Id	**1**
Question	Which of the following is true?
A	$f(x)=x^2$ Is uniformly continuous on $\mathbb{R}$
B	$f(x)=\sin x$ Is uniformly continuous on $\mathbb{R}$
C	$f(x)=x^3$ Is uniformly continuous on $\mathbb{R}$
D	$f(x)=\sin\frac{1}{x}$ Is uniformly continuous on (0,1)
Answer	B

Id	**2**
Question	Consider the function $f:\mathbb{R}\to\mathbb{R}$. let $a\in\mathbb{R}$. consider the two statements I. f is continuous at a . II. if $x_n\to a$, then $f(x_n)\to f(a)$ Then
A	$(II)\Rightarrow(I)$ But not the converse
B	$(I)\Rightarrow(II)$ But not the converse
C	There is no implication between (I) and (II)
D	$(I)\Leftrightarrow(II)$
Answer	D

Id	**3**
Question	On $\mathbb{R}\times\mathbb{R}$, define $d:\mathbb{R}\times\mathbb{R}\to\mathbb{R}$ by $d(x,y)=\begin{cases}0, x=y;\\ 1, x\neq y\end{cases}$ then
A	d Is a metric on $\mathbb{R}$ in which every singleton set is open
B	d Is a metric on $\mathbb{R}$ in which [0,1] is not open
C	d Is not a metric on $\mathbb{R}$ and the image of d has two elements
D	d Is monotonically increasing
Answer	A

Id	**4**
Question	Let $a_n = \begin{cases} 2+\frac{1}{n}, \text{if } n \text{ is even;} \\ 0, \quad \text{if } n \text{ is odd} \end{cases}$ Then
A	a_n Converges.
B	limsup $a_n = \liminf a_n = 2$
C	lim sup $a_n = 2$
D	$\liminf a_n = 2$
Answer	C

Id	**5**
Question	Consider the statements I. arbitrary intersection of closed sets is closed II. arbitrary union of closed sets is closed
A	Only (I) is true
B	Only (II) is true
C	Both (I) and (II) are true
D	Both (I) and (II) are false
Answer	A

Id	**6**
Question	Let G be a cyclic group of order 120. which of the following is false?
A	G has a unique subgroup of order 80
B	For every divisor d of 120, G has a unique subgroup of order d
C	Every proper subgroup of G has order less than or equal to 60
D	G has a subgroup of order 8 but not a subgroup of order 16
Answer	A

Id	**7**
Question	Which of the following is false?
A	A_4 Is a normal subgroup of S_4
B	A_4 Has 12 elements
C	A_4 Has no proper normal subgroup
D	A_5 Has no proper normal subgroup
Answer	C

Id	**8**
Question	Let σ be a permutation of 10 symbols. Then the order of σ
A	is 10
B	is at most 20
C	Can be 10
D	Can be 30
Answer	D

Id	**9**
Question	The number of conjugates of (1 2) (3 4) in the permutation group S_5 is
A	10
B	60
C	15
D	30
Answer	C

Id	**10**
Question	The number of injective group homomorphisms from $\mathbb{Z}_7$ to $\mathbb{Z}_{14}$ is
A	1
B	7
C	14
D	6
Answer	D

Id	**11**
Question	Which of the following space is normal?
A	Product of two normal spaces
B	Closed subspace of a normal space
C	The product space $\mathbb{R}^J$ where J is uncountable
D	Subspace of a normal space
Answer	B

Id	**12**
Question	I. If X is Hausdorff space, then every singleton set is closed. II. If every singleton set in X is closed, then X is Hausdorff.
A	Only (I) is true
B	Only (II) is true
C	Both (I) and (II) are true
D	Both (I) and (II) are false
Answer	A

Id	**13**
Question	I. $\mathbb{R}$ With usual topology is second countable. II. $\mathbb{R}$ With usual topology is first countable.
A	Only (I) is true
B	Only (II) is true
C	Both (I) and (II) are true
D	Both (I) and (II) are false
Answer	C

Id	**14**
Question	Let V be a vector space of all real $n \times n$ matrices $A=[a_{ij}]$ such that $a_{ij}=0 \, if \, i+j \neq n+1$ then the dimension of V is
A	$n+1$
B	1
C	n
D	n^2-n
Answer	C

Id	**15**
Question	The characteristics polynomial of the matrix $\begin{pmatrix} 0 & 1 & 0 & 0 & \dots & 0 \\ 0 & 0 & 1 & 0 & \dots & 0 \\ 0 & 0 & 0 & 1 & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 & \dots & 1 \\ a_0 & a_1 & a_2 & a_3 & \dots & a_{n-1} \end{pmatrix}$ is
A	$x^n + a_{n-1}x^{n-1} + \cdots + a_0$
B	$x^n - a_{n-1}x^{n-1} - \cdots - a_0$
C	$x^n + a_0 x^{n-1} + \cdots + a_{n-1}$
D	$x^n - a_0 x^{n-1} - \cdots - a_{n-1}$
Answer	B

