PU Ph D Mathematics

Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.

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189 PU_2015_118

Let *f*: *R* → *R* be a continuous function. Suppose that there exists a sequence $\{p_n\}_{n=1}^{\infty}$ of polynomials converging to *f* uniformly on *R* then:-

Error! Not a valid embedded object.*f* must be a polynomial
Error! Not a valid embedded object.*f* must be uniformly continuous on *R*
Error! Not a valid embedded object.*f* must be bounded
Error! Not a valid embedded object.*f* must be a constant function

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135 PU_2015_118

At *z* = 0, the function $f(z) = z^2\bar{z}$:-

Error! Not a valid embedded object. Is differentiable
Error! Not a valid embedded object. Is analytic
Error! Not a valid embedded object. Satisfies Cauchy-Reimann equation but is not differentiable
Error! Not a valid embedded object. Does not satisfy Cauchy Reimann equation

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112 PU_2015_118

If the Lagrangian of the harmonic oscillator is $L = \frac{1}{2m}p^2 - \frac{1}{2}m\omega^2q^2$ and $F(q,Q) = \frac{m}{2}\omega q^2 \cot Q$ be the generating function of the canonical transformation then the Hamiltonian in (*P*, *Q*) is:-

Error! Not a valid embedded object.*Q* sin *P*
Error! Not a valid embedded object.*P* sin *Q*
Error! Not a valid embedded object.ω *Q*
Error! Not a valid embedded object.ω *P*

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188 PU_2015_118

The rank of the matrix *A* = $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{bmatrix}$ is:-

Error! Not a valid embedded object.2
Error! Not a valid embedded object.4
Error! Not a valid embedded object.3
Error! Not a valid embedded object.1

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185 PU_2015_118

Let R be a commutative ring and let characteristic of R be n. If n is a prime number then:-

Error! Not a valid embedded object.R need not be an integral domain
Error! Not a valid embedded object.R is a direct product of two fields
Error! Not a valid embedded object.R is a field
Error! Not a valid embedded object.R is an integral domain but it need not be a field

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137 PU_2015_118

The function defined by $f(x) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ 0 & \text{if } x \text{ is irrational} \end{cases}$ is:-

Error! Not a valid embedded object. Unbounded
Error! Not a valid embedded object. Riemann integrable
Error! Not a valid embedded object. Continuous function
Error! Not a valid embedded object. Nowhere continuous

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197 PU_2015_118

Which of the following pair of functions is not a linearly independent pair of solutions of $y'' + 9y = 0$?

Error! Not a valid embedded object. $\sin 3x,\ \sin 3x \cos 3x$

Error! Not a valid embedded object. $\sin 3x + \cos 3x,\ 4\cos^3 x - 3\cos x$

Error! Not a valid embedded object. $\sin 3x + \cos 3x,\ 3\sin x - 4\sin^3 x$

Error! Not a valid embedded object. $\sin 3x, \sin 3x - \cos 3x$

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134 PU_2015_118

The value of $\int_{|z|=1} \frac{\sin z}{z^2 e^z} dz$:-

Error! Not a valid embedded object.$\pi i/2$

- 0
- πi
- $2\pi i$

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191 PU_2015_118

The value of $\int_2^3 \frac{dx}{1+2x}$ correct up to three decimal places by Simpson's 1/3rd rule is:-

- 0.148
- 0.138
- 0.166
- 0.158

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196 PU_2015_118

Which of the following is elliptic?

- $u_{xx} + 2u_{xy} + 4u_{yy} = 0$
- $u_{xx} + 2u_{xy} - 4u_{yy} = 0$
- $u_{xx} - 2u_{xy} - 4u_{yy} = 0$
- $2u_{xx} + 2u_{xy} - 4u_{yy} = 0$

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192 PU_2015_118

Three wheels make 60, 36 and 24 revolutions per minute respectively. There is a red spot on the rim of all the three wheels. If the red spot was at the bottom most point when they all started, after how much time would they be at the bottom most point again?

- 5 seconds
- 12 seconds
- 12 minutes
- 5 minutes

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132 PU_2015_118

What is the image of the set $\{z \in C : z = x + iy, x \geq o; y \geq o\}$ under the mapping $z \to z^2$?

