ACME MCA ENTRANCE ACADEMY

# NIMCET Previous year paper 2018

## Included Subjects

Mathematics
Logical Reasoning
Computer
English

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# NIMCET 2018

## Mathematics:

**1**. The point of intersection of circle $x^2 + y^2 + 10x - 12y + 51 = 0$ and the line $3y + x = 3$ is

(A) $(-6, 3)$ (B) $(3, -6)$
(C) $(6, -3)$ (D) $(-3, 6)$

**2**. The number of solutions of the equation $\sin x + \sin 5x = \sin 3x$ lying in the interval $[0, \pi]$ is

(A) 4 (B) 6
(C) 5 (D) 2

**3**. In an acute angled $\Delta ABC$ the least value of $\sec A + \sec B + \sec C$ is

(A) 6 (B) 8
(C) 3 (D) 2

**4**. Let $P = \{\theta: sin\ \theta - \cos\theta = \sqrt{2}\cos\theta\}$ and $Q = \{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$ be two sets. Then

(A) $P \subset Q$ and $Q - P \neq \Phi$ (B) $P \not\subset Q$
(C) $Q \not\subset P$ (D) $P = Q$

**5**. If $\frac{\tan x}{2} = \frac{\tan y}{3} = \frac{\tan z}{5}$ and $x + y + z = \pi$, then the value of $\tan^2 x + tan^2 y + tan^2 z$ is

(A) $\frac{38}{3}$ (B) 38
(C) 114 (D) None of these

**6**. The circles whose equations are $x^2 + y^2 + c^2 = 2ax$ and $x^2 + y^2 + c^2 - 2by = 0$ will touch one another externally if

(A) $\frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{a^2}$ (B) $\frac{1}{c^2} + \frac{1}{a^2} = \frac{1}{b^2}$
(C) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$ (D) None of these

**7**. The locus of the orthocenter of the triangle formed by the lines $(1 + p)x - py + p(1 + p) = 0, (1 + q)(x - q) + q(1 + q) = 0$ and $y = 0$ where $p \neq q$ is

(A) a hyperbola (B) a parabola
(C) an ellipse (D) a straight line

**8**. Equation of a common tangent with positive slope to the circle $x^2 + y^2 - 8x = 0$ as well as to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ is

(A) $2x - \sqrt{5}y - 20 = 0$ (B) $2x - \sqrt{5}y + 4 = 0$
(C) $3x - 4y + 8 = 0$ (D) $4x - 3y + 4 = 0$

**9**. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is

(A) 2/3 sq. unit (B) 1 sq. unit
(C) 1/6 sq. unit (D) 1/3 sq. unit

**10**. Equation of the line perpendicular to $x - 2y = 1$ and passing through $(1, 1)$ is

(A) $x + 2y = 3$ (B) $x + y = 2$
(C) $y = 2x + 3$ (D) $y = -2x + 3$

**11**. If $A = \begin{bmatrix} 0 & 5 \\ 0 & 0 \end{bmatrix}$ and $f(x) = 1 + x + x^2 + \cdots + x^{16}$, then $f(A) =$

(A) 0 (B) $\begin{bmatrix} 1 & 5 \\ 0 & 1 \end{bmatrix}$
(C) $\begin{bmatrix} 1 & 5 \\ 0 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 5 \\ 1 & 1 \end{bmatrix}$

**12**. 9 balls are to be placed in 9 boxes and 5 of the balls cannot fit into 3 small boxes. The number of ways of arranging one ball in each of the boxes is

(A) 18720 (B) 18270
(C) 17280 (D) 12780

**13**. Which of the following functions in inverse of itself?

(A) $f(x) = \frac{1-x}{1+x}$ (B) $f(x) = 3^{\log x}$
(C) $f(x) = 3^{x(x+1)}$ (D) None of these

**14**. A student council has 10 members. From this one President, one Vice-President, one Secretary, one Joint-Secretary and two Executive Committee members have to be elected. In how many ways this can be done?

(A) 151200 (B) 75600
(C) 37800 (D) 18900

**15**. In a survey where 100 students reported which subjects they like, 32 students in total liked Mathematics, 38 students liked Business and 30 students liked Literature. Moreover 7 students liked both Mathematics and Literature, 10 students liked both Mathematics and Business, 8 students liked both Business and Literature, 5 students liked all three subjects. Then the number of people who liked exactly one subject is
(A) 60 (B) 65
(C) 70 (D) 78

**16**. The number of natural numbers which are smaller than $2 \times 10^8$ and which contain only the digits 1 and 2 is
(A) 786 (B) 666
(C) 766 (D) 1066

**17**. If $\lim_{x\to\infty}\left(1+\frac{a}{x}+\frac{b}{x^2}\right)^{2x} = e^2$, then the value of $a$ and $b$ are
(A) $a \in R, b = 2$ (B) $a = 1, b \in R$
(C) $a \in R, b \in R$ (D) $a = 1, b = 2$

**18**. If $f(x) = sin^5x + sin^3x$ and $g(x) = cos^5x + sin^3x$, then the value of $\int_0^{\frac{\pi}{2}}[f(x) + f(-x)][g(x) + g(-x)]dx$ is
(A) 0 (B) $> 1$
(C) 0 and 1 (D) less than 0

**19**. $\frac{d^2x}{dy^2}$ equals
(A) $\left(\frac{d^2y}{dx^2}\right)^{-1}$ (B) $-\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-3}$
(C) $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-2}$ (D) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

**20**. Differential coefficient of $\log_{10} x$ w.r.to $\log_x 10$ is
(A) $-\frac{(\log x)^2}{(\log 10)^2}$ (B) $\frac{(\log_{10} x)^2}{(\log 10)^2}$
(C) $\frac{(\log_x 10)^2}{(\log 10)^2}$ (D) $-\frac{(\log 10)^2}{(\log x)^2}$

**21**. $f(x) = x + |x|$ is continuous for
(A) $x \in (-\infty, \infty)$ (B) $x \in (-\infty, \infty) - \{0\}$
(C) Only $x > 0$ (D) No value of $x$

**22**. If $a, b$ and $c$ are unit vectors, then $|a-b|^2 + |b-c|^2 + |c-a|^2$ does not exceed
(A) 4 (B) 9
(C) 8 (D) 6

**23**. The vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of the vectors $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{j} + \hat{k}$ and bisects the angle between $\vec{b}$ and $\vec{c}$. Then, which one of the following gives possible values of $\alpha$ and $\beta$?
(A) $\alpha = 2, \beta = 2$ (B) $\alpha = 1, \beta = 2$
(C) $\alpha = 2, \beta = 1$ (D) $\alpha = 1, \beta = 1$

**24**. Forces $4\hat{i} - 3\hat{j} + 7\hat{k}$ and $-2\hat{i} + 2\hat{j} - 8\hat{k}$ are acting on a particle and displace it from the point $(5, 7, 1)$ to $(2, 5, -6)$, then the work done by the force is
(A) 25 (B) 9
(C) 15 (D) 7

25. A bird is flying in a straight line with velocity vector $10\hat{i} + 6\hat{j} + \hat{k}$, measured in km/h. If starting points is $(1, 2, 3)$, how much time does it take to reach a point in space that is 13 m high from ground?
(A) 600 seconds (B) 360 seconds
(C) 36 seconds (D) 60 seconds

**26**. If $A$ and $B$ are two events and $P(A \cup B) = \frac{5}{6}, P(A \cap B) = \frac{1}{3}, P(B) = 1/2$, then $A$ and $B$ are two events which are
(A) Dependent (B) Independent
(C) Mutually exclusive (DD) Equally likely

**27**. If $\alpha_1, \alpha_2, \alpha_3, .., \alpha_n$ are positive real numbers whose product is a fixed number $C$, then the minimum value of $\alpha_1 + \alpha_2 + \cdots + 2\alpha_n$ is
(A) $n(2C)^{1/n}$ (B) $(n+1)C^{1/n}$
(C) $2nC^{1/n}$ (D) $(n+1)(2C)^{1/n}$

**28**. If $a, b, c$ are the roots of the equation $x^3 - 3x^2 + 3x + 7 = 0$, then the value of

$\begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix}$ is

(A) 9 (B) 27

(C) 81 (D) 0

**29**. The coefficient of $x^n$ in the expansion of $(1-2x+3x^2-4x^3+\cdots \text{ to } \infty)^{-n}$ is

(A) $\frac{(2n)!}{n!\,(n-1)!}$ (B) $\frac{(2n)!}{[(n-1)!]^2}$

(C) $\frac{(2n)!}{(n!)^2}$ (D) None of these

**30**. Let $\alpha, \beta$ be the roots of the equation $x^2-px+r=0$ and $\frac{\alpha}{2}, 2\beta$ be the roots of the equation $x^2-qx+r=0$. Then, the value of $r$ is

(A) $\frac{2}{9}(p-q)(2q-p)$ (B) $\frac{2}{9}(q-p)(2q-p)$

(C) $\frac{2}{9}(q-2p)(2q-p)$ (D) $\frac{2}{9}(2p-q)(2q-p)$

**31**. The value of $\cot\left(cosec^{-1}\frac{5}{3}+tan^{-1}\frac{2}{3}\right)$ is

(A) 6/17 (B) 3/17

(C) 4/17 (D) 5/17

**32**. If $\sin\theta = 3\sin(\theta+2\alpha)$, then the value of $\tan(\theta+\alpha)+2\tan\alpha$ is

(A) 3 (B) 2

(C) $-1$ (D) 0

**33**. In a $\Delta ABC, \angle A = 90°$ and $D$ is mid-point of $AC$. The value of $BC^2-BD^2$ is equal to

(A) $AD^2$ (B) $2AD^2$

(C) $3\,AD^2$ (D) $4\,AD^2$

**34**. Through any point $(x,y)$ of a curve which passes through the origin, lines are drawn parallel to the coordinate axes. The curve given that divides the rectangle formed by the two lines and the axes into two areas, one of the which is twice the other represents a family of

(A) circles (B) parabolas

(C) hyperbolas (D) straight lines

**35**. A line through $(4,2)$ meets the coordinate axes at $P$ and $Q$. Then the locus of the circumcentre of $\Delta OPQ$ is

(A) $\frac{1}{x}+\frac{1}{y}=2$ (B) $\frac{2}{x}+\frac{1}{y}=1$

(C) $\frac{1}{x}+\frac{2}{y}=1$ (D) $\frac{1}{x}+\frac{1}{y}=\frac{1}{2}$

**36**. $6+\log_{\frac{1}{4}}\frac{1}{\sqrt{2}}\left[\sqrt{1-\frac{1}{\sqrt{2}}\sqrt{1-\frac{1}{\sqrt{2}}\sqrt{1-\frac{1}{\sqrt{2}}\ldots}}}\right] =$

(A) 6 (B) $\frac{13}{2}$

(C) 4 (D) $\frac{25}{4}$

**37**. The function $f(x)=\log\left(x+\sqrt{x^2+1}\right)$ is

(A) an even function

(B) an odd function

(C) a periodic function

(D) Neither an even nor an odd function

**38**. Two persons $A$ and $B$ agree to meet on 20th April 2018 between 6 P.M. and 7 P.M. with the understanding that they will wait no longer than 20 minutes for the other. What is the probability that they meet?

