**NAME:……………………………………………….. INDEX NO………………………………**
**SCHOOL:……………………………………..……… STREAM:…………… ADM:………….**

**CANDIDATE’S SIGN …………………………….… DATE …………………………………..**

121/2

**MATHEMATICS**

**Paper 2**

**FORM 4**

November - December 2021
**Time: 2 ½ Hours**

 **DECEMBER EXAMINATION - 2021**

***Kenya Certificate of Secondary Education (K.C.S.E)***

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, stream, admission number and index number in the spaces provided above.

2. The paper contains two sections, Section I and II

3. Answer all questions in section I and **ONLY** any **FIVE** questions from section II.

4. All answers and working must be shown on the question paper in the spaces below each question

5. Show all steps in your calculations, giving answers at each stage

6. Marks may be given for each correct working even if the answer is wrong

7. Non-programmable silent electronic calculators and KNEC mathematical tables may be used.

**FOR EXAMINERS USE ONLY**

**Section I**

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

**Section II Grand Total**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | **Total** |
|  |  |  |  |  |  |  |  |  |

*This paper consists of 18 printed pages. Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing.*

**SECTION I**

**Answer all the questions in the spaces provided (50 marks)**

1. The expression x2 + 10x + c + 2 = 0 is a perfect square. Find the value of c if it is a scalar. (2mks)
2. Muya was asked to truncate 7/9 to 3 significant figures. He rounded it off instead to 3 decimal places. Calculate the percentage error resulting from his rounding off. (3mks)
3. The co-ordinates of a point A is (2, 8, 3) and B is (-4, -8, -5). A point P divides AB externally in the ratio 7: -3.

Find the co-ordinates of P (3mks)

1. In a triangle XYZ, XY = 2cm, YZ (2√3-1) cm, and angle YXZ = 600. Determine Sine XZY giving your answer in the form m + √3, where M and N are integers (4mks)

 n

1. Find the independent term of x in the expansion of (x3 – 2/X3) 6  (3mks)
2. Solve for x: (log3x)2 – ½ log3 x= 3/2  (3mks)
3. The cash price of a T.V set is Ksh.13,800. Walter opts to buy the set on hire purchase terms by paying deposit of Ksh.2,280. If simple interest of 20% p.a is charged on the balance and the customer is required to pay by monthly installments for 2 years, calculate the amount of each installment. (3mks)
4. Make x the subject of the formula ax = 3r - x2 (3mks)

 2 2

1. Calculate the area under the curve y = 3x2 + 8 and bounded by lines; y = 0, x = 1 and x = 6, using the mid-ordinate rule with 5 strips. (3mks)
2. A circle is tangent to the y – axis and intersects the x- axis at (2,0) and (8,0). Obtain the equation of the circle in the form x2 + y2 +ax +by +c = 0, where a, b and c are integers (4mks)
3. A variable y varies as the square of x and inversely as the square root of z. Find the percentage change in y when x is changed in the ratio 5:4 and z reduced by 19% (3mks)
4. Solve for X in the equation:

2 Sin2x – 1 = Cos2x + Sin x, for 00 ≤ x ≤ 3600 (3mks)

1. A die is biased so that when tossed, the probability of a narrator of a number n showing up, is given by p(n) = kn where k is a constant and n = 1, 2, 3, 4, 5, 6 (the numbers of the faces of the die)
2. Find the value of k (1mk)
3. If the die is tossed twice, calculate the probability that the total score is 11 (2mks)
4. In the figure below, the tangent ST meets chord VU produced at T. Chord SW passes through the Centre, O of the circle and intersects chord VU at X. Line ST = 12cm and UT = 8cm.

