Merging man and maths

## OBJ ECTI VE

Q. 7: Some possible answers to each statement are given below. Tick ( $\mathbf{P}$ ) mark the correct answer.
i) The number 1 is
a) Prime number
b) Irrational
c) Even Number
d) Odd Number
ii) Every set is a $\qquad$ subset of it self.
a) Proper
b) Improper
c) Finite
d) Infinite
iii) If $A=\left[\begin{array}{ll}2 & 1 \\ 6 & 3\end{array}\right]$ then cofactor of 6 is
a) 1
b) -1
c) -6
d) 3
iv) If $|A|$ is the determinant of a square matrix $A$ then $|A|$ is
a) Always positive
b) Modulus of $A$
c) Always Negative
d) May be +ve or -ve
v) If $4^{x}=\frac{1}{2}$ then $x$ equals
a) $\frac{1}{2}$
b) $-\frac{1}{2}$
c) 2
d) -2
vi) if polynomial $x^{2}+3 x+7$ is divided by $x+1$ then remainder is
a) -5
b) 11
c) 5
d) -11
vii) $\frac{1}{\left(x^{2}+1\right)(x+1)}$ equals
a) $\frac{A}{x^{2}+1}+\frac{B x+C}{x+1}$
b) $\frac{A}{x^{2}+1}+\frac{B}{x+1}$
c) $\frac{A x+B}{x^{2}+1}$
d) $\frac{A x+B}{x^{2}+1}+\frac{C}{x+1}$
viii) Common difference of the A.P. $17,13,9, \ldots$ equals
a) 4
b) -4
c) 30
d) 15
ix) No term in G.P. is
a) 3
b) 2
c) 1
d) 0
x) H.M between $a$ and $b$ is
a) $\frac{a+b}{2 a b}$
b) $\frac{2 a b}{a+b}$
c) $\frac{2 a b}{a-b}$
d) $\frac{a-b}{2 a b}$
xi) With usual notation ${ }^{6} P_{4}$ equals
a) 160
b) 260
c) 360
d) 340
xii) A die is rolled then $n(S)$ equals
a) 36
b) 6
c) 1
d) 9
xiii) The second term in the expansion of $(1-2 x)^{\frac{1}{2}}$ is
a) $x$
b) $2 x$
c) $3 x$
d) $4 x$
xiv) $\sin ^{2} \alpha+\cos ^{2} \beta$ equals
a) 1
b) 0
c) -1
d) None of these
$x v$ ) Co-ratio of cosine is
a) sec
b) sine
c) $\operatorname{cosec}$
d) $\cos$
xvi ) Domain of $y=\cos x$ is
a) $-\infty<x<+\infty$
b) $-1 \leq y \leq 1$
c) $0<x<\infty$
d) $-\infty<x<0$
$x v i i)$ Number of elements of a triangle are
a) 3
b) 4
c) 6
d) 8
xviii) Radius $r$ of inscribed circle is given as
a) $\frac{\Delta}{s}$
b) $\frac{s}{\Delta}$
c) $\frac{\Delta}{s-c}$
d) $\frac{4 \Delta}{a b c}$
xix) $2 \tan ^{-1} A$ equals
a) $\tan ^{-1} \frac{A}{1-A^{2}}$
b) $\tan ^{-1} \frac{2 A}{1+A^{2}}$
c) $\tan ^{-1} \frac{2 A}{1-A^{2}}$
d) $\frac{2 A}{1-A^{2}}$
$\mathrm{xx})$ If $\cos x=\frac{-\sqrt{3}}{2}$, then reference angle of $\cos x$ is
a) $\frac{\pi}{3}$
b) $\frac{\pi}{4}$
c) $\frac{\pi}{6}$
d) $-\frac{\pi}{6}$

