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GRADE 13

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**fojk jk jdr mÍCIKh - 2023**

**Second Term Examination - 2023**

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**COMBINED MATHEMATICS – I**

10

* **Answer all the questions of Part A and any 05 questions of Part B.**

**Part -A**

01. By using the principle of Mathematical Induction prove that,

……….  **1 - , n N**

02. If **,**  are the roots of the equation  **0**, then find the value of

03. If  then show that

04. If  then show that  **e**

05. Find the value of the real non-zero constant ***K*** such that  **1**

06. Sketch the graphs of the functions **y =**  and **y = 4 - 2*x*** in the same coordinate plane. Show that the area bounded by these graphs is squre units.

07. A curve is defined by equations ***x* =**  and **y =**  , where **.** If the tangents drawn to the curve at the points given by **t = 1** and **t = -1** are peroendicular to each other, find the value of ***a****.*

08. Integrate  **dx**, where where

09. In how many ways can be the word **“PENCIL”** be arranged so that **N** is always next to **E**.

10. Show that  **= (3*x* - )**

**Part – B**

**Answer any five (05) questions.**

11. a). If the roots of the equation,  **2 (P + 2) x + (2P + 7) = 0** are and .

Express,  in terms of ***P***

If and are the values of when,

**= 56**

With out finding and Seperately, Prove that  **=**

b). Let , where ***a*** and **b** are constants.

It is given that is a factor of and that when is divided by , the remainder is ***a***.

i. Find the values of ***a*** and ***b***.

ii. For these values of and , factorise completely.

12. a). Find the set of values of satistying the inequality **| | | |** , where ***a*** is a positive constant.

b). Given that , show that .

Let be the sum of n terms of the series,

….

Show that

Hence show that,

, is convergent and find its Sum, Where is the general term of the series.

13. a). If  then show that,

Hence find

b). The complex number is denoteol by ***U***,

i. Find the modulus and argument of ***U*** and

ii. Sketch an Argand diagram showing the points representing the complex numbers ***U*** and . Shade the region whose points represent the complex numbers ***Z***, Which satisfy both the inequalities **| Z | <2** and **| Z - | < | Z - U |** .

14. a). The curve with equation, where ***a*** and **b** are constants, has zero gradient at the point

i. Show that and find the value of **b**.

ii. Show that the gradient is also zero at the point

iii. Find for three asymptotes of this curve.

Sketch the curve stating the coordinates of the points at which the curve meets the

,

Using the sketch find the set of values of **y** for which no part of the curve exists.

b). The plane ends of right circular solid cylinder of height ***h*** and radius ***r*** are scooped out to form a hollow hemispherical surface of radius ***r***. If the volume of the remaining part is ***V***, and the total surface are is ***S***, then show that,

**+**

Find the value of ***r*** that the surface area ***S*** be minimum.

Also find the minimum surface area.

15. a). Using partial fractions, show that,

**=**

b). By using intergration by parts, evaluate.

c). Using the substitution , Show that

**=**

16. a). The points and are opposite vertices of a parallelogram . The sides , of the parallelogram lie along the lines and

**.** Calculate,

i. The coordinates of ***D***

ii. The tangent of the acute angle between the diagnonals parallelogram.

iii. The length of the perpendicular from ***A*** to the side ***CD***.

iv. Show that the area of the **ABCD** is **24 unit**

b). Find the values of c such that the line , shall be a tangent to the circle

. For each value of ***c*** find the coordinates of the point of contact. Draw a sketch of the circle and the two tangents.

17. a). Prove the identity,

.

Find the solutions of the equation,

, in the range

b). In the usual notation, state the sine rule for a trangle **ABC**.

In any triangle **ABC** prove that,

**= cot**

c). Solve for ,