(A) 5/9 (B) 7/9

(C) 2/9 (D) 4/9

**39**. Three numbers $a, b$ and $c$ are chosen at random (without replacement) from among the numbers 1, 2, 3, ..., 99. The probability that $a^3+b^3+c^3-3abc$ is divisible by 3 is

(A) $\frac{3.{}^{33}C_3+({}^{33}C_1)^3}{{}^{99}C_3}$ (B) $\frac{3.{}^{33}C_3-({}^{33}C_1)^3}{{}^{99}C_3}$

(C) $\frac{2.{}^{33}C_3+({}^{33}C_1)^3}{{}^{99}C_3}$ (D) $\frac{2.{}^{33}C_3-({}^{33}C_1)^3}{{}^{99}C_3}$

**40**. $A$ and $B$ play a game where each is asked to select a number from 1 to 25. If the two numbers match, both of them win a prize. The probability that they will not win a prize in a single trial is

(A) $\frac{1}{25}$ (B) $\frac{24}{25}$

(C) $\frac{2}{25}$ (D) None of these

**41**. The quadratic equation whose roots are $\sin^2 18°$ and $\cos^2 36°$ is

(A) $16x^2 - 12x + 1 = 0$ (B) $16x^2 + 12x + 1 = 0$
(C) $16x^2 - 12x - 1 = 0$ (D) $16x^2 + 10x + 1 = 0$

**42**. Sum to infinity of a geometric progression is twice the sum of the first two terms. Then, what are the possible values of the common ratio?
(A) $\pm\frac{1}{\sqrt{2}}$ (B) $\pm\frac{1}{2}$
(C) $\pm\frac{1}{\sqrt{3}}$ (D) $\pm\frac{1}{3}$

**43**. Suppose that $m$ and $n$ are fixed numbers such that the $m^{th}$ term $a_m$ is equal to $n$ and the $n^{th}$ term $a_n$ is equal to $m(m \neq n)$, then the $(m+n)^{th}$ term is
(A) $(m+n)/mn$ (B) $mn/(m+n)$
(C) $(m+n)/n$ (D) $(m+n)/m$

**44**. If $A$ is an invertible skew symmetric matrix, then $A^{-1}$ is a
(A) symmetric matrix (B) skew-symmetric matrix
(C) zero matrix (D) identity matrix

**45**. If the mean of the squares of first $n$ natural numbers be 11, then $n$ is equal to
(A) $\frac{-13}{2}$ (B) 11
(C) 5 (D) 4

**46**. The set of points, where $f(x) = \frac{x}{1+|x|}$ is differentiable is
(A) $(-\infty,-1) \cup (-1,-\infty)$ (B) $(-\infty,\infty)$
(C) $(0,\infty)$ (D) $(-\infty,0) \cup (0,\infty)$

**47**. $\int_0^{\pi} x\, f(\sin x)\, dx$ is equal to
(A) $\pi \int_0^{\pi} f(\sin x)dx$ (B) $\frac{\pi}{2}\int_0^{\pi} f(\sin x)dx$
(C) $\pi \int_0^{\pi/2} f(\cos x)dx$ (D) $\pi \int_0^{\pi} f(\cos x)dx$

**48**. Let $f: R \to R$ be defined by $f(x) = \begin{cases} x+2, & if\ x < 0 \\ |x-2|, & if\ x \geq 0 \end{cases}$. Find $\int_{-2}^{3} f(x)dx$.
(A) 0.5 (B) 2.5
(C) 4.5 (D) 6.5

**49**. Slope of two lines $6x^2 - 2xy - 2y^2 = 0$ differ by
(A) $\frac{5}{2}$ (B) $\frac{7}{2}$
(C) $\frac{7}{5}$ (D) $-1$

**50**. If the radius of a circle changes at the rate of $\frac{-2}{\pi}$ m/s at what rate does the circle's area change when the radius is 10 m?
(A) $40\ m^2/s$ (B) $30\ m^2/s$
(C) $-30\ m^2/s$ (D) $-40\ m^2/s$

## Reasoning/Aptitude:

**51**. Decide which of the assumptions is implicit in the statement and choose your answer accordingly.
**Statement**
"Buy pure and natural honey of company X."-
An advertisement in a newspaper.
**Assumptions.** I. Artificial honey can be prepared.
II. People do not mind paying more for pure. and natural honey.
III. No other company supplies pure honey.
(A) Only I is implicit (B) I and II are implicit
(C) I and III are implicit (D) All are implicit

**52**. Choose the conclusion which logically follows from the given statement(s).
**Statement**
All scientists working in America are talented.
Some Indian scientists are working in America.
**Conclusions**
1. None of Indian scientists is talented.
2. Some talented Indian scientists have migrated to America.
3. All talented scientists are Indians.
4. Some Indian scientists are talented.
The conclusion(s) correctly drawn is/are

(A) 1 only (B) 2 only
(C) 2 and 3 (D) 2 and 4

**53**. One New York publisher has estimated that 50,000 to 60,000 people in the United States want an anthology that includes the complete works of William Shakespeare. And what accounts for these renewed psychological insights into both male and female characters are amazing even today.
This paragraph best supports the statement that
(A) Shakespeare's characters are more interesting than fictional characters today
(B) People even today are interested in Shakespeare's work because of the characters
(C) Academic scholars are putting together an anthology of Shakespeare's work
(D) New Yorkers have a renewed interested in the work of Shakespeare

**54**. A runs $1\frac{2}{3}$ times as fast as B. If A gives B start of 80m, how far must the winning post be so that A and B might reach it at the same time?
(A) 200 m (B) 400 m
(C) 300 m (D) 160 m

**55**. Two men and three boys can do piece of work in ten days; while three men and two boys can do the same work in eight days. In how many days can two men and one boy do the work?
(A) 12.5 (B) 9
(C) 9.5 (D) 8.5

**56**. How many numbers between 1 and 1000 are divisible by all 2, 3, 4, 5 and 6?
(A) 16 (B) 32
(C) 17 (D) 33

**57**. There are 8436 steel balls, each with a radius of 1 cm, stacked in a pile, with 1 ball on top, 3 balls in the second layer, 6 in the third layer, 10 in the fourth and so on. The number of horizontal layers in the pile is
(A) 34 (B) 38
(C) 36 (D) 32

**58**. A body travels from A to B in 10 s with a speed of 50 km/h and returns with a speed of 100 km/h in 5 s. The average speed and the average velocity for the whole journey is
(A) 17.5 $ms^{-1}$, 0 km/h (B) 16.5 $ms^{-1}$, 0 km/h
(C) 15.5 $ms^{-1}$, 0 km/h (D) 18.5 $ms^{-1}$, 0 km/h

**59**. Find the odd one out.
(A) DEHG (B) RSVU
(C) JKNM (D) LMQP

**60**. Find out the wrong number in the following series.
15, 16, 34, 105, 424, 2124, 12756
(A) 16 (B) 34
(C) 424 (D) 2124

**61**. My mother is twice as old as my brother. I am five years younger to my brother but three years older to my sister. If my sister is twelve years of age, how old is my mother?
(A) 24 (B) 30
(C) 40 (D) 50

**62**. Find the missing term in the series.
3, 20, 63, 144, 275, ____.
(A) 354 (B) 468
(C) 548 (D) 554

**Directions (Q. Nos. 63 to 65)** Questions are based on the following passage:
Nine individuals Z, Y, X, W, V, U, T, S and R are the only candidates who can serve on three committees A, B and C and each candidate should serve on exactly one of the committees.
Committee A should consist of exactly one member more than committee B. It is possible that there are no members of committee C. Among Z, Y and X none can serve on Committee A. Among W, V and U none can serve on Committee B. Among T, S and R none can serve on Committee C.

**63**. In case T and Z are the individuals serving on Committee B, how many of the nine individuals should

serve on Committee C?
(A) 3 (B) 4
(C) 5 (D) 6

**64**. In case, T, S and X are the only individuals serving on committee B, the membership of Committee C should be
(A) Z and Y (B) Z and W
(C) Y and V (D) X and V

**65**. In case R is only individual serving on Committee B, which among the following should serve on Committee A?
(A) W and S (B) V and T
(C) U and S (D) T and S

**66**. In a city, 40% of the adults are illiterate while 85% of the children are literate. If the ratio of the adults to that of the children is 2 : 3, then what percent of the population is literate?
(A) 20% (B) 25%
(C) 50% (D) 75%

**67**. There are 50 students admitted to a nursery class. Some students can speak only English and some can speak only Hindi. 10 students can speak both English and Hindi. If the number of students who can speak English is 21, then how many students can speak Hindi, how many can speak only Hindi, and how many can speak only English?
(A) 21, 11 and 29 respectively
(B) 28, 18 and 22 respectively
(C) 37, 27 and 13 respectively
(D) 39, 29 and 11 respectively

**68**. The last digit of the number obtained by multiplying the numbers
$81 \times 82 \times 83 \times 84 \times 85 \times 86 \times 87 \times 88 \times 89$ will be
(A) 0 (B) 9
(C) 7 (D) 2

**69**. If has been reported in recent years that a very large number of seats in the engineering colleges in the country remain vacant at the end of the admission session.
Which of the following may be the probable cause of the above effect?
(A) There has been a considerable decrease in hiring of engineering graduates due to economic slowdown in the recent years
(B) Students have always preferred to complete graduation in three years time instead of four years for engineering
(C) The government has recently decided to provide post qualification professional training to all engineering graduates at its own cost
(D) None of the above

**70**. At what time, in minutes, between 3 O'clock and 4 O'clock, both the needles will coincide each other?
(A) $5\frac{1''}{11}$ (B) $12\frac{4''}{11}$
(C) $13\frac{4''}{11}$ (D) $16\frac{4''}{11}$

**71**. If $\log_3 2, \log_3(2^x - 5), \log_3\left(2^x - \frac{7}{2}\right)$ are in arithmetic progression, then the value of $x$ is equal to
(A) 5 (B) 4
(C) 3 (D) 2

**72**. Let $n$ be the number of different 5 digit numbers, divisible by 4 that can be formed with the digits 1, 2, 3, 4, 5 and 6, with no digit being repeated. What is the value of $n$?
(A) 144 (B) 168
(C) 192 (D) 222

**73**. Let S be the set of integers X such that
i. $100 \leq x \leq 200$
ii. $x$ is odd and
iii. $x$ is divisible by 3 but not by 7
How many elements does S contain?
(A) 16 (B) 12
(C) 11 (D) 13

**74**. Two pipes A and B can fill a cistern in 37.5 min and 45 min, respectively. Both pipes are opened. The cistern

will be filled in just half an hour, if the pipe B is turned off after

(A) 5 min (B) 9 min
(C) 10 min (D) 15 min

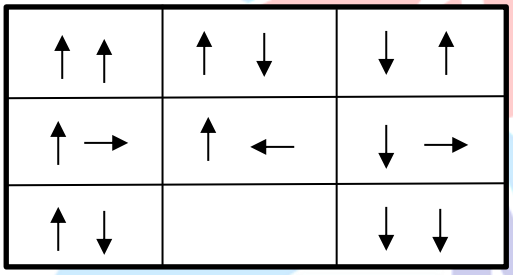
**75**. Three persons A, B and C wear shirts of Black, Blue and Orange colours (not necessarily in that order) and pants of Green, Yellow and Orange (not necessarily in that order). No person wore shirt and pant of the same colour. Further, it is given that,

1. A did not wear shirt of Black colour.
2. B did not wear shirt of Blue colour.
3. C did not wear shirt of Orange colour.
4. A did not wear the pant of Green colour.
5. B wore pant of Orange colour.

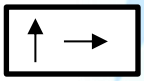
What were the colours of the pant and shirt worn by C respectively?

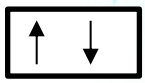
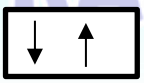
(A) Orange and Black (B) Green and Blue
(C) Yellow and Blue (D) Yellow and Black

**76**.

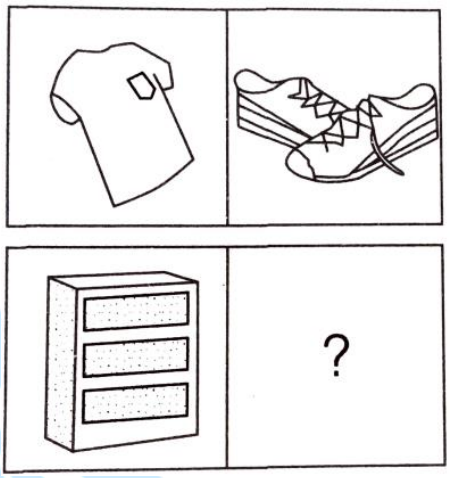


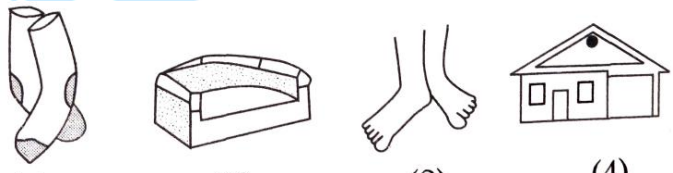
Which one of the following figures fits into blank part of the above matrix?

(A)  (B) 

(C)  (D) 

**77**. Choose the picture that would go in the empty box so that the two bottom pictures are related in the same ways as the top two are related.



(1) (2) (3) (4)

(A) 1 (B) 2
(C) 3 (D) 4

**78**. Decide which of the given conclusions logically follow from the given statement(s).

**Statements**

Some codes are secrets.
All secrets are puzzles.

**Conclusions**

I. All secrets being codes is a possibility.
II. Atleast some puzzles are codes.

(A) Only conclusion I is true.
(B) Only conclusion II is true.
(C) Either conclusion I or II is true.
(D) Both conclusions I and II are true.

**79**. Decide which of the given conclusions logically follow from the given statement(s).

**Statements**

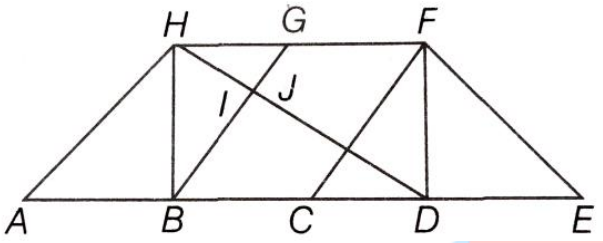
Some metals are alloys.
No metal is a stone.

**Conclusions**

I. No alloy is stone.
II. Atleast some alloys are metals.

(A) Neither conclusion I nor II true.
(B) Only conclusion II is true.
(C) Only conclusion I is true.
(D) Both conclusions I and II are true.

