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## MATHS

## BOOKS - MODERN PUBLICATION

## SAMPLE PAPER 2019

Exercise

1. A R is a relation on set A such that $R=R^{-1}$, then write the type of the relation R .
2. Write the value of $\cos ^{-1} \cos \left(\frac{3 \pi}{2}\right)$.

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3. 

$\left|\begin{array}{lll}1+x & x & x^{2} \\ x & 1+x & x^{2} \\ x^{2} & x & 1+x\end{array}\right|=a+b x+c x^{2}+d x^{3}+e x^{4}+f x^{5}$
then write the value of a.

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4. Let $A$ and $B$ be two mutually exclusive events, such that $P(A)=\frac{1}{2}$ and $P(B)=\frac{1}{3}$. Write the value of $P(A \cup B)$.

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5. If $f^{\prime}\left(2^{+}\right)=0$ and $f^{\prime}\left(2^{-}\right)=0$, then is $f(x)$ continuous at $x=2$ ?

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6. If $f$ is an odd function, then write the value of $\int_{-a}^{a} \frac{f(\sin x)}{f(\cos x)+f\left(\sin ^{2} x\right)} d x$

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7. Write the order of the differential equation whose solution is given by
$y=\left(c_{1}+c_{2}\right) \cos \left(x+c_{3}\right)+c_{4} e^{x+c_{5}}$
where $c_{1}, c_{2}, c_{3}, c_{4}$ and $c_{5}$ are arbitrary constants

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8. If veca=vecb+vecc, then write the value of $\vec{a} \cdot(\vec{b} \times \vec{c})$.

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9. Write the value of $k$ such that the line $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2} \quad$ lies on the plane

## $2 x-4 y+z=7$

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10. Construct the multiplication table $x_{7}$ on the set $\{1,2,3,4,5,6\}$. Also find the inverse element of 4 if it exists.

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11. Let $R$ be the relation on the set $R$ of real numbers such
that $a R b$ iff $a-b$ is and integer. Test whether $R$ is an equivalence relation. If so find the equivalence class of 1and $\frac{1}{2}$ wrt. This equivalence relation.
12. Solve: $2 \tan ^{-1}(\sin x)=\tan ^{-1}(2 \sec x), x \neq \frac{\pi}{2}$.

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13. Prove that :
$\cos ^{-1}\left(\frac{b+a \cos x}{a+b \cos x}\right)$
$`=2 " \tan ^{\wedge}(-1)(\operatorname{sqrt}((a-b) /(a+b))$ "tan" $x / 2)$

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14. If $A=\left[\begin{array}{lll}1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1\end{array}\right]$ then show that
$A^{3}-23 A-40 I=O$
15. Solve the following : $\left[\begin{array}{ccc}x+1 & \omega & \omega^{2} \\ \omega & x+\omega^{2} & 1 \\ \omega^{2} & 1 & x+\omega\end{array}\right]=0$

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16. A person takes 4 tests in succession. The probability of his passing the first test is p , that of his passing each succeeding test is p or $\frac{p}{2}$ depending on his passing or failing the preceding test, Find the probabilty of his passing just three tests.

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17. Find the probability distribution of number of heads in three tosses of a coin.

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18. If $A=\left[\begin{array}{ccc}1 & 2 & 0 \\ 0 & 1 & 3 \\ -2 & 5 & 3\end{array}\right]$, then verify that $\mathrm{A}+\mathrm{A}^{\prime}$ is symmetric and $A-A^{\prime}$ is skew-symmetric.

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19. Find $\frac{d^{2} y}{d x^{2}}$ if $\mathrm{x}=\mathrm{a} \cos \theta, y=b \sin \theta$.
20. Verify lagrange's Mean-Value theorem for
$F(x)=x^{3}-2 x^{2}-x+3$ on $[1,2]$

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21. Find the point on the curve $x^{2}+y^{2}-4 x y+2=0$
where the normal is paralell to the $x$-asis.

