mx + c$ . {4 marks}

7. Find the value of  $x$  in the following equation. {3 marks}  
 $9^x + 3^{2x} - 1 = 53$

8. The first and the last terms of an AP are 2 and 59 respectively. If the sum of the series is 610, find the number of terms in the series and the common difference. {4 marks}

9. The equation of a circle is  $2x^2 + 2y^2 + 12x - 20y - 4 = 0$ . Determine the coordinates of the centre of the circle and state its radius. {3 marks}

10. Make  $b$  the subject of the formula  $a = \frac{bd}{\sqrt{b^2 - d}}$  {3 marks}

11. Solve the inequality  $3 - 2x \leq x \leq \frac{2x+5}{3}$  and show the solution on the number line. {4 marks}

12. Solve for x given that  $\log_2 5x - \log_4 2x = 3$  {3 marks}

13. A salesman earns a basic salary of sh. 9,000 per month. In addition he is also paid a commission of 5% for sales above sh. 15,000. In a certain month he sold goods worth sh. 120,000 at a discount of 2½%. Calculate his total earnings that month. {3 marks}
14. A small cone of height 8 cm is cut off from a bigger cone to leave a frustum of height 16 cm. If the volume of the smaller cone is  $160 \text{ cm}^3$ , find the volume of the frustum. {3 marks}

15. Vector  $\mathbf{OP} = 6\mathbf{i} + \mathbf{j}$  and  $\mathbf{OQ} = -2\mathbf{i} + 5\mathbf{j}$ . A point N divides  $\mathbf{PQ}$  internally in the ratio 3:1. Find  $\mathbf{PN}$  in terms of  $\mathbf{i}$  and  $\mathbf{j}$ . {3 marks}

16. Without using mathematical tables or calculators express in surd form and simplify

$$\frac{1 + \cos 30^\circ}{1 - \sin 60^\circ}$$

{3 marks}



**SECTION II (50 MARKS)****Answer any five questions in this section**

17. In the figure below, vector  $\mathbf{OP} = \mathbf{p}$  and  $\mathbf{OR} = \mathbf{r}$ .  $\mathbf{OS} = 2\mathbf{r}$  and  $\mathbf{OQ} : \mathbf{OP} = 3 : 2$

a) Express the following vectors in terms of  $\mathbf{p}$  and  $\mathbf{r}$ .

