1. Patterns of stone chipping
   Ans. (B)

2. Towards the left.
   Ans. (D)

3. People's tendency to work with either hand.
   Ans. (C)

4. The prevalence of right handedness
   Ans. (D)

5. The history of right handedness and left handedness.
   Ans. (C)

6. The idiom "under the sun" means anything and everything.
   Ans. (A)

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7. Correct : When we arrive at the station, we (descend from) get off the train
Ans. (C)

8. Correct : The Medal was awarded for the student's exemplary conduct and courage.
Ans. (B)

9. Hindrance is correctly spelt word.
Ans. (D)

10. Correct : The earth revolves round the sun.
Ans. (A)

11. The Prepondenerance of evidence was on the side of plaintif since all but one witnesses testify his story was, correct.
Ans. (C)

12. "Turn UP" mean to "Show up"
Ans. (A)

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13. "Ready to believe" means Credulous.
Ans. (A)

14. The only possible option (A) forms the meaningful sentence.
Ans. (A)

15. Though green and black tea are obtained from the same plant, there are quite a few significant difference between them.
Ans. (C)

16. A person who travels to sacred place as an act of religious devotion is called Pilgrim.
Ans. (B)

17. Only option (C) forms a meaningful sentence.
Ans. (C)

18. In case of bad weather, the trip will be postponed to next week.
Ans. (B)

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19. "A book containing summarized information on all branches of knowledge is known as Encyclopedia.
Ans. (C)

20. The man was about to move his bike into the compound of his apartment when a passer by knocked down the motorcycle.
Ans. (D)

21. (A) $A \cdot A' = 0$
(B) $A + AB = (A + A) \cdot (A + B) = A \cdot (A + B)$
(C) $A + A'B = (A + A1) \cdot (A + B) = 1 \cdot (A + B) = A + B$
(D) $A(A + B) = A + AB = A(1 + B) = A$
So, option (C) is correct.
Ans. (C)

22. Fraction : 01001110 exponent : 000100
Ans. (A)

23. $AB + \bar{A}C + BC = AB + \bar{A}C$
Ans. (D)

24. **Ans. (B)**

25. $(-147)_{10} = (100010010011)_2$, 1's complement $(111101101100)_2$
2's complement is $(111101101101)_2$
Ans. (C)

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26. RAM

Ans. (A)

27. Ans. (Wrong)

28. -2^{n-1}, so, $-2^{8-1} = -128$
Ans. (B)

29. Ans. (D)

30. The total number binary function that can be defined using n boolean variables is 2^{2^n}.
Ans. (D)

31. Given conditions are –
i) $S \leq 40$
ii) $M = 38$ and $S \geq 43$
iii) $M \geq 39$
Now if all the statement are wrong, then condition will be
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i) $S > 40$ ii) $M \neq 38$ and $S < 43$ iii) $M < 39$
then following case will arise
(36, 40), (37, 41)
So, age of M and S can't be determined.
Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**

32. Ans. (B)

33. Given that A < B, C < D, B < C, A < E
$\Rightarrow$ A < B < C < D and A < E
So most intelligent person is either E or D.
Ans. (C)

34. A committee of 5 persons can be formed in following ways
3(M) 2(F) + 4(M) 1(F) + 5(M) 0(F)
i.e. ${}^{7}C_3\ {}^{6}C_2 + {}^{7}C_4\ {}^{6}C_1 + {}^{7}C_5\ {}^{6}C_0$
= 525 + 210 + 21
= 756
Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**

35. Ans. (wrong)

36. According to the given condition following arrangement is possible

C
D
E
A

B

Clearly, B lies on the bottom of the arrangement.

Ans. (B)

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

$(99)_{10} = 9 \times 10 + 9 = (99)_{10}$

$(90)_{11} = 9 \times 11 + 0 = (99)_{10}$

$(83)_{12} = 8 \times 12 + 3 = (99)_{10}$

$(78)_{13} = 7 \times 13 + 8 = (99)_{10}$

$(71)_{14} = 7 \times 14 + 1 = (99)_{10}$

$(69)_{15} = 6 \times 15 + 9 = (99)_{10}$

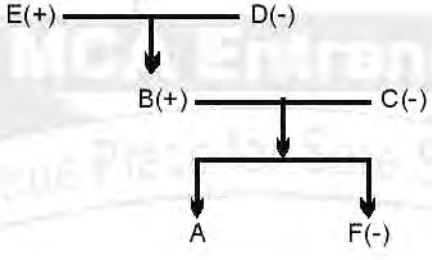
Hence, (71, 69) is the answer.

