

NIMCET 2009 SOLUTIONS

(1 to 40) – MATHEMATICS

1. $\tan^{-1}\left[\frac{1}{1+2}\right] + \tan^{-1}\left[\frac{1}{1+(2)(3)}\right] + \dots + \tan^{-1}\left[\frac{1}{1+n(n+1)}\right] =$

Given $\theta = \tan^{-1}\left(\frac{1}{1+2}\right) + \tan^{-1}\left(\frac{1}{1+(2)(3)}\right) +$

$\tan^{-1}\left(\frac{1}{1+(3)(4)}\right) + \dots + \tan^{-1}\left(\frac{1}{1+n(n+1)}\right)$

$\tan^{-1}\frac{1}{1+2} = \tan^{-1}\left(\frac{2-1}{1+(2)(1)}\right) = \tan^{-1}2 - \tan^{-1}1$

$\tan^{-1}\left(\frac{1}{1+(2)(3)}\right) = \tan^{-1}\frac{3-2}{1+(3)(2)} = \tan^{-1}3 - \tan^{-1}2$

Similarly,

$\tan^{-1}\left(\frac{1}{1+n(n+1)}\right) = \tan^{-1}\left(\frac{n+1-n}{1+n(n+1)}\right) = \tan^{-1}(n+1) - \tan^{-1}n$

$\theta = \tan^{-1}2 - \tan^{-1}1 + \tan^{-1}3 - \tan^{-1}2 + \dots + \tan^{-1}(n+1) - \tan^{-1}n$

$= \tan^{-1}(n+1) - \tan^{-1}1$

$\theta = \tan^{-1}\left(\frac{n+1-1}{1+(n+1)}\right)$

$= \tan^{-1}\left(\frac{n}{n+2}\right)$ Choice (C)

2. $d(x, y) = \max(|x|, |y|)$, then locus of (x, y) where $d(x, y) = 1$.

Given $d(x, y) = \max(|x|, |y|)$.

Given: $d(x, y) = 1$

$\Rightarrow \max(|x|, |y|) = 1$

$\Rightarrow (-1, -1), (1, 1), (1, -1), (-1, 1)$ are the vertices.

$|x|=1, |y|=1$.

$|x|+|y|=2$

\therefore It represents a square of side 2 units:

\therefore Area of the square is 4 sq units

Choice (D)

3. $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

$\tan^{-1}\sqrt{x(x+1)}$ is defined only if :

$x(x+1) \geq 0 \Rightarrow x \geq 0$ or $x+1 \geq 0$

$\Rightarrow x \leq -1$ or $x \geq 0 \rightarrow 1$

$\sin^{-1}\left(\sqrt{x^2+x+1}\right)$ is defined only if :

$0 \leq x^2+x+1 \leq 1$

$-1 \leq x(x+1) \leq 0 \rightarrow 2$

From (1) and (2), $x = -1$ and $x = 0$ satisfy the equation

\therefore Number of solutions is 2.

Choice (C)

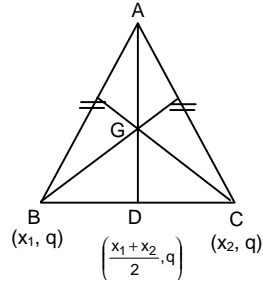
4. **Problem on isosceles triangle. m_1 and m_2 are slopes of medians**

Since BC is parallel to x-axis, slope of BC = 0

Let B = (x_1, q) , C = (x_2, q)

Since ABC is isosceles triangle, median AD \perp BC

\therefore Let the coordinates of A be $\left(\frac{x_1+x_2}{2}, p\right)$.



Let centroid $G = \left(\frac{x_1+x_2}{2}, r\right)$

Slope of BG (m_1) = $\frac{r-q}{\frac{x_1+x_2}{2}-x_1} = \frac{2(r-q)}{x_2-x_1}$

Slope of CG (m_2) = $\frac{r-q}{\frac{x_1+x_2}{2}-x_2}$

$\therefore m_1 + m_2 = \frac{2(r-q)}{x_2-x_1} + \frac{2(r-q)}{x_1-x_2} = 0$ Choice (B)

Note: In the problem it is given, that $AB = BC$; According to $AB = BC$; we do not get any relation between m_1 and m_2 . So we take $AB = AC$ instead of $AB = BC$.