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## Section - I

Note: All questions are to be attempted on answer book.
Q \#2: Write any TWENTY -FIVE short answers of the following questions:
(i) Prove that $\overline{z_{1}+z_{2}}=\overline{z_{1}}+\overline{z_{2}}, \quad \forall \bar{z}_{1}, \bar{z}_{2} \in \mathbb{C}$
(ii) State the closure property of multiplication of the set of real number $\mathbb{R}$.
(iii) Define a graph $(G, *)$.
(iv) What is deduction?
(v) What is the associated binary operation?
(vi) Define identity matrix.
(vii) If $A=\left[\begin{array}{ll}2 & 3 \\ 1 & 5\end{array}\right]$ find $|A|$.
(viii) Define raw echelon form of a matrix.
(ix) Solve the equation $\frac{a}{a x-1}+\frac{b}{b x-1}=a+b$.
(x) Evaluate $\left(1-\omega-\omega^{2}\right)^{8}$.
(xi) If $\alpha, \beta$ are the roots of the equation $x^{2}-p x-p-c=0$ prove that $(1+\alpha)(1+\beta)=1-c$.
(xii) Prove that $\frac{x^{2}}{a^{2}}+\frac{(m x+c)^{2}}{b^{2}}=1$ will have equal roots if $c^{2}=a^{2} m^{2} b^{2}$.
(xiii) Resolve $\frac{x^{2}+1}{(x+1)(x-1)}$ into partial fractions.
(xiv) Find the nth term of the sequence $\left(\frac{4}{3}\right)^{2},\left(\frac{7}{3}\right)^{2},\left(\frac{10}{3}\right)^{2}, \ldots$.
(xv) Find the sum of the infinite geometric series $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\ldots$.
(xvi) Find the $12^{\text {th }}$ term of H.P. $\frac{1}{2}, \frac{1}{5}, \frac{1}{8}, \ldots$.
(xvii) Find G.M between $-2 i$ and $8 i$.
(xviii) Verify that $A>G>H,(G>0)$ if $a=2, b=8$.
(xix) Find the value of $n$ when ${ }^{11} P_{n}=11.10 .9$.
(xx) How many diagonals can be formed by joining the vertices of the polygon having 5 sides?
(xxi) From a box containing slips numbered $1,2,3, \ldots, 5$ one slip is picked up; find the probability that the number on the slip is a prime number.
(xxii) Evaluate ${ }^{12} C_{3}$.
(xxiii) Prove that $1+3+5+\ldots+(2 n-1)=n^{2}$ for $n=1,2$
(xxiv) Find the term involving $x^{4}$ in the expansion of $(3-2 x)^{7}$.
(xxv) Expand $(8-2 x)^{-1}$ up to four terms.
(xxvi) Prove that $1+\cot ^{2} \theta=\operatorname{cosec}^{2} \theta$.
(xxvii) Find the values of all trigonometric function at $\theta=390^{\circ}$.
(xxviii) Prove that $\sin \left(360^{\circ}-\theta\right)=-\sin \theta$.
(xxix) Prove that $\sin 2 \alpha=2 \sin \alpha \cos \alpha$.
(xxx) Prove that $\cos 20^{\circ}+\cos 100^{\circ}+\cos 140^{\circ}=0$.
(xxxi) Find the period of $3 \cos \frac{x}{5}$.
(xxxii) When the angle between the ground and the sun is $30^{\circ}$, flag pole casts a shadow of 40 m long? Find the height of the top of the flag.
(xxxiii) Solve the triangle ABC if $a=32, b=40, c=66$
(xxxiv) Find the area of the triangle ABC where $b=37, c=45, \alpha=30^{\circ} 50$
(xxxv) Show that $r_{1}=s \tan \frac{\alpha}{2}$.
(xxxvi) Show that $\tan \left[\sin ^{-1} x\right]=\frac{x}{\sqrt{1-x^{2}}}$.
(xxxvii) Solve the equation $\sin 2 x=\cos x$.

## Section - II

Note: Attempt any THREE questions.
Q \# 3 (a) Prove that $A \cap(B \cup C)=(A \cap B) \cup(A \cap C)$
(b) Prove that the determinant $\left|\begin{array}{lll}b+c & a & a^{2} \\ c+a & b & b^{2} \\ a+b & c & c^{2}\end{array}\right|=(a+b+c)(a-b)(b-c)(c-a)$

Q \# 4 (a) Show that the roots of the equation $(p+q) x^{2}-p x+q=0$ will be rational.
(b) Sum to n terms the series $1+(a+b)+\left(a^{2}+a b+b^{2}\right)+\left(a^{3}+a^{2} b+a b^{2}+b^{3}\right)+\ldots \quad 5$

Q \# 5 (a) There is 8 men and 10 women of a club. How many committees of seven can be formed having at least 4 girls?
(b) Find the term independent of $x$ in the expansion of $\left(x-\frac{2}{x}\right)^{10}$.

Q \# 6 (a) Prove that $\frac{\tan \theta+\sec \theta-1}{\tan \theta-\sec \theta+1}=\tan \theta+\sec \theta$.
(b) Prove that $\cos 20^{\circ} \cos 40^{\circ} \cos 60^{\circ} \cos 80^{\circ}=\frac{1}{16}$.

Q \# 7 (a) Prove that $R=\frac{a}{2 \sin \alpha}=\frac{b}{2 \sin \beta}=\frac{c}{2 \sin \gamma}$ with usual notations.
(b) Prove that $2 \tan ^{-1} \frac{1}{3}+\tan ^{-1} \frac{1}{7}=\frac{\pi}{4}$.

