**NAME:……………………………………… DATE: …..……………..…….…**

**121/2**

**MATHEMATICS**

**PAPER 2**

**DECEMBER, 2020**

**TIME: 2 ½ HOURS**

**LANJET JOINT EVALUATION TEST 2020**

**MARKING SCHEME**

**SECTION A (50MARKS)**

**ANSWER ALL QUESTIONS IN THIS SECTION IN THE SPACES PROVIDED.**

1. Use logarithms tables to evaluate. (4mks)



|  |  |
| --- | --- |
| *Log* | *No* |
|  *1.5649* | *36.72**(0.46)22**3.474 x 10-1**= 0.3474* |

1. If A = 2.3, B = 8.7 and C = 2.0. Find the percentage error in calculating $\frac{A+B}{C}$ (3mks)

Max $\frac{2.35+8.75 }{1.95}$=5.6923

Min $\frac{2.25+8.65}{2.05}$ = 5.3171

Actual $\frac{2.3+8.7}{2.0}$ = 5.0

Error $\frac{5.6923-5.3171}{2}$=0.1876

% Error $\frac{0.1876 }{5.0}x 100$

= 3.752%

1. Given that *M=i – 3j + 4k, W= 6i + 3j – 5k* and *Q =* 2M + 5N, find the magnitude of Q to 3 significant figures. (3mks)



1. Solve the following equation 22x + 3 –2x +4 = 17(2x) –4 (4mks)



1. If  , find the value of a, b and c (3mks)











1. Pipe A can fill an empty water tank in 3hrs while Pipe B can fill the same tank in 6hrs. When the tank is full it can be emptied by Pipe C in 8hrs. Pipe A and B are opened at the same time when the tank is empty. If one hour later Pipe C is also opened, find the total time taken to fill the tank. (3mks)

In 1 hour

 

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1. The figure below shows a circle center O, radius 10 cm. The chord PQ = 16cm. Calculate the area of the unshaded region. (4mks)



162 = 102 + 102 – 2 x 10 x 10 cos ϴ

256 = 200 – 200 cos ϴ

56 = -2 cos ϴ

ϴ = cos-1 (-0.28)

 = 1800 – 73.740

 = 106.260

Area of shaded region

 = 106.26 × r2– 1 r2 sin 106.260

360 2

= 100(106.26 x 3.142 – 1sin 106.26)

360 2

 = 100(0.9274 – 0.48)

= 100 x 0.4474

 = 44.74 cm2

1. The mean weight of 36 students is 45kg; two of the students leave and the mean weight increases by 0.5kg. If one of the students who left weighed 43kg, find the weight of the other one. (3mks)

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1. Use the trapezium rule to estimate the area bounded by the curve y + x2 = 4 and the lines y = 0, x = −2 and x = 2 using four strips. (3mks)

y1 = 0, y2 = 3, y3 = 4, y4 = 3, y5 = 0

Area = ½ x (1 x 1 (0 + 0) + 2 (3 + 4 + 3)

 ½ (2 x 10)

 = 10square units

1. 4x2- 10x + 4y2+ 12y-1 = 0 represents a circle centre C (a, b) and of radius K. Find the values of a, b and K. (3mks)

x2- $\frac{5x}{2}$ + ( $\frac{-5}{4}$)2 + y2 + 3y + 1.52= $\frac{1}{4}$+ $\frac{25}{16}$+ $\frac{9}{4}$

(x- $\frac{5}{4}$)2 + ( y+ $\frac{3}{2}$)2 = $\frac{65}{16}$

 C ( $\frac{5}{4}$, $\frac{-3}{2}$)

r= 2. 0156 units.

1. Make *x* the subject of the equation (3mks)



 

1. Use reciprocal, square and cube root tables to evaluate to 4 significant figures, the expression. (3mks)



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1. (a)Expand the expression (1 + ½x) 5 in ascending powers of x, leaving the coefficients as fractions in their simplest form. (2mks)



(b) Use the first three terms of the expansion in (a) above to estimate the value of (l1/20)5. (2mks)



1. In the diagram below, BT is a tangent to the circle at B. AXCT and BXD are straight lines. AX = 6cm, CT = 8cm, BX = 4.8cm and XD = 5cm.