5. **Problem on system of equations, given $a + b + c \neq 0$**

Given $(b+c)(y+z) - ax = b-c$

$(c+a)(z+x) - by = c-a$

$(a+b)(x+y) - cz = a-b$

The matrix form of the above equations is

$$\begin{bmatrix} -a & b+c & b+c \\ c+a & -b & c+a \\ a+b & a+b & -c \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} b-c \\ c-a \\ a-b \end{bmatrix}$$

Consider $A = \begin{bmatrix} -a & b+c & b+c \\ c+a & -b & c+a \\ a+b & a+b & -c \end{bmatrix}$

$R_1 \rightarrow R_1 + R_2 + R_3$

$$= \begin{bmatrix} a+b+c & a+b+c & a+b+c \\ c+a & -b & c+a \\ a+b & a+b & -c \end{bmatrix}$$

$$= (a+b+c) \begin{bmatrix} 1 & 1 & 1 \\ c+a & -b & c+a \\ a+b & a+b & -c \end{bmatrix}$$

$C_2 \rightarrow C_2 - C_1$

$C_3 \rightarrow C_3 - C_1$

$$= (a+b+c) \begin{bmatrix} 1 & 0 & 0 \\ c+a & -(a+b+c) & 0 \\ a+b & 0 & -(a+b+c) \end{bmatrix}$$

$$= (a+b+c)^3 \begin{bmatrix} 1 & 0 & 0 \\ c+a & -1 & 0 \\ a+b & 0 & -1 \end{bmatrix} = (a+b+c)^3 (1)$$

$|A| \neq 0 \quad \therefore a+b+c \neq 0$

\therefore The system has a unique solution. Choice (A)

(96 – 105) – COMPUTER AWARENESS

96. On receiving an interrupt from an I/O device, the CPU branch off to interrupt service subroutine immediately to find out from which input/ output device interrupt signal has come. Choice (B)
97. In each location in control memory, a program for, say addition, subtraction, multiplication etc is written. Depending upon the address of control memory it performs the corresponding operation. This concept is called Micro Programming. It always refers to memory. On the other hand, in hard-wired, there is no need to refer to memory. But there is no flexibility. Therefore Micro Programming is slower than hard-wired and easy to implement new instructions. Choice (D)
98. In the CPU of a computer, an index register is used for indirect addressing where, an immediate constant (i.e, which is part of the instruction itself) is added to the contents of a register to form the address to the actual operand or data. Choice (B)
99. Virtual memory is used whenever data size is more than RAM capacity. It is a part of hard disk created by OS for processing. Therefore the address space of CPU must be larger than the physical memory (RAM) and smaller than the secondary storage size. Choice (C)

100. Given Boolean function is $f(A,B,C,D) = \sum(1,4,5,9,11,12)$
Binary equivalents and fundamental products for given decimals are as below.

1 →	0001 →	$\bar{A} \bar{B} \bar{C} D$	9 →	1001	$A \bar{B} \bar{C} D$
4 →	0100 →	$\bar{A} B \bar{C} \bar{D}$	11 →	1011	$A \bar{B} C \bar{D}$
5 →	0101 →	$\bar{A} B \bar{C} D$	12 →	1100	$A B \bar{C} \bar{D}$

The k – map for given Boolean expression is

	$\bar{C} \bar{D}$	$\bar{C} D$	$C D$	$C \bar{D}$
$\bar{A} \bar{B}$	0	1	0	0
$\bar{A} B$	1	1	0	0
$A B$	1	0	0	0
$A \bar{B}$	0	1	1	0

Using pairs simplification method, the Boolean expression is $B \bar{C} \bar{D} + \bar{A} \bar{C} D + A \bar{B} D$

Choice (A)

101. 2's complement of given number 11111011 is 00000101 which is equivalent to 5 in decimal. The 2's complement and equivalent decimal numbers of given choices are as follows.

