NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ INDEX NO. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 SIGNATURE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

JULY, 2017

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

**INSTRUCTIONS TO CANDIDATES**

1. Write your **name** and **index number** in the spaces provided above.
2. Sign and write the **date** of examination in the spaces provided above.
3. This paper consists of **two** sections, **section I** and section II.
4. Answer **ALL** the questions in **section I** and only **five** questions from **section II**.
5. **All** answers and working **must** be written on the question paper in the spaces provided below each question.
6. Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
7. Marks may be given for correct working even if the answer is wrong.
8. Non- programmable silent calculators and KNEC mathematical tables may be used except where stated otherwise.
9. This paper consists **16** printed pages.
10. Candidates should check the question paper to ascertain that all the papers are printed as indicated and that no questions are missing.

FOR EXAMINER’S USE ONLY

SECTION I

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | TOTAL |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

SECTION II

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | TOTAL |  | GRAND TOTAL |  |
|  |  |  |  |  |  |  |  |  |  |

**SECTION I** (50 MARKS)

Answer ALL the questions from this section.

1. Use logarithms to evaluate, (4 marks)

$\sqrt[3]{\frac{45.3 ×0.00697}{0.534}}$

1. Make P the subject of the formula

d = $\sqrt[3]{\frac{P}{q-P}}$ (3 marks)

1. Find the circle centre and radius whose equation is

3x2 + 3y2 + 18x – 6y + 18 = 0 (3 marks)

1. The volumes of two similar cylindrical containers are 27cm3 and 64cm3 respectively. Given that the height of the smaller container is 12cm, find the height of the larger container. (2 marks)
2. 3cm3 of water is added to 2cm3 of a certain medicine which costs sh.12 per cm3.

The chemist sells the diluted medicine at sh.6 per cm3. Calculate the percentage profit. (3 marks)

1. Given that 4y = 3 $\sin(\frac{2}{5})$ for 0 < $θ$ < 360o. Determine
2. The amplitude of the curve (1 mark)
3. The period of the curve. (1 mark)
4. Find the length BC of the following triangle if AC = 3.7cm, AB = 4cm and angle ABC = 63o. (3 marks)

 

1. Solve for x in the equation

27x − 1 $×$ 3x + 1 = 729 (3 marks)

1. In the figure below ABCD is a cyclic quadrilateral. Point O is the centre of the circle.

∠ABO = 30o and ∠BCD = 110o.

 

**C**

Calculate the size of angle ADB. (2 marks)

1. Three people Mutua, Wanza and Kiilu contributed money to start a business. Mutua contributed a quarter of the money and Wanza two fifths of the reminder. Kiilu’s contribution was one and a half times that of Mutua. They borrowed the rest of the money from a bank which was sh.60,000 less than Kiilu’s contribution. Find the total amount required to start the business. (4 marks)
2. Simplify $\frac{\sqrt{3}}{\sqrt{3}- \sqrt{2}}$ (3 marks)
3. Expand $\left(2-\frac{1}{4}x\right)^{5}$and use the first three terms to find the value of 1.9755 to four significant figures. (4 marks)
4. The radius of a spherical ball is measured as 7cm correct to the nearest centimeter. Determine to 2 decimal places, the percentage error in calculating the surface area of the ball. (3 marks)
5. Given that $\tan(θ)= \frac{1}{\sqrt{5}}$ where $θ$ is an acute angle, find without using tables or calculator $\sin(\left(90- θ\right))$ leaving your answer in the simplified surd form. (4 marks)
6. Given that a = 1.2, b = 0.02 and c = 0.2, express ac $÷$ b in the form $\frac{m}{n}$ where m and n are integers. (3 marks)
7. The diagram below shows sector AOB of a circle centre O.

∠AOB = 1.5C and arc AB is of length 12cm.