Ans. (A)

Q. (38 - 40)

Male = (+)

Female = (-)



38. In the above figure C is wife of B and mother of F, so, C is mother of F.
Ans. (B)

39. Since Gender of A is unknown. So, (A), (B) and (C) all are not true.
Ans. (D)

40. According the above tree DE and BC are two married couples in the family. Hence DE is one of the couples.
Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

41. Given series is as follows : -
336, 210, 120, 60, _____, 6
$7^3 - 7, 6^3 - 6, 5^3 - 5, 4^3 - 4,$_____ $2^3 - 2$
So, missing term will be $3^3 - 3 = 24$
Ans. (A)

42. 3 days before Friday is Tuesday and The day after the day after tomorrow is 3 days before Tuesday.
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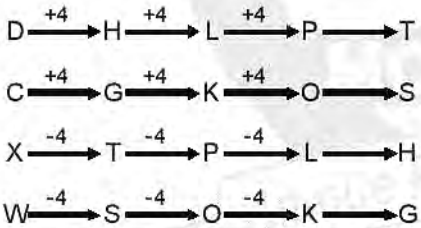
Hence Sat ← (Day after day after tomorrow) → Tue ← (3 days) → Friday
Thus answer is Saturday. Ans. (C)

Note : This question can also be solved direct by **SHORTCUT**

43.



So, Required answer is LKPO.

Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**

44. Given condition are

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

Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

Q. (45 – 47)

(+) = Together ⇒ = (implies)

(×) = Not together

(|) = or

Now by given statements it is clear that

(i) Feroz ⇒ Gautam (Feroz then Gautam)

(ii) (Gautam + Harish) × Javed (Gautam & Harish together then Javed cannot)

(iii) (Harish + Javed) × Laxman (Harish & Javed together than Laxman cannot)

(iv) J + (K |M) (If Javed then kumar or Mohan)

(v) (K × L) but K | L (only one of kumar or Laxmna must be present)

(vi) (K × M) (Kumar & Mohan both cannot ride together)

45. Clearly from above aspersion

Option (A) is wrong by cond. (iii)

Option (B) is true

Option (C) is wrong by cond. (v)

Option (D) is wrong by cond. (v)

Ans. (B)

46. By condition (vi) Mohan and Kumar not ride together and By condition (v) one of kumar or Laxman must ride.

Hence, Laxman must ride.

Ans. (D)

47. Feroz → Gautam, Harish, Mohan, Laxman is the Largest team of 5 member.

Ans. (A)

Note : This question can also be solved direct by **SHORTCUT**

48. Ans. (C) 51

49. Ans. (A) 4

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

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

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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 theif 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

$$\frac{x-7}{8}=3\Rightarrow x=31$$

Ans. (B)

Note : This question can also be solved direct by SHORTCUT

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. Ans. (B)

Note : This question can also be solved direct by SHORTCUT

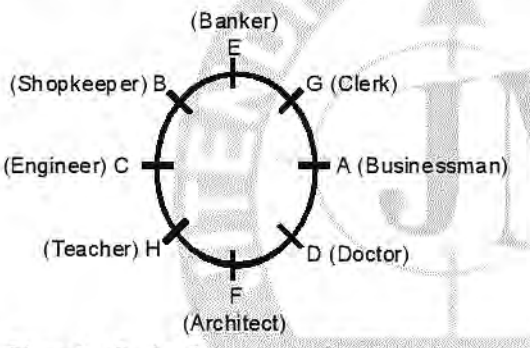
52. Investment double every 5 year hence.,

5000 (1990)	10000 (1995)	20000 (2000)	40000 (2005)	80000 (2010)
	5000 (1990)	10000 (2000)	20000 (2005)	40000 (2010)
		5000 (2000)	10000 (2005)	20000 (2010)
			5000 (2005)	10000 (2010)
			Total	**150000**

Ans. (D)

Note : This question can also be solved direct by SHORTCUT

Q. (53 – 57) Given circular sitting arrangement is as follows : -



53. Clearly G, is the clerk. **Ans. (D)**

54. Clearly from the figure option (C) is true. **Ans. (C)**

55. From the figure profession of H is Teacher. **Ans. (D)**

56. Doctor sits exactly between the architect and the businessman. **Ans. (D)**

57. Clerk sits immediately right of the businessman. **Ans. (C)**

Note : This question can also be solved direct by SHORTCUT

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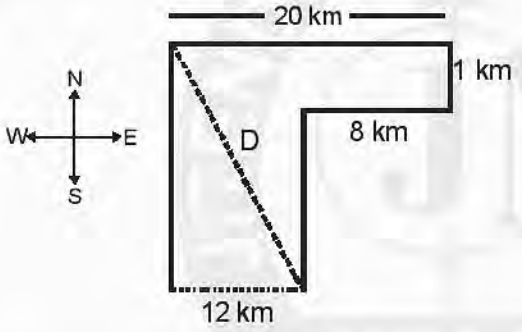
58.