**80**. Find the number of triangles in the given picture.




(A) 10 (B) 12
(C) 14 (D) 16

**81**. Decide which of the given conclusions logically follows from the given statement(s).
**Statements**
All mangoes are golden in colour.
No golden coloured things are cheap.
**Conclusions**
(I) All mangoes are cheap.
(II) Golden-coloured mangoes are not cheap.
(A) Only conclusion I follows
(B) Only conclusion II follows
(C) Either I or II follows
(D) Neither I nor II follows

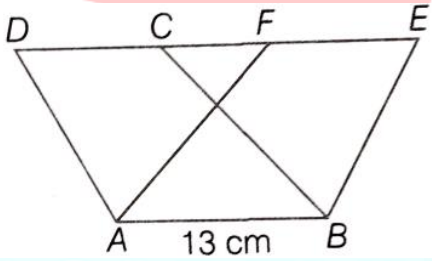
**82**. By selling an article, what is the profit percent gained?
I. 5% discount is given on list price.
II. If discount is not given, 20% profit is gained.
III. The cost price of the articles is Rs. 5,000.
(A) I and II (B) II and III
(C) I and III (D) All of I, II and III

**83**. Decide which of the given conclusions logically follows from the given statement(s).
**Statements**
All politicians are honest.
All honest are fair.
**Conclusions**
(I) Some honest are politicians.
(II) No honest is politicians.
(III) Some fairs are politicians.
(IV) All fair are politicians.
(A) None follows (B) I and IV follow
(C) I and II follow (D) I and III follow

**84**. Forty students watched films A, B and C over a week. Each student watched either only one film or all three. Thirteen students watched film A, sixteen students watched film B and nineteen students watched film C. How many students watched all three films?
(A) 0 (B) 2
(C) 4 (D) 8

**85**. Two bus tickets from city A to B and three tickets from city A to C cost Rs. 77, but three tickets from city A to B and two tickets from city A to C cost Rs. 73. What are the fares for cities B and C from A?
(A) Rs. 4, Rs. 23 (B) Rs. 13, Rs. 17
(C) Rs. 15, Rs. 14 (D) Rs. 17, Rs. 13

**86**. In the figure given below, if the area of parallelogram ABCD is 208 $cm^2$, what is the height of the parallelogram ABEF?




(A) 15 cm (B) 15.5 cm
(C) 16 cm (D) 16.5 cm

**87**. If the first and the third letters in the group DISTRIBUTION are interchanged and also the second and fourth letter, the fifth and the seventh and so on, then which of the following would be the seventh letter from the left?
(A) U (B) R
(C) B (D) T

**88**. In the below series, you will be looking at the letter pattern, diagram pattern or number pattern. Fill in the blank in the end of the series.
JAK, KBL, LCM, MDN, _____.
(A) OEP (B) NEO
(C) MEN (D) PFQ

**89**. A caterpillar crawls up a pole of 75 inches high, starting from the ground. Each day, it crawls up 5 inches and each night it slides down 4 inches. When will it reach the top of the pole?
(A) End of 70 days (B) End of 71 days
(C) End of 72 days (D) End of 73 days

**90**. The time on the watch is quarter to three. If the minute hand points of North-East, in which direction does the hour hand point?
(A) North-West (B) South-West
(C) South-East (D) North-East

# Computer:

**91**.What is the minimal form of Karnaugh map shown below? (Assume that x denotes a don't care term)

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | X | X | 1 |
| 01 | X | | | 1 |
| 11 | | | | |
| 10 | 1 | | | X |

(A) $\bar{b}\bar{d}$ (B) $\bar{b}\bar{d} + \bar{b}\bar{c}$
(C) $\bar{b}\bar{d} + \bar{a}\bar{d}\bar{c}\bar{d}$ (D) $\bar{b}\bar{d} + \bar{b}\bar{c} + \bar{c}\bar{d}$

**92**. In order to store floating numbers in computers using the normalized representation and 32-bit single precision, the number of bits used for exponent and fraction are ____, ____ respectively.
(A) 11, 21 (B) 16, 15
(C) 16, 16 (D) 8, 23

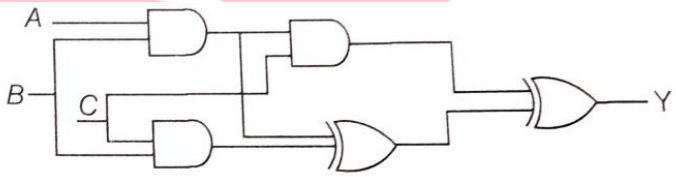
**93**. Let the memory access time is 10 milliseconds and cache access time is 10 microseconds. Assume the cache hit ratio 15%. The effective memory access time is
(A) 2 milliseconds (B) 1.5 milliseconds
(C) 1.85 microseconds (D) 1.85 milliseconds

**94**. What are the values of $R_1$ and $R_2$ respectively in the expression $(235)_{R_1} = (565)_{10} = (1065)_{R_2}$
(A) 8, 16 (B) 16, 8
(C) 8, 12 (D) 16,12

**95**. If a signal passing through a gate is inhibited by sending a low into one of the inputs and the output is high, the gate is
(A) NOR (B) NAND
(C) AND (D) OR

**96**. Given, $\sqrt{(224)_r} = (13)_r$, the value of the radix is
(A) 10 (B) 8
(C) 5 (D) 6

**97**. The output of the combinational circuit given below is




(A) A + B + C (B) A (B + C)
(C) B (C + A) (D) C (A + B)

**98**. Which one of the following expressions does NOT represent exclusive NOR of x and y?
(A) $xy + \bar{x}\bar{y}$ (B) $x \oplus \bar{y}$
(C) $\bar{x} \oplus y$ (D) $\bar{x} \oplus \bar{y}$

**99**. What type of errors are not detected by assemblers?
(A) Syntax error (B) Run time error
(C) Logical error (D) All of these

**100**. Consider the equation $(43)_x = (y3)_8$, where x and y are unknown. The number of possible solutions is

(A) 4 (B) 5
(C) 6 (D) 7

# English:

**101**. Find the synonym that is most nearly similar in meaning to the word: DEBACLE.

(A) Catastrophe (B) Dandy
(C) Corker (D) Opulence

**102**. Choose the phrasal verb the means "to spend time doing unimportant things-instead of doing necessary things".

(A) fake out (B) faff about
(C) fade out (D) fall apart

**103**. Which of the following is close to the meaning of the word, IMPOLITIC?

(A) Impolite (B) Intolerant
(C) Incongruous (D) Injudicious

**104**. Choose an option to replace the phrase given in bold. The bank has hired a consultant who **will look into** any issue which arise during the merger.

(A) is looking over (B) will be looked over
(C) will look out (D) no correction required

**105**. The sentence given below when properly sequenced, form a coherent paragraph. Each sentence is labelled with a letter. Choose the most logical order of sentences from the given choice to construct a coherent paragraph.

P : It refers to those times when there is no war or fight among nations
Q : Many people argue that war is a necessary evil and the only process of solving International disputes.
R : Peace means complete freedom from disturbance.
S : Once the world starts believing that wars are unnecessary, they decide to abolish war completely.
T : But in reality, war happens only because people are not ready to settle disputes in a peaceful manner.

(A) TSRQP (B) RTQPS
(C) SPTQR (D) QTRPS

**Directions (Q. Nos. 106 to 108)** The following passage and answer the questions based on it.

I do not wish to cast aspersions on the corporate takeover. On the contrary, it is a key facilitator of creative destruction and doubtless the most effective remaining means by which shareholder voices can mold a corporation. But while change in management is often necessary, you cannot effectively run a corporation with differing authoritative voices espousing corporate goals. It has to be one or the other. If the board is riven with conflicting interests, corporate governance will suffer. If directors cannot agree with the CEO's strategy, they should replace him. Corporate dissonance, of course, is unavoidable in periods of transition. But is not a value to be pursued for its own sake. A cacophony produces only red ink.

**106**. What according to the author facilities creative destruction?

(A) Corporatism (B) Modernism
(C) Terrorism (D) Cosmopolitanism

**107**. Which of the following words used in the passage reinforces the idea contained in the word, 'DISSONANCE'?

(A) Aspersions (B) Cacophony
(C) Strategy (D) Transition

**108**. What according to the author makes corporate governance suffer?

(A) Conflicting strategies of executives
(B) Conflicting interests of customers
(C) Conflicting interests of statemen
(D) Conflicting interests of the Board of Directors

**109**. Fill in the blank choosing the correct word.
The vote will have to be laid ..... Until next week.
(A) on (B) in
(C) over (D) from

**110**. Fill in the blank choosing the correct question tag.
He has done his duty, ..... .
(A) Shouldn't he? (B) Hasn't he?
(C) Won't he? (D) Has he?

**111**. Choose one of the options that is most nearly same as meaning of the word Epitome.
(A) Final verdict (B) Climax
(C) Essence (D) Tombstone

**112**. Which collocation goes with the word AWARE?
(A) rightly (B) fully
(C) nearly (D) exactly

**113**. Change the speech: "If you don't keep quite, I shall shoot you", he said to her in a calm voice.
(A) He warned her to shoot if she didn't keep quite calmly
(B) He and calmly that I shall shoot you if you don't be quite
(C) He warned her calmly that he would shoot her if she didn't keep quite
(D) Calmly he warned her that be quite or else he will have to shoot her

**114**. Choose the correct spelling for the word given below:
(A) Cieling (B) Cealing
(C) Ceiling (D) Ceeling

**115**. Select the pair of words, which are related in the same way as the capitalized words are related to each other. **BUTTERFLY: FREEDOM**
(A) Frog : Tadpole (B) Self-reliant : Buoyant
(C) Alga : Lichens (D) Chicken : Rooster

**116**. Which of the following is the closest in meaning to the word, CLOWN?
(A) Idiot (B) Dunce
(C) Don (D) Jester

**117**. Identify the underlined part which has an error. He <u>couldn't cope up</u> the hot <u>climate</u> of the place <u>any longer</u>
(A) couldn't (B) cope up
(C) climate (D) any longer

**118**. The ..... pittance the widow receives from the government cannot keep her from poverty.
(A) Meagre (B) Indulgent
(C) Meticulous (D) Magnanimous

**119**. The other boys or Henry ..... to blame.
(A) is (B) are
(C) were (D) will

**120**. In the question, the word 'Echo' is usual in four different ways, numbered A to D.
Choose the option in which the usage of the word is inappropriate
(A) The crowd cheered to the echo in the football match
(B) I started to feel nostalgic as I stood in the old neighbourhood that echoed with my children
(C) A loud thunder echo hit the tallest building
(D) My thoughts echoed with the sounds of spring

# ACME ACADEMY

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## Answer Key

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

# Solution

## Mathematics

**1.** *(a)* We have,

$$x^2 + y^2 + 10x - 12y + 51 = 0 \text{ and } 3y + x = 3$$

To find the intersection point of circle, put $x = 3 - 3y$ in equation of circle, we have

$$(3 - 3y)^2 + y^2 + 10(3 - 3y) - 12y + 51 = 0$$
$$\Rightarrow \quad 9 + 9y^2 - 18y + y^2 + 30 - 30y - 12y + 51 = 0$$
$$\Rightarrow \quad 10y^2 - 60y + 90 = 0$$
$$\Rightarrow \quad y^2 - 6y + 9 = 0$$
$$\Rightarrow \quad (y - 3)^2 = 0$$
$$\Rightarrow \quad y = 3$$
$$\therefore \quad x = 3 - 3y = 3 - 3 \times 3 = -6$$

$\therefore$ Intersection point is $(-6, 3)$,

**2.** *(b)* We have,

$$\sin x + \sin 5x = \sin 3x$$
$$\Rightarrow \quad 2\sin\left(\frac{x + 5x}{2}\right)\cos\left(\frac{x - 5x}{2}\right) = \sin 3x$$

$[\because \cos(-x) = \cos n]$

$$\Rightarrow \quad 2\sin 3x \cos 2x = \sin 3x$$
$$\Rightarrow \quad 2\sin 3x \cos 2x - \sin 3x = 0$$
$$\Rightarrow \quad \sin 3x(2\cos 2x - 1) = 0$$
$$\Rightarrow \quad \sin 3x = 0 \text{ or } \cos 2x = \frac{1}{2}$$
$$\Rightarrow \quad 3x = 0, \pi, 2\pi, 3\pi \text{ or } 2x = \frac{\pi}{3}; \frac{5\pi}{3}$$
$$\Rightarrow \quad x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \frac{\pi}{6}, \frac{5\pi}{6}$$

$\therefore$ Number of solution is 6.