- $\{z = x + iy, x \geq o\}$
- $\{z = x + iy: x^2 + y^2 = 1\}$
- $\{z = x + iy: x^2 + y^2 \leq 1\}$
- $\{z = x + iy: \ y \geq o\}$

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203 PU_2015_118

Which of the following statements is true?

- If the Lebesgue outer measure of *A* is positive, then *A* must contain an interval of positive length
- If the Lebesgue outer measure of *A* is zero, then *A* is nowhere dense in *R*
- If *A* is nowhere dense in [0,1], then the Lebesgue outer measure of *A* is zero
- The Lebesgue outer measure of any non empty open set in *R* is positive

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119 PU_2015_118

The topology on the real line R generated by the class of all closed intervals with length *l* is:-

- Indiscrete
- Neither discrete nor Hausdorff
- Standard topology
- Discrete

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115 PU_2015_118

If $J(\bar{x},t)$ is the Jacobian of the fluid flow map of an incompressible fluid, then:-

- $J(\bar{x},t) \equiv 1$
- $J(\bar{x},t) \equiv 0$

- $J(\bar{x},t) < 0$
- $J(\bar{x},t) > 1$

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165 PU_2015_118
Which one is the correct statement?
- Irreducible polynomials over finite fields have distinct roots
- All the polynomials over a field of characteristic zero have distinct roots
- All polynomial with zero derivative over afield of characteristic p have distinct roots
- Irreducible polynomials over a field of characteristic p have distinct roots

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117 PU_2015_118
A connected graph G with at least two vertices contains:-
- At most two vertices that are not cut vertices
- At least three vertices that are not cut vertices
- At least two vertices that are not cut vertices
- At most three vertices that are not cut vertices

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150 PU_2015_118
Let G be a group of order np^k and gcd (n,p) = 1. Then G contains a subgroup H of order p^r only if:-
- G is abelian and r = k
- r = k
- r less than or equal to k
- G is abelian and r less than or equal to k

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198 PU_2015_118
Which of the following is not an integrating factor of $xdy - ydx = 0$?
- $\frac{1}{xy}$
- $\frac{x}{y}$
- $\frac{1}{x^2+y^2}$
- $\frac{1}{x^2}$

20 of 100
194 PU_2015_118

Pick the region in which the PDE $yU_{xx} + 2xy\,U_{xy} + xU_{yy} = U_x + U_y$ is hyperbolic.

- $xy > 1$
- $xy \neq 1$
- $xy \neq 0$
- $xy > 0$

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110 PU_2015_118

The involute of a circular helix is a plane curve then:-

- $\kappa^2 = \tau$
- $\tau = 0$
- $\kappa = \tau$
- $\kappa = 0$

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120 PU_2015_118

Let $S = \left\{\frac{1}{n} : n \in N\right\} \cup \{0\}$ and $T = \left\{n + \frac{1}{n} : n \in N\right\}$ be the subsets of the metric space R with the usual metric. Then:-

- S is complete but not T
- Both S and T are complete
- T is complete but not S
- Neither T nor S is complete

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186 PU_2015_118

Which of the following statements is true?

- The diagonal elements of a diagonal matrix are zero
- The diagonal elements of a skew symmetric matrix are zero
- The diagonal elements of a symmetric matrix are zero
- The diagonal elements of a triangular matrix are zero

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136 PU_2015_118

Which of the following function is uniformly continuous on (0,1)?

- $\frac{1}{x}$
- $\frac{\sin\left(x^2\right)}{\sin^2(x)}$

- $e^{\frac{1}{x}}$
- $\sin\left(\frac{1}{x}\right)$

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164 PU_2015_118

Let K be a field extension of F and an element a in K satisfies the polynomial of degree n over F. Then:-

- [F(a) :F] = n
- n divides [F(a) :F]
- [F(a) :F] > n
- [F(a) :F] ≤ n but need not equal to n

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113 PU_2015_118

If the eigen values are $s \pm \sqrt{s^2 - d}$, where $s = -\frac{1}{2}\alpha, d = \beta$, then $\beta < 0$ is:-

- Stable node
- Stable spiral
- Saddle
- Unstable spiral

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111 PU_2015_118

A particle gliding on the rough inner surface of a rotation paraboloid belongs to a class of system:-

- Scleronomic, holonomic and conservative
- Nonholonomic
- Rheonomic
- Scleronomic, holonomic but not conservative

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163 PU_2015_118

Let K be an extension of F.

