Series: SSO/1

Code No. 6511/1

m;f.

Roll No.

"tm" ';f.

Candidates must write the Code on the title page of the answer-book.

~ ~-~ c); ~"TO 1R m -;:f. ~ft;;&

- Please check that this question paper contains 8 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 29 questions.
- Please write down the serial number of the question before attempting it.
- 15 Minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the student will read the question paper only and will not write any answer on the answer script during this period.
- ~~CR~fcnw~-q;r.q~"T08t I
- ~--q;r.q ~ ~ qft m~ ~ m;p:<iR Cfim;r ~-~ c);~-"T01R ft;;& I
- ~~CR~fcnw~--q;r.q29~t I
- WCm "RFI' ~ ~ fi;ror;rr ~~ ~ ~ "RFI' q)f ~ ~ ft;Rj I
- ~~--q;rCfiT~C);~ 15 ilRGCfif~m~~ I ~--q;rCfiffc1mur~.q 10.15 ~~ \1lWrr I 10.15 ~~ 10.30 ~(iCfim;r~~--q;rCfiT-q$T ~~ ~c);~~~-~ 1Rq#~~~1

MATHEMATICS

alfOH't

Time allowed: 3 *hours* / ~ *w:r<l .'* 3 *erut]* .

[Maximum marks: 100 *[~afcf;.'* 100

General Instructions :

(i) *All questions are compulsory.*

(ii) *The question paper consists of* 29 *questions divided into three Sections A, Band* C. *Section A comprises of 10 questions of one mark each, Section B comprises of 12 questions of four marks each and Section* C *comprises of* 7 *questions of six marks each.*

(iii) *All questions in Section* A *are to be answered in one word, one sentence or as per the exact requirement of the question.* .

(iv) *There is no overall choice. However, internal choice has. been provided in 4 questions offour marks each and* 2 *questions of six marks each. You have to attempt only one of the alternatives in all sucb questions.*

(v) *Use of calculators is not permitted.*

(i) "R"It JIR a#tcncf ~ I

(ii) W JIR-q;{ '429 JIR ~ ;;ff r{t;:((gugf '4~ ~ : 3T, 'if, (fP[{ rr I ~ 3T '410 JIR ~ f.ir;rlf "# ~ rp#) .3fq; CfiT t I ~ (if '412 JIR ~ f.ir;rlf "# ~ Tm" .3fq; CfiT t I ~ rr '4 7 JIR ~ f.ir;rlf "#~ 'f§: .3fq; CfiT t I

(iii) ~ 3T '4 "R"It m cl; "3flT rp#) ~ rp#) CfTil<T 3'{Plqf JIR qft 311C1:t<1Cfi(1f ~ ~ irfT N ~

(iv} rpf JIR q;{ '4~ ::rtf ~ I m ~ Tm" 3fqff CfTff 4 m '4 (fP[{ 'f§: 3fqff CfTff 2 m '43fl"rlRCfi ~ ~ I # ~ m '4"# 3TTflCfiT rp#) tt~ cnRT t I

(v) 4lH1H2< cl;wWrqft~o:rift I

SECTION-A

~-3T

Question numbers 1 to **10** carry one mark each.

~~1 ~10(fCf;~~~3lq;cnrt I

1. Find the projection of $\vec{a}$ on $\vec{b}$ if $\vec{a}\cdot\vec{b} = 8$ and $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$.

   $\vec{a}$ cnr $\vec{b}$ IR~m~~ $\vec{a}\cdot\vec{b}$ =8om $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$ I

2. Write a unit vector in the direction of $\vec{a} = 2\hat{i} - 6\hat{j} + 3\hat{k}$.

   ~ $\vec{a} = 2\hat{i} - 6\hat{j} + 3\hat{k}$ Cfft~ll"QCfi~~~ I

3. Write the value of p for which $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors.

4. If matrix A = (1 2 3), write AA', where A' is the transpose of matrix A.

   ~~A=(1 2 3)tm~AA'~~A',~Acnr-qftcfflt I

5. Write the value of the determinant $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$

   flRlOlCfi $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$ cnr11R~ I

6. Using principal value, evaluate the fo11owing :

sin-1 (sin 3;)

~ llR Cf;T'WWr Cji"{ f.rr;:r Cf;T"t:fR"~ ~ I

$\sin^{-1}\left(\sin \frac{3\pi}{5}\right)$ 31t)

