ANSWER KEY AND SOLUTIONS
NIMCET 2017 PAPER

1.	(2)	**16.**	(2)	**31.**	(4)	**46.**	(4)	**61.**	(1)	**76.**	(1)	**91.**	(1)	**106.**	(1)
2.	(4)	**17.**	(3)	**32.**	(2)	**47.**	(1)	**62.**	(4)	**77.**	(4)	**92.**	(4)	**107.**	(3)
3.	(3)	**18.**	(2)	**33.**	(3)	**48.**	(3)	**63.**	(4)	**78.**	(3)	**93.**	(3)	**108.**	(2)
4.	(4)	**19.**	(3)	**34.**	(4)	**49.**	(1)	**64.**	(2)	**79.**	(2)	**94.**	(3)	**109.**	(4)
5.	(3)	**20.**	(4)	**35.**	(4)	**50.**	(2)	**65.**	(3)	**80.**	(3)	**95.**	(2)	**110.**	(1)
6.	(1)	**21.**	(3)	**36.**	(2)	**51.**	(2)	**66.**	(2)	**81.**	(1)	**96.**	(4)	**111.**	(1)
7.	(3)	**22.**	(1)	**37.**	(1)	**52.**	(4)	**67.**	(2)	**82.**	(2)	**97.**	(4)	**112.**	(4)
8.	(2)	**23.**	(4)	**38.**	(2)	**53.**	(4)	**68.**	(3)	**83.**	(1)	**98.**	(2)	**113.**	(1)
9.	(4)	**24.**	(2)	**39.**	(4)	**54.**	(3)	**69.**	(1)	**84.**	(3)	**99.**	(1)	**114.**	(2)
10.	(1)	**25.**	(3)	**40.**	(2)	**55.**	(4)	**70.**	(3)	**85.**	(1)	**100.**	(4)	**115.**	(4)
11.	(3)	**26.**	(1)	**41.**	(1)	**56.**	(4)	**71.**	(1)	**86.**	(4)	**101.**	(2)	**116.**	(2)
12.	(1)	**27.**	(4)	**42.**	(3)	**57.**	(3)	**72.**	(2)	**87.**	(4)	**102.**	(4)	**117.**	(1)
13.	(1)	**28.**	(2)	**43.**	(4)	**58.**	(1)	**73.**	(2)	**88.**	(3)	**103.**	(3)	**118.**	(2)
14.	(1)	**29.**	(4)	**44.**	(2)	**59.**	(3)	**74.**	(3)	**89.**	(2)	**104.**	(2)	**119.**	(1)
15.	(3)	**30.**	(4)	**45.**	(2)	**60.**	(3)	**75.**	(1)	**90.**	(3)	**105.**	(1)	**120.**	(4)

SOLUTIONS

1. Refer to the lines 'Stone age hand axes …… cutting edges.' **Choice (2)**

2. Refer to the 'A right hander…..toward the left.' **Choice (4)**

3. Refer to the lines 'Both kinds ….handed'. **Choice (3)**

4. Refer to the lines 'Between the Bronze Age….. survive'. **Choice (4)**

5. **Choice (3)**

6. The idiom "under the sun" means 'in existence' (especially the large number of something). **Choice (1)**

7. When we arrive at the station, we (descend from) <u>get off</u> the train. **Choice (3)**

8. We need a positive expression as the sentence mentions the word 'medal'. Thus , the correct expression will be 'the student's exemplary conduct and courage' . **Choice (2)**

9. The only correctly spelt word is Hindrance. **Choice (4)**

10. In choice (2) 'since' is incorrect. In choice (3) 'an' is incorrect. In choice (4) 'are' is incorrect. **Choice (1)**

11. The expression 'Prepondenerance' means 'the the quality or fact of being greater which perfectly suits the given sentence and the second word-'correct'. **Choice (3)**

12. To "turn up" is to "show up" **Choice (1)**

13. Credulous is a person who shows great readiness in believing things. **Choice (1)**

14. Only choice (1) forms the meaningful sentence. **Choice (1)**

15. We need a contrasting word in the first blank. For two things the word is 'between'. **Choice (3)**

16. 'Pilgrim' is a person who travels to sacred places as an act of religious devotion. **Choice (2)**

17. To 'delude' is to 'mislead'. Thus, only choice (3) forms a meaningful sentence. **Choice (3)**

18. 'In case of' is the only correct expression. **Choice (2)**

19. An 'encyclopedia' is "a book that contains summarized information on all branches of knowledge' **Choice (3)**

20. The only correct expression is 'knocked down'. **Choice (4)**

21. A . A' = 0
A + AB = (A + A) . (A + B) = A . (A + B)
A + A'B = (A + A') . (A + B) = 1 . (A + B) = A + B
A (A + B) = A + AB = A(1 + B) = A.
Thus, Choice (3) is correct. **Choice (3)**

22. +1001.11 $\Rightarrow$ 01001110.000100.
Thus, Fraction $\Rightarrow$ 01001110 and Exponent $\Rightarrow$ 000100 **Choice (1)**

23. $AB + \overline{A}C + BC = AB + \overline{A}C$. Hence none of the choices is redundant. **Choice (4)**

24. **Choice (2)**

25. $(-147)_{10} = (100010010011)_2$
1's complement $(111101101100)_2$ and 2's complement is $(111101101101)_2$. **Choice (3)**

26. **Choice (1)**

27. Since $(40)_x = (132)_y \Rightarrow 4x = y^2 + 3y + 2$

Or $4x = (y + 1)(y + 2)$

Since $y > 3$, and one of $(y + 1)$ and $(y + 2)$ is a multiple of 4, hence minimum value of y will be 6.