Distance = $\sqrt{16^2 + 12^2} = \sqrt{400}$

= 20 km north west.

Ans. (A)

Note : This question can also be solved direct by SHORTCUT

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 by given condition

$2(x + 10) = x + 30$

$X = 10$

Ans. (C)

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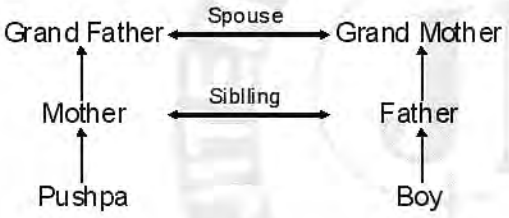
60. By given information

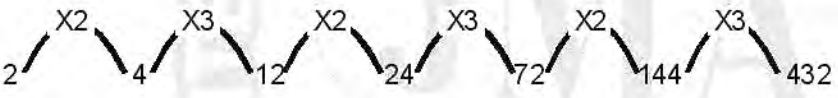


So, Pushpa is clearly cousin sister of boy.

Ans. (C)

Note : This question can also be solved direct by SHORTCUT

61.



So, answer is 144, 432

Ans. (A)

62. By given information, sitting arrangement will be

P	T	R
U	Q	S

Cleary PTR are in a row.

Ans. (D)

Q. (63 – 66)

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

63. C's compulsory subject is History.
Ans. (D)

64. Only B has Chemistry as a subject.
Ans. (B)

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65. A, B and C has History as their compulsory subject.
Ans. (C)

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66. F has Mathematics and Physics as Compulsory and optional subject. E has Physic and Maths as compulsory subject. Therefore E has same combination of subject as F.
Ans. (B)

Note : This question can also be solved direct by SHORTCUT

67.

Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

68. Given series is

$$61, 57 \xrightarrow{-7} 50, 61, 43 \xrightarrow{-7} 36, 61, 29 \xrightarrow{-7} 22$$

Ans. (29, 22)

Ans. (C)

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. $\frac{6}{2} = 3$

Ans. (A)

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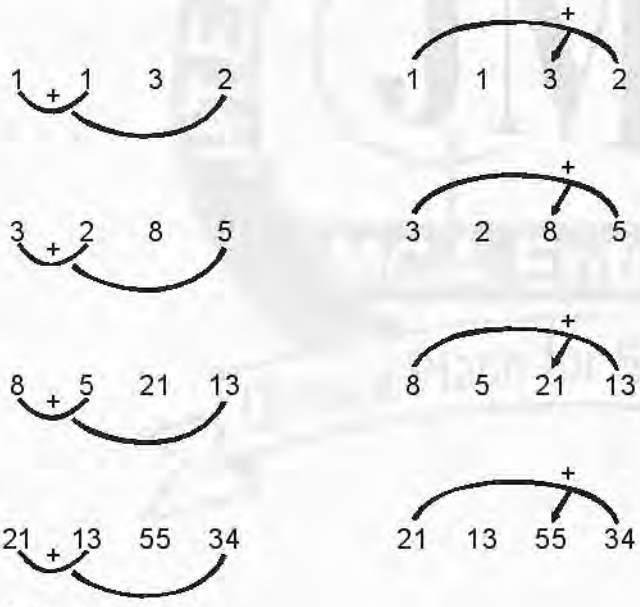
70. 1 1 3 2 8 5 21 13 55 34



Ans. (C)

Note : This question can also be solved direct by **SHORTCUT**

71. Prob (A Speaks truth) = x
Prob (B Speaks truth) = y
But before the case A and B agree on a certain statement i.e. if A speaks truth then B also speaks truth and if A speak lies, then B also speak lies.
i.e. total probability is = $xy + (1 - x)(1 - y)$

and favorable cases is = both speaks truth
= xy

Then prob. (statement is true) = $\frac{xy}{xy+(1-x)(1-y)}$

Ans. (A)

Note : This question can also be solved direct by SHORTCUT

72. Given that harmonic mean of two no.'s is 4. And Arithmetic mean (A) and Geometric mean (G) satisfy the relation $2A + G^2 = 27$.