Id	**16**
Question	Let T be a linear operator on $\mathbb{R}^2$ such that $T(3,1)=(2,-4)$ and $T(1,1)=(0,2)$. Then $T(-1,5)$ is
A	(-6, 28)
B	(2, 3)
C	(-2, 4)
D	(2, 4)
Answer	A

Id	**17**
Question	Let V be a vector space of polynomials of degree less than or equal to n . The T be a linear operator given by $T(f(x))=f'(x)$. Then
A	Rank $T=1$
B	Rank $T=n-1$
C	Rank $T=n+1$
D	Rank $T=n$
Answer	D

Id	**18**
Question	The rank and nullity of the matrix $\begin{pmatrix} a & a & \cdots & a \\ a & a & \cdots & a \\ \vdots & \vdots & \cdots & \vdots \\ a & a & \cdots & a \\ a & a & \cdots & 0 \end{pmatrix}_{n\times n}$. where $a\neq 0$ are respectively.
A	2 and $n-2$
B	n And $n-1$
C	1 and $n-1$
D	$n-2$ And 2 .
Answer	A

Id	**19**
Question	The characteristics roots of a Hermitian matrix are
A	real
B	imaginary
C	rational
D	none
Answer	A

Id	**20**
Question	Let f be an entire function with $\lvert f(z)\rvert \leq c\lvert z\rvert^n$, for some $n\in\mathbb{N}$ and for all $z\in\mathbb{C}$. then
A	$f\equiv 0$
B	f Is a polynomial
C	f Is constant
D	$f(z)=z\ \forall z$
Answer	B

Id	**21**
Question	The integral of $\frac{sinz}{z}$ around the unit circle is
A	$\pi/2$
B	$2\pi i$
C	1
D	0
Answer	D

Id	**22**
Question	Which of the following statement is false?
A	$sinz$ is analytic on $\mathbb{C}$
B	$cosz$ is analytic on $\mathbb{C}$
C	$sinz$ Is unbounded on $\mathbb{C}$
D	$cosz$ Is bounded on $\mathbb{C}$
Answer	D

Id	**23**
Question	Suppose $f(z)=\frac{1}{(z-1)\sin(z-1)}$. Then $z=1$ is
A	A simple pole
B	An essential singularity
C	A removable singularity
D	A pole of order 2
Answer	D

Id	**24**
Question	A Mobius transformation on the complex plane maps the set of straight lines and circles to the set of
A	Straight lines and hyperbola
B	Circles and ellipse
C	Hyperbola and parabola
D	Straight lines and circles
Answer	D

Id	**25**
Question	Let X be a normed linear space and $x, y \in X$ such that $x \neq y$. Then
A	There is no bounded linear functional f such that $f(x)=f(y)$
B	There is no bounded linear functional f and g such that $f(x)=\|\|x\|\|$ and $g(y)=\|\|y\|\|$
C	There is no bounded linear functional f such that $f(x)\neq f(y)$
D	There is a bounded linear functional f such that $f(x)\neq f(y)$
Answer	D

Id	**26**
Question	In a separable Hilbert space every orthonormal system is:
A	infinite
B	complete
C	finite
D	countable
Answer	D

Id	**27**
Question	The initial value problem $\frac{dy}{dx}=2y^{1/3}, y(0)=1$ has
A	No solution
B	Infinitely many solutions
C	Exactly one solution
D	Finitely many solutions
Answer	C

Id	**28**
Question	Consider the following two statements I. let $\Phi_1(x) an \Phi_2(x)$ be two linearly independent functions on $I ; -\infty < x < \infty$ II. $W(\Phi_1, \Phi_2) \neq 0$ for some $x_0 \in I$
A	$(I) \Leftrightarrow (II)$
B	$(I) \Rightarrow (II)$ But not the converse
C	$(II) \Rightarrow (I)$ But not the converse
D	$(I) \not\Leftrightarrow (II)$
Answer	C

Id	**29**
Question	$\sum_{d \mid 208} \phi(d)$
A	207
B	103
C	208
D	104
Answer	C

Id	**30**
Question	Which of the following isn't an integrating factor of $xdy - ydx = 0$
A	$\frac{1}{x^2}$
B	$\frac{1}{x^2+y^2}$
C	$\frac{1}{xy}$
D	$\frac{x}{y}$
Answer	D

Id	**31**
Question	The general solution of the PDE $\frac{\partial^2 z}{\partial x \partial y} = x + y$ is
A	$\frac{1}{2}xy(x+y)+F(x)+G(y)$
B	$\frac{1}{2}xy(x-y)+F(x)+G(y)$
C	$\frac{1}{2}xy(x-y)+F(x)G(y)$
D	$\frac{1}{2}xy(x+y)+F(x)G(y)$
Answer	A

Id	**32**
Question	The equation $u_{xx} + yu_{yy} = 0 \quad y > 0$ is
A	hyperbolic
B	parabolic
C	elliptic
D	Laplacian
Answer	C