$\Rightarrow y = 6$ and $x = 14$. **Choice (4)**

28. The smallest integer that can be represented by an 8 bit number in 2's complement form is $-2^{n-1} \Rightarrow -2^{8-1}$ thus, -128 **Choice (2)**

29. **Choice (4)**

30. The total number binary function that can be defined using n Boolean variables is 2^{2^n} **Choice (4)**

31. We know that: S ≤ 40, M = 38, S ≥ 43 and M ≥ 39. Since all the statements are wrong, S > 40, M ≠ 38, S < 43 and M < 39. Thus there are two possibilities for ages of M and S

Case 1: 36, 40

Case 2: 37, 41

Therefore, we cannot determine the exact ages of M and S. **Choice (4)**

32. **Choice (2)**

33. We know that A < B, C < D, B < C, A < E ⇒ A < B < C < D and A < E

Thus, the most intelligent person is either D or E. **Choice (3)**

34. Since the number of males have to be more than the females, committee of 5 persons can be formed in following ways 3(M) × 2(F) + 4(M) × 1(F) + 5(M) × 0(F)

i.e. $^7C_3 \times {^6C_2} + {^7C_4} \times {^6C_1} + {^7C_5} \times {^6C_0} \Rightarrow$ 525 + 210 + 21 = 756 **Choice (4)**

35. It is mentioned that Lawyer is married to D, who is a housewife thus D is female and C an accountant is married to F, who is a lecturer. Also no lady is either an architect or an accountant thus C is male and F is female. Now if E is not housewife, E can either be the lawyer or an architect. **Choice (4)**

36. According to the information given in the question we can arrange the books in the following order.

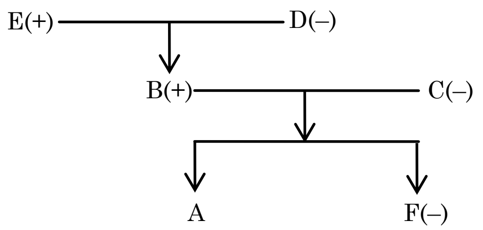
C
D
E
A
B

Thus, B touches the surface of the table. **Choice (2)**

37. Clearly in the given series the decimal 99 is written having different bases as follows

$(99)_{10}$, $(99)_{11}$ = 90, $(99)_{12}$ = 83, $(99)_{13}$ = 78, Similarly $(99)_{14}$ = 71 and $(99)_{15}$ = 69. Hence the next terms will be 71, 69. **Choice (1)**

Solutions for questions 38 to 40: From the information given in the question we can conclude the following results.



38. C is wife of B and mother of F. **Choice (2)**

39. Since we have no information regarding the gender of A thus, None of the options is true. **Choice (4)**

40. DE ad BC are two married couples in the family. **Choice (2)**

41. The given series is: $7^3 - 7$, $6^3 - 6$, $5^3 - 5$, $4^3 - 4$, ? $2^3 - 2$

Thus, the missing term will be $3^3 - 3 = 24$. **Choice (1)**

42. 3 days before Friday is Tuesday and the day after the day after tomorrow is 3 days before Tuesday.

Hence, $\text{Sat} \xleftrightarrow[\text{after tomorrow}]{\text{Day after day}} \text{Tue} \xleftrightarrow{\text{3 days}} \text{Friday}$

Thus, answer is Saturday. **Choice (3)**

43. The pattern for the series is:

$$D \xrightarrow{+4} H \xrightarrow{+4} L \xrightarrow{+4} P \longrightarrow T$$
$$C \xrightarrow{+4} G \xrightarrow{+4} K \xrightarrow{+4} O \longrightarrow S$$
$$X \xrightarrow{-4} T \xrightarrow{-4} P \xrightarrow{-4} L \longrightarrow H$$
$$W \xrightarrow{-4} S \xrightarrow{-4} O \xrightarrow{-4} K \longrightarrow G$$

Thus, the answer is LKPO. **Choice (4)**

44. From the information given in the question we can tabulate the following results

Doctor	Lawyer	Doctor / Lawyer	Doctor / Lawyer
Christian	Christian	Muslim	Muslim
Hindi	Bengali	Hindi / Bengali	Hindi / Bengali

So, clearly only logical conclusion is

Lawyer – Christian – Bengali **Choice (2)**

Solutions for questions 45 to 47:

45. Choice (2) can only be the acceptable combination as, Choice (1) is wrong since if Harish and Javed both ride Lakshman can not ride, Choice (3) is wrong because if Javed rides either Kumar or Mohan must ride and Choice (4) is also incorrect since Kumar and Lakshman both cannot ride together. **Choice (2)**