**3.** *(a)* Generally, maximum or minimum values of triangles occurs when all the angles of triangle are equal.

$$\therefore \quad A = B = C = \frac{\pi}{3}$$

$\therefore$ Minimum value of $\sec A + \sec B + \sec C$

$$= \sec\frac{\pi}{3} + \sec\frac{\pi}{3} + \sec\frac{\pi}{3} = 2 + 2 + 2 = 6$$

**4.** *(d)* We have,

$$P = \{\theta : \sin\theta - \cos\theta = \sqrt{2}\cos\theta\} \text{ and}$$
$$Q = \{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$$

Now,

$$\sin\theta - \cos\theta = \sqrt{2}\cos\theta$$
$$\Rightarrow \quad (\sin\theta - \cos\theta)^2 = 2\cos^2\theta$$
$$\Rightarrow \quad \sin^2\theta + \cos^2\theta - 2\sin\theta\cos\theta = 2\cos^2\theta$$
$$\Rightarrow \quad \sin^2\theta = \cos^2\theta + 2\sin\theta\cos\theta$$
$$\Rightarrow \quad 2\sin^2\theta = \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta$$
$$\Rightarrow \quad 2\sin^2\theta = (\sin\theta + \cos\theta)^2$$
$$\Rightarrow \quad \sqrt{2}\sin\theta = \sin\theta + \cos\theta$$
$$\therefore \quad P = Q \quad \text{[taking positive square root]}$$

**5.** *(a)* Given, $x + y + z = \pi$

$$\tan(x + y + z) = \tan\pi$$
$$\therefore \quad \tan x + \tan y + \tan z = \tan x \tan y \tan z \qquad \ldots(i)$$

Let $\quad \frac{\tan x}{2} = \frac{\tan y}{3} = \frac{\tan z}{5} = K$

$$\Rightarrow \quad \tan x = 2K, \tan y = 3K \text{ and } \tan z = 5K$$

Put these values in Eq. (i), we get

$$\Rightarrow \quad 2K + 3K + 5K = 2K \times 3K \times 5K$$
$$\Rightarrow \quad 10K = 30K^3$$
$$\Rightarrow \quad K^2 = \frac{1}{3}$$

So, $\tan^2 x + \tan^2 y + \tan^2 z$

$$= (2K)^2 + (3K)^2 + (5K)^2$$
$$= 4K^2 + 9K^2 + 25K^2$$
$$= K^2(38)$$
$$= \frac{38}{3} \qquad \left(\because K^2 = \frac{1}{3}\right)$$

**6.** *(c)* Given equation of circle is

$$x^2 + y^2 - 2ax + c^2 = 0 \qquad \ldots(i)$$

On comparing to the standard equation of circle with

$$x^2 + y^2 + 2gx + 2fy + C_1 = 0$$

we get, $\quad g = -a, f = 0, C_1 = c^2$

Here, centre $\quad C_1 = (-g, -f) = (a, 0)$

and radius $\quad (r_1) = \sqrt{g^2 + f^2 - C_1} = \sqrt{a^2 - c^2}$

Equation of another circle is

$$x^2 + y^2 - 2by + c^2 = 0 \qquad \ldots(ii)$$

Here, centre $\quad C_2 = (0, b)$

and radius $\quad (r_2) = \sqrt{b^2 - c^2}$

As we know that, two circles touch each other externally, if

$$C_1C_2 = r_1 + r_2$$
$$\Rightarrow \quad \sqrt{a^2 + b^2} = \sqrt{a^2 - c^2} + \sqrt{b^2 - c^2}$$

Squaring both sides, we get

$$\Rightarrow \quad a^2 + b^2 = a^2 - c^2 + b^2 - c^2 + 2\sqrt{a^2 - c^2}\sqrt{b^2 - c^2}$$
$$\Rightarrow \quad 2c^2 = 2\sqrt{a^2 - c^2}\sqrt{b^2 - c^2}$$
$$\Rightarrow \quad c^2 = \sqrt{a^2 - c^2}\sqrt{b^2 - c^2}$$

Again squaring both sides, we get

$$\Rightarrow \quad c^4 = (a^2 - c^2)(b^2 - c^2)$$
$$\Rightarrow \quad c^4 = a^2b^2 - a^2c^2 - b^2c^2 + c^4$$
$$\Rightarrow \quad a^2c^2 + b^2c^2 = a^2b^2 \qquad \ldots(iii)$$

Divide Eq. (iii) by $a^2b^2c^2$, we get

$$\Rightarrow \quad \frac{1}{b^2} + \frac{1}{a^2} = \frac{1}{c^2} \quad \Rightarrow \quad \frac{1}{c^2} = \frac{1}{a^2} + \frac{1}{b^2}$$

**7.** (*) Given lines

$$(1+p)x - py + p(1+p) = 0 \quad \ldots(i)$$

$$(1+q)(x-q) + q(1+q) = 0 \quad \ldots(ii)$$

and $$y = 0 \quad \ldots(iii)$$

From Eq. (i)

$$py = (1+p)x + p(1+p)$$

$$\Rightarrow \quad py = (1+p)(x+p) \quad \ldots(iv)$$

From Eq. (ii)

$$x - q + q = 0 \quad [\text{divide by } (1+q)]$$

$$\Rightarrow \quad x = 0 \quad \ldots(v)$$

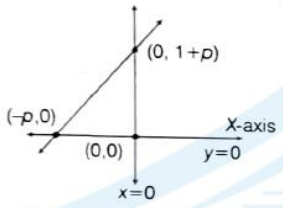
From Eqs. (iv) and (v), we get

$$py = (1+p)(0+p)$$

$$\Rightarrow \quad y = (1+p)$$

So, intersecting point of lines (i) and (ii) is $(0, 1+p)$

Now, intersecting point of lines (i) and (iii), put $y = 0$ in line (i), we get




$$\Rightarrow \quad (1+p)x - 0 + p(1+p) = 0$$

$$\Rightarrow \quad x = -p$$

So, intersecting point $(-p, 0)$.

And intersecting point of lines (ii) and (iii) is (0, 0). So, orthocentre of the triangle formed by given line is (0, 0).

None option is correct.

**Note** Under the consideration of the given condition in question such as in line (ii) only one variable $x$ is used doing solving the question. We get conclusion about the locus of the orthocentre is not match with option. So, we can say question has some conditional error.

**8.** *(b)* Let the equation of line $y = mx + c \quad \ldots(i)$

If Eq. (i) is tangent to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$

$$\therefore \quad c = \pm\sqrt{9m^2 - 4} \quad [\because a = 3,\ b = 2]$$

So, equation of line (i) is

$$y = mx \pm \sqrt{9m^2 - 4} \quad \ldots(ii)$$

It is also tangent to the circle $x^2 + y^2 - 8x = 0$ here, centre $c = (4, 0)$ and radius $(r) = 4$.

$\because$ Perpendicular distance from centre to the tangent = Radius

$$\therefore \quad \frac{|4m \pm \sqrt{9m^2 - 4}|}{\sqrt{1+m^2}} = 4$$

$$(4m \pm \sqrt{9m^2 - 4})^2 = 16(1+m^2) \quad \ldots(iii)$$

[squaring both sides]

By solving Eq. (iii), we get

$$m = \frac{2}{\sqrt{5}}$$

Put the value of $m = \frac{2}{\sqrt{5}}$ in Eq. (i)

$$\therefore \quad y = \frac{2}{\sqrt{5}}x \pm \sqrt{9 \times \frac{4}{5} - 4}$$

$$= \frac{2}{\sqrt{5}}x \pm \sqrt{\frac{16}{5}} = \frac{2x}{\sqrt{5}} \pm \frac{4}{\sqrt{5}}$$

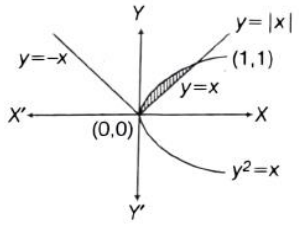
$$\Rightarrow \quad \sqrt{5}y = 2x \pm 4$$

$$\Rightarrow \quad 2x \pm 4 - \sqrt{5}y = 0$$

$$\Rightarrow \quad 2x - \sqrt{5}y + 4 = 0$$

**9.** *(c)* We have,

$$y^2 = x \text{ and } y = |x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$




The intersecting point of given curve is given by

$$x^2 = x$$

$$\Rightarrow \quad x^2 - x = 0$$

$$\Rightarrow \quad x(x-1) = 0$$

$$\Rightarrow \quad x = 0, 1$$

$$\Rightarrow \quad y = 0, 1$$

$\therefore$ Point of intersection are (0, 0) and (1, 1).

$$\therefore \text{ Required area} = \int_0^1 (\sqrt{x} - x)dx = \left[\frac{x^{\frac{3}{2}}}{3/2} - \frac{x^2}{2}\right]_0^1$$

$$= \frac{2}{3} - \frac{1}{2} = \frac{1}{6} \text{ sq. unit}$$

**10.** *(d)* Given equation of line is $x - 2y = 1$

$$\therefore \text{ Slope, } \quad m = \frac{-1}{(-2)} = \frac{1}{2}$$

$$\left[\because \text{for a line } Ax + By + C = 0, \text{ Slope} = \frac{-A}{B}\right]$$

Since, required line is perpendicular to the given line,

$$\therefore \text{ Slope of required line} = \frac{-1}{m} = -2$$

$\therefore$ Equation of line passing through (1, 1) and having slope $-2$ is given by

$$y - 1 = -2(x-1)$$

[$\because$ equation of line is $y - y_1 = m(x - x_1)$]

$$\Rightarrow \quad y - 1 = -2x + 2$$

$$\Rightarrow \quad 2x + y = 3$$

$$\Rightarrow \quad y = -2x + 3$$

**11.** *(b)* Given, $A = \begin{bmatrix} 0 & 5 \\ 0 & 0 \end{bmatrix}$

and $$f(x) = 1 + x + x^2 + \ldots + x^{16}$$

$$\therefore \quad f(A) = 1 + A + A^2 + \ldots\ldots + A^{16} \quad [\text{put } x = A]$$

Now, $A^2 = A \cdot A$

$$= \begin{bmatrix} 0 & 5 \\ 0 & 0 \end{bmatrix}\begin{bmatrix} 0 & 5 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 0+0 & 0+0 \\ 0+0 & 0+0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$\therefore \quad A^2 = A^3 = \ldots = A^{10} = 0$

Hence, $f(A) = I + A$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 0 & 5 \\ 0 & 0 \end{bmatrix} \qquad [\because |I| = 1]$$

$$= \begin{bmatrix} 1+0 & 0+5 \\ 0+0 & 1+0 \end{bmatrix} = \begin{bmatrix} 1 & 5 \\ 0 & 1 \end{bmatrix}$$

**12.** *(c)* 


Given that 5 balls cannot fit in small boxes.

So, we have only 4 balls to arrange in 3 small boxes.

Which can be arranged in ${}^4C_3 \times 3!$

Now, we have (6) balls left, which can be arranged in 6! ways.

Hence, the total number of ways

$${}^4C_3 \times 3! \times 6! = 4 \times 6 \times 720 = 17280$$

**13.** *(a)* As we know that any function will be inverse of itself it $f(f(x)) = x$.

By taking option (a) $f(x) = \dfrac{1-x}{1+x}$

Then, $$f(f(x)) = f\left[\frac{1-x}{1+x}\right]$$

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

$\Rightarrow \quad f(f(x)) = x$

**14.** *(b)* Given that,

Student council has total numbers = 10

To select one President, one Vice-President, one Secretary, one Joint-Secretary and two Executive Committee members from 10 members.

Firstly, we have to select 6 members from 10 members.

Which can be done in total number of ways $= {}^{10}C_6$

But there are two Executive (repetition) members.

$\therefore$ That number of ways will be $= \dfrac{6!}{2!}$

Hence, total number of ways in which we can appoint three members $= {}^{10}C_6 \times \dfrac{6!}{2!}$

$$= \frac{10!}{4!6!} \times \frac{6!}{2!} \qquad \left[\because {}^nC_r = \frac{n!}{(n-r)!r!}\right]$$

$$= \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5}{2} = 10 \times 9 \times 8 \times 7 \times 5 \times 3 = 75600$$

**15.** *(b)* Let $M$, $B$ and $L$ be the set of students studying Mathematics, Business and Literature, respectively.

$\therefore \quad n(M) = 32,\ n(B) = 38,\ n(L) = 30$

$n(M \cap L) = 7,\ n(M \cap B) = 10,\ n(B \cap L) = 8$ and $n(M \cap B \cap L) = 5$

Hence, total number of students studying exactly one subject $= n(M) + n(B) + n(L) - 2\{n(M \cap B) + n(B \cap L) + n(M \cap L)\} + 3n(M \cap B \cap L)$

$$= 32 + 38 + 30 - 2(7 + 10 + 8) + 3(5)$$

$$= 100 - 50 + 15 = 65$$

**16.** *(c)* According to question, following cases arrises nine digit number (less than $2 \times 10^8$) having only digits 1 and $2 = 2^8$

Eight digit number (less than $2 \times 10^8$) having only digits 1 and $2 = 2^8$

Similarly, Seven digit numbers $= 2^7$

Six digit numbers $= 2^6$, Five digit numbers $= 2^5$,

Four digit numbers $= 2^4$, Three digit numbers $= 2^3$,

Two digit numbers $= 2^2$ and One digit numbers $= 2$

So, number of all such natural numbers

$$= 2 + 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + 2^8 + 2^8$$

$$= 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 + 256 = 766$$

**17.** *(b)* Given that, $\lim\limits_{x \to \infty}\left(1 + \dfrac{a}{x} + \dfrac{b}{x^2}\right)^{2x} = e^2$

LHS is the form of $1^\infty$, therefore $\lim\limits_{x \to \infty}\left(1 + \dfrac{1}{x}\right)^x = \lim\limits_{x \to \infty} f(x)$