	Given	2's complement	Decimal
(A)	11100100	00011100	28
(B)	11010111	00101001	41
(C)	11011011	00100101	37
(D)	00000110	11111010	250

Among the given choices 250 is divisible by 5

Choice (D)

102. In digital electronics, a multiplexer is a device that performs multiplexing i.e it selects one of many input signals and forwards the selected input into a single line. A multiplexer of 2^n inputs has n select bits, which are used to select which input line to send to the output. Choice (C)

103. Range of integers that can be represented in 2's complement using n bit registers is -2^{n-1} to $2^{n-1}-1$. Therefore with 32 bits range is -2^{31} to $2^{31}-1$. Choice (C)

104. Upper case letter 'A' in ASCII is 65
Lower case letter 'a' in ASCII is 97
The difference is 32 In binary, 0100000.
∴ to change upper case to lower case in ASCII correct mark and operation should be 0100000 and OR
Choice (C)

105. Consider the words width and speed given in the question. If the width in more, the processing speed is also greater. This is directly given in choice (c). Choice (C)

(106 – 120) – GENERAL ENGLISH

106. The correct answer is Choice (D). Although Choices (C) and (D) are correct passive voice of the verb in the given sentence. The word 'known' is followed by only 'to' and not 'by'. Choice (D)

107. Something can be 'impossible to determine' only when it is hidden or inactive. So, for the first blank, we can have dormant in choice (A) and latent (hidden) in choice (D). (We eliminate choices (B) and (C)). Now for the second blank, postulate is absurd as it does make any sense with 'dormant'. However, observation in choice (D) makes sense with 'latent'. Choice (D)

108. 'Quibble' means 'complain'. Choice (D)

109. 'Gung ho' means 'enthusiastic'. Choice (C)

110. To 'disparage' is to belittle and the correct antonym is choice (D) applaud (to praise). Choice (D)

111. The blank requires the verb persuade. The phrase that means 'persuade' is choice (B), 'prevail upon'. Choice (B)

112. We 'have' a difficulty, we do not 'get' it or 'be getting' it. Hence, choices (B) and (D) are wrong. Also, we have difficulty 'in' doing something not 'on' doing something. Choice (A)

113. The word 'object' can be used as both noun and verb. As a noun it means 'a thing' and as a verb it means 'to take exception'. Hence, we can replace the underlined parts with choice (A), object. The other words don't have the same meanings in any of their forms.

Note: In statement I, the article before the underlined word (thing) should have been given as a/an, since 'a' would make the student wonder if the word can be replaced by one beginning with a vowel. Choice (A)

114. The meaning of the given idiom is choice (D), 'to express disbelief'. Choice (D)

115. Plagiarism is an act of misusing other's ideas, words etc., and similarly misappropriation is an act of misusing someone else's money or property. Hence, the correct answer is choice (B). Theft in choice (C) can be the stealing of anything, not necessarily 'gold' and so choice (C) is wrong. Choice (B)

116. Abstemious means temperate (not allowing yourself much food or alcohol). Choice (B)

117. The first sentence (S) says Tagore had 'no blue print'. This is apt by followed by R which says he did not believe in any 'ism'. So choices (A) and (B) can be ruled out. Between choices (C) and (D), the latter is better since 'He merely emphasised certain basic truths.....' carries forward the idea in R (did not believe in any 'ism'). While S can also follow R, P following R, (with 'therefore') is incorrect. P correctly follows Q (he emphasized 'basic truths' and 'therefore never be out of date'). Choice (D)

118. We cannot say 'can be able to' as both 'can' and 'able to' mean the same. One of the two is redundant. 'be able' is

given as an option and so is the answer. The other parts are correct.

Note: The question should have underlined 'be able to' and choice (A) should include 'to' since the sentence would not read right with 'to'. Choice (A)

119. Sentence 1 of paragraph 2 clearly states that 'the least controversial assertion about the pterosaurs is that they were reptiles'. From this we can 'infer' that the answer is choice (D). Choice (D)

120. From 2nd, 3rd and 4th statements in 2nd paragraph, we can understand that the correct answer is choice (C). Choice (C)