46. In any case one among Kumar and Lakshman must ride. **Choice (4)**

47. Feroz → Gautam, Harish, Mohan, Laxman is the Largest team of 5 member. **Choice (1)**

48. **Choice (3)**

49. **Choice (1)**

50. Let x be no. of breads available

So, the no. of bread robbed by 1st thief is

$\frac{x}{2} + \frac{1}{2} = \frac{x+1}{2}$

So, No. of bread left after 1st (Robbery)

$x - \frac{x+1}{2} = \frac{x-1}{2}$

Now, no. of bread left after 2nd thief is

$\frac{x-1}{4} + \frac{1}{2} = \frac{x+1}{4}$

So, no. of bread left after 2nd Robbery is

$\frac{x-1}{2} - \frac{x+1}{4} = \frac{x-3}{4}$

Now, no. of bread robbed by 3rd thief is

$\frac{x-3}{8}+\frac{1}{2}=\frac{x+1}{8}$

No. of bread left after third Robbery is

$\frac{x-3}{4}-\frac{x+1}{8}=\frac{x-7}{8}$

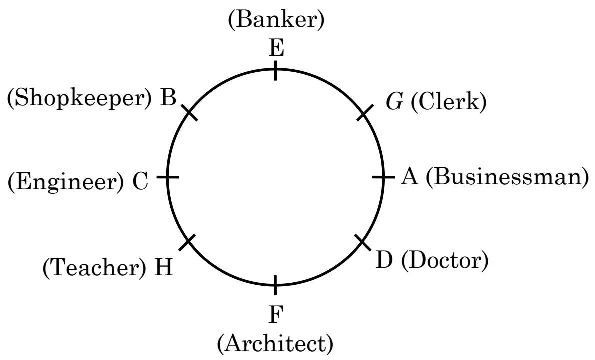
Now, by given cond.

$\frac{x-7}{8}=3 \Rightarrow x=31$ **Choice (2)**

51. Caterpillar rows up 5 inches in a day and stand down 4 inches at night.
Hence, it finally crawls upward 1 inch in a day. Hence after 70 complete day it will crawl up 70 inches and at the 71th day it will crawls up 5 inches in the morning and reaches top of the pole. **Choice (2)**

52. Choice (4)

Solutions for questions 53 to 57: From the information given in the question we can conclude the following results.



53. Choice (4)

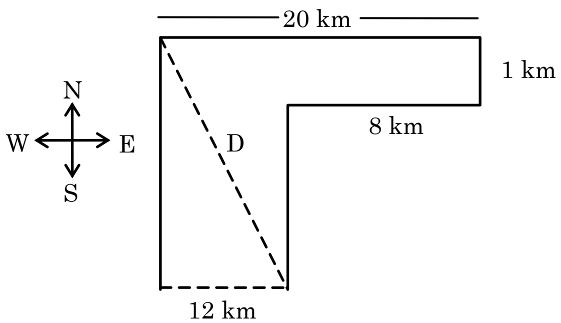
54. Choice (3)

55. Choice (4)

56. Choice (4)

57. Choice (3)

58. From the information given in the question:



Thus, distance = $\sqrt{16^2+12^2}=\sqrt{400}$ = 20 km north–west. **Choice (1)**

59. Let the age of Steve be "x" then the age of John is x + 20 after 10 years Steve age be (x + 10), John's age is x + 30. Now,

$2(x + 10) = x + 3 \Rightarrow x = 10$ **Choice (3)**

60. From the information given in the question we can conclude the following results

$$\begin{array}{ccc} \text{Grand Father} & \xleftrightarrow{\text{Spouse}} & \text{Grand Mother} \\ \uparrow & & \uparrow \\ \text{Mother} & \xleftrightarrow{\text{Siblling}} & \text{Father} \\ \uparrow & & \uparrow \\ \text{Pushpa} & & \text{Boy} \end{array}$$

So, Pushpa is clearly cousin sister of boy. **Choice (3)**

61.

$$2 \xrightarrow{X2} 4 \xrightarrow{X3} 12 \xrightarrow{X2} 24 \xrightarrow{X3} 72 \xrightarrow{X2} 144 \xrightarrow{X3} 432$$

So, answer is 144, 432. **Choice (1)**

62. By given information, sitting arrangement will be

P T R
U Q S

Clearly PTR are in a row. **Choice (4)**

Solutions for questions 63 to 66: From the information given in the question we can tabulate the following results.