Thus, $$\lim_{x \to \infty}\left(\frac{a}{x} + \frac{b}{x^2}\right)^{2x} = e^2 \qquad \text{[using property]}$$

$\Rightarrow \quad \lim\limits_{x \to \infty}\left(2a + \dfrac{2b}{x}\right) = e^2$

$\Rightarrow \quad e^{(2a+0)} = e^2$

On comparing exponent power both sides, we get

$$a = 1,\ b \in R$$

**18.** *(a)* Given, $f(x) = \sin^5 x + \sin^3 x$

and $$f(-x) = \sin^5(-x) + \sin^3(-x)$$

$$= -\sin^5 x - \sin^3 x$$

$$= -(\sin^5 x + \sin^3 x)$$

$\Rightarrow \quad f(-x) = -f(x)$

$\Rightarrow \quad f(-x) + f(x) = f(x) - f(x) = 0$

$\therefore \quad \int_0^{\pi/2}[f(x) + f(-x)][g(x) + g(-x)]dx$

$$= \int_0^{\pi/2} 0 \cdot [g(x) + g(-x)\,dx] = 0$$

**19.** *(d)* Given, $\dfrac{d^2x}{dy^2}$

$\because \quad \dfrac{dx}{dy} = \left(\dfrac{dy}{dx}\right)^{-1}$

Differentiate both sides w.r.t y, we get

$\Rightarrow \quad \dfrac{d}{dy}\left(\dfrac{dx}{dy}\right) = \dfrac{d}{dy}\left\{\left(\dfrac{dy}{dx}\right)^{-1}\right\}$

$\Rightarrow \quad \dfrac{d^2x}{dy^2} = \dfrac{d}{dx}\left\{\left(\dfrac{dy}{dx}\right)^{-1}\right\}\dfrac{dx}{dy}$

$\Rightarrow \quad \dfrac{d^2x}{dy^2} = -\left(\dfrac{dy}{dx}\right)^{-2}\dfrac{d}{dx}\left(\dfrac{dy}{dx}\right)\left(\dfrac{dy}{dx}\right)^{-1}$

$$\Rightarrow \quad \frac{d^2x}{dy^2} = -\left(\frac{dy}{dx}\right)^{-3}\left(\frac{d^2y}{dx^2}\right)$$

**20.** *(a)* Let $u = \log_{10} x$ and $v = \log_x 10$

$$\therefore \quad u = \frac{\log_e x}{\log_e 10},\ v = \frac{\log_e 10}{\log_e x}$$

$$\frac{du}{dx} = \frac{1}{\log_e 10}\cdot\frac{1}{x} \quad \text{[differentiating w.r.t.}x\text{]}$$

and $$\frac{dv}{dx} = \log_e 10 \cdot \frac{1}{(\log_e x)^2}\cdot\frac{1}{x}$$

Now, $$\frac{du}{dv} = \frac{du/dx}{dv/dx} = \frac{\frac{1}{\log_e 10}\cdot\frac{1}{x}}{-\frac{\log_e 10}{(\log_e x)^2}\cdot\frac{1}{x}}$$

$$= -\frac{1}{\log_e 10}\cdot\frac{1}{x}\cdot\frac{x}{\log_e 10}(\log_e x)^2$$

$$= -\frac{(\log x)^2}{(\log 10)^2}$$

**21.** *(a)* Given, $f(x) = x + |x|$

$$= \begin{cases} x+x, & x \geq 0 \\ x-x, & x<0 \end{cases} = \begin{cases} 2x, & x \geq 0 \\ 0, & x<0 \end{cases}$$

Here, we see that $f(x)$ is a polynomial functions, so it is continuous for every value of $x$ except 0.

Now, we have to check the continuity only at $x = 0$.

$$\text{LHL} = \lim_{x\to 0^-} f(x) = \lim_{h\to 0} f(0-h) = 0$$

$$\text{RHL} \lim_{x\to 0^+} f(x) = \lim_{h\to 0} f(0+h) = \lim_{h\to 0} 2(0+h) = 0$$

and $$f(0) = 0$$

$$\therefore \quad \text{LHL} = \text{RHL} = f(0)$$

So, $f(x)$ is continuous at $x = 0$ also.

Hence, $f(x)$ is continuous at $x \in (-\infty, \infty)$.

**22.** *(b)* Given, $|a| = |b| = |c| = 1$

Since, $$|a+b+c| = 0$$

$$0 \leq |a|^2 + |b|^2 + |c|^2 + 2(a\cdot b + b\cdot c + c\cdot a)$$

$$1+1+1+2(a\cdot b + b\cdot c + c\cdot a) > 0$$

$$(a\cdot b + b\cdot c + c\cdot a) > -\frac{3}{2}$$

Now, $$|a-b|^2 + |b-c|^2 + |c-a|^2$$

$$= 2(|a|^2 + |b|^2 + |c|^2) - a\cdot b - b\cdot c - c\cdot a)$$

$$\leq 2(1+1+1) + 3$$

$$\therefore \quad |a-b|^2 + |b-c|^2 + |c-a|^2 \leq 9$$

**23.** *(d)* We have, $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$, $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{j} + \hat{k}$

Now, unit vector along angle bisector of $\vec{b}$ and $\vec{c}$ is

$$\vec{d} = \frac{1}{2}\left(\frac{\vec{b}}{|\vec{b}|} + \frac{\vec{c}}{|\vec{c}|}\right) = \frac{1}{2}\left(\frac{\hat{i}+\hat{j}}{\sqrt{1^2+1^2}} + \frac{\hat{j}+\hat{k}}{\sqrt{1^2+1^2}}\right)$$

$$= \frac{1}{2\sqrt{2}}(\hat{i} + 2\hat{j} + \hat{k})$$

Since, $\vec{a}$ is along $\vec{d}$,

$$\therefore \quad \vec{a} = \lambda\vec{d}$$

$$\Rightarrow \quad \alpha\hat{i} + 2\hat{j} + \beta\hat{k} = \frac{\lambda}{2\sqrt{2}}(\hat{i} + 2\hat{j} + \hat{k})$$

On comparing the coefficient of $i$, $j$ and $k$, we get

$$\lambda = 2\sqrt{2}$$

$$\therefore \quad \alpha = 1 \text{ and } \beta = 1$$

**24.** *(*)* Let $\vec{F}_1 = 4\hat{i} - 3\hat{j} + 7\hat{k}$, $\vec{F}_2 = -2\hat{i} + 2\hat{j} - 8\hat{k}$

$\therefore$ Resultant force $\vec{F}_1 + \vec{F}_2 = (4\hat{i} - 3\hat{j} + 7\hat{k}) + (-2\hat{i} + 2\hat{j} - 8\hat{k})$

$$= 2\hat{i} - \hat{j} - \hat{k}$$

Since, point is displace from $A(5,7,1)$ to $B(2,5,-6)$

$$\therefore \quad \overrightarrow{AB} = (2-5)\hat{i} + (5-7)\hat{j} + (-6-1)\hat{k}$$

$$= -3\hat{i} - 2\hat{j} - 7\hat{k}$$

$\therefore$ Work done $= \vec{F}\cdot\overrightarrow{AB}$

$$= (2\hat{i} - \hat{j} - \hat{k})\cdot(-3\hat{i} - 2\hat{j} - 7\hat{k})$$

$$= -6 + 2 + 7 = 3 \text{ units}$$

No option match.

**25.** *(c)* Here, velocity vector of bird is

$\vec{v} = 10\hat{i} + 6\hat{j} + \hat{k}$ or $|\vec{v}_x| = 10\text{km/h}$

$|\vec{v}_y| = 6\text{km/h}$

$|\vec{v}_z| = 1\text{km/h}$

Initial position vector of the bird

$$\overrightarrow{OA} = \hat{i} + 2\hat{j} + 3\hat{k}$$

When bird reach a point in space that is 13 m high from the ground then final position vector of the bird will be

$$\overrightarrow{OB} = \hat{i} + 2\hat{j} + 13\hat{k}$$

$$\therefore \quad \overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = 10\hat{k}$$

or $$|\overrightarrow{AB}| = 10\text{m}$$

Time taken by bird to cover a distance of 10 m along the vertical is

$$t = \frac{|\overrightarrow{AB}|}{|\vec{V}_z|} = \frac{10}{1\times\frac{5}{18}} = \frac{10\times 18}{5} = 36 \text{ seconds}$$

**26.** *(b)* Given that, $P(A\cup B) = \frac{5}{6}$, $P(A\cap B) = \frac{1}{3}$ and $P(B) = \frac{1}{2}$

$$\because \quad P(A\cup B) = P(A) + P(B) - P(A\cap B)$$

$$\Rightarrow \quad \frac{5}{6} = P(A) + \frac{1}{2} - \frac{1}{3}$$

$$\Rightarrow \quad P(A) = \frac{5}{6} + \frac{1}{3} - \frac{1}{2}$$

$$= \frac{5+2-3}{6}$$

$$\Rightarrow \quad P(A) = \frac{4}{6} = \frac{2}{3}$$

$$\because \quad P(A)\cdot P(B) = \frac{2}{3}\times\frac{1}{2} = \frac{1}{3} = P(A\cap B)$$

$\therefore$ $A$ and $B$ are independent events.

**27.** *(a)* We know that,

$$\text{A.M} \geq \text{G.M}$$

$$\therefore \quad \frac{a_1 + a_2 + \ldots + a_{n-1} + 2a_n}{n} \geq (a_1, a_2, \ldots, 2a_n)^{1/n}$$

$$\Rightarrow \quad \frac{a_1 + a_2 + \ldots + a_{n-1} + 2a_n}{n} \geq (2c)^{1/n} \qquad [\because a_1, a_2, a_3 \ldots a_n = C]$$

$$\Rightarrow \quad a_1 + a_2 + \ldots + a_{n-1} + 2a_n \geq n(2c)^{1/n}$$

**28.** *(d)* Given equation,

$$x^3 - 3x^2 + 3x + 7 = 0$$

$$\left.\begin{array}{c} a+b+c=3 \\ ab+bc+ca=3 \\ abc=-7 \end{array}\right\} \quad \ldots(i)$$

Now,
$$\begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix}$$

$$= \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} \times \begin{vmatrix} -a & c & b \\ -b & a & c \\ -c & b & a \end{vmatrix}$$

$$= \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} \times \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2$$

$$= [a(bc-a^2) + b(ac-b^2) + c(ab-c^2)]$$

$$= [3abc - a^3 - b^3 - c^3]^2 = 0 \qquad \text{[using (i)]}$$

**29.** *(c)* $\because (1 - 2x + 3x^2 - 4x^3 + \ldots \text{to } \infty) = (1+x)^{-2}$

[by Binomial expansion]

$$\therefore \quad (1 - 2x + 3x^2 - 4x^3 + \ldots\ldots \text{to} \infty)^{-n} = (1+x)^{2n}$$

Now, $r^{th}$ term in the expansion of $(1+x)^{2n}$

$$= {}^{2n}C_r (1)^{2n-r} (x)^r$$

For $x^n$, put $r = n$

$\therefore$ Coefficient of $x^n$ is ${}^{2n}C_n$

and
$${}^{2n}C_n = \frac{2n!}{(2n-n)!n!} = \frac{(2n!)}{(n!)^2}$$

**30.** *(d)* Given that, $\alpha, \beta$ are the roots of equation $x^2 - px + r = 0$

$$\therefore \quad \alpha + \beta = -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2} = p \qquad \ldots(i)$$

and
$$\alpha\beta = \frac{\text{constant}}{\text{Coefficient of } x^2} = r$$

Also, $\frac{\alpha}{2}$ and $2\beta$ are roots of equation $x^2 - qx + r = 0$

$$\therefore \quad \frac{\alpha}{2} + 2\beta = -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2} = q$$

$$\Rightarrow \quad \alpha + 4\beta = 2q \qquad \ldots(ii)$$

Now, subtract Eq.(i) from Eq. (ii), we get

$$3\beta = 2q - p$$

$$\Rightarrow \quad \beta = \frac{2q-p}{3}$$

Put the values of $\beta$ in Eq. (i),

$$\Rightarrow \quad \alpha = p - \frac{2q-p}{3} = \frac{3p-2q+p}{3} = \frac{4p-2q}{3}$$

$$= \frac{2}{3}(2p-q)$$

$$\therefore \quad r = \alpha\beta$$

$$\Rightarrow \quad r = \frac{2}{3}(2p-q)\frac{(2q-p)}{3}$$

$$= \frac{2}{9}(2p-q)(2q-p)$$

**31.** *(a)* We have,

$$\cot\left(\text{cosec}^{-1}\frac{5}{3} + \tan^{-1}\frac{2}{3}\right)$$

$$= \cot\left[\tan^{-1}\frac{1}{\sqrt{\left(\frac{5}{3}\right)^2 - 1}} + \tan^{-1}\frac{2}{3}\right]$$

$$\left[\because \text{cosec}^{-1} x = \tan^{-1}\frac{1}{\sqrt{x^2-1}}\right]$$

$$= \cot\left[\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{2}{3}\right]$$

$$= \cot\left(\tan^{-1}\left(\frac{\frac{3}{4}+\frac{2}{3}}{1-\frac{3}{4}\times\frac{2}{3}}\right)\right)$$

$$= \cot\left(\tan^{-1}\frac{17}{6}\right)$$

$$\cot\left(\cot^{-1}\frac{6}{17}\right) = \frac{6}{17} \qquad \left[\because \tan^{-1} x = \cot^{-1}\frac{1}{x}\right]$$

