



## MATHS

## **BOOKS - SHARAM PUBLICATION**

# **MODEL QUESTION PAPER -16**



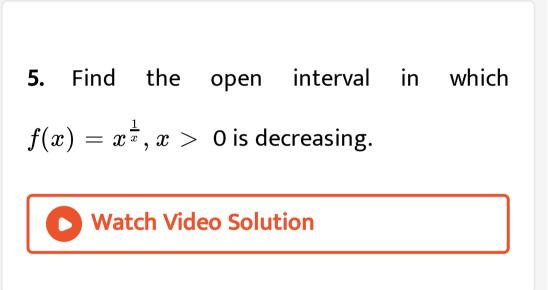
1. If  $f\colon R o R$  and  $g\colon R o R$  are given by  $f(x)=8x^3$  and  $g(x)=x^{rac{1}{3}}$ , then write fog.

2. Write the principal value of 
$$\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1}\left(-\frac{1}{2}\right)$$
.  
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**3.** If 
$$\begin{bmatrix} 2x & 4 \end{bmatrix} \begin{bmatrix} x \\ -8 \end{bmatrix} = 0$$
 then find the positive

value of x.

**4.** Find 
$$\frac{d}{dx} \ln \sin^{-1} \cos \left( \frac{\pi - 2e^x}{2} \right)$$
.



**6.** What is the value of 
$$\int rac{1+rac{1}{x^2}}{x-rac{1}{x}+4} dx$$

7. Write the particular solution of  $\frac{dy}{dx} = 8x$ ,

given that y=2, when x=1.

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8. If 
$$\overrightarrow{a} = 3\hat{i} + 3\hat{j} + \hat{k}$$
 and  $\overrightarrow{b} = -2\hat{i} + \hat{j} - 2\hat{k}$  then what is the unit vector parallel to  $\overrightarrow{a} + \overrightarrow{b}$ 

**9.** Find the value of k for which the line  $\frac{x-2}{3} = \frac{1-y}{k} = \frac{z-1}{4}$  is parallel to the plane 2x + 6y + 3z - 4 = 0.

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10. If  $f\colon R o R$  is defined as f(x)=10x+7.Find the function  $g\colon R o R$ , such that  $gof=fog=I_R.$ 

11. Show that the relation R on the set A of real

numbers defined as R = {(a,b): a  $\leq b$ ).is

reflexive. and transitive but not symmetric.



**12.** If S is a set of all rational numbers except 1 and \* be defined on S by a \* b = a + b - abfor all  $a, b \in s$  then prove that \* is a binary operation. **13.** If S is a set of all rational numbers except 1 and \* be defined on S by a \* b = a + b - abfor all  $a, b \in s$  then prove that \* is commutative as well as associative.



14. Prove that 
$$\cot^{-1}7 + \cot^{-1}8 + \cot^{-1}18 = \cot^{-1}3$$

15. Solve the following LPP graphically

Maximize, Z=20x+30y

Subject to  $3x + 5y \leq 15$ 

 $x,y\geq 0.$ 

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16. Verify that 
$$A = egin{bmatrix} a & b \ c & d \end{bmatrix}$$

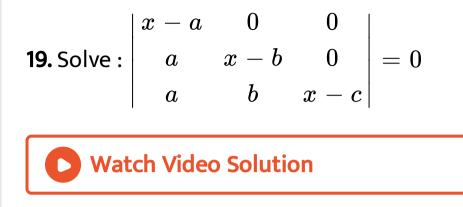
satisfies the equation  $A^2 - (a+d)A + (ad-bc)I = 0$  where I is

the 2x2 unit matrix.



**17.** If the matrix A is such that 
$$\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} A = \begin{bmatrix} -4 & 1 \\ 7 & 7 \end{bmatrix}$$
, find A. Watch Video Solution

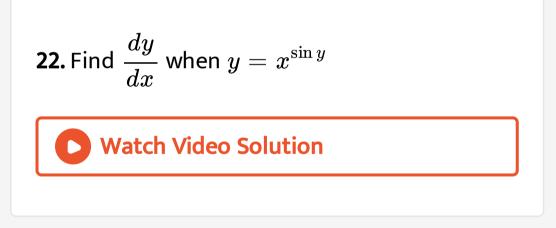
**18.** Show that 
$$(a + 1)$$
 is a factor of  $\begin{vmatrix} (a + 1) & 2 & 3 \\ 1 & a + 1 & 3 \\ 3 & -6 & a + 1 \end{vmatrix}$ 



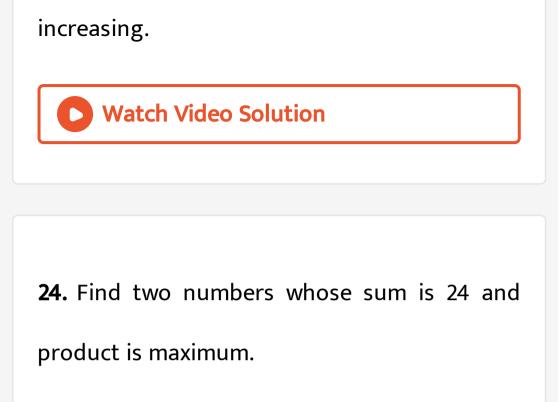
**20.** For what value of k is the function defined by  $\begin{cases} k(x^2+2) & when x \leq 0\\ 3x+1 & when x > 0 \end{cases}$ . Continuous at x = 0. Also write whether the function is continuous at x = 1.



