PaperCode: 2010 **Paper Name:** 2010-M.Sc. (SET-VI) M.SC(MATHS) **Set Name:** Original

Q-1 Let $M = \begin{bmatrix} -1 & 2 & 3 & 4 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 5 & 4 \\ 0 & 0 & 0 & 2 \end{bmatrix}$, then the determinant of M is

A **-20**
B 0
C 20
D -10

Correct Answer : A

Q-2 Consider the system of equations

$$x + y + 5z = 3,$$
$$x + 2y + mz = 5,$$
$$x + 2y + 4z = n,$$

where x, y, z are the variables and m, n are the constants. The system is consistent if

A m=4
B **m≠4**
C n≠5
D None of these

Correct Answer : B

Q-3 Let $T: R^2 \to R^3$ be a linear transformation given by $T(x_1, x_2) = (x_1 + x_2, x_1 - x_2, x_2)$. Then, the rank of T is equal to

A 3
B 4
C **2**
D 1

Correct Answer : C

Q-4 Cayley – Hamilton theorem states that every square matrix satisfies…

A Its determinant
B Its simultaneous equation
C **Its own characteristic equation**
D None of these

Correct Answer : C

Q-5 Let V be the space of all $n \times n$ matrices and $T: V \to V$ be the linear operator defined by $T(A) = \frac{A - A^T}{2}$, then the nullity of T is

A 2n
B $n^2/2$
C **(n(n+1))/2**
D (n(n-1))/2

Correct Answer : C

Q-6 Let V be the vector space of complex number $\mathbb{C}$ over the field of real number $\mathbb{R}$. Then, the dimension $\mathbb{C}(\mathbb{R})$ is

A 1
B 2
C 3
D 4

Correct Answer : B

Q-7 The number of generators in the cyclic group of order 10 are

A 1
B 2
C 3
D 4

Correct Answer : D

Q-8 The number of homomorphism from Z_{12} to Z_{30} are

A 4
B 6
C 20
D 120

Correct Answer : B

Q-9 Which of the following statement is false ?

A Every integral domain is a field
B Every finite integral domain is a field
C Every field is an integral domain
D Every field is a ring

Correct Answer : A

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Q-10 Which of the following is prime ideal of Z

A 4Z
B 6Z
C 9Z
D 3Z

Correct Answer : D

Q-11 The $\lim_{Z\to 0}\frac{\bar{Z}}{Z}$ is

A 0
B 1
C 1/2
D does not exist

Correct Answer : D

Q-12 The function $f(z)=|z|^2$ is

A everywhere analytic
B nowhere analytic
C analytic at z=0
D None of these

Correct Answer : B

Q-13 Which of the following is not harmonic function?

A u=sinhx cosy
B $u = \frac{1}{2}\log(x^2+y^2)$
C $u=x^2+y^2$
D $u=x^2-y^2$

Correct Answer : C

Q-14 The mapping $w=z^2-2z$ is

A conformal at z=1

B not conformal at z=1

C not conformal at z=-1

D everywhere conformal

Correct Answer : B

Q-15 Let $S_n = 1 + \frac{(-1)^n}{n}, n \in \mathbb{N}$. Then the sequence $\{S_n\}$ is

A monotonically increasing and is convergent to 1

B monotonically decreasing and is convergent to 1

C neither monotonically increasing nor monotonically decreasing but is convergent to 1

D divergent

Correct Answer : C

Q-16 Suppose that S is the sum of convergent series $\sum_{n=1}^{\infty} u_n$. Define $t_n = u_n + u_{n+1} + u_{n+2}$, then the series $\sum_{n=1}^{\infty} t_n$

A diverges

B converges to $3S-u_1-u_2$

C converges to $3S-u_1-2u_2$

D converges to $3S-2u_1-u_2$

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Correct Answer : D

Q-17 If $s_n = \frac{(-1)^n}{2^n+3}$ and $t_n = \frac{(-1)^n}{3n-1}, n = 1,2,3, \ldots$, then the series

A $\sum_{n=1}^{\infty} t_n$ is conditionally convergent

B $\sum_{n=1}^{\infty} s_n$ is conditionally convergent

C $\sum_{n=1}^{\infty} t_n$ is absolutely convergent

D $\sum_{n=1}^{\infty} s_n$ is divergent

Correct Answer : A

Q-18 Let $a_n = \sin\frac{n\pi}{3}, n \in \mathbb{N}$. Then the set of limit points of the sequence $\{a_n\}$ is