**32.** *(d)* We have,

$$\sin\theta = 3\sin(\theta + 2\alpha)$$

$$\Rightarrow \quad \frac{\sin(\theta+2\alpha)}{\sin\theta} = \frac{1}{3}$$

Apply componendo and dividendo,

$$\Rightarrow \quad \frac{\sin(\theta+2\alpha)+\sin\theta}{\sin(\theta+2\alpha)-\sin\theta} = \frac{1+3}{1-3}$$

$$\Rightarrow \quad \frac{2\sin\left(\frac{\theta+2\alpha+\theta}{2}\right)\cos\left(\frac{\theta+2\alpha-\theta}{2}\right)}{2\cos\left(\frac{\theta+2\alpha+\theta}{2}\right)\sin\left(\frac{\theta+2\alpha-\theta}{2}\right)} = \frac{4}{-2}$$

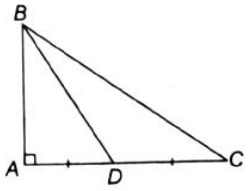
$$\Rightarrow \quad \frac{2\sin(\theta+\alpha)\cos\alpha}{2\cos(\theta+\alpha)\sin\alpha} = -2$$

$$\Rightarrow \quad \frac{\tan(\theta+\alpha)}{\tan\alpha} = -2$$

$$\Rightarrow \quad \tan(\theta+\alpha) = -2\tan\alpha$$

$$\Rightarrow \quad \tan(\theta+\alpha) + 2\tan\alpha = 0$$

**33.** *(c)* Given, $D$ is mid-point of $\Delta ABC$ right angled at $A$.



In $\Delta ABC$,

$$BC^2 = AB^2 + AC^2 \quad \ldots(i)$$

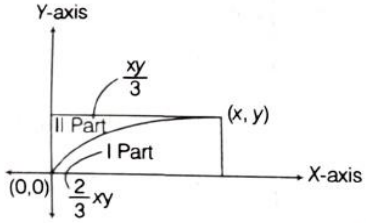
and in $\Delta ABD$

$$BD^2 = AB^2 + AD^2 \quad \ldots(ii)$$

On subtracting Eq. (ii) from Eq. (i), we get

$$\begin{aligned} BC^2 - BD^2 &= AB^2 + AC^2 - AB^2 - AD^2 \\ &= AC^2 - AD^2 \\ &= (2AD)^2 - AD^2 \ [\because AC = 2AD] \\ &= (2AD)^2 - AD^2 \\ &= 4AD^2 - AD^2 = 3AD^2 \end{aligned}$$

**34.** ***(b)***




Area of rectangle = $xy$

Area of first part = 2× Area of IInd part

$$\therefore \quad \int_0^x y\,dx = \frac{2xy}{3}$$

$$\Rightarrow \quad y = \frac{2}{3}\left[y + x\frac{dy}{dx}\right]$$

$$\Rightarrow \quad \frac{y}{3} = \frac{2x}{3}\frac{dy}{dx}$$

$$\Rightarrow \quad y = 2x\frac{dy}{dx}$$

$$\Rightarrow \quad \frac{dx}{x} = \frac{2dy}{y}$$

$$\Rightarrow \quad \log x + \log c = 2\log y$$

$$\Rightarrow \quad \log cx = \log y^2$$

$$\Rightarrow \quad y^2 = cx$$

$\Rightarrow$ Which is a parabola.

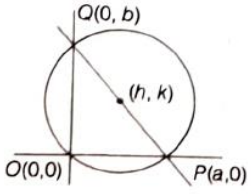
**35.** ***(b)*** Let the equation of line having intercept $a$, $b$, on coordinates axes is

$$\frac{x}{a} + \frac{y}{b} = 1 \quad \ldots(i)$$

$\therefore$ This intercept line meet the coordinate axes at $P(a,0)$ and $Q(0,b)$, respectively.

Since, Eq. (i) passes through (4, 2)

$$\therefore \quad \frac{4}{a} + \frac{2}{b} = 1 \quad \ldots(ii)$$




Since, $(h,k)$ is circumcentre of $\Delta OPQ$. Therefore $(h,k)$ is the mid-point of $PQ$.

$$\therefore \quad h = \frac{0+a}{2} = \frac{a}{2} \text{ and } k = \frac{0+b}{2} = \frac{b}{2} \quad \ldots(iii)$$

$$\Rightarrow \quad a = 2h \text{ and } b = 2k$$

$\therefore$ From Eq. (ii) and Eq. (iii), we get

$$\frac{4}{2h} + \frac{2}{2k} = 1$$

$$\Rightarrow \quad \frac{2}{h} + \frac{1}{k} = 1$$

$\therefore$ Locus of the circumcentre is $\frac{2}{x} + \frac{1}{y} = 1$

**36.** ***(b)*** Given that,

$$6 + \log_{\frac{1}{4}} \frac{1}{\sqrt{2}}\left[\sqrt{1 - \frac{1}{\sqrt{2}}\sqrt{1 - \frac{1}{\sqrt{2}}\sqrt{1 - \frac{1}{\sqrt{2}}}}}\right] \quad \ldots(i)$$

Let $$y = \frac{1}{\sqrt{2}}\sqrt{1 - \frac{1}{\sqrt{2}}\sqrt{1 - \frac{1}{\sqrt{2}}}\ldots} \quad [y > 0]$$

Squaring both sides, we get

$$2y^2 = 1 - y \Rightarrow 2y^2 + y - 1 = 0$$

$$\Rightarrow \quad y = \frac{-1 \pm \sqrt{1+8}}{4}$$

$$\Rightarrow \quad = \frac{-1+3}{4}, \frac{-1-3}{4} = \frac{1}{2}, -1$$

$$\because \quad y > 0 \Rightarrow y = \frac{1}{2}$$

So, putting the value of $y$ in Eq. (i),

$$6 + \log_{\frac{1}{4}} \frac{1}{2} = 6 + \log_{\left(\frac{1}{2}\right)^2} \frac{1}{2}$$

$$= 6 + \frac{1}{2} = \frac{12+1}{2} = \frac{13}{2}$$

**37.** ***(b)*** Given that,

$$f(x) = \log\left(x + \sqrt{x^2+1}\right)$$

$$\therefore \quad f(-x) = \log\left(-x + \sqrt{x^2+1}\right)$$

$$= \log\left(\frac{\sqrt{x^2+1} - x}{1} \times \frac{\sqrt{x^2+1} + x}{\sqrt{x^2+1} + x}\right)$$

[by rationalisation]

$$= \log\left(\frac{x^2 + 1 - x^2}{\sqrt{x^2+1} + x}\right)$$

$$\log\left(x + \sqrt{x^2+1}\right)^{-1}$$

$$= -\log\left(x + \sqrt{x^2+1}\right)$$

$$\because \quad f(-x) = -f(x)$$

Hence, $f(x)$ is an odd function.

**38.** ***(a)*** There are total minutes between 6 P.M to 7 P.M = 60 min.

Probability of meeting longer than 20 minutes of 2 persons

$$= \left(\frac{40}{60}\right)^2 = \frac{4}{9}$$

So, the probability of meeting no longer than 20 minutes will be $= 1 - \frac{4}{9} = \frac{5}{9}$

**39.** *(a)* Total number of ways of choosing 3 numbers from the given set of numbers 1, 2,...99 = $^{99}C_3$

Let us divide the given numbers into 3 groups $G_1, G_2, G_3$ as follows.

$G_1: 3, 6, 9 \ldots 99$ [33 elements]
$G_2: 1, 4, 7 \ldots 97$ [33 elements]
$G_3: 2, 5, 8 \ldots 98$ [33 elements]

Given that $a^3 + b^3 + c^3 - 3abc$ is to be divisible by 3.

If $a^3 + b^3 + c^3 - 3abc$ is divisible by 3, then which is possible in the following cases.

(i) All the numbers belong to the first group.
(ii) All the numbers belong to the second group
(iii) All the numbers belong to the third group
(iv) One number belong to the first group, one belong to second group and one belong to the third group.

So, favourable number of cases are $3 \cdot {}^{33}C_3 + ({}^{33}C_1)^3$

$\therefore$ Required probability $= \dfrac{3 \cdot {}^{33}C_3 + ({}^{33}C_1)^3}{{}^{99}C_3}$

**40.** *(b)* There are $A$ and $B$ have to select as number from set of numbers {1, 2, ... 25}.

According to given condition, they will win prize if they choose the same numbers, i.e., then probability of choosing same numbers is $\dfrac{1}{25}$.

Hence, the probability that they will not win a prize in a single trial $= 1 - \dfrac{1}{25} = \dfrac{25-1}{25} = \dfrac{24}{25}$

**41.** *(a)* Given that roots are $\sin^2 18°$ and $\cos^2 36°$.

$\therefore$ Sum of roots $= \sin^2 18° + \cos^2 36°$

$$= \left(\frac{\sqrt{5}-1}{4}\right)^2 + \left(\frac{\sqrt{5}+1}{4}\right)^2$$

$$= \frac{5+1-2\sqrt{5}+5+1+2\sqrt{5}}{16} = \frac{12}{16} = \frac{3}{4}$$

Product of roots $= (\sin^2 18°) \times (\cos^2 36°)$

$$= \left(\frac{\sqrt{5}-1}{4}\right)^2 \times \left(\frac{\sqrt{5}+1}{4}\right)^2 = \frac{1}{16}$$

Hence, required equation will be

$x^2 -$ (Sum of roots) $x +$ (Product of roots) $= 0$

$$\Rightarrow \quad x^2 - \frac{3}{4}x + \frac{1}{16} = 0$$

$$\Rightarrow \quad 16x^2 - 12x + 1 = 0$$

**42.** *(a)* According to question,

$$\text{G.M} = 2(a + ar)$$

$$\Rightarrow \quad \frac{a}{1-r} = 2(a + ar)$$

$$\Rightarrow \quad \frac{1}{1-r} = 2(1 + r)$$

$$\Rightarrow \quad (1+r)(1-r) = \frac{1}{2}$$

$$\Rightarrow \quad 1 - r^2 = \frac{1}{2}$$

$$\Rightarrow \quad r^2 = \frac{1}{2}$$

$$\Rightarrow \quad r = \pm \frac{1}{\sqrt{2}}$$

**43.** *(b)* Given that, $m^{th}$ term of H.P

$$\frac{1}{n} = \frac{1}{a} + (m-1)d \qquad \ldots(i)$$

and $n^{th}$ term $\quad \dfrac{1}{m} = \dfrac{1}{a} + (n-1)d \qquad \ldots(ii)$

Subtract Eq. (ii) from Eq. (i), we get

$$\frac{1}{n} - \frac{1}{m} = \frac{1}{a} + (m-1)d - \frac{1}{a} - (n-1)d$$

$$\Rightarrow \quad \frac{m-n}{mn} = d\,[m-1-n+1]$$

$$\Rightarrow \quad d = \frac{1}{mn}$$

Put the value of $d$ in Eq. (i)

$$\frac{1}{n} = \frac{1}{a} + \frac{m-1}{mn}$$

$$\frac{1}{a} = \frac{1}{n} - \frac{(m-1)}{mn} = \frac{m-m+1}{mn} = \frac{1}{mn}$$

$$a = mn$$

$\therefore$

$$T_{m+n} = \frac{1}{\frac{1}{mn} + (m+n-1)\frac{1}{mn}}$$

$$= \frac{1}{\frac{1+m+n-1}{mn}} = \frac{mn}{m+n}$$

**44.** *(b)* We have, $A$ is skew-symmetric matrix.

$\therefore$ $\quad A^T = -A$

$$\Rightarrow \quad (A^T)^{-1} = (-A)^{-1}$$

$$\Rightarrow \quad (A^{-1})^T = -A^{-1}$$

$\therefore A^{-1}$ is also skew-symmetric matrix.

