



MATHS

BOOKS - ARIHANT PUBLICATION

QUESTION PAPER 2020

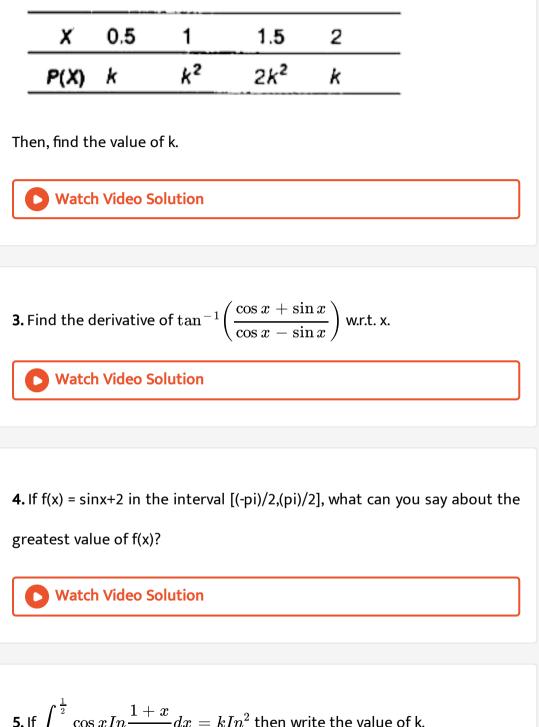
Group A Answer All Questions

1. A is a square matrix of order 3. write the value n, |2A|=n|A|.

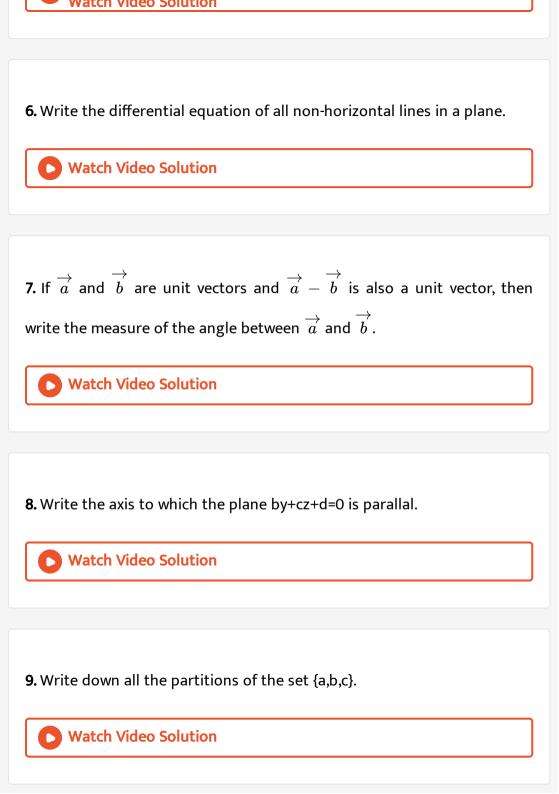
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2. A discrete random variable X has the probability distribution as given

below:



. If
$$\int_{-rac{1}{2}}^{2} \cos x In rac{1+x}{1-x} dx = k In^2$$
 then write the value of k



10. Write the domain of the function defined by f(x)= $\sin^{-1}x + \cos x$

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Group B Answer Any Three Questions

1. A man plans to start a poultry farm by investing at most ₹ 3000. He can buy old hens for ₹80 each and young ones for ₹ 140 each, but he cannot house more than 30 hens. Old hens lay 4 eggs per week ,each ell bing sold at ₹5. It costs ₹ 5 to feed an old hen and ₹8 to feed a young hen per week. Formulate his problem determining the number of hens of each type he should buy so as to earn a proft of more than ₹ 300 per week.

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2. Test whether the relation : $R = \{(m, n): 2 \mid (m + n)\}$ on \mathbb{Z} is reflexive, symmetric or transitive.



3. Prove that for any $f \colon X o Y,$ $foid_x = f = id_Y$ of.

4. Solve equation
$$3 \tan^{-1} \frac{1}{\left(2 + \sqrt{3}\right)} - \tan^{-1} \frac{1}{x} = \tan^{-1} \frac{1}{3}$$

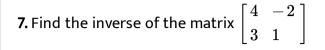
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5. Prove that
$$\tan\left\{\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{a}{b}\right\} + \tan\left\{\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right\} = \frac{2b}{a}.$$

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6. Four cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of aces. Calculate the mean and variance of the number of aces.







8. There are two families A and B. There are 4 men, 6 women and 2 children in family A and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women and 1800 for children, and 45 g of proteins for men, 55 g for women and 33 g for children. Represent the above information by matrices. Using matrices multiplication, calculate the total requirement of calories and proteins for each of the 2 families.

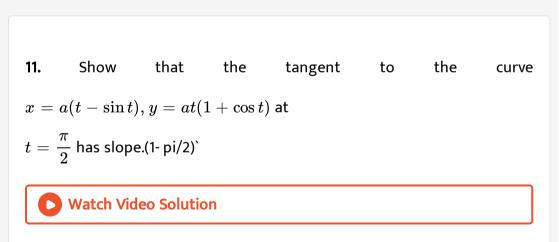


9. Eliminate x,y,z from

a=x/y-z, b=y/z-x, c=z/x-y

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10. There are 25 girls and 15 boys in class XI and 30 boys and 20 girls in class XII. If a student chosen from a class, selected at random, happens to be a boy, find the probability that he has been chosen from class XII.