Teacher	Compulsory Subject	Optional Subject
A	History	English
B	History	Chemistry
C	History	Maths
D	English	History
E	Physics	Maths
F	Mathematics	Physics

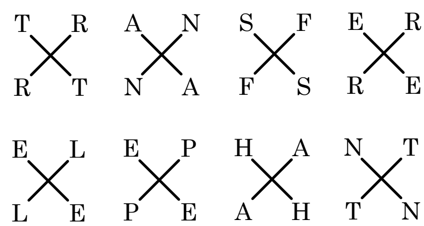
63. Choice (4)

64. Choice (2)

65. Choice (3)

66. F has Mathematics and Physics as Compulsory and optional subject. E has Physics and Maths as compulsory subject. Therefore, E has same combination of subject as F. **Choice (2)**

67. The pattern is:



Choice (2)

68. The given series is:

$61,57 \xleftrightarrow{-7} 50,61,43 \xleftrightarrow{-7} 36,61,29 \xleftrightarrow{-7} 22$ Thus, following the same pattern next two terms will be 29 and 22. **Choice (3)**

69. By painting, opposite, sides with same colour, we can paint all the sides of a cube without the adjacent sides having the same colour i.e. $\frac{6}{2}=3$ **Choice (1)**

70. Choice (3)

71. Given that probabilities of A and B speaking truth are x and y respectively, A and B agree on a certain statement i.e. if A speaks truth then B also speaks truth and if A lies, then B also lies. i.e. total probability is $= xy + (1 - x)(1 - y)$ and probability that both speaks truth $= xy$

So the probability that statement is true is $\frac{xy}{xy+(1-x)(1-y)}$ **Choice (1)**

72. Given that harmonic mean of two numbers is 4. And Arithmetic mean (A) and Geometric mean (G) satisfy the relation $2A + G^2 = 27$ ….. (i)

we know that $G^2 = A \times H \Rightarrow G^2 = 4A$

From equation (i) $A = \frac{9}{2}$, only option (2) satisfies the condition. **Choice (2)**

73. Let, $P(A)$ is Probability that a student knows the answer $=\frac{9}{10}$, $P(B)$ is probability that he guesses the answer $= \frac{1}{10}$ and $P(C)$ is probability he answers correctly.

$P(C/A)$ = He gives correct answer as he knows the answer = 1.

$P(C/B)$ = He guesses the answer correctly $= \frac{1}{4}$

as there are 4 choices.

We have to find $P(B/C)=\frac{P(B)P(C/B)}{P(B)P(C/B)+P(A)P(C/A)}$

$$=\frac{\frac{1}{10}\times\frac{1}{4}}{\frac{1}{10}\times\frac{1}{4}+\frac{9}{10}\times 1}=\frac{1}{37}$$ **Choice (2)**

74. Probability that he speaks truth is $= \frac{2}{3}$

Probability that six appears on top face is $=\frac{1}{6}$

Then the required probability is $= \frac{\frac{2}{3}\times\frac{1}{6}}{\frac{2}{3}\times\frac{1}{6}+\frac{1}{3}\times\frac{5}{6}\times\frac{1}{5}}=\frac{2}{3}$ **Choice (3)**

75. Give that $P(\overline{A\cup B}) = \frac{1}{6}, P(A\cap B)=\frac{1}{4}$ $P(\overline{A})=\frac{1}{4}$ so

$P(A\cup B)=1-P(\overline{A\cup B}) \Rightarrow P(A\cup B)=\frac{5}{6}$ $\quad P(A)=\frac{3}{4}$

Now, $P(A\cup B)=P(A)+P(B)-P(A\cap B)$

$\frac{5}{6}=\frac{3}{4}+P(B)-\frac{1}{4}$

$P(B) = \frac{1}{3}$ Now we see that $P(A\cap B) = P(A).P(B)$ but $P(A) \neq P(B)$ Hence events A and B are independent but not equally likely. **Choice (1)**

76. Given that $np = 4$ and $npq = 2$, hence $q = \frac{1}{2}$, $p = \frac{1}{2}$ and $n = 8$. $P(X=1)={}^{n}C_1pq^7=8\times\frac{1}{2}\times\left(\frac{1}{2}\right)^7=\frac{1}{32}$

Choice (1)

77. Mean deviation from mean is 0. **Choice (4)**

78. Given that $P(E_2) = 0.35$

$P(E_1 \text{ or } E_2) = 0.85$

And $P(E_1 \,\&\, E_2) = 0.15$

We now that

$P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) - P(E_1 \,\&\, E_2)$

$0.85 = 0.35 + P(E_2) - 0.15$

$P(E_2) = 0.65$ **Choice (3)**

79. Given that $A = \begin{bmatrix}-1 & 2\\ 3 & 4\end{bmatrix}$ and $B = \begin{bmatrix}3 & -2\\ 1 & 5\end{bmatrix}$

Let $X = \begin{bmatrix}a & b\\ c & d\end{bmatrix}$

Given that $2A + B + X = 0$

$\Rightarrow 2\begin{bmatrix}-1 & 2\\ 3 & 4\end{bmatrix}+\begin{bmatrix}3 & -2\\ 1 & 5\end{bmatrix}+\begin{bmatrix}a & b\\ c & d\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

$\begin{bmatrix}-2 & 4\\ 6 & 8\end{bmatrix}+\begin{bmatrix}3 & -2\\ 1 & 5\end{bmatrix}+\begin{bmatrix}a & b\\ c & d\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

$\begin{bmatrix}a & b\\ c & d\end{bmatrix}+\begin{bmatrix}1 & 2\\ 7 & 13\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

$\begin{bmatrix}a & b\\ c & d\end{bmatrix}=\begin{bmatrix}-1 & -2\\ -7 & -13\end{bmatrix}$ **Choice (2)**

80. If altitudes of a triangle are in HP then its side will be in AP because sides are inverse proportion to height as area is constant. a, b, c are sides of triangle.