**45.** *(c)* Given that,

Mean [First $n$ natural number] = 11

$$\Rightarrow \quad \frac{n(n+1)(2n+1)}{6n} = 11$$

$$\Rightarrow \quad (n+1)(2n+1) = 66$$

$$\Rightarrow \quad 2n^2 + 3n + 1 = 66$$

$$\Rightarrow \quad 2n^2 + 3n - 65 = 0$$

$$\Rightarrow \quad n = \frac{-3 \pm \sqrt{9 + 520}}{4}$$

$$= \frac{-3 \pm \sqrt{529}}{4}$$

$$\Rightarrow \quad = \frac{-3 \pm 23}{4} = \frac{20}{4} = 5$$

As, $\quad n = \dfrac{-3-23}{4} = \dfrac{-26}{4}$ [$\because n$ cannot be negative]

$\therefore$ $\quad n = 5$

**46.** *(b)* We have,

$$f(x)=\begin{cases}\dfrac{x}{1-x}, & x<0\\ \dfrac{x}{1+x}, & x>0\end{cases}$$

Given function $f$ is differentiable at all points except possible at $x=0$.

$$\therefore \quad Lf'(0)=\lim_{x\to 0^-}\frac{f(x)-f(0)}{x-0}$$

$$=\lim_{x\to 0^-}\frac{\frac{x}{1-x}}{x}=\lim_{x\to 0^-}\frac{1}{1-x}=1$$

and $$Rf'(0)=\lim_{x\to 0^+}\frac{f(x)-f(0)}{x-0}$$

$$=\lim_{x\to 0^+}\frac{\left(\frac{x}{1+x}\right)}{x}=\lim_{x\to 0^+}\frac{1}{1+x}=1$$

$$\because \quad Lf'(0)=Rf'(0)=1,$$

we get

$f$ is differentiable at $x=0$.

Thus, $f$ is differentiable for all $x\in(-\infty,\infty)$.

**47.** *(c)* Given, $I=\int_0^{\pi} xf(\sin x)\,dx$

$$=\int_0^{\pi}(\pi-x)f\{\sin(\pi-x)\}\,dx$$

$$=\int_0^{\pi}(\pi-x)f(\sin x)\,dx$$

$$=\int_0^{\pi}\pi f(\sin x)\,dx-\int_0^{\pi}xf(\sin x)\,dx$$

$$=\pi\int_0^{\pi}f(\sin x)\,dx-I$$

$$\Rightarrow \quad 2I=\pi\int_0^{\pi/2}[f(\sin x)+f\sin(\pi-x)]\,dx$$

$$=2\pi\int_0^{\pi/2}f(\sin x)\,dx$$

$$\Rightarrow \quad I=\pi\int_0^{\pi/2}f\sin\left(\frac{\pi}{2}-x\right)dx$$

$$\Rightarrow \quad I=\pi\int_0^{\pi/2}f(\cos)x\,dx$$

**48.** *(c)* Given, $f(x)=\begin{cases}x+2; & x<0\\ -(x-2); & 0\le x<2\\ x-2; & x>2\end{cases}$

$$f(x)=\begin{cases}x+2; & x<0\\ 2-x; & 0\le x<2\\ x-2; & x\ge 2\end{cases}$$

$$\therefore \quad \int_{-2}^{0}f(x)\,dx+\int_0^2 f(x)\,dx+\int_2^3 f(x)\,dx$$

$$=\int_{-2}^{0}(x+2)\,dx+\int_0^2(2-x)\,dx+\int_2^3(x-2)\,dx$$

$$=\left[\frac{x^2}{2}+2x\right]_{-2}^{0}+\left[2x-\frac{x^2}{2}\right]_0^2+\left[\frac{x^2}{2}-2x\right]_2^3$$

$$=\left[0-\left(\frac{4}{2}-4\right)\right]+\left[\left(4-\frac{4}{2}\right)-0\right]+\left[\left(\frac{9}{2}-6\right)-\left(\frac{4}{2}-4\right)\right]$$

$$=2+2-\frac{3}{2}+2=6-\frac{3}{2}=\frac{9}{2}=4.5$$

**49.** *(b)* Let two slopes of lines may be $m_1$ and $m_2$.

$$\therefore \quad m_1+m_2=\frac{-2h}{b}=\frac{2}{(-2)}=-1$$

and $$m_1m_2=\frac{a}{b}=\frac{6}{(-2)}=-3$$

Now, $$(m_1-m_2)^2=(m_1+m_2)^2-4m_1m_2$$

$$(m_1-m_2)^2=(-1)^2-4(-3)$$

$$\therefore \quad (m_1-m_2)^2=1+12=13$$

$$m_1-m_2=\sqrt{13}=3.60=\frac{7}{2}\ \text{(approx.)}$$

**50.** *(d)* Given that, $\frac{dr}{dt}=\frac{-2}{\pi}$ m/s

We know that,

Area of circle $=\pi r^2$

$\therefore A=\pi r^2$

Differentiate w.r.t to $t$, we get

$$\frac{dA}{dt}=\pi(2r)\cdot\frac{dr}{dt}$$

$$=2\pi r\left(\frac{-2}{\pi}\right)\text{m}^2/\text{s}=-\frac{4\pi}{\pi}(10)\,\text{m}^2/\text{s}\ [\text{given, } r=10]=-40\ \text{m}^2/\text{s}$$

## Analytical Ability and Logical Reasoning

**51.** *(a)* Artificial honey can be prepared as the word natural is mentioned in the advertisement. No comparison regarding the price of natural honey is given.

Also, no information regarding other companies is given.

Hence, only assumption I is implicit.

**52.** *(d)* From the given statement it is clear the some talented Indian Scientist have migrated to America and also some Indian Scientists are talented.

Hence, conclusion (2) and (4) are true.

**53.** *(b)* Clearly, the paragraph best supports the statement (b).

**54.** *(a)* A runs $1\frac{2}{3}$ times as fast as B.

Hence, ratio of speed of A and B = 5 : 3 or we can say that A moves 5 m in the same time in which B moves 3 m.

Hence, A gains 2 m over B by running 5 m.

$\therefore$ Required distance $=\frac{5}{2}\times 80=200$ m

**55.** *(a)* Let the efficiency of one man be 'M' and of one boy be 'B'.

According to the question,

$$(2M+3B)\,10=(3M+2B)\,8$$

$$\Rightarrow \quad 20M+30B=24M+16B$$

$$\Rightarrow \quad 14B=4M$$

or $$2M=7B$$

**or** We can say 10 boys can complete the work in 10 days.

Now, time taken to complete the work by 2 men and 1 boy = time taken to complete the work by 8 boys.
Now, 10 boys can do work in 10 days
$\therefore$ 8 boys can do it in $\frac{10 \times 10}{8} = 12.5$ days

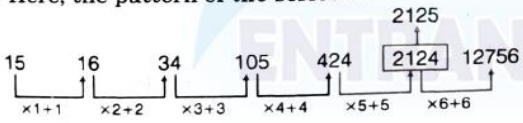
**56.** *(a)* LCM of 2, 3, 4, 5 and 6 = 60
Hence, Number between 1 and 1000 which are divisible by 60 = 16
as $1000 = 60 \times 16 + 40$

**57.** *(c)* Number of balls in 1st layer = 1
Number of balls in 2nd layer = $3 = 1 + 2$
Number of balls in 3rd layer = $6 = 1 + 2 + 3$
Number of balls in 4th layer = $10 = 1 + 2 + 3 + 4$
Now, the $n$th term = $\frac{n(n+1)}{2} = \frac{n^2}{2} + \frac{n}{2}$
Sum of $n$ terms of series = $\frac{1}{2}[\Sigma n^2 + \Sigma n]$
$= \frac{1}{2}\left[\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}\right] = \frac{n(n+1)(n+2)}{6}$
Now,
$$\frac{n(n+1)(n+2)}{6} = 8436$$
or
$$n(n+1)(n+2) = 50616$$
The above condition is satisfied only for $n = 36$

**58.** *(d)* Speed while travelling from A to B = 50 km/h
Speed while travelling from B to A = 100 km/h
$\therefore$ Required average speed = $\frac{2 \times 50 \times 100}{50 + 100} \times \frac{1000}{3600} = 18.5$ m/s
Now, average velocity is 0 km/h as displacement is zero.

**59.** *(d)* Here,
$D \xrightarrow{+1} E \xrightarrow{+3} H \xrightarrow{-1} G$
$R \xrightarrow{+1} S \xrightarrow{+3} V \xrightarrow{-1} U$
$J \xrightarrow{+1} K \xrightarrow{+3} N \xrightarrow{-1} M$
$L \xrightarrow{+1} M \xrightarrow{+4} Q \xrightarrow{-1} P$
Hence, L M Q P is the odd one.

**60.** *(d)* Here, the pattern of the series is




Hence, 2124 is the wrong number.

**61.** *(c)* Age of man's sister = 12 yr
$\therefore$ Age of man = 12 + 3 = 15 yr
$\therefore$ Age of man's brother = 15 + 5 = 20 yr
Hence, age of man's mother = $20 \times 2 = 40$ yr

**62.** *(b)* The pattern of the series is,
$(1)^2 = 1 \times 3 = 3$
$\downarrow +2$
$(2)^2 = 4 \times 5 = 20$
$\downarrow +2$
$(3)^2 = 9 \times 7 = 63$
$\downarrow +2$
$(4)^2 = 16 \times 9 = 144$
$\downarrow +2$
$(5)^2 = 25 \times 11 = 275$
$\downarrow +2$
$(6)^2 = 36 \times 13 = \boxed{468}$

**63.** *(b)* Two members (T and Z) are serving committee B.
$\therefore$ Three members would serve committee A
and hence, 4 members would serve on committee C.

**64.** *(a)* T, S and X serve committee B.
$\therefore$ 4 members would serve committee A.
Now, Z, Y and X cannot serve committee A.
Hence, Z and Y serve on committee C.

**65.** *(d)* R is the only individual serving committee B.
$\therefore$ 2 members would serve committee A and the rest would serve committee C.
Now, T, S and R cannot serve on committee C.
Hence, T and S serve on committee A.

**66.** *(d)* Let the total population be 100.
$\therefore$ Number of adults = $\frac{2}{5} \times 100 = 40$
and number of children = 60
Now, 60% of adults are literate.
$\therefore$ Number of literate adults = $\frac{60}{100} \times 40 = 24$
and number of literate children = $\frac{85}{100} \times 60 = 51$
$\therefore$ Total number of literates = 24 + 51 = 75
$\therefore$ Required percentage = $\frac{75}{100} \times 100 = 75\%$

**67.** *(d)* Total number of students = 50
Number of students who speak English = 21 and number of students who speak both English and Hindi = 10
$\therefore$ Number of students who speak only English = 21 − 10 = 11
and number of students who speak Hindi = 50 − 11 = 39
and number of students who speak only Hindi = 39 − 10 = 29

**68.** *(a)* The last digit can be obtained by multiplying the last digits of the given numbers.
Here, $82 \times 85$, i.e. $2 \times 5 = 10$
Hence, the last digit would be 0.

**69.** *(a)* As there is a considerable decrease in hiring of engineering graduates, a large number of engineering seats remains vacant.

**70.** *(d)* At 3 O' clock both the hands of the clock are 15 min space apart.
To coincide, the minute hand must gain 15 min over the hour hand.
Now, 55 min are gained in 60 min.
$\therefore$ 15 min would be gained in $\frac{60}{55} \times 15 = 16\frac{4}{11}$
Hence, the needles will coincide after $16\frac{4}{11}$ min.

**71.** *(c)* As, $\log_3 2, \log_3 (2^x - 5), \log_3 \left(2^x - \frac{7}{2}\right)$ are in arithmetic progression.

$\therefore \log_3 (2^x - 5) - \log_3 2 = \log_3 \left(2^x - \frac{7}{2}\right) - \log_3 (2^x - 5)$

$$= \log_3 \left(\frac{2^x - 5}{2}\right) = \log_3 \left(\frac{2^x - \frac{7}{2}}{2^x - 5}\right)$$

$$\left[\because \log \left(\frac{a}{b}\right) = \log a - \log b\right]$$

$\Rightarrow (2^x - 5)(2^x - 5) = \left(2^x - \frac{7}{2}\right) \times 2$

$\Rightarrow (2^x - 5)^2 = 2^{x+1} - 7$

$\Rightarrow 2^{2x} + 25 - 2 \times 2^x \times 5 = 2^{x+1} - 7$

$\Rightarrow 2^{x+1} + 2^{x+1} \times 5 - 2^{2x} = 32$

$\Rightarrow 2^{x+1}(6) - 2^{2x} = 32$

$\Rightarrow 2^x(12 - 2^x) = 32$

The above equation is satisfied for $x = 3$

**72.** *(c)* For a number to be divisible by 4 the last two digits must be divisible by 4.

$\therefore$ The possible cases are

| | |
|---|---|
| — — — — 12 | — — — — 16 |
| — — — — 24 | — — — — 32 |
| — — — — 36 | — — — — 52 |
| — — — — 56 | — — — — 64 |

$\therefore$ Value of $n = 4 \times 3 \times 2 \times 1 \times 8 = 192$

**73.** *(d)* First number divisible by 3 between 100 and 200 = 102

Last number divisible by 3 between 100 and 200 = 198

Total numbers divisible by 3 between 100 and 200 = 33

Out of which 105, 126, 147, 168 and 189 are divisible by 7 and from remaining numbers 102, 108, 114, 120, 132, 138, 144, 150, 156, 162, 174, 180, 186, 192 and 198 are even numbers.