Let the two number be a, b

Then, $\frac{2ab}{a+b} = 4$

$2ab = 4(a + b)$

$\frac{ab}{2} = a+b$

Clearly, option (b) satisfies, the given relation.

Ans. (B)

Note : This question can also be solved direct by SHORTCUT

73. Consider the following events :

$E_1 \rightarrow$ He knows the answer,

$E_2 \rightarrow$ He guesses the answer

$A \rightarrow$ He gets the correct answer.

We have,

$P(E_1) = \frac{90}{100} = \frac{9}{10}$, $P(E_2) = \frac{1}{10}$

$P(A/E_1) = 1$, $P(A/E_2) = \frac{1}{4}$

$\therefore$ Required probability $= P(E_2/A)$

$$= \frac{P(E_2)P(A/E_2)}{P(E_1)P(A/E_1) + P(E_2)P(A/E_2)}$$

$$= \frac{\frac{1}{10} \times \frac{1}{4}}{\frac{9}{10} \times 1 + \frac{1}{10} \times \frac{1}{4}} = \frac{1}{37}$$

Ans. (B)

Note : This question can also be solved direct by SHORTCUT

74. Prob. (Man speaks truth) = 2/3

Prob. (1 appear on dice) = 1/6

Then two cases, arise, that,

Man speaks truth and 1 appears, on dice, as man speaks, lies and 1 doesn't appear on dice.

i.e. total probability is $= \frac{2}{3} \times \frac{1}{6} + \frac{1}{3} \times \frac{5}{6} = \frac{7}{18}$

and favorable cases, is = Man speaks, truth and 1 appear on dice.

$$= \frac{2}{3} \times \frac{1}{6} = \frac{2}{18}$$

Then required probability $= \frac{\text{No. of favorable cases}}{\text{Total no. of cases}} = \frac{2/18}{7/18} = \frac{2}{7}$ Ans. (c)

Note : This question can also be solved direct by SHORTCUT

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

Thus $P(A) = \frac{3}{4}$ and

$P(\overline{A \cup B}) = 1 - P(A \cup B)$

$\frac{1}{6} = 1 - P(A \cup B)$

$P(A \cup B) = \frac{5}{6}$

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

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

$P(B) = \frac{5}{6} - \frac{1}{2}$

$P(B) = \frac{2}{6}$

$P(B) = \frac{1}{3}$

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.

Ans. (A)

Note : This question can also be solved direct by SHORTCUT

76. We know that mean of the binomial distribution = np

Variance = npq

Given $np = 4$ .....(1)

& $npq = 2$ .....(2)

Divide eq. (ii) by (i)

$$\frac{npq}{np} = \frac{2}{4}$$

$$q = \frac{1}{2}$$

$P = 1 - q$

$P = 1 - ½$

$P = ½$

From eq. (i) $np = 4$

$$n \times \frac{1}{2} = 4$$

$$n = 8$$

now, $p(x = r) = {}^nC_r q^{n-r} p^r$

$p(x = 1) = {}^8C_1 (1/2)^{8-1} (1/2)^1$

$$= 8 \times \frac{1}{2^8}$$

$$= \frac{8}{256} = \frac{1}{32}$$

Ans. (A)

Note : This question can also be solved direct by **SHORTCUT**

77. By property of Arithmetic mean, i.e.,
The algebraic sum of deviation taken about the Arithmetic mean is always zero.
Ans. (d)

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
$P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) - P(E_1 \text{ and } E_2)$
$0.85 = 0.35 + P(E_2) - 0.15$
$P(E_2) = 0.85 - 0.20$
$P(E_2) = 0.65$
Ans. (C)

Note : This question can also be solved direct by SHORTCUT

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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 $2A + B + X = 0$

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

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

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

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

Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

80. We have,

$$\Delta = \frac{1}{2}ap_1 = \frac{1}{2}bp_2 = \frac{1}{2}cp_3$$

$$\Rightarrow a = \frac{2\Delta}{p_1}, b = \frac{2\Delta}{p_2} \text{ and } c = \frac{2\Delta}{p_3}$$

It is given that

P_1, P_2, P_3 are in H.P.

$$\Rightarrow \frac{1}{p_1}, \frac{1}{p_2}, \frac{1}{p_3} \text{ are in A.P.}$$

$$\Rightarrow \frac{2\Delta}{p_1}, \frac{2\Delta}{p_2}, \frac{2\Delta}{p_3} \text{ are in A.P.}$$

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

$\Rightarrow$ sin A, sin B, sin C are in A.P.