- For any element a in K every element of F(a) algebraic over F
- For any element a in K, F(a) is a finite extension of F
- If an element a in K satisfies a polynomial over F, then every element of F(a) is algebraic over F
- Then every element of K is algebraic over F

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195 PU_2015_118

Which of the following concerning the solution of the Neumann problem for Laplace's equation, on a smooth bounded domain, is true?

- Solution is unique upto a multiplicative constant
- No conclusion can be drawn about uniqueness
- Solution is unique
- Solution is unique upto an additive constant

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138 PU_2015_118

The sequence of functions $f_n(x) = \frac{1}{1+(x-n)^2}$ on $(-\infty, 0)$ is:-

- Neither pointwise Convergent nor uniformly convergent
- Pointwise convergent but not uniformly convergent
- Uniformly convergent
- Divergent

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199 PU_2015_118

The solution of the initial value problem $u_t = 4u_{xx}, t > 0, -\infty < x < \infty$ satisfying the condition $u(x,0) = x, u_t(x,0) = 0$ is:-

- 2x
- $\frac{x^2}{2}$
- x
- 2t

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207 PU_2015_118

In a Boolean algebra, *a* ≤ *b* is not equivalent to:-

- $a' \wedge b = 1$
- $a \wedge b' = 0$
- $b' \leq a'$
- $a' \leq b'$

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206 PU_2015_118

The fundamental cycles in a (p, q) - simple graph, having k ≥ 1 components is:-

- *p* - *q* + *k*
- *q* - *p* + 1

- $p + q + k$
- $q - p + k$

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161 PU_2015_118
The number of elements in a minimal generating set of Q(w), where w = cube root of 2, over the field Q is:-

- 3
- 6
- 2
- 1

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201 PU_2015_118
Which of the following is false?

- On every non compact subset E of R there exists a continuous function f: $E \rightarrow R$ which is not bounded
- There exists a non compact space X such that every continuous f: $X \rightarrow R$ is uniformly continuous
- If E is a non empty subset of R such that every continuous function f: $E \rightarrow R$ is uniformly continuous; then R is compact
- Every continuous real valued function defined on a compact metric space is uniformly continuous

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183 PU_2015_118
Let R be an integral domain having n elements. Then:-

- n is a prime number
- n may be any finite integer
- n is a product of distinct prime numbers
- n need not be a prime number but it is a power of a prime number

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184 PU_2015_118
In a ring R, consider the two statements.

i) If x.a = 0 for every a in R, then x = 0
ii) If x.x = x, then x = 1, the multiplicative identity of R.

Which one of the following is correct?

- i) is true but ii) is not true
- ii) is true but i) is not true
- Both i) and ii) are true
- Neither i) nor ii) is true

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116 PU_2015_118

Let $\vec{F} = (x^2 + y - 4)\vec{i} + 3xy\vec{j} + (3xz + z^2)\overline{k}.$ Then $\nabla \times \vec{F}$ over the surface $x^2 + y^2 + z^2 = 16,\ z \geq 0$ is:-

- 4π
- -16π
- $\frac{7}{5}\pi$
- π

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180 PU_2015_118

G has an element of order 7 only if:-

- o(G) = 7^n, for some n in N
- gcd (o(G), 7) = 1
- o(G) = 7.n for some n in N
- o(G) = 7

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193 PU_2015_118

$tanh^{-1} x =$

- $\frac{1}{2}\log\left(\frac{1-x}{1+x}\right)$
- $\frac{1}{2}\log\left(\frac{1+x}{1-x}\right)$
- $2\log\left(\frac{1+x}{1-x}\right)$
- $\log\left(x+\sqrt{x^2+1}\right)$

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169 PU_2015_118

Let K be an extension of a field F and a in K. If a is algebraic over:-

- K, then a is algebraic over F
- K, then a is algebraic over any extension of F
- F, then a is algebraic over K
- Some extension of K, then a is algebraic over F

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182 PU_2015_118

Let p divide the order of a finite group G and let G have k distinct p-sylow subgroups of G. Which one is not a correct statement?

