Task 1 in mathematics:

Study materials:

https://biomath.weebly.com/uploads/3/0/2/7/30272185/1math2023.docx

https://biomath.weebly.com/uploads/3/0/2/7/30272185/2math2023.docx

https://biomath.weebly.com/uploads/3/0/2/7/30272185/i3math2023.docx

https://biomath.weebly.com/uploads/3/0/2/7/30272185/4math2023.docx

https://biomath.weebly.com/uploads/3/0/2/7/30272185/1sets.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/2propositions.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/3proofs.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/4sequences.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/5relations.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/6primes.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/7combinatorics.ppt

https://biomath.weebly.com/uploads/3/0/2/7/30272185/8probability.ppt

Instructions:

Write all your answers in this Word Document and email the Word Document with your answers to me.

Try to write only text. Try to avoid pictures, videos and other things, which make files big.

Write your name(s)

Write your student number(s)

s is your student number.

k = s mod 10000 = m10000

T = s mod 100 = m100

m = s mod 35 = m35

a = s mod 25 = m25

L = s mod 10 = m10

m9 = s mod 9

e = s mod 8 = m8

m7 = s mod 7

m6 = s mod 6

m5 = s mod 5

m4 = s mod 4.

m3 = s mod 3

m2 = s mod 2

1. What do you want from this math course?

2. Describe your project.

3. Give examples of natural, integer, rational, irrational, real, complex numbers.

4. What are the main functions?

5. How many subsets are there in a set of T elements?

6. Give truth tables of NOT, AND, OR and their arithmetic equivalents.

7. Give expression of implication through NOT, AND, OR and their arithmetic equivalents.

8. Compare truth tables of implication, conversion, inversion, contraposition.

9. Prove by induction.

.

10. Find

11. Prove the Triangular Number expression .

12. Prove the expression for

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/p2integration2vs2summation.docx

**13. Give a direct proof of the theorem:**

**“IF n is an odd integer, THEN n2 is odd”**

**14. Give a direct proof of the theorem:**

**“IF m is an odd integer and n is even integer, THEN m + n is odd”**

**15. Give a direct proof that:**

**“IF m and n are both perfect squares, THEN nm is also a perfect square”**

**16. Prove that:**

**“IF n is an integer and 3n + 2 is odd, THEN n is odd”**

**17. Prove that:**

**“IF n = ab, where a and b are positive integers,**

**THEN a ≤ √n or b ≤ √n ”**

**18. Prove that:**

**“IF 3n + 2 is odd, then n is odd”**

**19. Prove that:**

**“IF n2 is even, then n is even”**

20. Prove that

**1 + 2 + … + n = n(n+1)/2**

21. Prove that

**1 + 3 + 5 + … + (2n -1) = n2**

22. Prove that

**1 + 4 + 7 + … + (3n -2) = n2**

23. Prove that

**1 + 2 + 22 + … + 2n = 2n+1 -1**

24. Prove that

**1 + 22 + … +n2 = n(n+1)(2n+1)/6**

25. Prove that

**n < 2n**

26. Calculate number of permutations L out of T: P(T,L).

27. In how many ways you can write the digits of your k?

28. 10 fair coins there tossed. How many options? (use multiplication rule)

How many options contain 5 heads?

How many options contain at least 5 heads?

29. Solve the simultaneous linear equations.

Tx + Ly = m11

ax + my = m22

30. Find Highest Common Divisor and Lowest Common Multiple of e+4 and L+4.

31. Convert T to e+2 and L+2 counting systems.

32. Calculate the largest prime number you can using your own computer code.

n = 13

For i = 2 To Int(Sqr(n))

If n Mod i = 0 Then GoTo 1

Next i

MsgBox "prime"

GoTo 2

1 MsgBox "not prime"

2 Label2 = 2

33. Give prime factorization of s.

34. Draw the histogram of tossing L+2 fair coins. Draw the histogram of the first e+3 digits of π.

35. Draw the histogram of adding random between e+2 times.

36. Give the histogram of Benford of the first digit of e+2 the most populated countries.

worldometers.info/world-population/population-by-country/

37. Transpose matrix

38. Give the matrix of linear transformation of vector (m10, m20) stretching by m11 and m22 respectively.

39. Rotate vector (m10, m20) by a degrees anticlockwise.

a = m25

Ar = aπ/180

40. Give projection matrix.

41. Calculate trace and determinant of

42. Find eigenvalues and eigenvectors for

43. Use the rule:

to publicly pass secret information.

Use p and q as your private keys, these are secret numbers for you and your partner.

b, n, r, m are public numbers, everybody can know these numbers.

planetcalc.com/8326/

44. Find the equation for the sequence: 1, 4, 9, 16, 25, 36, 49, …

45. Hack password.

https://calculus1only.weebly.com/uploads/5/9/8/5/59854633/password-hacking-game-rules.docx

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/code4password\_cracki4game.txt

https://calculus1only.weebly.com/uploads/5/9/8/5/59854633/guessinput.txt

46. Solve the Graceful Graph Problem for *(e+3)* vertices.

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code5better.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code6.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/7code7.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/8code.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/9code.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/10code10.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/11code11.txt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/12code12.txt

http://azspcs.com/Contest/GracefulGraphs

47. Solve the linear programming problem.

Each table takes 10 units of lumber,

5 hours of labour, make $180

Each bookcase takes 20 units of lumber,

4 hours of labour, make $200

200 units of lumber available

80 hours of labour available

I want to make as much money as possible.

Optimise: f(x,y) = 180x + 200y

Constraints:

5x + 4y 80

10x + 20y 200

x 0

y 0

48. Use conjunctive normal form and disjunctive normal form to express f(x,y,z) through x,y,z.

|  |  |  |  |
| --- | --- | --- | --- |
| x | y | z | f(x,y,z) |
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

49. Find the function for your truth table for your *e*.

e = 0: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e0\_truth\_table.docx

e = 1: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e1\_truth\_table.docx

e = 2: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e2\_truth\_table.docx

e = 3: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e3\_truth\_table.docx

e = 4: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e4\_truth\_table.docx

e = 5: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e5\_truth\_table.docx

e = 6: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e6\_truth\_table.docx

e = 7: http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/e7\_truth\_table.docx