Ans. (C)

Note : This question can also be solved direct by **SHORTCUT**

81. The given quadratic equation is

$x^2 - 2x\cos\theta + 1 = 0$ .....(1)

let α, β are the roots of the equation (1) Then

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

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

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

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

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

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

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

And $\alpha^n \beta^n = (\cos n\theta + i\sin n\theta)(\cos n - i\sin n\theta)$

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

Then quadratic equation whose roots are

α^n and β^n are

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

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

Ans. (A)

Note : This question can also be solved direct by SHORTCUT

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.

Ans. (B)

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83. Let the three terms in A.P. be a – d, a, a + d.
Given that a – d + a + a + d = 21
We get,
$3a = 21$
$a = 7$
then the three term in A.P. are 7 – d, 7, 7 + d
According to given condition. 7 – d + 2, 7 + 2, 7 + d + 14 are in G.P.
$\therefore$ 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
Therefore, Ans. (A)
Ans. (A)

Note : This question can also be solved direct by SHORTCUT

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84. We know that $2\tan^{-1}x = \sin^{-1}\frac{2x}{1+x^2}$

$\therefore$ $\sin^{-1}\frac{2a}{1+a^2} + \sin^{-1}\frac{2b}{1+b^2} = 2\tan^{-1}n$ can be written as,

$2\tan^{-1}a + 2\tan^{-1}b = 2\tan^{-1}n$

$\tan^{-1}a + \tan^{-1}b = \tan^{-1}n$

Now we know that

$$\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-x.y}\right)$$

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

We get, $n = \frac{a+b}{1-ab}$

Ans. (C)

Note : This question can also be solved direct by SHORTCUT

85. Standard Result

Ans. (A)

86. Given that $\tan x = \frac{-3}{4}$ and $\frac{3\pi}{2} < x < 2\pi$

It is clear that x lie in fourth quadrant

Then $\sin x = -\frac{3}{5}$ and $\cos x = \frac{4}{5}$

Now we know that $\sin 2x = 2 \sin x . \cos x$

$$\text{Sin } 2x = -2 \times \frac{3}{5} \times \frac{4}{5}$$

$$\sin 2x = \frac{-24}{25}$$

Ans. (d)

Note : This question can also be solved direct by SHORTCUT

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87. We know that $\cot^{-1}(-x) = \pi - \cot^{-1}(x)$

Therefore $\cot^{-1}(-\sqrt{3}) = \pi - \cot^{-1}(\sqrt{3})$

$$= \pi - \frac{\pi}{6}$$

$$\cot^{-1}\left(-\sqrt{3}\right) = \frac{5\pi}{6}$$

Ans. (D)

88. Given that $\cos\theta = \frac{4}{5}, \cos\phi = \frac{12}{13}$

Given than α and ϕ both lies in fourth quadrant then

$$\sin\theta = \frac{-3}{5} \text{ and } \sin\phi = \frac{-5}{13}$$

Now, $\cos(\theta + \phi) = \cos\theta\cos\phi - \sin\theta\sin\phi$

$$= \frac{4}{5} \times \frac{12}{13} - \left(\frac{-3}{5}\right)\left(\frac{-5}{13}\right)$$

$$= \frac{48}{65} - \frac{15}{65} = \frac{33}{65}$$ Ans. (C)

Note : This question can also be solved direct by SHORTCUT

89. Standard Result

$$\sin 36^\circ = \frac{\sqrt{10 - 2\sqrt{5}}}{4}$$

Ans. (B)

90. we know that

$$\text{Cos C} - \cos \text{D} = 2\sin\left(\frac{C+D}{2}\right)\sin\left(\frac{D-C}{2}\right)$$

$$\therefore \cos 5x - \cos 7x = 2\sin\left(\frac{5x+7x}{2}\right)\sin\left(\frac{7x-5x}{2}\right)$$

$$= 2 \sin 6x \sin x$$

Ans. (C)