$\Rightarrow a, b, c$ are in A.P.

$\Rightarrow \sin A, \sin B, \sin C$ are in A.P. **Choice (3)**

81. The given quadratic equation $x^2 - 2x\cos\theta + 1 = 0$ having roots α and β.

so $x = \frac{2\cos\theta \pm \sqrt{4\cos^2\theta - 4}}{2}$

$x = \cos\theta \pm i\sin\theta$

then, $\alpha = \cos\theta + i\sin\theta$

$\beta = \cos\theta - i\sin\theta$

Now, $\alpha^n = \cos n\theta + i\sin n\theta$

& $\beta^n = \cos n\theta - i\sin n\theta$

Now $\alpha^n + \beta^n = 2\cos n\theta$

$\alpha^n\beta^n = 1$

Then quadratic equation whose roots are α^n and β^n are

$x^2 - (\alpha^n + \beta^n)x + (\alpha\beta)^n = 0$

$x^2 - (2\cos n\theta)x + 1 = 0$ **Choice (1)**

82. Let $f(x) = (x - a)^3 + (x - b)^3 + (x - c)^3$.

Then $f'(x) = 3\{(x - a)^2 + (x - b)^3 + (x - c)^2\}$

clearly, $f'(x) > 0$ for all x.

so, $f'(x) = 0$ has no real roots.

Hence, $f(x) = 0$ has two imaginary and one real root. **Choice (2)**

83. Let the three terms in A.P. be $a - d, a, a + d$.
given that $a - d + a + a + d = 21 \Rightarrow a = 7$
then the three term in A.P. are $7 - d, 7, 7 + d$
According to given condition $9 - d, 9, 21 + d$ are in G.P.
$(9)^2 = (9 - d)(21 + d)$
$81 = 189 + 9d - 21d - d^2$
$81 = 189 - 12d - d^2$
$d^2 + 12d - 108 = 0$
$d(d + 18) - 6(d + 18) = 0$
$(d - 6)(d + 18) = 0$
We get, $d = 6, -18$
Putting $d = 6$ in the term $7 - d, 7, 7 + d$ we get 1, 7, 13.
Choice (1)

84. Given that $\sin^{-1}\frac{2a}{1+a^2} + \sin^{-1}\frac{2b}{1+b^2} = 2\tan^{-1} n$

it can be written as
$2\tan^{-1} a + 2\tan^{-1} b = 2\tan^{-1} n$
$\tan^{-1} a + \tan^{-1} b = \tan^{-1} n$
$\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$
$\tan^{-1}\left(\frac{a+b}{1-ab}\right) = \tan^{-1}(n) \Rightarrow n = \frac{a+b}{1-ab}$ **Choice (3)**

85. Given that $a\sin A + b\cos A = c$ divide the equation by $\sqrt{a^2+b^2}$
$\frac{a}{\sqrt{a^2+b^2}}\sin A + \frac{b}{\sqrt{a^2+b^2}}\cos A = \frac{c}{\sqrt{a^2+b^2}}$,
let $\frac{a}{\sqrt{a^2+b^2}} = \sin\alpha$ then $\frac{b}{\sqrt{a^2+b^2}} = \cos\alpha$
$\cos(A - \alpha) = \frac{c}{\sqrt{a^2+b^2}}$
$\Rightarrow A = \tan^{-1}\left(\frac{a}{b}\right) \pm \cos^{-1}\left(\frac{c}{\sqrt{a^2+b^2}}\right)$ **Choice (1)**

86. Given that $\tan x = \frac{-3}{4}$ and $\frac{3\pi}{2} < x < 2\pi$
means x lies in fourth quadrant
Then $\sin x = -\frac{3}{5}$ and $\cos x = \frac{4}{5}$
Now $\sin 2x = 2\sin x.\cos x$
$\sin 2x = -2 \times \frac{3}{5}\times\frac{4}{5}$
$\sin 2x = \frac{-24}{25}$ **Choice (4)**

87. We know that $\cot^{-1}(-x) = \pi - \cot^{-1}(x)$
Therefore $\cot^{-1}\left(-\sqrt{3}\right) = \pi - \cot^{-1}\left(\sqrt{3}\right)$
$= \pi - \frac{\pi}{6} = \frac{5\pi}{6}$ **Choice (4)**

88. Given that $\cos\theta = \frac{4}{5}, \cos\phi\frac{12}{13}$
Given than θ, and ϕ both lies in fourth quadrant then
$\sin\theta = \frac{-3}{5}$ and $\sin\phi = \frac{-5}{13}$
Now, $\cos(\theta + \phi) = \cos\theta\cos\phi - \sin\theta\sin\phi$
$= \frac{4}{5}\times\frac{12}{13} - \left(\frac{-3}{5}\right)\left(\frac{-5}{13}\right)$
$= \frac{48}{65} - \frac{15}{65} = \frac{33}{65}$ **Choice (3)**