A $\left\{\frac{\sqrt{3}}{2}\right\}$

B $\left\{\frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{2}, 0\right\}$

C $\left\{\frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{2}, \frac{1}{2}\right\}$

D $\left\{\frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{2}\right\}$

Correct Answer : B

Q-19 Consider the sequence $\left\{\frac{2n-7}{3n+2}\right\}$. Then the sequence is

A convergent to 1.5

B divergent

C bounded

D monotonically decreasing

Correct Answer : C

Q-20 The radius of convergence of power series $\sum_{n=1}^{\infty}\left(\frac{n^3}{4^n}\right)x^{2n}$ is

A 2

B 1/2

C 4

D 1/4

Correct Answer : A

Q-21 The value of k for function $f(x)=\begin{cases}x\sin\frac{1}{x}, & x\neq 0\\ k, & x=0\end{cases}$ is continuous at $x=0$ is

A 0

B 1

C -1

D None of these

Correct Answer : B

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Q-22 If $f(x)=\begin{cases}\frac{\sin[x]}{[x]}, & [x]\neq 0\\ 0, & [x]=0\end{cases}$, where $[x]$ denotes the greatest integer less than or equal to x. Then $\lim_{x\to 0} f(x)$ is

A 0

B 1

C -1

D None of these

Correct Answer : D

Q-23 If $f(x)=\begin{cases}x^2+3x+a & if\ x\leq 1\\ bx+2 & if\ x>1\end{cases}$ is differentiable for every x. Then the values of a and b are

A 1,3

B 1,2

C 2,3

D 3,5

Correct Answer : D

Q-24 Find 'c' of Lagrange's mean value theorem, if $f(x)=e^x$ in $[0,1]$.

A 1

B $\log_e(e-1)$

C e+1

D e-1

Correct Answer : B

Q-25 If $f(x) = f(0) + xf'(\theta x)$, then find the value of θ as x tends to 1, $f(x)$ being $(1-x)^{3/2}$.

A 9/25

B 3/5

C 5/9

D None of these

Correct Answer : C

Q-26 In Taylor's series expansion of e^x about $x = 2$, the coefficient of $(x-2)^4$ is

A $\frac{2^4}{4!}$

B $\frac{e^2}{4!}$

C $\frac{e^4}{4!}$

D $\frac{1}{4!}$

Correct Answer : B

Q-27 The maximum value of f(x)=sin x+cos2x is

A 9/8

B 1

C 5/4

D 0

Correct Answer : A

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Q-28 Let $f(x,y) = \begin{cases} \frac{xy}{\sqrt{x^2+y^2}}, & if\ (x,y) \neq 0 \\ 0, & if\ (x,y) = 0 \end{cases}$. Then which of the following is not correct ?

A f_x (0,0)=f(0,0)

B f(x,y) is differentiable at origin

C $f_y(0,0) = f(0,0)$

D f(x,y) is continuous at origin

Correct Answer : B

Q-29 Rolle's theorem is applicable to the

A functions differentiable in [a,b] and continuous in (a,b) only and having same value at point 'a' and 'b'

B functions continuous in [a,b]only and having same value at point 'a' and 'b'

C functions continuous in [a,b] and differentiable in (a,b) only and having same value at point 'a' and 'b'

D monotonically Increasing functions

Correct Answer : C

Q-30 If directional derivative of function $z = y^2e^{2x}$ at $(2,-1)$ along the unit vector $\vec{b} = m\hat{i} + n\hat{j}$ is zero, then $m+n$ is

A 0

B $\frac{1}{2}m$

C 2m

D $\frac{1}{4}m$

Correct Answer : C

Q-31 Let $g: \mathbb{R} \to \mathbb{R}$ be a twice differentiable function. If $f(x,y) = g(y) + xg'(y)$, then

A $\frac{\partial f}{\partial x} + y\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial f}{\partial y}$

B $\frac{\partial f}{\partial y} + y\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial f}{\partial x}$

C $\frac{\partial f}{\partial x} + x\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial f}{\partial y}$

D $\frac{\partial f}{\partial y} + x\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial f}{\partial x}$

Correct Answer : C

Q-32 Which of the following is false?