91. **Ans. (Wrong)**

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 $m_1m_2 = -1$

Slope of $x + (a - 1)y + 1 = 0$ i.e. $m_1 = \frac{-1}{(a-1)}$

and

Slope of $2x + a^2y - 1 = 0$ i.e. $m_2 = \frac{-2}{a^2}$

and $m_1m_2 = -1$

$$\therefore \frac{1}{(a-1)}\frac{2}{a^2} = -1$$

$2 = -a^2 (a - 1)$

$a^3 - a^2 + 2 = 0$ .....(1)

on solving equation (1) we get $a = -1$ **Ans. (d)**

Note : This question can also be solved direct by SHORTCUT

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93. We have,

$$R = \frac{c}{2\sin C} = \frac{c}{2} \text{ and } r = (s-c)\tan\frac{C}{2} = s-c$$

$$\therefore\ 2(R+r) = 2\left(\frac{c}{2}+s-c\right) = 2s-c = a+b$$

Ans. (C)

94. We know that the pair of straight line
$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ intersect each other at

$$\left(\frac{hf-bg}{ab-h^2}, \frac{hg-af}{ab-h^2}\right)$$

Therefore point of intersection of pair of straight line
$x^2 + 3xy + 2y^2 - x - 4y - 6 = 0$ is (8, -5)

Ans. (C)

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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 $\left(\frac{\pi}{2}, \pi\right)$

$$y - \pi = \left(\frac{dy}{dx}\right)_{\left(\frac{\pi}{2},\pi\right)}\left(x - \frac{\pi}{2}\right)$$

$$y - \pi = 2\left(x - \frac{\pi}{2}\right)$$

$y - \pi = 2x - \pi$

$y = 2x.$

Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

96. Given equation of curve $y = (x - 2)^2 - 3$ .....(1)

Since y is shifted up along y –axis by 5 units,

Therefore replacing y, by y – 5 units i.e.

$y \to y - 5$

and since x is shifted along right by 2 units,

therefore replacing x by x – 2 units i.e.

$x \to x - 2$

therefore eq. (1) becomes

$y - 5 = (x - 2 - 2)^2 - 3$

$y - 5 = (x - 4)^2 - 3$

$y = (x - 4)^2 + 2$

Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**

97. We know that direction cosine of a vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ is

$$\frac{x}{\sqrt{x^2+y^2+z^2}}, \frac{y}{\sqrt{x^2+y^2+z^2}}, \frac{z}{\sqrt{x^2+y^2+z^2}} \quad \text{.....(1)}$$

Given vector $\vec{r} = -2\hat{i} + \hat{j} - 5\hat{k}$

Here x = -2, y = 1 & z = -5

Putting value in eq. (1)

We get ,

$$\frac{-2}{\sqrt{30}}, \frac{1}{\sqrt{30}}, \frac{-5}{\sqrt{30}}$$

Ans. (D)

Note : This question can also be solved direct by SHORTCUT

98. We know that 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 by eq. (1)

3e = 4

e = 4/3

since give hyperbola is conjugate

$\because \quad e^2 = 1 + \frac{a^2}{b^2}$

$$\frac{16}{9} = 1 + \frac{a^2}{9}$$

$$\frac{7}{9} = \frac{a^2}{9}$$

$a^2 = 7$

$\therefore$ eq. of hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$$

$$\frac{x^2}{7} - \frac{y^2}{9} = -1$$

$$\frac{y^2}{9}-\frac{x^2}{7}=1$$

Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

99. We have

$\vec{a}+\vec{b}+\vec{c}=0$

$\vec{a}=-(\vec{b}+\vec{c})$

$|\vec{a}|=|-(\vec{b}+\vec{c})|$

$|\vec{a}|^2=|\vec{b}|^2+|\vec{c}|^2+2(\vec{b}\cdot\vec{c})$

$|\vec{a}|^2=|\vec{b}|^2+|\vec{c}|^2+2|\vec{b}||\vec{c}|\cos\theta,$

Where θ is angle between $\vec{b}$ and $\vec{c}$

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$49 = 25 + 9 + 30\cos\theta$

$15 = 30\cos\theta$

$\cos\theta = ½$

$\theta = \pi/3$

Ans. (A)

Note : This question can also be solved direct by **SHORTCUT**
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100. **Ans. (wrong)**

101. Given that $\vec{a} \times (\vec{a} \times \vec{c}) - \vec{b} = 0$

Also, $|a| = 1$, $|b| = 1$ & $|c| = 2$

$$(\vec{a} \cdot \vec{c})\,\vec{a} - (\vec{a} \cdot \vec{a})\,\vec{c} = \vec{b} \qquad \left[\vec{a} \times (\vec{b} \times \vec{c}) = (a \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}\right]$$

$$(|\vec{a}|\,|\vec{c}|\cos\theta)\,\vec{a} - |a|^2\,\vec{c} = \vec{b}$$

$$(2\cos\theta)\vec{a} - \vec{c} = \vec{b}$$

Squaring both the sides, we get

$$4\cos^2\theta\,|\vec{a}|^2 + |\vec{c}|^2 - (4\cos\theta)\vec{a}.\vec{c} = |\vec{b}|^2$$