5cm

4.8cm

6cm

8cm

X



D

B

A

C

Find the length of BT. (2mks)

AX.CX) = (DX.XB)

6.CX = 5x 4.5

 CX = 3.75cm

AC x CT = (BT)2

(BT)2 = (6 + 3.75) x 8

(BT)2 = $\sqrt{78}$

BT = 8.832cm (4 s.f)

1. Find x if Cos x = $\frac{\sqrt{3}}{2}$ for -1800≤ x ≤ 1800. (2mks)

x = Cos -1$\frac{\sqrt{3}}{2}$ = 300, -300

1. The following were recorded on a field note book by a surveyor. Taking the base line as 550m. Find the area in m². (3mks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | B |  |  |  |
|  |  |  | 550 | 120 | TO | A |
|  | C | 150 | 450 |  |  |  |
|  |  |  | 250 | 90 | T O | D |
|  | E | 60 | 40 |  |  |  |
|  |  |  | F |  |  |  |



Area 1 = ½ x 150 x 100 = 7500

  = 43050

 A3 = ½ x 60 x 4²0 = 1200

 A4 = ½ x 90 x 250 = 11250

  = 31500

 94500m²

**SECTION II (50MKS).**

**ATTEMPT ANY FIVE QUESTIONS IN THIS SECTION.**

1. Mr. Kobe is a civil servant who earns a monthly salary of Ksh. 21200. He has a house allowance of Ksh. 12000 per month, other taxable allowances are commuter Ksh. 1100, medical allowance Ksh. 2000. He is entitled to a personal relief of Ksh. 1240 per month.

 Using the income rates below, solve the questions that follow.

|  |  |
| --- | --- |
| Income in Ksh. per month | Rates in Ksh per sh 20 |
|  1 – 8,400 8401 – 18,00018001 – 30,00030001 – 36,00036001 – 48,000Above 48,000 | 234567 |

Determine;

1. i) His monthly taxable income. (2mks)

 21200 + 12000 + 1100 + 2000

 = Sh36, 300

 ii) Net tax (PAYE) (5mks)

First $\frac{8400}{20} ×2 $ = 840/-

Next $\frac{9600}{20} ×3 $ = 1440/-

Next $\frac{12000}{20} ×4 $ = 2400/-

Next $\frac{6000}{20} ×5 $ = 1500/-

Remaining $\frac{300}{20} ×6 $= 90/-

Tax payable 6,270/-

Less personal relief 1,240

Net paye = 5,030/-

1. In addition to the PAYE, the following deductions were made. Ksh. 250 for NHIF, Ksh. 120 service charges, he repays a loan at sh. 4500 and contributes towards savings at sh. 1800 every month. Calculate his net salary per month. (3mks)

36,300 (5030 + 250 + 120 + 4500 + 1800)

Net salary = 36,300 – 11700

 = Sh24, 600

1. The figure below is a square based pyramid ABCDV with AD=DC = 6cm and height V = 10cm



1. State the projection of VA on the base ABCD. (1mk)

**VO**

 b) Find:

 i) The length of VA (3mks)

 A **(AC)2 = (AD)2 + (DC)2**

 **AC=√62 + 62**

 6 **AC = √ 72**

 AO=√72

 D 6 C 2

 V

 **VA=√102+4.2432**

 10 VA= 10.86CM

 O √72/2 A

 ii) The angle between VA and ABCD (2mks)

 **SinѲ=10/10.86**

**Ѳ=67.01O**

 iii) The angle between the planes VDC and ABCD (2mks)

 **cosѲ= 3**

 √ 91

 **Ѳ = 71.67O**

iv) Volume of the pyramid (2mks)