- k is a multiple of p
- k is not a power of p
- k is a divisor of o(G)
- k is relatively prime to p

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190 PU_2015_118

In Regula Falsi method, the first approxiation is given by:-

- $x_2 = x_0 + \frac{x_1 - x_0}{f(x_1) - f(x_0)} f\left(\frac{x_0}{2}\right)$
- $x_2 = x_0 - \frac{x_1 - x_0}{f(x_1) - f(x_0)} f\left(\frac{x_0}{2}\right)$
- $x_2 = x_0 + \frac{x_1 - x_0}{f(x_1) - f(x_0)} f(x_0)$
- $x_2 = x_0 - \frac{x_1 - x_0}{f(x_1) - f(x_0)} f(x_0)$

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167 PU_2015_118

Let a and b satisfies same irreducible polynomial f(x) over a field F. Then:-

- F(a) and F(b) need not be isomorphic but are extensions of same degree over F
- Any field extension of F containing a will also contains b and vice versa
- F(a) and F(b) are isomorphic with an isomorphism leaving every element of F fixed
- F(a) = F(b)

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202 PU_2015_118

Consider *f*: [0,1] → *R* defined as $f(x) = \begin{cases} x^2 \text{ if } x \text{ is rational} \\ 0 \text{ if } x \text{ is irrational} \end{cases}$. Then, the Lebesgue integral of *f* over [0,1] is:-

- $\frac{1}{3}$
- *f* is not Lebesgue integrable over [0,1]
- 0
- 1

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131 PU_2015_118

The residue of *f*(*z*) = *cotz* at any of its poles is:-

- 1
- 0
- $2\sqrt{3}$
- $\sqrt{2}$

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162 PU_2015_118
Let K be a field extension of F and L be a field extension of K. Which one is not correct?

- [K:F] divides [K:L]
- [K:K] divides [K:F]
- [L:K] divides [L:F]
- [K:F] divides [L:F]

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187 PU_2015_118
In Eigen value (differential equation) problems:-

- Both Eigen values and Eigen functions are unique
- Eigen values but not Eigen functions are unique
- Eigen functions but not Eigen values are unique
- Eigen values and Eigen functions are not unique

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133 PU_2015_118
The function $f(z) = |z|^2$ is:-

- Differentiable on real axis
- Not Differentiable anywhere
- Differentiable only at the origin
- Differentiable everywhere

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160 PU_2015_118
Which one is a correct statement? The symmetric group:-

- S_3 is a direct product of subgroups isomorphic to Z_2, Z_2 and Z_2
- S_3 cannot be a direct product of its proper subgroups
- S_3 is a direct product of subgroups isomorphic to Z_2 and Z_3
- S_3 is a direct product of subgroups isomorphic to Z_4 and Z_2

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168 PU_2015_118
In a splitting field K, of a polynomial f(x) over a field F. Then f(x) contains:-

- All the roots in K and the degree [K:F] is minimum
- Exactly one root and the degree [K:F] is minimum
- All the roots and the degree [K:F] is maximum
- At least one root

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179 PU_2015_118

The center of a group G is always a:-

- Normal subgroup of G
- Proper subgroup of G
- Nontrivial subgroup of G
- Cyclic subgroup of G

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166 PU_2015_118

Let f(x) be a polynomial over a field F of degree n. In any extension of F, f(x) will have:-

- At least n roots
- Exactly n roots
- Atleast one root
- At most n roots

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181 PU_2015_118

Let G be the symmetric groups on 5 symbols. Then the number of distinct conjugate classes in G is:-

- 5
- 120
- 25
- 7

55 of 100

204 PU_2015_118

The radius of convergence of the power series $\sum_{n=1}^{\infty}\frac{1}{n}x^{n!}$ is:-

- *e*
- ∞
- 1
- 0

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139 PU_2015_118

Let A and B be fuzzy sets, and the operation ∧ on fuzzy sets defined by:-

- $\mu_A(x) \wedge \mu_B(x) = \max\{\mu_A(x), \mu_B(x)\}$
- $\mu_A(x) \wedge \mu_B(x) = 0$
- $\mu_A(x) \wedge \mu_B(x) = |\mu_A(x) - \mu_B(x)|$
- $\mu_A(x) \wedge \mu_B(x) = \min\{\mu_A(x), \mu_B(x)\}$

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208 PU_2015_118

The sum-of-products form of $(x_1 \oplus x_2)' * x_3$ is:-

- min 2
- min 1
- min 3
- min 0

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118 PU_2015_118

If G is k-critical, then:-

- $\delta \geq k-1$
- $\delta \leq k-1$
- $\Delta \leq k-1$
- $\Delta \geq k-1$

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114 PU_2015_118

If *A* and *B* are two nonempty subsets of a metric space (*X*, *d*), then which of the following is false?