89. **Choice (2)**

90. $\cos C - \cos D = 2\sin\left(\frac{C+D}{2}\right)\sin\left(\frac{D-C}{2}\right)$
$\therefore \cos 5x - \cos 7x = 2\sin\left(\frac{5x+7x}{2}\right)\sin\left(\frac{7x-5x}{2}\right)$
$= 2\sin 6x \sin x$ **Choice (3)**

91. Since a, b and c are in A. P. $2b = a + c \Rightarrow a - 2b + c = 0$
The line passes through $(1, -2)$. **Choice (1)**

92. Given that lines $x + (a - 1)y + 1 = 0$ and $2x + a^2y - 1 = 0$ are perpendicular. Then product of slopes of both the lines will be $m_1 m_2 = -1$
$m_1 = \frac{-1}{(a-1)}$ and $m_2 = \frac{-2}{a^2}$
$\frac{1}{(a-1)}\frac{2}{a^2} = -1$
$a^3 - a^2 + 2 = 0 \Rightarrow a = -1$ **Choice (4)**

93. Given that $\angle C = \frac{\pi}{2}$ in right angle triangle ABC $R = \frac{c}{2}$ and $r = \frac{a+b-c}{2} \Rightarrow 2(r + R) = a + b$ **Choice (3)**

94. **Choice (3)**

95. Given the equation of curve is $y = 2x\sin x$
Slope at point $\left(\frac{\pi}{2}, \pi\right)$
$\left(\frac{dy}{dx}\right)_{\left(\frac{\pi}{2},\pi\right)} = 2\sin x + 2x\cos x = 2 + 0 = 2$
Therefore equation of tangent at $\left(\frac{\pi}{2}, \pi\right)$
$y - \pi = \left(\frac{dy}{dx}\right)_{\left(\frac{\pi}{2},\pi\right)}\left(x - \frac{\pi}{2}\right)$
$y - \pi = 2\left(x - \frac{\pi}{2}\right)$
$y - \pi = 2x - \pi$
$y = 2x$. **Choice (2)**

96. When $y = f(x)$ is shifted by α units to the right along x – axis, it become $y = f(x - \alpha)$. Hence, new equation of graph is $y = (x-4)^2 + 2$ **Choice (4)**

97. Direction cosine of a vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ is
$\frac{x}{\sqrt{x^2+y^2+z^2}}, \frac{y}{\sqrt{x^2+y^2+z^2}}, \frac{z}{\sqrt{x^2+y^2+z^2}}$ ...(1)

Given vector $\vec{r} = -2\hat{i} + \hat{j} - 5\hat{k}$
Here $x = -2$, $y = 1$ & $z = -5$
$\frac{-2}{\sqrt{30}}, \frac{1}{\sqrt{30}}, \frac{-5}{\sqrt{30}}$ **Choice (4)**

98. focus of hyperbola is (0, be)
Given focus of hyperbola = (0, 4)
$\therefore$ be = 4 ...(1)

Also give that transverse axis
$2b = 6$
$b = 3$
then e = 4/3
Since give hyperbola is conjugate
$\because e^2 = 1 + \frac{a^2}{b^2}$
$\frac{16}{9} = 1 + \frac{a^2}{9}$
$\frac{7}{9} = \frac{a^2}{9}$
$a^2 = 7$
equation of hyperbola
$\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$
$\frac{x^2}{7} - \frac{y^2}{9} = -1$
$\frac{y^2}{9} - \frac{x^2}{7} = 1$ **Choice (2)**

99. $\vec{b} + \vec{c} = -\vec{a}$
$|b|^2 + |c|^2 + 2|b||c|\cos\theta = |a|^2$
$25 + 9 + 2 \times 5 \times 3 \cos\theta = 49$
$\Rightarrow \cos\theta = \frac{1}{2}$ or $\theta = 60°$ **Choice (1)**

100. Choice (4)

101. Given that $\vec{a} \times (\vec{a} \times \vec{c}) - \vec{b} = 0$
Also $|a| = 1, |b| = 1$ & $|c| = 2$
$(\vec{a} . \vec{c})\vec{a} - (\vec{a} . \vec{a})\ \vec{c} = \vec{b}$
$\left[\vec{a} \times (\vec{b} \times \vec{c}) = (a . \vec{c})\vec{b} - (\vec{a} . \vec{b})\vec{c}\right]$
$\left(|\vec{a}|\ |\vec{c}|\cos\theta\right)\vec{a} - |a|^2\ \vec{c} = \vec{b}$
$(2\cos\theta)\ \vec{a} - \vec{c} = \vec{b}$
Squaring both the sides we get
$4\cos^2\theta\ |\vec{a}|^2 + |\vec{c}|^2 - (4\cos\theta)\vec{a}.\vec{c} = |\vec{b}|^2$
$|\vec{a}|^2 4\cos^2\theta - (4\cos\theta)|\vec{a}||\vec{c}|\cos\theta + |\vec{c}|^2 = |\vec{b}|^2$
$4\cos^2\theta - 4 \times 2\cos^2\theta + 4 = 1$
$-8\cos^2\theta + 4\cos^2\theta = -3$
$4\cos^2\theta = 3 \Rightarrow \cos\theta = \pm\frac{\sqrt{3}}{2}$
since θ is acute $\theta = \frac{\pi}{6}$ **Choice (2)**