7. Evaluate: $\int \frac{\sec^2 x}{3 + \tan x}\, dx.$

"t:fR"~~: $\int \frac{\sec^2 x}{3+\tan x} dx.$

8. If $\int_0^1 (3x^2 + 2x + k)\, dx = 0$, find the value of k.

~ $\int_0^1 (3x^2 + 2x + k)\, dx = 0$ t "ffi k Cf;T"t:fR" ~ I

9. If the binary operation * on the set of integers Z, is defined by $a * b = a + 3b^2$, then find the value of 2 * 4.

~ it~ ~ *~ ~ 'Wl-c.:q;q Z 1R ~ ~ ~ ~ fcf; $a * b = a + 3b^2$ ~,"ffi 2 * 4 Cf;TllR~~

10. If A is an invertible matrix of order 3 and $|A| = 5$, then find $|\text{adj. } A|$.

~ A ~oy;&lJ40n4 ~t~Cfi1fc 3~, ~ $|A| = 5$ ~m $|\text{adj. } A|$ ~~ I

SECTION -B

~-if

Question number 11 to 22 carry 4 marks each.

~~11 tt22(fCf;~~4~Cf;Tt I

11. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, show that $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$, where $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$.

~ $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ ~ $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$ t m~fcf; $\vec{a} - \vec{d}$ ~ $\vec{b} - \vec{c}$,~

~t,~ $\vec{a} \neq \vec{d}$ ~ $\vec{b} \neq \vec{c}$ ~ I

12. Prove that: Sin-{~} + Sin-{ 1 5 3)+ Sin-{~~} = ¥

OR

Solve for *x:* tan-1 3x + tan-l 2x = 4 1π

~~~: sin-{~)+Sin-{153)+sin-{~~)=¥,

~

13. Find the value of')... so that the lines

1 - *x* 7y - 14 5z - 10 7 -7*x* Y.=1 6 - z
-3-= 2')... = 11 and~= 1 =-5-

are perpendicular to each other.

14. Solve the following differential equation:

.Qy
dx + Y= cos *x* - sin *x.*

~~*141Ch<Oj~re~ I

.Qy
dx + Y= cos *x* - sin *x.*

15. Find the particular solution, satisfying the given condition, for the following differential equation :

~ - ; + cosec (;) = 0,; Y= 0 when *x* = 1.

~ ~ fI'I1Ch<Oj;ft;nt~~~~~'CfiBcm;rr~~mo~ I

~ - ; + cosec (;) = 0; y = 0 \ifGf *x* = 1.
~~~

16. By using properties of determinants, prove the following:

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & 'x+4 \end{vmatrix} = (5x+4)(4-x?$$

~1{fUlcN ~~CiiTwmm~cRfu;[~:

$$\begin{vmatrix} x+4\cdot & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x?$$

17. A die is thrown again and again until three sixes are obtained. Find the probability of obtaining the third six in the sixth throw of the die.

~ tfffi cR GfR'GfR~ CiCfi ~ \1fffil' ~ ~ CiCfi ~ ~ tR 6 CiiT~ 'ffi;r GfR~ ~ m\1fffil' I
~ l'llf~Cfii.'11m~~tfffitRmmr 6 CiiT~~~GfR'~tR~mm~ I

18. Differentiate the following function w.r.t. x:

$x^{\sin x} + (\sin x)^{\cos x}$

~ ~CiiT x ~~ -31ClCfiW1 ~ :

$x^{\sin x} + (\sin x)^{\cos x}$

19. Evaluate: $\int \frac{1}{\sqrt{5-4e^{x}-e^{2x}}}\, dx.$

OR

Evaluate: $\int \frac{(x-4)e^{x}}{(x-2)^3}\, dx.$

attrcn'

l1R' m ~ qlll"l~ : $\int \frac{(x-4)e^{x}}{(x-2)^3}\, dx.$

20. Prove that the relation R in the set A = {1,2,3,4, 5} given by R = {(a, b) : |a - b| is even}, is an equivalence relation.

fu;[~~ A = {1, 2, 3, 4, 5} ll, R = {(a, b) : |a - b| ~~} 1ITU~m R ~
~m~1

21. Find ~ if $(x^2 + y^2)^2 = xy$.

OR

If y = 3 cos (log *x*) + 4 sin (log *x*), then show that $x^2 \cdot \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$

~(x2+y2?=xymmdx~~ S!Y I

~

~ Y= 3 cos (log *x*) + 4 sin (logx)t, m~f.:px2. $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$

22. Find the equation of the tangent to the curve y = ~3*x* - 2 which is parallel to the line *4x-2y* + 5 =0.

OR

Find the intervals in which the function f given by f(x) = $x^3 + \frac{1}{x^3}$, *x* ':t 0 is

(i) increasing (ii) decreasing.

CfSf)y=~3x- 2 ~~~~COTfl41Ch<OI mc;~"tT~4x-2y + 5 = O~~
tl

~

~m~FFr-qr~f"tTf(x) =x^3 + ~ ,x':tO~~t, (i)~t(ii) ~IWtH

tl

SECTION-C

~-~

Question number **23 to 29** carry 6 marks each.