i)  $\mathbf{QR}$

{1 mark}

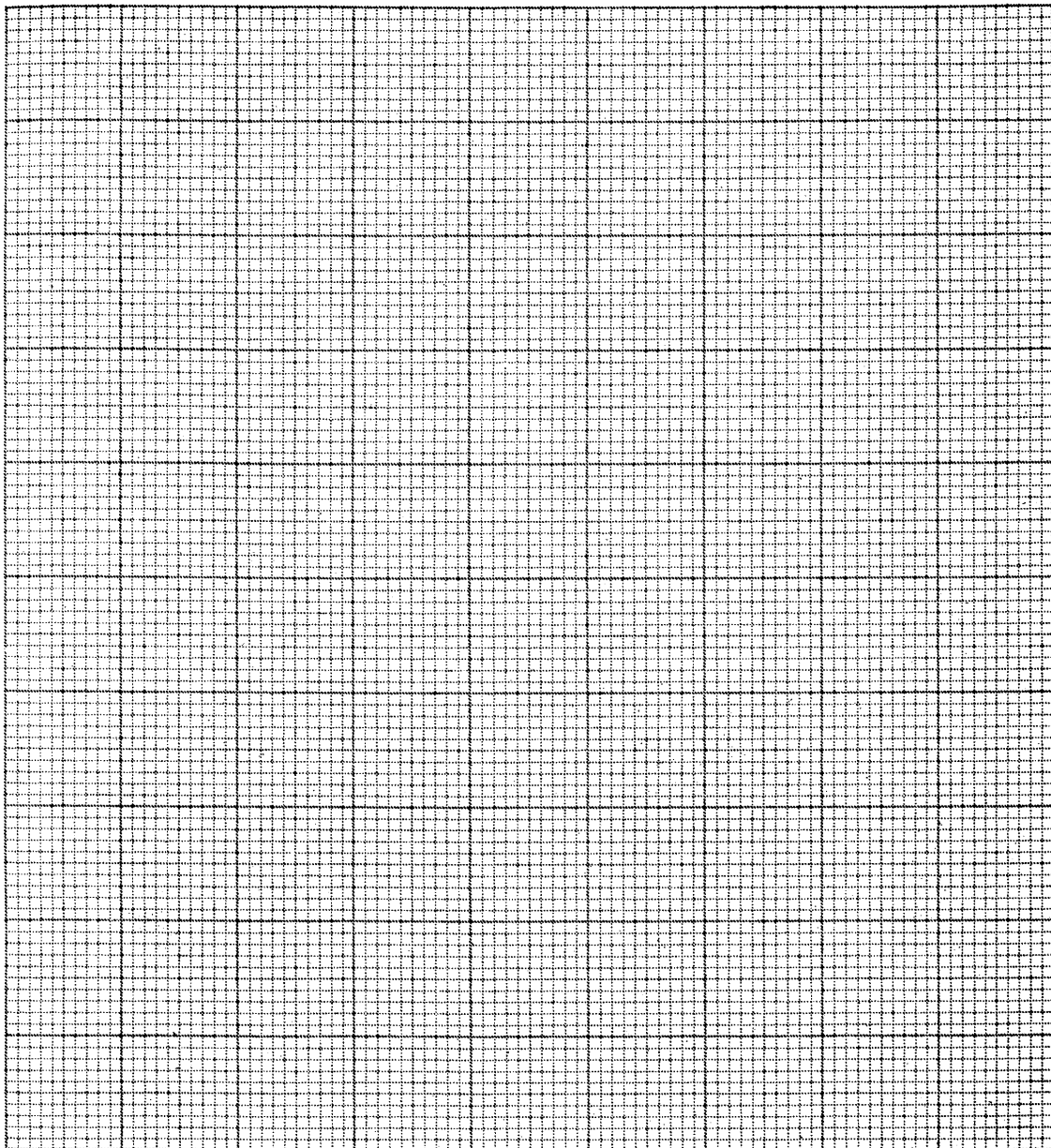
ii)  $\mathbf{PS}$

{1 mark}

b) The lines QR and PS intersect at K. By expressing  $\mathbf{OK}$  in two different ways, find the ratio PK : KS

{8 marks}

18. On the graph paper provided, plot the triangle
- a) whose co-ordinates are A(1, 2) B(5, 4) and C(2, 6) {1 mark}
  - b) On the same axes
    - i) Draw the image  $A^1B^1C^1$  of ABC under a rotation of  $90^\circ$  clockwise about origin. {2 marks}
    - ii) Draw the image  $A^{11}B^{11}C^{11}$  of  $A^1B^1C^1$  under a reflection in the line  $y = -x$ . State the coordinates of  $A^{11}B^{11}C^{11}$ . {3 marks}
  - c)  $A^{111}B^{111}C^{111}$  is the image of  $A^{11}B^{11}C^{11}$  under the reflection in the line  $x = 0$ . Draw the image  $A^{111}B^{111}C^{111}$  and state its coordinates. {2 marks}
  - d) Describe a single transformation that maps  $A^{111}B^{111}C^{111}$  onto ABC. {2 marks}



19. A bus left Kitale at 10.45 a.m and travelled towards Nairobi at an average speed of 60 km/h. A Nissan left Kitale on the same day at 1.15 p.m and travelled along the same road at an average speed of 100 km/h. The distance between Kitale and Nairobi is 500 km.
- a) Determine the time of the day when the Nissan overtook the bus. {6 marks}
- b) Both vehicles continued towards Nairobi at their original speed. Find how long the Nissan had to wait in Nairobi before the bus arrived. {4 marks}