102. Given that
$\vec{a} + \vec{b} + \vec{c} = \vec{0}$
$|\vec{a} + \vec{b} + \vec{c}| = \vec{0}$
$|\vec{a} + \vec{b} + \vec{c}|^2 = \vec{0}$
$|\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2 + 2(\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}) = 0$
$4 + 9 + 25 + 2(\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}) = 0$
$\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} = -19$ **Choice (4)**

103. Given that $\vec{a} = (\hat{i} + 2\hat{j} - 3\hat{k})$ and $\vec{b} = (3\hat{i} - \hat{j} + 2\hat{k})$
Now, $\vec{a} + \vec{b} = (\hat{i} + 2\hat{j} - 3\hat{k}) + (3\hat{i} - \hat{j} + 2\hat{k})$
$= 4\hat{i} + \hat{j} - \hat{k}$
And $\vec{a} - \vec{b} = (\hat{i} + 2\hat{j} - 3\hat{k}) - (3\hat{i} - \hat{j} + 2\hat{k})$
$= -2\hat{i} + 3\hat{j} - 5\hat{k}$
$|\vec{a} + \vec{b}| = \sqrt{16 + 1 + 1} = 3\sqrt{2}$
$|\vec{a} - \vec{b}| = \sqrt{4 + 9 + 25} = \sqrt{38}$
$(\vec{a} + \vec{b}).(\vec{a} - \vec{b}) = (4\hat{i} + \hat{j} - \hat{k}).(-2\hat{i} + 3\hat{j} - 5\hat{k})$
$= -8 + 3 + 5 = 0$
Thus, $\cos\theta = \frac{(\vec{a} + \vec{b}).(\vec{a} - \vec{b})}{|\vec{a} + \vec{b}|.|\vec{a} - \vec{b}|} = 0$
$\cos\theta = 0 \Rightarrow \theta = 90°$ **Choice (3)**

104. Choice (2)

105. Given $(1 - x + x^2)^n = a_0 + a_1x + a_2x^2 + \ldots + a_{2n}x^{2n}$ ...(1)
Put $x = 1$ in eq. (1)
$(1)^n = a_0 + a_1 + a_2 + \ldots + a_{2n}$ ...(2)
Now put $x = -1$ eq. (1)
$3^n = a_0 - a_1 + a_2 - a_3 + \ldots + a_{2n}$ ...(3)

Adding equation (2) & (3)
We get
$3^n + 1 = 2[a_0 + a_2 + a_4 + \ldots + a_{2n}]$
$a_0 + a_2 + a_4 + \ldots + a_{2n} = \frac{3^n + 1}{2}$ **Choice (1)**

106. Choice (1)

107. Given that A and B two sets containing four and two elements respectively.
Therefore no. of elements in (A × B) = 8
therefore total no. of subsets of A × B is = 2^8 = 256

then, the no. of subsets of the set A × B, each heaving at least three elements is = 256 – $({}^8C_0 + {}^8C_1 + {}^8C_2)$

= 256 – (1 + 8 + 28) = 256 – 37 = 219 **Choice (3)**

108. Given function $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0 & x = 0 \end{cases}$

Now, slope of function dy/dx = $f'(x)$
checking differentiability at $x = 0$
L.H.D.

$$\lim_{h\to 0} \frac{F(-h) - F(0)}{-h}$$

$$\lim_{h\to 0} \frac{F(-h)}{-h}$$

$$\frac{(-h)^2 \sin(-1/h)}{-h}$$

$$\lim_{h\to 0} = h\sin(1/h) = 0$$

Now checking R.H.D. at $x = 0$

$$\lim_{h\to 0} \frac{F(h) - F(0)}{h}$$

$$\lim_{h\to 0} = \frac{h^2 \sin(1/h)}{h}$$

= h sin (1/h) = 0
The given function is differentiable at $x = 0$
since L.H.D. = R.H.D.
Therefore slope = 0 **Choice (2)**

109. Area of $\Delta ABC = \frac{1}{2} ab \sin C$

Given $a = 3$ and $b = 3$

Area of $\Delta ABC = \frac{1}{2} \times 3 \times 3 \times \sin C$

Area of $\Delta ABC = \frac{9}{2} \sin C$

to maximize the area $A = \frac{\pi}{2}$

Then maximum area of $\Delta ABC = \frac{9}{2} \times 1 = \frac{9}{2}$ **Choice (4)**