Id	**33**
Question	The set of all spheres with unit radius with center in the XY-plane is characterised by
A	First order PDE
B	First order nonlinear PDE
C	Second order linear PDE
D	Second order nonlinear PDE
Answer	B

Id	**34**
Question	I. F_9 Is a subfield of F_{81} II. F_{27} Is a subfield of F_{81}
A	Only (I) is true
B	Only (II) is true
C	Both (I) and (II) true
D	Both (I) and (II) false
Answer	A

Id	**35**
Question	The number of integral domains containing 15 elements is
A	1
B	3
C	5
D	0
Answer	D

Id	**36**
Question	Which one of the following statements is correct? The differential equation $\left(\frac{dy}{dx}\right)^2 + 5y^{1/3} = x$ is a
A	Linear equation of order 2 and degree 3
B	Non linear equation of order 1 and degree 2
C	Linear equation of order 1 and degree 6
D	Non linear equation of order 1 and degree 6
Answer	B

Id	**37**
Question	The singular solution of $y=x\frac{dy}{dx}+\frac{dy}{dx}-\left(\frac{dy}{dx}\right)^2$ is
A	$y-(x+1)^2=0$
B	$y^2+4(x+1)=0$
C	$y^2-4(x+1)=0$
D	$4y-(x+1)^2=0$
Answer	D

Id	**38**
Question	Number of ring homomorphisms from $\mathbb{Z}_{30}\to\mathbb{Z}_{30}$ is
A	8
B	30
C	1
D	2
Answer	A

Id	**39**
Question	The first integral of the Euler-Lagrange's differential equation of functional $f=f(y,y')$ is
A	$\frac{\partial f}{\partial y}-\frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right)=k$
B	$\frac{\partial^2 f}{\partial y'^2}=k$
C	$f-y'\frac{\partial f}{\partial y'}=k$
D	$y'\frac{\partial f}{\partial y'}=k$
Answer	C

Id	**40**
Question	The curve which extremizes the functional: $I(y(x))=\int_0^{\frac{\pi}{4}}[(y'')^2-y^2+x^2]\,dx$ and satisfy $y(0)=0, y'(0)=1, y\left(\frac{\pi}{4}\right)=y'\left(\frac{\pi}{4}\right)=\frac{1}{\sqrt{2}}$ is
A	$y=1-\cos x$
B	$y=\tan x$
C	$y=\cos x$
D	$y=\sin x$
Answer	D

Id	**41**
Question	The resolvent kernel of the Volterra IE having kernel $k(x,i)=1$ is
A	$e^{(t-s)(\lambda)}$
B	$e^{(t-s)^2(\lambda)}$
C	$\lambda(t-s)^2$
D	$\lambda(t-s)$
Answer	D

Id	**42**
Question	The eigenvalue λ of Fredholm integral equation $y(x)=\lambda\int_0^1 x^2 t y(t)\,dt$ is
A	$\lambda=4$
B	$\lambda=-4$
C	$\lambda=2$
D	$\lambda=-2$
Answer	A

Id	**43**
Question	The boundary of the set of feasible solutions of a LPP is formed by
A	Intersecting hyperplanes
B	Intersection of closed sets
C	Orthogonal hyperplanes
D	Separating hyperplanes
Answer	A

Id	**44**
Question	The set of feasible solutions to a linear programming problem is a:
A	Concave set
B	Noon-empty set
C	Bounded set
D	Convex set
Answer	D

Id	**45**
Question	An urn contains 6 black and 5 white balls. Two balls are drawn one by one at random with replacement. The probability of getting two white balls is
A	$2/11$
B	$4/25$
C	$25/121$
D	$2/25$
Answer	C

Id	**46**
Question	A continuous r.v. X with support (0,4) has the p.d.f $f(x)=\frac{1}{2}-ax$. Then the value of a must be:
A	1
B	$\frac{1}{4}$
C	$\frac{1}{8}$
D	0
Answer	C

Id	47
Question	A cubic polynomial which takes the following values x: 0, 1, 2, 3 f(x): 1, 2, 1, 10 By Newton's forward interpolation formula is
A	$4x^3-2x^2+5x+1$
B	$2x^3-7x^2+6x+1$
C	$2x^3-x^2+8x+1$
D	$4x^3-3x^2+6x+1$
Answer	B

Id	48
Question	Simpsons's rule for integration gives exact result when $f(x)$ is a polynomial of degree
A	1
B	2
C	3
D	All of these
Answer	D

Id	49
Question	Let $\alpha:(0,1)\to\mathbb{R}^3$ given by $\alpha(s)=(s, s+1, s^2)$ be curve parametrized by arc length s. Then the curvature of α at s is
A	2
B	2s
C	$\sqrt{2+4s^2}$
D	s
Answer	A

Id	**50**
Question	For the function $f(x,y)=(x-1)(x^2-y^2)$, the point (2/3,0) is
A	Not a critical point
B	Local minimum
C	Local maximum
D	Saddle point
Answer	D