- *A* and *B* are compact implies *A* ∪ *B* is compact
- *A* and *B* are connected implies *A* ∪ *B* is connected
- *A* and *B* are closed implies *A* ∪ *B* is closed
- *A* and *B* are compact implies *A* ∩ *B* is compact

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205 PU_2015_118

The number of distinct simple graphs having *n* vertices are:-

- $2^{\frac{n(n-1)}{2}}$
- $2^{n(n+1)}$
- $2^{\frac{n(n+1)}{2}}$
- $2^{n(n-1)}$

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254 PU_2015_118

If for a prime p, p^n divides, but p^{n+1} does not divide order of a finite group G, then:-

- For every d ≤ p^n, G has a subgroup of order d
- For every divisor d of o(G), G has a subgroup of order d
- For every positive integer r ≤ n, G has a subgroup of order p^r
- G has a subgroup of order p^r if r = n, but G need not have subgroups order p^r if r < n

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220 PU_2015_118
Let f(x) be a polynomial over a field F and K be a field extension of F which contains all the roots of f(x) but no subfield of K contains all the roots of f(x). If an element a in K satisfies the property that g(a) = a for by all automorphisms g in G(K,F), then:-

- a is the multiplicative identity element 1
- a is the additive identity 0
- a need not be an element of F
- a is an element of F

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229 PU_2015_118

The solution of the integral equation $3\sin 2x = y(x) + \int_0^x (x-t)y(t)dt$ is:-

- $-2\sin x + 4sin2x$
- $e^{-x}(x-1)^2$
- $x^3 + \frac{1}{20}x^5$
- $\cos x$

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245 PU_2015_118
In a metric space (X,d):-

- Every infinite set E has a limit point in E
- Every closed subset of a compact set is compact
- Every subset of a compact set is closed
- Every closed and bounded set is compact

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224 PU_2015_118
In Plane Poiseuille flow between two parallel plates the velocity profile is:-

- An ellipse
- A straight line
- A parabola
- A hyperbola

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257 PU_2015_118

The Eigen values of the matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ -1 & 0 & -4 \\ -2 & 4 & 0 \end{bmatrix}$ are:-

- (0,0,1)
- (1,2,4)
- $(i\sqrt{21}, -i\sqrt{21}, 0)$
- (-1,2,4)

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251 PU_2015_118

Let a be an element of a group G of order mn, for some m,n in N. Then the number of elements in the conjugacy class of a cannot contain:-

- mn elements
- gcd (m,n) elements
- m elements
- 1 element

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248 PU_2015_118

The inverse Laplace Transform of $\frac{(2s^2-4)}{(s-3)(s^2-s-2)}$ is:-

- $\frac{1}{3}e^{t} + te^{-t} + 2t$
- $\frac{7}{2}e^{3t} - \frac{1}{6}e^{-t} - \frac{4}{3}e^{2t}$
- $(1+t)\,e^{-t} + \frac{7}{2}e^{-3t}$
- $\frac{7}{2}e^{-3t} - \frac{1}{6}e^{t} - \frac{4}{3}e^{-2t}$

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249 PU_2015_118

Consider the fuzzy relation $R = \{(x,y), \mu_R(x,y) / \mu_R(x,y) \in [0,1], (x,y) \in A\text{x}B\}$, where A&B are two fuzzy sets. The total projection of the fuzzy relation is:-

- $\min_x \min_y \{\mu_R(x,y) / \mu_R(x,y) \in [0,1], (x,y) \in A\text{x}B\}$
- $\max_x \max_y \{\mu_R(x,y) / \mu_R(x,y) \in [0,1], (x,y) \in A\text{x}B\}$
- $\max_x \min_y \{\mu_R(x,y) / \mu_R(x,y) \in [0,1], (x,y) \in A\text{x}B\}$