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$$|\vec{a}|^2\,4\cos^2\theta - (4\cos\theta)\,|\vec{a}||\vec{c}|\cos\theta + |\vec{c}|^2 = |\vec{b}|^2$$

$4\cos^2\theta - 4 \times 2\cos^2\theta + 4 = 1$

$-8\cos^2\theta + 4\cos^2\theta = -3$

$-4\cos^2\theta = -3$

$4\cos^2\theta = 3$

$$\cos\theta = \pm\frac{\sqrt{3}}{2}$$

Since θ is acute

$$\theta = \frac{\pi}{6}$$

Ans. (B)

Note : This question can also be solved direct by **SHORTCUT**

102. We have

$\vec{a}+\vec{b}+\vec{c}=\vec{0}$

$|\vec{a}+\vec{b}+\vec{c}|=\vec{0}$

$|\vec{a}+\vec{b}+\vec{c}|^2=\vec{0}$

$|\vec{a}|^2+|\vec{b}|^2+|\vec{c}|^2+2(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a})=0$

$4+9+25+2(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a})=0$

$\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}=-19$ **Ans. (D)**

Note : This question can also be solved direct by SHORTCUT

103. Given $\vec{a}=(\hat{i}+2\hat{j}-3\hat{k})$ 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, $\cos\theta=\dfrac{(\vec{a}+\vec{b}).(\vec{a}-\vec{b})}{|\vec{a}+\vec{b}|.|\vec{a}-\vec{b}|}=0$

$\cos\theta = 0$

$\theta = 90^\circ$ **Ans. (C)**

Note : This question can also be solved direct by SHORTCUT

104. Given that S = {2, {1, 4}}
By definition of powerset
P(s) = {ϕ, 2, {1, 4}, {2, {1, 4}}}
n{P(s)} = 4
Ans. (B)

105. Given $(1 - x + x^2)^n = a_0 + a_1x + a_2x^2 + ... + a_{24}x^{2n}$ .....(1)
Put x = 1 in eq. (1)
$(1)^n = a_0 + a_1 + a_2 + ... + a_{2n}$ .....(2)
Now put x = -1 eq, (1)
$3^n = a_0 + a_1 + a_2 - a_3 + ... + a_{2n}$ .....(3)
Adding eq. (2) & (3)
We get,

$$3^n + 1 = [a_0 + a_2 + a_4 + ... + a_{2n}]$$

$$a_0 + a_2 + a_4 + ... + a_{2n} = \frac{3^n + 1}{2}$$

Ans. (A)

106. Only option (A) satisfies the given condition.
Ans. (A)

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107. given $n(A) = 4$ & $n(B) = 2$

Therefore no. of elements in $(A \times B)$

i.e. $n(A \times B) = 8$

therefore total no. of subsets of $A \times B$ is $= 2^8 = 256$

then, the no. of subsets of the set $A \times B$, each heaving atleast three element is,

$= 256 - ({}^8C_0 + {}^8C_1 + {}^8C_2)$

$= 256 - (1 + 8 + 28)$

$= 256 - 37$

$= 219$

Ans. (C)

Note : This question can also be solved direct by SHORTCUT

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 L.H.L. at $x = 0$

$\lim_{x \to 0^-} F(x)$

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

$= (-h)^2 \sin\left(-\frac{1}{h}\right)$

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

$= 0$ since $0 \times$ (oscillating function)

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

$\lim_{x \to 0^+} F(x)$

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

$= (h)^2 \sin\left(\frac{1}{h}\right)$

$= h\sin\left(\frac{1}{h}\right)$

$= 0$

Since, L.H.L. = R.H.L. = f(0) therefore limit exists.

