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MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER 20

Exercise

1. If R= {(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)} a symmetric relation on the set {1,

2,3, 4}. The relation R is



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2. What is the principal value of $\sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right)$?



3. Show that feasible region for the following constarints in a graph

$$2x + y \le 4, x \ge 0y \ge 0.$$



4. If ω is a complex cube root of 1,then for what value of. lamda the determinant $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \lambda & 1 \\ \vdots & \ddots & \vdots \end{vmatrix} = 0$?

5. If
$$y= an^{-1}\sqrt{1+x^2}$$
 then find $rac{dy}{dx}$.



6. Find the open interval in which $f(x)=x^{\frac{1}{x}}, x>0$ is decreasing.



7. Evaluate $\int \cot\left(\frac{x}{3}\right) dx$.



- **8.** What is the general solution of the differential equation $\frac{dy}{dx} = \frac{y^2}{x^2}$.
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- **9.** Find the scalar projection of the vector $2\hat{i}+\hat{j}+5\hat{k}$ on the vector $2\hat{i}-\hat{j}+3\hat{k}$.
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- **10.** Find the direction cosines of the line $\frac{x-4}{3} = \frac{y-2}{6} = \frac{z-1}{3}$.
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- **11.** Evaluate $\int \tan 3x dx$.
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- **12.** Prove that the following. $egin{bmatrix} 1+a & 1 & 1 \ 1 & 1+b & 1 \ 1 & 1 & 1+c \end{bmatrix}$
- = abc(1+1/a+/b+1/c)
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- **13.** Find the value of $\begin{vmatrix} 17 & 58 & 97 \\ 19 & 60 & 99 \\ 18 & 59 & 98 \end{vmatrix}$ without expanding.
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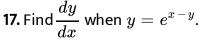
14. If
$$A=egin{bmatrix} 0 & -\tan\Bigl(rac{lpha}{2}\Bigr) \\ \tan\Bigl(rac{lpha}{2}\Bigr) & 0 \end{bmatrix}$$
 show that
$$(I+A)=(I-A)egin{bmatrix} \cos lpha & -\sin lpha \\ \sin lpha & \cos lpha \end{bmatrix} \text{ where } I=\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$



15. Find the inverse of the matrix
$$\begin{bmatrix} 0 & 0 & 2 \\ 0 & 2 & 0 \\ 2 & 0 & 0 \end{bmatrix}$$
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16.
$$f(x)=\left\{egin{array}{ll} x^2\sin\left(rac{1}{x}
ight) & x
eq 0 \ 0 & x=0 \end{array}
ight.$$







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18. If
$$y=2^{x^2}+ an^{-1}2x$$
 then find $rac{dy}{dx}$.



- **19.** Find $\frac{dy}{dx}when\sin y=\cos(x+y)$.
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- **20.** Find the intervals in which the function $y=\frac{\ln x}{x}$ is increasing and decreasing.
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- **21.** Integrate $\int e^x \tan e^x dx$.
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22. Evaluate $\int \frac{e^x-1}{e^x+1} dx$



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23. Evaluate $\int_0^{\pi/4} \log(1+\tan x) dx$.



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24. Find the area of the region bounded by the curve $y=6x-x^2$, the X-axis and the two ordinates x=0 and x=9.



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25. Solve $(x \log x) \frac{dy}{dx}$ +y= $2 \log x$.



26. Show that the relation R defined on the set Z of all integers defined as $R=\{(x,y):x-y \text{ is an integer}\}$ is reflexive, symmetric and transtive.



27. If A = R -{3} and B = R -{1}. Consider the function $f\colon A\to B$ defined by $f(x)=rac{x-2}{x-3}$, for all $x\in A$. Then, show that f is bijective. Find $f^{-1}(x)$.



28. Prove that
$$2 an^{-1}igg(rac{1}{2}igg)+ an^{-1}igg(rac{1}{7}igg)= an^{-1}igg(rac{31}{17}igg).$$

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29. Find the feasible region of the system.

$$2y - x \ge 0, 6y - 3x \le 21, x \ge 0, y \ge 0$$

30. Prove by vector method that in a $\Delta ABC,$ $c^2=a^2+b^2-2ab\cos C.$



31. The diagonals of a parallelogram are given by $\overrightarrow{a}=2\hat{i}-3\hat{j}+5\hat{k}$ and $\overrightarrow{b}=-2\hat{i}+2\hat{j}+2\hat{k}$, Determine the area of the parallelogram .



32. Find the image of the point (2, 3, 4) with respect to the plane x - y + 2z = 4. Obtain the foot of the perpendicular from P on the plane and the corresponding perpendicular distance.



33. Find the equation of planes passing throught the points $(1,2,3),\,(1,\,-4,3)$ and $(\,-1,3,2)$



34. Prove that the lines x=ay+b, z=cy+d and x=a'y+b', z=c'y+d' are perpendicular, if aa'+cc'+1=0



35. Show that $f\colon N o N$, given by $f(x)=\left\{egin{array}{l} x+1, ext{if x is odd} \ x-1, ext{if x is even} \end{array}
ight.$

is bijective (both one-one and onto).



36. If
$$\cos^{-1}\left(\frac{x}{a}\right) = \cos^{-1}\left(\frac{y}{b}\right) = \theta, \text{ prove that } \frac{x^2}{a^2} - \frac{2xy}{ab}\cos\theta + \frac{y^2}{b^2} = \sin^2\theta.$$



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37. Solve the LPP Maximize z = 5x + 3y

Subject to $3x + 5y \le 15$ 5x + 2y < 10, x > 0, y > 0



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38. If $A=egin{bmatrix} 2&0&1\\2&1&3\\1&-1&0 \end{bmatrix}$ then find the value of $A^2-3A+2I$

39. If a, b and c are all positive real, then prove that minimum value of

determinant

$$\begin{vmatrix} a^2 + 1 & ab & ac \\ ab & b^2 + 1 & bc \\ ac & bc & c^2 + 1 \end{vmatrix}$$
 = $1 + a^2 + b^2 + c^2$



40. Find the value of k so that the function f defined by $f(x)=\left\{\left(\frac{k\cos x}{\pi-2x}\right),whenx\neq\frac{\pi}{2}\right),\left(0,atx=\frac{\pi}{2}\right):\right\} \text{ is continuous}$ at $x=\frac{\pi}{2}$.



- **41.** If $y = x^{\cot x}$ then find $\frac{dy}{dx}$.
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42. Show that the rectangle of maximum area that can be inscribed in a given circle is a square.



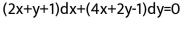
43. Evaluate
$$\int_0^\pi \frac{x}{1+\sin x} dx$$



44. Find the area of region in the first quadrant enclosed by the X-axis, the line y=x and the circle $x^2+y^2=32$.

45. Find the solution of the following differential equations:







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46. Three vectors \overrightarrow{a} , \overrightarrow{b} and \overrightarrow{c} satisfy the condition $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = 0$.

Find the value of $\overrightarrow{a}.\overrightarrow{b}+\overrightarrow{b}.\overrightarrow{c}+\overrightarrow{c}.\overrightarrow{a}$ if

$$\left|\overrightarrow{a}\right|=1,\left|\overrightarrow{b}\right|=4,\left|\overrightarrow{c}\right|=2.$$