12. Examine the contiunity of the following functions at the indicated

$$ext{points} . f(x) ext{=} \left\{egin{array}{cccc} 2x+1 & ext{if} & x \leq 0 \ x & ext{if} & 0 < x < 1 ext{ at } x = 0, 1. \ 2x-1 & ext{if} & x \geq 1 \end{array}
ight.$$

13. If sin
$$(x + y) = y \cos(x + y)$$
 then prove that

$${dy\over dx}=~-~{1+y^2\over y^2}$$

14. What is the derivative of
$$\sec^{-1}\left(\frac{1}{2x^2-1}\right)$$
, with respect to $\left(\sqrt{1-x^2}\right)$?

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15. Find the approximate value of $\sqrt{48.96}$

16. Solve :
$$In\left(\frac{dy}{dx}\right) = 3x + 4y$$
 given that y=0, when x=0.

17. Evaluate
$$\int \frac{4\sin x + 5\cos x}{5\sin x + 4\cos x} dx$$

It is an integration of the form $\int \frac{a\sin x + b\cos x}{c\sin x + d\cos x} dx$. So, write $4\sin x + 5\cos x = a\frac{d}{dx}(5\sin x + 4\cos x) + b(5\sin x + 4\cos x)$

18. Evaluate the following integrals :

$$\int_0^{\pi/2} \log \Bigl| rac{4+3\sin x}{4+3\cos x} \Bigr| dx.$$

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19. The area between $x=y^2$ and x=4 is divided into two equal parts by

the line x = a. Find the value of a.



20. Solve the following differential equations

$$xrac{dy}{dx}+y=y^2\log x$$

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21. Prove that the measure of the angle between two main diagonals of a

cube is $\cos^{-1}\frac{1}{3}$.

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22. Prove that the four points with position vectors $2\overrightarrow{a} + 3\overrightarrow{b} - \overrightarrow{c}, \overrightarrow{a} - 2\overrightarrow{b} + 3\overrightarrow{c}, 3\overrightarrow{a} + 4\overrightarrow{b} - 2\overrightarrow{c}$ and $\overrightarrow{a} - 6\overrightarrow{b} + 6\overrightarrow{c}$

are coplanar.

23. If $\overrightarrow{a} = 3\hat{i} + \hat{j} - 2\hat{k}$, $\overrightarrow{b} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ then verify that $\overrightarrow{a} \times \overrightarrow{b}$ is perpendicular to both \overrightarrow{a} and \overrightarrow{b} .

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24. Passing through the point (2, -3, 1) and (-1, 1-7) and perpendicular to the plane x - 2y + 5z + 1 = 0.

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25. Find the perpendicular distance of the point (-1, 3, 9) from the line

$$rac{x-13}{5} = rac{y+8}{-8} = rac{z-31}{1}$$

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Group C Answer Any One Questions

1. Find the solution of the following differential equations:

(4x+6y+5)dx-(2x+3y+4)dy=0

2. Find the area of the smaller region bounded by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and the line $\frac{x}{3} + \frac{y}{2} = 1$.

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3. Evaluate :
$$\int \!\! rac{x^5+x^4+x^3+x^2+4x+1}{x^2+1} dx$$

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4. Show that
$$\overrightarrow{a}, \overrightarrow{b}$$
 and \overrightarrow{c} are coplanar if $\overrightarrow{a} + \overrightarrow{b}, \overrightarrow{b} + \overrightarrow{c}$ and $\overrightarrow{c} + \overrightarrow{a}$ are coplanar.

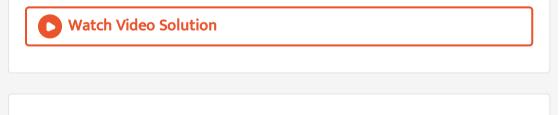
5. Find the shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y-7}{2} = \frac{z-6}{4}$ Find also the

equation of the line of shortest distance.

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6. Solve the following LPP graphically Optimize $Z = 5x_1 + 25x_2$ subject

 ${\sf to} - 0.5 x_1 + x_2 \le 2, \, x_1 + x_2 \ge 2, \, -x_1 + 5 x_2 \ge 5, x_1, x_2 \ge 0$



7.

lf

$$\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$$
 prove that $x^4 + y^4 + z^4 + 4x^2y^2z^2 = 2(x^2)^2$

8. (Z,*) where a* b = a+b-ab for all $a, b \in Z$ prove that the given binary

operation * is associative and commutative.



9. The probability of a shooter hitting a target is $\frac{3}{4}$ Find the minimum number of times he must fire, so that the probability of hitting the target atleast once is greater than 0.999.

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10. Prove the following:

$$egin{bmatrix} (b+c)^2 & a^2 & bc\ (c+a)^2 & b^2 & ca\ (a+b)^2 & c^2 & ab \end{bmatrix} \ = & (a^2+b^2+c^2)(a+b+c)(b-c)(c-a)(a-b) \end{split}$$

11. If A,B,C are matrices of order 2 imes 2 each and $2A + B + C = \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$

$$A+B+C=egin{bmatrix} 0&1\2&1\end{bmatrix}$$

 $A+B-C=egin{bmatrix} 1&2\1&0\end{bmatrix}$ find A,B and C.

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12. If
$$y=x^{\sin x}+x^3rac{\sqrt{x^2+4}}{\sqrt{x^3+3}}$$
 find $rac{dy}{dx}.$

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13. Show that the semivertical angle of a cone of given slant height is

 $an^1\sqrt{2}$ when its volume is maximum.