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22. Find the intervals in which the function $y=\frac{\ln x}{x}$ is increasing and decreasing.
23. Integrate the following $\int\left[\frac{2 x+1}{\sqrt{x^{2}+10 x+29}}\right] d x$

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24. Evaluate : $\int_{0}^{\pi / 2} \frac{\cos x d x}{(2-\sin x)(3+\sin x)}$

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25. Find the area of the region bounded by the curve $y=6 x-x^{2}$ and the $x$-axis.

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26. Find differential equation of the curve $y=a e^{3 x}+b e^{5 x}$.

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27. Obtain the general solution of the following differential equations.

$$
\left(x^{2}+7 x+12\right) d y+\left(y^{2}-6 y+5\right) d x=0
$$

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28. Find a unit vector perpendicular to both of the vectors
$\vec{a}+\vec{b}$ and $\vec{a}-\vec{b} \quad$ where $\quad \vec{a}=\hat{i}+\hat{j}+\hat{k} \quad$ and $b=\hat{i}+2 \hat{j}+3 \hat{k}$.

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29. Show that $(\vec{a} \times \vec{b})^{2}=a^{2} b^{2}-(\vec{a} \cdot \vec{b})^{2}$.

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30. Find the vector equation of a plane which is at a distance of 3 units from the origin , $2 \hat{i}+3 \hat{j}-6 \hat{k}$ being a normal to the plane. Also get its cartesian equation
31. Find the point where the line $\frac{x-2}{1}=\frac{y}{-1}=\frac{z-1}{2}$ meets the plane $2 x+y+z=2$.

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32. Prove that $f: X \rightarrow Y$ is injective iff for all subsets $\mathrm{A}, \mathrm{B}$ of $X, f(A \cap B)=f(A) \cap f(B)$.

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33. If $\sin ^{-1}\left(\frac{x}{a}\right)+\sin ^{-1}\left(\frac{y}{b}\right)=\sin ^{-1}\left(\frac{c^{2}}{a b}\right)$,
then prove that $b^{2} x^{2}+2 x y \sqrt{a^{2} b^{2}-c^{4}}+a^{2} y^{2}=c^{4}$
34. Find the inverse of the following matrices using
elementary transformation:

$$
\left[\begin{array}{lll}
1 & 2 & 3 \\
2 & 1 & 4 \\
1 & 0 & 2
\end{array}\right]
$$

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35. Examining consistency and solvability, solve the following equation by matrix method.
$x-2 y=3$
$3 x+4 y-z=-2$
$5 x-3 z=-1$

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36. Out of the adult population in a village $50 \%$ are farmers, $30 \%$ do business and $20 \%$ are service holders.

It is known that $10 \%$ of the farmers, $20 \%$ of the business holders and $50 \%$ of service holders are above poverty line. What is the probability that a member chosen from any one of the adult population, selected at random, is above poverty line?

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37. If $(a+b x) e^{\frac{y}{x}}=x$, then show that
$x^{3} \frac{d}{d x}\left(\frac{d y}{d x}\right)=\left(x \frac{d y}{d x}-y\right)^{2}$
38. Show that the shrtest distance of the point ( $0,8 \mathrm{a}$ ) from the curve $a x^{2}=y^{3}$ is $2 a \sqrt{11}$.

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39. Evaluate the following integrals $\int \frac{d x}{2 \cos ^{2} x+3 \cos x}$

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40. Determine the area common to the parabola $y^{2}=x$ and the circle $x^{2}+y^{2}=2 x$.
41. Solve $y^{2}+x^{2} \frac{d y}{d x}=x y \frac{d y}{d x}$.

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42. Show by vector method that the four points ( $6,2,-1$ ),
$(2,-1,3),(-1,2,-4)$ and (-12, -1, -3 ) are coplanar.

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43. Find the distance of the point $(1,-1,-10)$ from the line $\frac{x-4}{1}=\frac{y+3}{-4}=\frac{z+1}{7}$ measured parallelto the line $\frac{x+2}{2}=\frac{y-3}{-3}=\frac{z-4}{8}$