A $\lim_{x \to 0^+} \frac{\cos x}{1+2x} = 0$

B $\lim_{x \to \infty} \frac{x}{e^x} = 0$

C $\lim_{x \to 0^+} \frac{1}{xe^{1/x}} = 0$

D $\lim_{x \to 0^+} \frac{\sin x}{1+2x} = 0$

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Correct Answer : A

Q-33 If $\int_0^1 \int_{2y}^2 e^{x^2} dx\, dy = k(e^4 - 1)$, then the value of k is

A 1

B 1/2

C 1/4

D 1/8

Correct Answer : C

Q-34 The value of β(3,2) is

A 1/8

B 1/12

C 1/4

D 1/16

Correct Answer : B

Q-35 The formula for Green's theorem is

A $\oint_c (Pdx + Qdy) = -\iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dA$

B $\oint_c (Pdx + Qdy) = -\iint_R \left(\frac{\partial Q}{\partial x} + \frac{\partial P}{\partial y}\right) dA$

C $\oint_c (Pdx + Qdy) = \iint_R \left(\frac{\partial Q}{\partial x} + \frac{\partial P}{\partial y}\right) dA$

D $\oint_c (Pdx + Qdy) = \iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dA$

Correct Answer : D

Q-36 Divergence and Curl of a vector field are

A Vector & Scalar

B Scalar & Vector

C Vector & Vector

D Scalar & Scalar

Correct Answer : B

Q-37 What is the order and degree of differential equation $\frac{d^2y}{dx^2} + \sqrt{1 + \left(\frac{dy}{dx}\right)^3} = 0$?

A 1, 2

B 2, 3

C 1, 3

D 2, 2

Correct Answer : D

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Q-38 The complementary function of differential equation $(x^2 D^2+xD)y=\log(x)$ is

A $c_1+c_2 \log(x)$

B $c_1 x+c_2 \log(x)$

C $c_1+c_2 x^2$

D $c_1+c_2 x$

Correct Answer : A

Q-39 The solution of differential equation $\left[\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right]\frac{dx}{dy} = 1, x \neq 0$ is

A $ye^{2\sqrt{x}} = 2\sqrt{x} + c$

B $ye^{-2\sqrt{x}} = 2x^{3/2} + c$

C $ye^{-2\sqrt{x}} = 3\sqrt{x} + c$

D $ye^{2\sqrt{x}} = 3x^{3/2} + c$

Correct Answer : A

Q-40 The general solution of the linear partial differential equation yzp+zxq=xy is

A $F(x^2-y^2,z-x)=0$

B $F(x^2-y^2,y^2-z^2)=0$

C $F(x^2-z^2,z^2-x^2)=0$

D $F(x^2-y^2,y-x)=0$

Correct Answer : B

Q-41 The partial differential equation corresponding to $z = f\left(\frac{xy}{z}\right)$ is

A **px=qy**

B py=qx

C px+qy=0

D $\frac{p}{q} = xy$

Correct Answer : A

Q-42 For any function f(x,y) and r,s,t having their usual meaning then f will be minimum if

A $rt-s^2>0$

B $rt-s^2<0$

C $rt-s^2, r<0$

D **$rt-s^2, r>0$**

Correct Answer : D

Q-43 Let f(x,y,z) be a function of three variables x ,y ,z which are connected by relation ϕ(x,y,z). Then new function generated by Lagrange's method of undetermined multipliers is

A $\phi = f(x,y,z) + \lambda F(x,y,z)$

B $f = F(x,y,z) + \lambda\phi(x,y,z)$

C $F = f(x,y,z) + \lambda\phi(x,y,z)$

D All of the these

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Correct Answer : C

Q-44 Laplace transformation of unit step function u(t-a) is

A 1

B e^{-as}

C $\frac{e^{as}}{s}$

D $\frac{e^{-as}}{s}$

Correct Answer : D

Q-45 Laplace transformation of function $f(t) = 2^t$ is

A $\frac{1}{\log(2)}$

B $\frac{1}{s - \log(2)}$

C $\frac{\log(2)}{s-2}$

D $\log(s-2)$

Correct Answer : B

Q-46 The value of $\mathcal{L}^{-1}\left[\frac{1}{(s+4)(s+5)}\right]$ is

A $e^{4t} + e^{5t}$

B $e^{-4t} + e^{5t}$

C $e^{-4t} - e^{5t}$

D $e^{-4t} - e^{-5t}$

Correct Answer : D

Q-47 The value of $\mathcal{L}\left[t^{-\frac{1}{2}}\right]$ is

A **√(π/s)**

B √π

C √s

D √(s/π)

Correct Answer : A

Q-48 Virtual work refers to

A virtual work done by virtual forces

B **virtual work done by actual forces**

C actual work done by virtual forces

D actual work done by actual forces

Correct Answer : B

Q-49 A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

A 1/8

B **3/8**

C 5/8

D 7/8

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Correct Answer : B

Q-50 In a Binomial Distribution, if p=q, then P(X = x) is given by?