110. To evaluate $\int_0^{\pi} x^3 \sin x \, dx$

Integration by parts

$$\int u v dx = u\left(\int v dx\right) - \int\left(\frac{du}{dx}\int v dx\right)dx$$

$$-\left[x^3 \cos x\right]_0^{\pi} - \int_0^{\pi} 3x^2(-\cos x)dx$$

$$-\left[-\pi^3\right] + 3\int_0^{\pi} x^2 \cos x dx$$

$$\pi^3 + 3\left[[x^2 \sin x]_0^{\pi} - \int_0^{\pi} 2x \sin x dx\right]$$

$$\pi^3 - 6\int_0^{\pi}(x \sin x)dx$$

$$\pi^3 - 6\left[-x\cos x + \sin x\right]_0^{\pi}$$

$$\pi^3 - 6\left[-\pi(-1)\right]$$

$$\pi^3 - 6\pi$$

Choice (1)

111. Given that $\lim_{x\to 0}\left[1 + \frac{f(x)}{x^2}\right] = 3$**,** since limit exist hence x^2 + $f(x) = ax^4 + bx^3 + 3x^2$
$\Rightarrow f(x) = ax^4 + bx^3 + 2x^2$
$\Rightarrow f'(x) = 4ax^3 + 3bx^2 + 4x$
Also $f'(x) = 0$ at $x = 1, 2$

$\Rightarrow a = \frac{1}{2}, b = -2$

$\Rightarrow f(x) = \frac{x^4}{2} - 2x^3 + 2x^2$

$\Rightarrow f(2) = 8 - 16 + 8 = 0$ **Choice (1)**

112. Given $f(x) = 4\sin^2 x + 3\cos^2 x + \sin x/2 + \cos x/2$
$f(x) = 3 + \sin^2 x + \sin x/2 + \cos x/2$

$0 \le \sin^2 x \le 1$ and $-\sqrt{2} \le \sin\frac{x}{2} + \cos\frac{x}{2} \le \sqrt{2}$ at $x = \frac{\pi}{2}$ so

maximum value of expression is $4 + \sqrt{2}$ **Choice (4)**

113. Given differential equation is $(e^x + 1)\, y\, dy = (y + 1)\, e^x\, dx$

$$\frac{y}{(y+1)} dy = \frac{e^x}{e^x + 1} dx$$

Now integrating both sides, we get

$$\int \frac{y}{y+1} dy = \int \frac{e^x}{e^x + 1} dx$$

$$\int dy - \int \frac{dy}{y+1} = \int \frac{e^x}{e^x + 1} dx$$

$y - \log(y + 1) = \log(e^x + 1) + c$
$y = \log(y + 1) + \log(e^x + 1) + \log c$
$y = \log(c\,(y + 1)\,(e^x + 1))$
$e^y = c(y + 1)(e^x + 1)$ **Choice (1)**

114. Choice (2)

115. Given that $f(x, y) = x^2 - 2x + 2y^2 + 4y - 2$
For critical points,

$\frac{\partial f}{\partial x} = 0$ and $\frac{\partial f}{\partial y} = 0$

$2x - 2 = 0$ and $4y + 4 = 0$
$x = 1$ and $y = -1$
Hence critical point of the given function is $(1, -1)$

The given function is maximum at $(1, -1)$ if $rt - s^2 > 0$ and $r < 0$.
Moreover, minimum at $(1, -1)$ if $rt - s^2 > 0$ and $r > 0$.

For maximum and minimum

$r = \frac{\partial^2 f}{\partial x^2} = 2$, $t = \frac{\partial^2 f}{\partial y^2} = 4$ and $s = \frac{\partial^2 f}{\partial x \partial y} = 0$

clearly, $r > 0$ & $rt - s^2 > 0$
Hence the given function is minimum at $(1, -1)$ **Choice (4)**

116. Given that $y = (\cos x^2)^2$
using chain rule

$$\frac{dy}{dx} = 2(\cos x^2)^{2-1}\frac{d}{dx}(\cos x^2)$$

$$= 2\cos x^2\left(-\sin x^2\right)\frac{d}{dx}\left(x^2\right)$$

$$= -2\cos x^2 \sin x^2 \times (2x)$$

$$\frac{dy}{dx} = -4x \sin x^2 \cos x^2$$ **Choice (2)**

117. Choice (1)

118. Given differential equation is

$$\frac{dy}{dx} = e^{x+y} + x^2 e^y$$

$$\frac{dy}{dx} = e^y(x^2 + e^x)$$

$$\frac{dy}{e^y} = (x^2 + e^x)dx$$

Integrating both sides, we get

$$\int e^{-y}dy = \int\left(x^2 + e^x\right)dx$$

$$-e^{-y} = \frac{x^3}{3} + e^x + c$$

$$= e^x + e^{-y} + \frac{x^3}{3} + c$$ **Choice (2)**

119. Choice (1)

120. $\lim\limits_{x\to 0}\frac{x\tan x}{(1-\cos x)}$ is a function in $\frac{0}{0}$ form therefore by using L 'Hospital's rule $\lim\limits_{x\to 0}\frac{x\sec^2 x + \tan x}{\sin x}$

The function is still in the form $\frac{0}{0}$ again we can use L' Hospital's Rule again

$\lim\limits_{x\to 0}\frac{x(2\sec^2 x\tan x) + \sec^2 x + \sec^2 x}{\cos x}$ Putting $x = 0$

$$\lim_{x\to 0} f(x) = 2$$ **Choice (4)**