Now, 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

Ans. (B)

Note : This question can also be solved direct by SHORTCUT

109. Area of $\Delta ABC = \frac{1}{2} bc \sin A$

Given b = 3 and c = 3

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

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

Area will be max. for $A = \frac{\pi}{2}$

Then maximum area of $\Delta ABC = \frac{9}{2} \times 1 = \frac{9}{2}$

Ans. (D)

Note : This question can also be solved direct by SHORTCUT

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

By using byparts,

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

$$\int_0^{\pi} x^3 \sin x dx$$

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

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

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

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

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

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

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

Ans. (A)

Note : This question can also be solved direct by SHORTCUT

111. $\lim\limits_{x\to 0}\left[1+\dfrac{f(x)}{x^2}\right]=3$, 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 $x = 1, 2$

$\Rightarrow a = ½, b = -2$

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

$\Rightarrow f(x) = 8 - 16 + 8 = 0$

Ans. (A)

Note : This question can also be solved direct by **SHORTCUT**

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

$f(x) = 3 + \sin^2 x + \sin x/2 + \cos x/2$

$f(x) = 3 + \sin^2 x + \sqrt{1+\sin x}$

$$f'(x) = 2\sin x \cos x + \frac{\cos x}{2\sqrt{1+\sin x}}$$

$$f'(x) = \cos x\left(2\sin x + \frac{1}{2\sqrt{1+\sin x}}\right)$$

now, $f'(x) = 0$

when $x = \frac{\pi}{2}$

now, $f''\left(\frac{\pi}{2}\right) < 0$

therefore given function f(x) attain maximum at $x = \frac{\pi}{2}$

so, $f\left(\frac{\pi}{2}\right) = 4 + \sqrt{2}$

Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**

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

It is clear that given eq. will get solved using variable separable form

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

Now integrating both sides, we get

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

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

$$y - \log (y+1) = \int \frac{e^x}{e^x+1} dx$$

now solving, R.H.S. = $\int \frac{e^x}{e^x+1} dx$ .....(1)

put $e^x + 1 = t$ in eq. (1)

$e^x dx = dt$

$= \int \frac{dt}{t}$

$= \log t$

$= \log (e^x + 1) + c$

Now,

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

$y = \log (y+1) + \log (e^x + 1) + \log c$

$y = \log (c (y+1) (e^x + 1))$

$e^y = c(y+1) (e^x + 1)$

Ans. (A)

Note : This question can also be solved direct by **SHORTCUT**

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114. $I = \int_0^1 x(1-x)^n dx$

Using property $\int_0^1 f(x)dx = \int_0^a f(a-x)dx$

$I = \int_0^1 (1-x)x^n dx$

$I = \int_0^1 x^n dx - \int_0^1 x^{n+1} dx$

$\left[\frac{x^{n+1}}{n+1} - \frac{x^{n+2}}{n+2}\right]_0^1$

$I = \frac{1}{n+1} - \frac{1}{n+2}$

We get,

$I = \frac{1}{(n+1)(n+2)}$

Ans. (B)

Note : This question can also be solved direct by SHORTCUT

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

For critical points,

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

$2x - 2 = 0$ and $4y + y = 0$

$X = 1$ 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 $r < 0$

And 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, by putting the value of r, t and s we get $r > 0$ & $rt - s^2 > 0$

Hence the given function is minimum at (1, -1)

Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**

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116. Given $y = (\cos x^2)^2$

$y = \cos^2 x^2$

using chain rule,

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

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

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

$$\frac{dy}{dx} = -4x\sin x^2\cos x^2$$

Ans.(B)

Note : This question can also be solved direct by **SHORTCUT**

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117. Let given function is $y = x^3 + e^x + 3^x + \cot x$

Now, $\frac{dy}{dx} = 3x^2 + e^x + 3^x \log 3 - \text{cosec}^2 x$

$$\frac{d}{dx}\left(x^n\right) = nx^{n-1},\ \frac{d}{dx}\left(e^x\right) = e^x$$

$$\frac{d}{dx}\left(a^x\right) = a^x \log a,\ \&\ \frac{d}{dx}(\cot x) = -\text{cosec}^2 x$$

Ans. (A)

118. Given differential equation is

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

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

Using variable separable, form

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

Integrating both sides, we get

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

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

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

Where c is constant

Ans. (B)

Note : This question can also be solved direct by SHORTCUT

119. **Ans. (wrong)**

120. To evaluate $\lim_{x\to 0}\frac{x\tan x}{(1-\cos x)}$

Clearly the function is of the form $\frac{0}{0}$ therefore by using L'Hospital's rule

$$\lim_{x\to 0}\frac{x\sec^2 x + \tan x}{\sin x}$$

The function is still in the form $\frac{0}{0}$ therefore using L'Hospital's Rule again

$$\lim_{x\to 0}\frac{x(2\sec^2 x\tan x)+\sec^2 x+\sec^2 x}{\cos x}$$

Putting $x = 0$

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

Ans. (D)

Note : This question can also be solved direct by **SHORTCUT**