A $\binom{n}{n}(p)^{n-x}$

B $\binom{n}{x}(p)^{n-x}$

C $\binom{n}{n}(0.5)^n$

D $\binom{n}{x}(0.5)^n$

Correct Answer : D

Q-51 A train overtakes two persons who are walking in the same direction in which the train is going, at the rate of 2 kmph and 4 kmph and passes them completely in 9 and 10 seconds respectively. The length of the train is

A 40 m

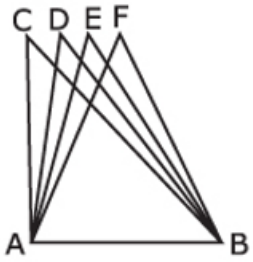
B 45 m

C **50 m**

D 55 m

Correct Answer : C

Q-52 Which of the following is the shortest route for travelling from A to B in the figure given below?



A ACB

B ADB

C AEB

D AFB

Correct Answer : D

Q-53 Speed of a boat in still water is 9 km/hr. It goes 12 km down- stream and comes back to the starting point in three hours. What is the speed of water in the stream?

A 3 km/hr

B 3.5 km/hr

C 5 km/hr

D 5.5 km/hr

Correct Answer : A

Q-54 A bucket containing water is tied to one end of a rope of length 2.5 m and rotated about the other end in a vertical circle. What should be the minimum velocity of the bucket at the highest point, so that the water in the bucket will not spill? ($g = 10\ m/s^2$)?

A 2.5 m/s

B 4 m/s

C 5 m/s

D 7 m/s

Correct Answer : C

Q-55 A, B, C, D, E, F and G are members of a family consisting of four adults and three children, two of whom, F and G are girls. A and D are brothers and A is a doctor. E is an engineer married to one of the brothers and has two children. B is married to D and G is their child. Who is C?

A E's daughter

B F's father

C G's Brother

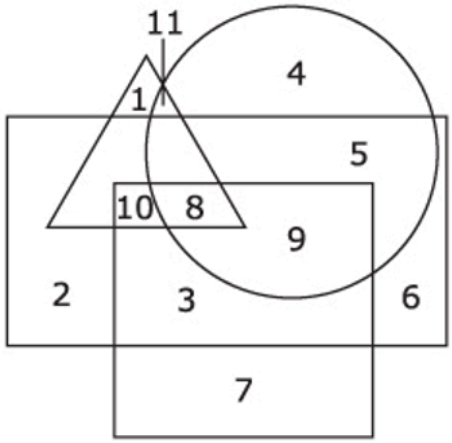
D A's son

Correct Answer : D

Q-56 In the figure given below:

(a) Rectangle represents Males,
(b) Circle represents the urbans
(c) Square represents the educated and
(d) Triangle represents the civil servants.

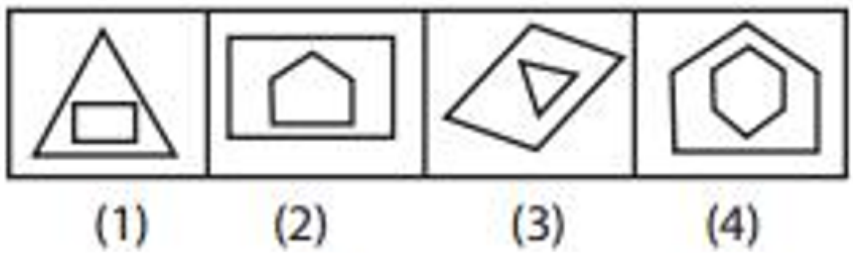
The number indicating the educated urban males who are not civil servants is



A 8
B 9
C 10
D 11

Correct Answer : B

Q-57 Which of the following figures is different?



A 1
B 2
C 3
D 4

Correct Answer : C

Q-58 In covering a distance of 30 km, A takes 2 hours more than B. If A doubles his speed, then he would take 1 hour less than B. A's speed is:

A 5 km/h
B 7 km/h
C 9 km/h
D 10 km/h

Correct Answer : A

Q-59 Which of the following parts of the sun is easily visible only during a total solar eclipse?

A Core
B Photosphere
C Sunspots
D Corona

Correct Answer : D

Q-60 Sickle Cell Anemia is a

A **Genetic Disorder**

B Virus Disease

C Bacterial Disease

D None of these

Correct Answer : A

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