S

 T

 U

O

X

V

W

1. Calculate the length of chord VU (1mk)
2. If VX : XU = 2 : 3, Find SX (2mks)
3. Dota measured the heights in centimeters of 104 trees seedlings are shown in the table below

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Height | 10 - 19 | 20 - 29 | 30 - 39 | 40 - 49 | 50 - 59 | 60 - 69 | 70 - 79 |
| No. of Seedlings | 9 | 16 | 19 | 26 | 20 | 10 | 4 |

Calculate the quartile deviation (4mks)

1. Given that the ratio x:y = 2:3, find the ratio (5x – 2y) : (x +y) (2mks)

**SECTION II**

**Answer ONLY five questions in this section (50 marks)**

1. A curve is represented by the function, y = 2x3 + 3x2
2. Find: (i) the x-intercept of the curve (2mks)

(ii) the y-intercept of the curve (1mk)

1. (i) Determine the stationary points of the curve of the curve (3mks)

(ii) For each point in b(i) above, determine if it is maximum or minimum (2mks)

1. Sketch the curve in the space below ( 2mks)
2. Use ruler and a pair of compasses only in this question
3. Construct; (i) triangle ABC in which AB = 8.5cm, BC = 7.5cm and <BAC = 300 and <ABC = 1050

(3mks)

ii) a circle that passes through the vertices of triangle ABC. Measure the radius (3mks)

1. the height of triangle ABC with line AB as the base. Measure the height. (2mks)
2. Determine area of the circle that lies outside the triangle (2mks)

19. a) Complete the table below, giving your values to 2 decimal places (2mks)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | 360 |
| (2cos x) -1 |  |  | 0 |  | -2 |  | -3 |  | -2 | -1 | 0 |  | 1 |
| Sin x | 0 |  |  | 1 |  | 0.50 | 0 |  |  | -1 |  |  | 0 |

b) Draw the graph of y= (2 co x) – 1 and y=sin x on the grid provided below. Use the scale 1cm represent 300 horizontal 2 cm represent 1 unit vertically and 2cm for 1 unit on the y-axis (4 mks)

c) Use the graph to solve:

 i) (2cos x) – 1 = -1.5 (1mk)

ii) 2 cos x – sin x =1 (2mks)

d) State the amplitude of the wave y=2cos x – 1 (1mk)

20. A bag contains blue, green and red pens of the same type in the ratio 8:2:5 respectively. A pen is picked at random without replacement and its colour noted.

 a) Determine the probability that the first pen picked is

 i) Blue (1mk)

 ii) Either green or red. (2mks)

 b) Using a tree diagram, determine the probability that

 i) The first two pens picked are both green (4mks)

 ii) Only one of the first two pens picked is red. (3mks)

21. A and B are two points on the earth’s surface and on latitude 300N.The two points are on the longitude 400W and 1040E respectively.

 Calculate

 (a) (i) The distance from A to B along a parallel of latitude in kilometres. (3mks)

 (ii) The shortest distance from A to B along a great circle in kilometre (4mks)

 (Take =and radius of the earth =6370km)

 (b) If the local time at B is 8.00am, calculate the local time at A (3mks)

22. Lengths of 100 mango leaves from a certain mango tree were measured t the nearest centimeter and recorded as per the table below,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Length in cm | 9.5-12.5 | 12.5-15.5 | 15.5-18.5 | 18.5-21.5 | 21.5-24.5 |
| No. of Leaves | 3 | 16 | 36 | 31 | 14 |
| Cumulative frequency |  |  |  |  |  |

1. Fill in the table above. (2 mks)
2. Draw a cumulative frequency curve from the above data. (3 mks)

b) Use your graph to estimate

 i) The quartile deviation of the leaves (3mks)

 ii) The number of leaves whose lengths lie between 13cm and 17cm. (2mks)

23. a) Use the trapezium rule with 7 ordinates to estimate the area enclosed by the curve $y=\frac{1}{2}x^{2}+3$ and the lines x = 0, x = 6 and the x-axis. (4 mks)

b) Determine the exact area bounded the curve and the lines in section a) above (3 mks)

c) Calculate the percentage error from the trapezoidal rule (3 mks)

24. A manufacturer sells two types of books X and Y. Book X requires 3 rolls of paper while Book Y requires 21/2 rolls of paper. The manufacturer uses not more than 600 rolls of paper daily in making both books. He must make not more than 100 books of type X and not less than 80 of type Y each day

1. Write down four inequalities from this information (4mks)
2. On the grid provided, draw a graph to show inequalities in (a) above (3mks)
3. If the manufacturer makes a profit of sh 80 on book X and a profit of sh 60 on book Y, how many books of each type must it make in order to maximize the profit. (3mks)