20. The table below shows how income tax was charged in a certain year.

| (Kenya pounds)  | (Ksh. per Kenya pound) |
|-----------------|------------------------|
| 1 – 3630        | 2                      |
| 3631 - 7260     | 3                      |
| 7261 - 10890    | 4                      |
| 10891 - 14520   | 5                      |
| 14521 - 18150   | 6                      |
| 18151 - 21780   | 7                      |
| 21781 and above | 7.5                    |

During the year Mwadime earned a basic salary of Ksh. 25,200 and a house allowance of Ksh. 12,600 per month. He was entitled to a personal tax relief of Ksh. 1,162 per month.

a) Calculate:

i) Mwadime's taxable income in Kenya pounds per annum. {2 marks}

ii) The net tax he pays per month. {6 marks}

b) Apart from income tax he also contributes monthly NHIF Ksh. 1600, WCPS Ksh. 1000. Calculate his net monthly pay. {2 marks}

21. X, Y and Z are three quantities such that X varies directly as the square of Y and inversely as the square root of Z.
- a) Given that  $X = 18$  when  $Y = 3$  and  $Z = 4$ , find X when  $Y = 6$  and  $Z = 16$ . {5 marks}
- b) If Y increases by 10% and Z decreases by 19%, find the percentage increase in X. {5 marks}

- 22(a) A port B is on a bearing  $080^\circ$  from a port A and a distance of 95 km. A Submarine is stationed at a port D, which is on a bearing of  $200^\circ$  from A, and a distance of 124 km from B. A ship leaves B and moves directly Southwards to an Island P, which is on a bearing of  $140^\circ$  from A. The Submarine at D on realizing that the ship was heading to the Island P, decides to head straight for the Island to intercept the ship. Using a scale of 1 cm to represent 10 km, make a scale drawing showing the relative positions of A, B, D and P. {4 marks}

Hence find:

- b) The distance from A to D. {2 marks}
- c) The bearing of the Submarine from the ship when the ship was setting off from B. {1 mark}
- d) The bearing of the Island P from D. {1 mark}

- e) The distance the Submarine had to cover to reach the Island P. {2 marks}
23. The data below represent the heights taken to the nearest centimeters of 40 lemon trees in a garden. (NB: A = Assumed mean)

| Height (cm) | f  | x | $d = x - A$ | fd | $d^2$ | $fd^2$ |
|-------------|----|---|-------------|----|-------|--------|
| 131 – 140   | 3  |   |             |    |       |        |
| 141 – 150   | 4  |   |             |    |       |        |
| 151 – 160   | 7  |   |             |    |       |        |
| 161 – 170   | 11 |   |             |    |       |        |
| 171 – 180   | 9  |   |             |    |       |        |
| 181 – 190   | 5  |   |             |    |       |        |
| 191 – 200   | 1  |   |             |    |       |        |

- a) Complete the table. {6 marks}
- b) Using 165.5 as the assumed mean, calculate the mean height. {2 marks}
- c) Calculate the standard deviation of the distribution. {2 marks}

24. The line segment  $BC = 7.5$  cm long is one side of triangle  $ABC$ .
- a) Use a ruler and compasses only to complete the construction of triangle  $ABC$  in which  $\angle ABC = 45^\circ$ ,  $AC = 5.6$  cm and angle  $BAC$  is obtuse. {3 marks}
- b) Draw the locus of a point  $P$  such that  $P$  is equidistant from a point  $O$  and passes through the vertices of triangle  $ABC$ . {3 marks}
- c) Locate point  $D$  on the locus of  $P$  equidistant from lines  $BC$  and  $BO$ .  $Q$  lies in the region enclosed by lines  $BD$ ,  $BO$  extended and the locus of  $P$ . Shade the locus of  $Q$ . {4 marks}