~ 'tt&:rr **23 ~ 29** '(f'Cf;" ~ ~ 6 3tCfl COt I

23. Find the volume of the largest cylinder that can be inscribed in a sphere of radius r.

OR

A tank with rectangular base and rectangular sides, open at the top is to be constructed so that its depth is 2 m and volume is 8 m^3. If building of tank costs Rs. 70 per sq. metre for the base and Rs. 45 per sq. metre for sides, what is the cost of least expensive tank?

~~~~~COT~~~~rR"m~~~~~\1fT~t I

~

~1'4('1IChR3W:IR q atI4('1IChRcftcmT ~ 2 "1ft. rrr0 ~ 8 "Ift3 ~ ~ ~ m-~ ~M q;r mtur ~ t I~ M~mtur.q: .3W:IR ~ ~ 70 Q. m qlhfl2< attt cftcmT -qr45 Q. m .ql!lOi"i2< .a:nmtm f~x:rt('14~~iFftM~~CFl'Tt?
~~~~~

24. A diet is to contain at least 80 units of Vitamin A and 100 units of minerals. Two foods FI and F2 are available. Food FI costs Rs. 4 per unit and F2 costs Rs. 6 per unit. One unit of food F} contains 3 units of Vitamin A and 4 units of minerals. One unit of food F2 contains 6 units of Vitamin A and 3 units of minerals. Formu~ate this as a linear programming problem and find graphically the minimum cost for diet that consists of mixture of these two foods and also meets the minimal nutritional requirements.

~~ m~Cfi11 ~ Cfi11 80 ~ fq21f~1A ,afu- 100 ~ * -rr.rr ~ IGT m ~
~ FI ,afu- F2 ~ ~ I ~ FI ~ ~ 4~. ~~ F2 ~ ~ 6~. ~ ~
~ I~Fl~~~~3~fcI2If~1A~4~~~ IF2~~~~6~
fCj21f~A *3 ~~~ I~~~~mr~~~~~ I~
'[RT ~ .am cpr ~ ~ ~ ~, ~ ~ GT ~ cpr fl:r~ ~ ,afu- ~ ~
¢1lql(atCf)~~~ I

25. Thre e b ags con tam b a11s as shown In the table below:

Bag	Number of White balls	Number of Black balls	Number of Red balls
I	1	2	3
II	2	1	1
III	4	3	2

A bag is chosen at random and two balls are drawn from it. They happen to be white and red. What is the probability that they came from the III bag? .

cfR ~ ~ ~ ~ ~ Fp:;nmBcpr ~ -ey ~ :

~	~~Cf>1 .~	~~Cf>1 ~	~~Cf>1 ~
I	1	2	3
II	2	1	1
ill	4	3	2

~ ~ atl~atl ~ '1fatT (MT ~ ~ GT ~ f.:rcf;rffi Tf{ I <$ ~ (MT ~ trT ~ -qrft ll<fT I
I'llfatCf)('11~~~<$ III ~~~'ffiTfCft ~?

26. Using matrices, solve the following system of equations:

$$2x - 3y + 5z = 11$$
$$3x + 2y - 4z = -5$$
$$x + y - 2z = -3$$

~ cprw:O<r ~ Ffl:;:r '€ltftCf)~OI ~ em rn ~ :

$$2x - 3y + 5z = 11$$
$$3x + 2y - 4z = -5$$
$$x + y - 2z = -3$$

27. Evaluate: $\int_{0}^{7t} \frac{eCosx}{e^{\cos x} + e^{-\cos x}} \, d.x$

OR

Evaluate: $\int_{0}^{7th} (2 \log \sin x - \log \sin 2x) \, d.x$

l:fRm~: $\int_{0}^{7t} \frac{eCosx}{eCosx + e\text{-}cosx} \, d.x$

~

l:fRm~: $\int_{0}^{7th} (2 \log \sin x - \log \sin 2x) \, d.x$

28. Using the method of integration, find the area of the region bounded by the lines

$2x + y = 4,\ 3x - 2y = 6$ and $x - 3y + 5 = 0$

~lilCflH'1fqftT'q1nr~lTf~ ~ ~an

$2x + Y = 4,\ 3x - 2y =$ 6'('f?IT$x - 3y + 5 = 0$

~M~'q1f~m~ ı

29. Find the equation of the plane passing through the point (-1, 3, 2) and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = O$.

~ (-1, 3, 2) ~ ~ '\i'fR ~ ~ ~ 'q1f~41Cfl{OIm ~ ~ ~"i('kl1

$x + 2y + 3z = 5$ '('f?IT$3x + 3y + z = 0$ .q.~~lR~~ i

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