 

1. Determine the radius OA of the circle. (1 mark)
2. Calculate the area of the shaded region. Give your answer correct to 3 s.f. (3 marks)

**SECTION II** (50 MARKS)

 Answer any FIVE questions from this section

1. The table below shows the taxation rates.

|  |  |
| --- | --- |
| Income (£ per month) | Rate % |
| 0 – 382  | 10 |
| 383 – 754  | 15 |
| 755 – 1126  | 20 |
| 1127 – 1498  | 25 |
| 1499 – 1870  | 30 |
| 1871 – 2242  | 35 |
| Over 2242 | 40 |

Mueni is housed by her employer but pays a nominal rent of sh.1200 per month. She is entitled to a personal relief of sh.950 per month. If her monthly P.A.Y.E is sh.7024,

1. Calculate her gross income. (5 marks)
2. In addition to the tax the following monthly deductions are also made

Sacco shares Ksh. 1200

Coop loan Ksh.1500

Union dues Ksh.300

Calculate

1. Her monthly salary. (3 marks)
2. Net monthly salary (2 marks)
3. Use a ruler and compasses only for all construction in this question.
4. Construct a triangle ABC in which AB = 8cm, BC = 7.5cm and ∠ABC = 112$\frac{1}{2}^{ o}$. (3 marks)
5. Measure the length of AC. (1 mark)
6. By shading the unwanted region show the locus of P within the triangle ABC such that AP $\leq $ BP, AP > 3cm. Mark the required region as P. (3 marks)
7. Construct a normal from C to meet AB produced at D. (1 mark)
8. Locate the locus of R in the same diagram such that the arc of triangle ARB is $\frac{3}{4}$ the arc of the triangle ABC. (2 marks)
9. In the triangle PQR below, L and M are points on PQ and QR respectively such that PL : LQ = 1 : 3 and Qm : mR = 1 : 2. Pm and RL intersect at X. Given that PQ = b and PR = c



1. Express the following vectors in terms of b and c.
2. QR (1 mark)
3. Pm (1 mark)
4. RL (1 mark)
5. By taking PX = hPm and RX = kRL where h and k are constants. Find two expressions of PX in terms of h, k, b and c. Hence determine the values of the constants h and k. (6 marks)
6. Determine the ratio LX : XR. (1 mark)
7. OABC is a parallelogram with vertices O(0, 0), A(2, 0), B(3, 2) and C(1, 2).

OIAIBICI is the image of OABC under a transformation matrix $\left(\begin{matrix}-2&0\\0&-2\end{matrix}\right)$.

1. i) Find the coordinates of OIAIBICI (2 marks)

ii) On the graph provided, draw OABC and OIAIBICI (2 marks)



1. i) Find OIIAIIBIICII, the image of OIAIBICI under the transformation matrix $\left(\begin{matrix}1&0\\0&-2\end{matrix}\right)$. (2 marks)

ii) On the same grid, draw OIIAIIBIICII. (1 mark)

1. Find the single matrix that maps OIIAIIBIICII onto OABC. (3 marks)
2. An aircraft leaves town P (30oS, 17oE) and moves directly towards Q (60oN, 17oE). It then moved at an average speed of 300 knots for 8 hours Westwards to town R. Determine
3. The distance PQ in nautical miles. (2 marks)
4. The position of town R. (4 marks)
5. The local time at R if local time at Q is 3.12p.m (2 marks)
6. The total distance moved from P to R in kilometers. (Take 1nm = 1.853km) (2 marks)
7. The figure below is a sketch of a curve whose equation is y = x2 + x + 5.

It cuts the line y = 11 at points P and Q.

**y = *x*2 + *x* + 5**

**y - axis**

 

**y = 11**

**y - axis**

**2**

**0**

**-3**

**Q**

**P**

1. Find the area bounded by the curve y = x2 + x + 5 and the line y = 11 using the trapezium rule with 5 strips. (5 marks)
2. Calculate the difference in the area if the mid-ordinate rule with 5 ordinates was used instead of the trapezium rule. (5 marks)
3. The figure below represents a rectangular based pyramid VABCD. AB = 12cm and AD = 16cm.

Point O is vertically below V and VA = 26cm.

 

Calculate:

1. The height, VO, of the pyramid. (4 marks)
2. The angle between the edge VA and the plane ABCD. (3 marks)
3. The angle between the planes VAB and ABCD. (3 marks)
4. The distances S metres from a fixed point O, covered by a particle after t seconds is given by equation

S = t3 – 6t2 + 9t + 5

1. Calculate the gradient to the curve at t = 0.5 seconds. (3 marks)
2. Determine the values of S at the maximum and minimum turning points of the curve. (4 marks)
3. On the space provided, sketch the curve of S = t3 – 6t2 + 9t + 5. (3 marks)