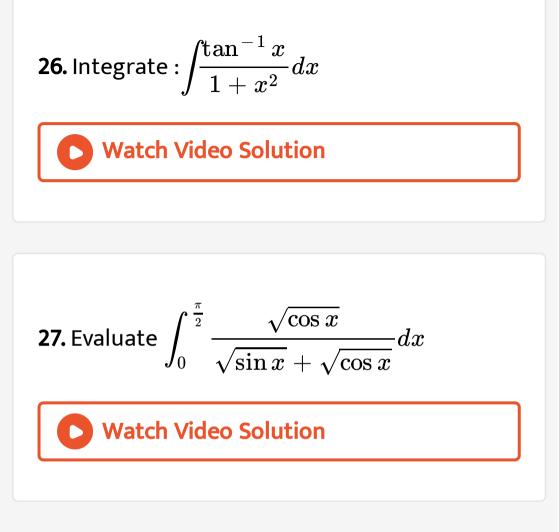
21. If sin y = x sin (a + y) then show that
$$\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$$



23. Find the interval in which the function  $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$  is strictly



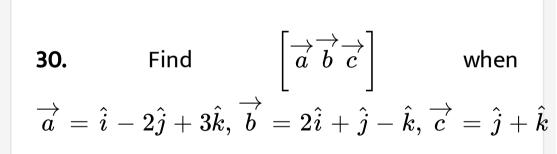
25. Integrate: 
$$\int \!\!\! x \frac{e^x}{\left(1+x
ight)^2} dx$$



28. Find the area bounded by the line y = 2x, x-

axis and the ordinate x = 3.

**29.** Solve 
$$2y^3 rac{dy}{dx} = ax$$

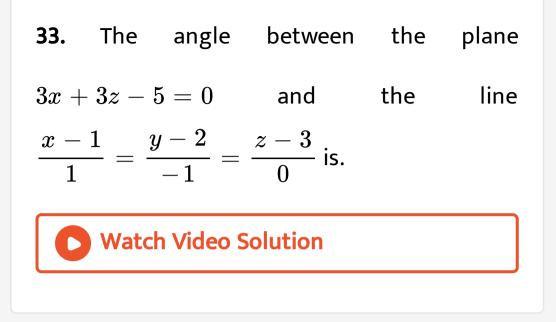


**31.** If the position vectors of the points A, B, C are  $2\hat{i} + \hat{j} - \hat{k}$ ,  $3\hat{i} - 2\hat{j} + \hat{k}$  and  $\hat{i} + 4\hat{j} - 3\hat{k}$ respectively, then prove that A, B, C are collinear.

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32. Write the volume of the parallelopiped

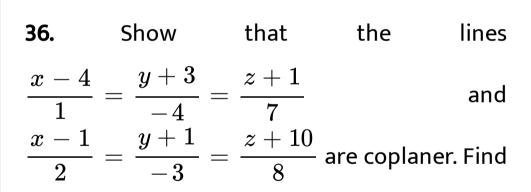
whose sides are given by $-\,\hat{j},\,\hat{k},\,-\,\hat{i}$ 



**34.** Find the equation of the plane passing through the intersection of the planes 3x + y-

z = 2 and x-y + 2z =1and the point (1, 0,2)

$$\left(\overrightarrow{a},\overrightarrow{b}
ight)^2 = a^2b^2 - \left(\overrightarrow{a} imes \overrightarrow{b}
ight)^2$$



their point of intersection.

**37.** If  $x = \frac{1 - \cos^2 \theta}{\cos \theta}$ ,  $y = \frac{1 - \cos^{2n} \theta}{\cos^n \theta}$  then show that  $\left(\frac{dy}{dx}\right)^2 = n^2 \left(\frac{y^2 + 4}{x^2 + 4}\right)$ 

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**38.** Find the altitude of a right circular cylinder of maximum volume inscribed in a sphere of radius r.

**39.** Evaluate the following integrals 
$$\int \frac{12\sin x - 2\cos x + 3}{\sin x + \cos x} dx$$
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**40.** Determine the area common to the parabola  $y^2 = x$  and the circle  $x^2 + y^2 = 2x$ .



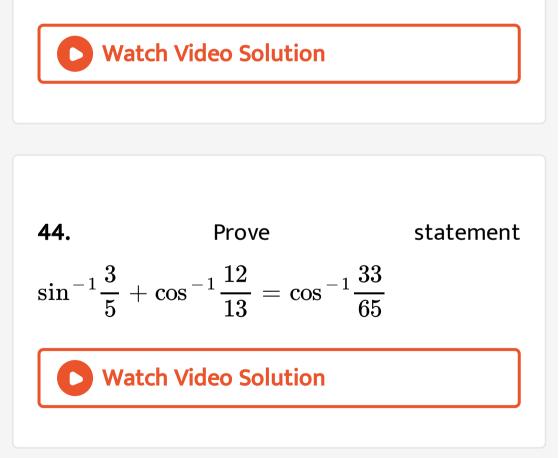
41. Solve the following differential equations

$$rac{dy}{dx} + 2y an x = \sin x, y \Big(rac{\pi}{3}\Big) = 0$$

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**42.** If 
$$A=egin{bmatrix}1&1\\-1&-1\end{bmatrix},B=egin{bmatrix}-1&3\\-3&1\end{bmatrix}$$
 then show that  $(A+B)^2
eq A^2+2AB+B^2.$ 

**43.** If  $f: R \to R$  defined by f(x) = 5x - 8 for all  $x \in R$ , then show that f is invertible. Find the corresponding inverse function.



45. Solve the following LPP graphically: Maximize:  $Z=4x_1+3x_2$  subject to $x_1+x_2\leq 50, x_1+2x_2\leq 80, 2x_1+x_2\geq 20,$  $x_1,x_2\geq 0$