$\therefore \quad x = 33 - 20 = 13$

**74.** *(b)* Pipe A can fill a cistern in 37.5 min

$\therefore$ Part of cistern filled by pipe A in 1 min $= \frac{1}{37.5}$

Similarly, part of cistern filled by pipe B in 1 min $= \frac{1}{45}$

Now, the cistern will be filled in half an hour if pipe B is turned off after some time.

Let pipe B is turned off after $x$ min.

$\therefore \quad \frac{30}{37.5} + \frac{x}{45} = 1$

$0.8 + \frac{x}{45} = 1$

$x = 45 \times 0.2 = 9$ min

**75.** *(b)* According to the given information,

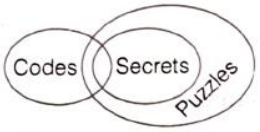
| Person | Shirt's Colour | Pant's Colour |
|---|---|---|
| A | Orange | Yellow |
| B | Black | Orange |
| C | Blue | Green |

Clearly, C wore pant and shirt of Green and Blue colour, respectively.

**76.** *(b)* In each column the element on the left hand side remains the same while the element on the right rotates 90° clockwise in each step.

**77.** *(b)* T-shirt and shoes both items are worn on the body. Similarly, rack and sofa are kept inside the house.

**78.** *(d)*




Conclusion

I. (✓) II. (✓)

Hence, both conclusions I and II are true.

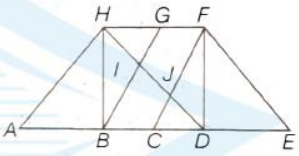
**79.** *(b)*


**Conclusion**

I. (×) II. (✓)

Hence, only conclusion II is true.

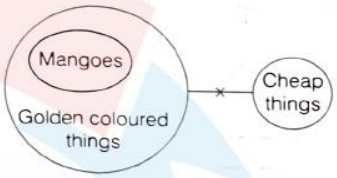
**80.** *(c)*




Total number of triangles = 14

(ΔABH, ΔHIB, ΔHGI, ΔFJD, ΔCJD, ΔFDE, ΔHFJ, ΔDIB, ΔHFD, ΔDBH, ΔAHD, ΔCFE, ΔCFD and ΔBHG)

**81.** *(b)*




**Conclusion**

I. (×) II. (✓)

Hence, only conclusion II is true.

**82.** *(d)* All the statements are necessary to find the profit percentage. Let the marked price of the item be ₹$x$.

From statement III,

Cost price of article = ₹ 5000

From statement II,

If discount is not given, profit percentage = 20%

$\therefore \quad \frac{x - 5000}{5000} \times 100 = 20$

$\therefore x$ = marked price = ₹ 6000

Now, from statement I,

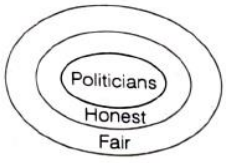
Discount = 5%

$\therefore$ Selling price $= \frac{(95)}{100} \times 6000$

$= ₹\ 5700$

Hence, profit percentage $= \frac{5700 - 5000}{5000} \times 100 = 14\%$

**83.** *(d)*




**Conclusions**

I. (✓) II. (×)

III. (✓) IV. (×)

Hence, only conclusions I and III follow.

**84.** *(d)* Students who watched film A = 13

Students who watched film B = 16

Students who watched film C = 19

But total number of students = 40

Hence, students who watched all the films

$= (13 + 16 + 19) - 40 = 8$

**85.** *(b)* Let the fare of 1 ticket from city A to B be ₹ $x$ and the fare of 1 ticket from city A to C be ₹ $y$

According to the question,

$2x + 3y = 77$ ...(i)

$3x + 2y = 73$ ...(ii)

On solving Eqs. (i) and (ii), we get

$x = 13, \quad y = 17$

∴ The fares for cities B and C from A are ₹ 13 and ₹ 17, respectively.

**86.** *(c)* Area of parallelogram $ABCD = 208\ cm^2$

∵ Area of parallelogram = Base × Height

Let height of parallelogram $ABCD$ be h.

∴ $h \times 13 = 208$

$\therefore \quad h = 16\ cm$

Now, height of parallelogram ABEF = Height of parallelogram ABCD

∴ Required height = 16 cm

**87.** *(b)* Original word = D I S T R I B U T I O N

New word = S T D I B U R I O N T I

Hence, seventh letter from left = R

**88.** *(b)* Here, the pattern of the series is,

J $\xrightarrow{+1}$ K $\xrightarrow{+1}$ L $\xrightarrow{+1}$ M $\xrightarrow{+1}$ N

A $\xrightarrow{+1}$ B $\xrightarrow{+1}$ C $\xrightarrow{+1}$ D $\xrightarrow{+1}$ E

K $\xrightarrow{+1}$ L $\xrightarrow{+1}$ M $\xrightarrow{+1}$ N $\xrightarrow{+1}$ O

**89.** *(b)* A caterpillar crawls up 5 inches each day and slides down 4 inches each night.

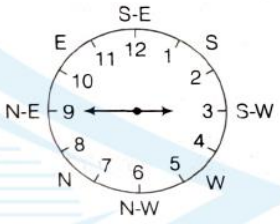
∴ In 1 day it crawls up 1 inch.

Hence, in 70 days it crawls up 70 inches.

At the end of 71 days it will crawl up 5 inches again.

Hence, at the end of 71 days it will reach the top of the pole.

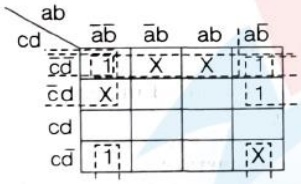
**90.** *(b)* Time on the watch is quarter to three, i.e. 2 : 45




Clearly, the hour hand points South-West direction.

## Computer Awareness

**91.** *(d)*




By this K-map, we conclude

$F = \bar{c}\bar{d} + \bar{b}c + \bar{b}\bar{d}$

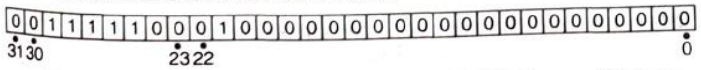
**92.** *(d)* The IEEE 754 standard specifies a binary 32 bit as having:

Sign bit : 1 bit

Exponent width : 8 bits

Significant precision : 24 bits (23 explicitly stored)

The bits are laid out as follows:




The real value assumed by a given 32-bit binary 32 data with a given biased sign, exponent e (the 8-bits unsigned integer) and a 23-bit fraction.

**93.** (*) Hit Ratio = 15%

Cache memory time = 10 microseconds

Memory access time = 10 milliseconds

Effective Memory Access Time (EAT) = Hit Ratio * (Cache memory time + Memory access time) + (1-hit) * (Cache memory time + 2 * Memory access time )

EAT = .15 (0.01 + 10) + (1 – 0.15) (0.01 + 2 × 10)

= (0.15) (10.01) + (0.85) (20.01)

= 15015 + 17.0085

= 18.51 milliseconds

**94.** *(b)* $(235)_{R_1} = (565)_{10} = (1065)_{R_2}$

$\Rightarrow \quad (235)_{R_1} = (565)_{10}$

$\Rightarrow \quad 2R_1^2 + 3R_1 + 5 = 565$

$\Rightarrow \quad 2R_1^2 + 3R_1 - 560 = 0$

If we put $R_1 = 16$, then

$2(16)^2 + 3(16) - 560 = 0$

$\Rightarrow \quad 512 + 48 - 560 = 0$

$\Rightarrow \quad 560 - 560 = 0$

$\Rightarrow \quad (565)_{10} = (1065)_{R_2}$

$\Rightarrow \quad R_2^3 + 6R_2 + 5 = 565$

$\Rightarrow \quad R_2^3 + 6R_2 - 560 = 0$

If we put $R_2 = 8$, then

$\Rightarrow \quad (8)^3 + 6(8) - 560 = 0$

$\Rightarrow \quad 512 + 48 - 560 = 0$

$\Rightarrow \quad 560 - 560 = 0$

**95.** *(b)* In NOR gate, if one input is 0 and other is 1. Then, the output will be 0. If both inputs are low. Then, the output is 1. So, NOR gate is not a answer.
In NAND gate, if one input is 0 and other is either 0 or 1, the output is high. So, NAND gate is a answer.

**96.** *(c)* $\sqrt{(224)_r} = (13)_r$

On squaring both sides,

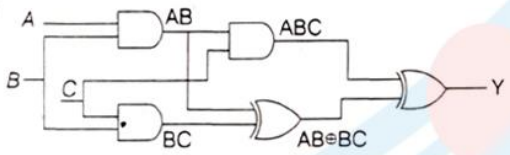
$$(224)_r = (13)_r^2$$

Now, converting to decimal number

$$2r^2 + 2r + 4 = (1r + 3)^2$$
$$2r^2 + 2r + 4 = (r + 3)^2$$
$$2r^2 + 2r + 4 = r^2 + 9 + 6r$$
$$r^2 - 4r - 5 = 0$$

Root of the above equation is 5, −1
Therefore, radix = 5

**97.** *(c)*




So, $Y = ABC \oplus (AB \oplus BC)$
$Y = B(C + A)$

**98.** *(d)* The exclusive NOR and exclusive OR of $x$ and $y$ is given by the expressions
$x \odot y = xy + x'y'$ (exclusive NOR or XNOR)
$x \oplus y = x'y + xy'$ (exclusive OR or XOR)
So, option (A) is automatically true.
Option (B)is $x \oplus y'$ which evaluates to $x'y' + x(y')'$.
$= x'y' + xy$ which is equivalent to $x \odot y$.
Option (C) is $x' \oplus y$ which evaluates to
$(x')'y + x'y' = xy + x'y'$ which is equivalent to $x \odot y$
Option (D) is $x' \oplus y'$ which evaluates to $(x')'y' + x'(y')'$
$= xy' + x'y$ which is not equivalent to $x \odot y$.

**99.** *(c)* Logical error.

**100.** *(b)* $(43)_x = (y3)_8$

Since, a number in base $K$ can only have digits from 0 to $(K - 1)$, we can conclude that

$$x \geq 5 \text{ and } y \leq 7$$

Now, the original equation, when converted to decimal base gives:

$$4x^1 + 3x^0 = y(8^1) + 3(8^0)$$
$$\Rightarrow \quad 4x + 3 = 8y + 3$$
$$\Rightarrow \quad x = 2y$$

So, we have the following constraints

$$x \geq 5$$
$$y \leq 7$$

$x = 2y$, $x$ and $y$ are integers.
The set of values of $(x, y)$ that satisfy these constraints are:

$$(6, 3), (8, 4), (10, 5), (12, 6), (14, 7)$$

So, the number of possible solution is 5.

## General English

**101.** *(a)* 'Debacle' means 'a sudden and igominious failure' and 'catastrophe' also means 'something very unsuccessful'. So, option (a) is the most suitable answers.

**102.** *(b)* 'Faff about' means to spend time doing unimportant things instead of doing necessary things.

**103.** *(d)* Impolitic means 'unwise' and injudicious also means the same. Hence, option (d) is the suitable answer.

**104.** *(d)* No correction required. The given sentence is correct.

**105.** *(d)* The correct sequence is QTRPS.

**106.** *(a)* Corporatism facilitates creative destruction.

**107.** *(b)* 'Cacophony' reinforces the idea, contained in dissonance as dissonance means lack of agreement or harmony and cacophony also means the same.

**108.** *(d)* Conflicting interests of the Board of Directors make corporate governance suffer.

**109.** *(c)* 'Over' is the suitable answer.

**110.** *(b)* 'Hasn't he' is the suitable answer.

**111.** *(c)* Epitome means a person or thing that is a perfect example of a particular quality or type and essence also means the intrinsic nature of something. Therefore, option (c) is the most suitable answer.

**112.** *(b)* Fully

**113.** *(c)* He warned her calmly that he would shoot her if she didn't kept quiet.

**114.** *(c)* 'Ceiling' is the correct spelling.

**115.** *(b)* Self reliant : Buoyant are related in same way as BUTTERFLY : FREEDOM.

**116.** *(d)* 'Clown' means a comic entertainer' and 'jester' means 'a professional joker'. Hence, option (d) is the closest in meaning to Clown.

**117.** *(b)* 'Cope up' should be replaced by 'cope' to make the sentence grammatically correct.

**118.** *(a)* Meagre is the suitable answer.

**119.** *(a)* 'Is' is the suitable answer because a singular subject 'Henry' is used after the word 'or' so the verb should also be singular.

**120.** *(c)* A loud thunder echo hit the tallest building. 'Echo' is used inappropriately in this sentence because it is used to represent the reflection of sound which cannot hit the building.

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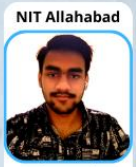
|  NIT Surathkal<br>Himank |  NIT Trichy<br>Pushpak |  NIT Raipur<br>T. Shilpa |  NIT Kurukshetra<br>Nitin |  NIT Raipur<br>Rishi |  NIT Warangal<br>Himanshu |  NIT Raipur<br>Nizam |  NIT Allahabad<br>Prateek |
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