**v= 1/3BA x h**

**= 1/3x 6 x 6 x 10**

**= 120cm3**

1. a) Complete the table below for y=sin 2x and y=sin ( 2x + 30) giving values to 2d.p.(2mks)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X | 0 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 |
| Sin 2x | 0 |  |  |  | 0.87 |  |  |  | -0.87 |  |  |  | 0 |
| Sin ( 2x +30) | 0.5 |  |  |  | 0.5 |  |  |  | -1 |  |  |  | 0.5 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x | 0 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 |
| Sin 2x | 0 | 0.5 | 0.87 | 1 | 0.87 | 0.5 | 0 | -0.5 | -0.87 | -1 | -0.87 | -0.5 | 0 |
| Sin (2x+30) | 0.5 | 0.87 | 1 | 0.87 | 0.5 | 0 | -0.5 | -0.87 | -1 | -0.87 | -0.5 | 0 | 0.5 |

 b) Draw the graphs of y=sin 2x and y = sin (2x + 30) on the axis. (4mks)



c) Use the graph to solve  (1mk)

x = 30.6 o 120.9o

d) Determine the transformation which maps  (1mk)

Translation -30o

 0

e) State the period and amplitude of  (2mks)

Period 180o amplitude 1unit

1. In the figure below E is the midpoint of BC. AD: DC 3:2 and F is the meeting point of BD and AE.
2. If AB = b and AC = c, find:
3. BD = (2mks)
4. AE (2mks)

 =

 = or =

1. If BF = *t* BD and AF = *n* AE. Find the value of t and n. (5mks)

 =

 ==

 =



Then 1-t= and 

 2-2t=n 5n=6t





 10-10t=6t

 10=16t therefore, 

 n===

1. State the ratio of BD to BF. (1mk)

BF=tBD





1. The position of two towns X and Y are given to the nearest degree as X (450 N, 1100 W) and

Y (450 N, 700 E). Take π = 3.142, R = 6370km.Find:

1. The distance between the two towns along the parallel of latitude in km. (3mks)

XY = 180ox 2 x 3.142 x 6370 Cos 45o

 360o

 = 14152.42 km

(b) The distance between the towns along a parallel of latitude in nautical miles. (2mks)

XY = 60 x 180 Cos 450

= 7636.75 nm

(c) A plane flew from X to Y taking the shortest distance possible. It took the plane 15hrs to

move from X and Y. Calculate its speed in Knots. (2mks)

 Angle XOY = 90o

Shortest distance XY = 60 x 90

= 5400 nm

Speed = 5400

 15

= 360 knots

1. If the plane left town X on Monday 12:45PM. Find the local time it arrived at town Y. (3mks)

Longitude diff. = 180o

Time diff.180 x 4

 60

= 12 hrs

Local time at X = 10.00 p.m + 12 hrs

= 10.00 p.m on 11th April

1. The 2nd and 5th terms of an arithmetic progression are 8 and 17 respectively. The 2nd, 10th and42nd terms of the A.P. form the first three terms of a geometric progression. Find

(a) The 1st term and the common difference. (3mks)

a + d = 8



 d = 3

 a = 5

(b) The first three terms of the G.P and the 10th term of the G.P. (4mks)

2nd = 8

10th = 5 + 9 × 3 = 32

42nd = 5 + 41 × 3 = 128

∴GP is 8, 32, 128, - - - -

 a = 8

 r = 4

nth term of G.P = arn – 1

∴10th term = 8(4)9

 = 2097152

(c) The sum of the first 10 terms of the G.P. (3mks)



 

 

 = 2796200

1. The diagram below, not drawn to scale shows part of the curve and the line y = 8-2x. The line intersects the curve at points C and D. Lines AC and BD are parallel to the y-axis.



1. Determine the coordinates of C and D. (4mks)

 (b) Use integration to calculate the area bounded by the curve and the x-axis between the

points C and D. (3mks)

 (c) Calculate the area enclosed by the lines CD, CA, BD and the x-axis. (3mks)

 (d) Hence determine the area of the shaded region. (1mk)



1. Using a ruler and pair of compasses only.
2. Construct triangle ABC in which AB = 9cm, AC = 8cm and angle BAC = 600. Measure BC (2mks)
3. On the same side of AB as C, draw the locus of a point such that angle APB = 600 (3mks)
4. A region T is within the triangle ABC such that AT > 4cm and angle ACT ≥ angle BCT. Show the region T by shading it. (5mks)