- [ ] $\min_x \max_y \{\mu_R(x,y)/\mu_R(x,y) \in [0,1], (x,y) \in AxB\}$

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255 PU_2015_118
Let A be a nonzero commutative ring. Then:-
- [ ] A is isomorphic to a subring of a field, if A contains multiplicative identity element
- [ ] A is isomorphic to a subring of a field, only if A is a field
- [ ] A is isomorphic to a subring of a field, if A has no zero divisors but has multiplicative identity element
- [ ] A is always isomorphic to a subring of a field

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226 PU_2015_118
The eigen values λ_n for the equation $y'' + \lambda y = 0$ with $y(-L) = 0, y(L) = 0$ when $L > 0$:-
- [ ] $\frac{n^2\pi^2}{L^2}$
- [ ] $n^2\pi^2$
- [ ] $\frac{2n^2\pi^2}{3L^2}$
- [ ] $\frac{n^2\pi^2}{4L^2}$

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223 PU_2015_118
If the Helmholtz-Hodge Decomposition theorem, $\bar{w} = \bar{u} + \nabla p$, in a domain D, $\bar{u}$ satisfies:-
- [ ] $\nabla \times \bar{u} = 0$ in D and $\bar{u}.\bar{n} = 0$ on ∂D
- [ ] $\nabla . \bar{u} \neq 0$ in D and $\bar{u}.\bar{n} = 0$ on ∂D
- [ ] $\nabla . \bar{u} = 0$ in D and $\bar{u}.\bar{n} \neq 0$ on ∂D
- [ ] $\nabla . \bar{u} = 0$ in D and $\bar{u}.\bar{n} = 0$ on ∂D

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247 PU_2015_118
A fuzzy set A is included in the fuzzy set B is denoted by $A \subseteq B$, if for all x in the universal set satisfies:-
- [ ] $\mu_B(X) = \mu_A(X)$
- [ ] $\mu_A(X) > \mu_B(X)$
- [ ] $\mu_B(X) \leq \mu_A(X)$
- [ ] $\mu_A(X) \leq \mu_B(X)$

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246 PU_2015_118
The algebraic sum of fuzzy set A and B is defined by:-

- $\mu_{A+B}(x) = \mu_A(x)\mu_B(x)$
- $\mu_{A+B}(x) = \mu_A(x) + \mu_B(x)$
- $\mu_{A+B}(x) = \mu_A(x) + \mu_B(x) + \mu_A(x)\mu_B(x)$
- $\mu_{A+B}(x) = \mu_A(x) + \mu_B(x) - \mu_A(x)\mu_B(x)$

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256 PU_2015_118

Which of the following statements is true? A is a $n \times n$ square matrix.

- $A + A'$ is skew symmetric and $A - A'$ is symmetric
- Both $(A + A')$ *and* $(A - A')$ are skew symmetric
- $A + A'$ is symmetric and $A - A'$ is skew symmetric
- Both $(A + A')$*and* $(A - A')$ are symmetric

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225 PU_2015_118

If $x = x_0$ is a regular singular point of $y'' + P(x)y' + Q(x)y = 0$, then $P(x)$ has atmost:-

- Infinite number of poles
- Infinite number of zeros
- Single pole
- Ordinary point only

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228 PU_2015_118

Let $P_n(x)$ be a Legendre polynomial then $P_n(x)$ satisfies:-

- $nP_{n+1}(x) = 2\,nxP_n(x) - P_{n-1}(x)$
- $(n+1)P_{n+1}(x) = (2\,n+1)xP_n(x) - nP_{n-1}(x)$
- $2\,p_n(x) = 3\;p_{n-1}(x) - p_{n+1}(x)$
- $xP_n'(x) = np_{n-1}(x) + p_{n+1}(x)$

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253 PU_2015_118

Let G be a group and H is the set of all elements g in G such that the conjugate class containing g is {g}:-

- H is a normal subgroup of G but need not be the center of G
- H is abelian subgroup of G but need not be the center of G
- Then H is a trivial subgroup of G
- H is the center of G

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Which one is not a correct statement: If G is a group:-

- If G is finite the number of elements in a conjugate class is a divisor of o(G)
- Union of all conjugate classes in G is G
- A conjugate class in G is a subgroup
- Intersection of any two distinct conjugate classes is empty

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The solution of $x_{n+2} - 5x_{n+1} + 6x_n = 0$ when $x_0 = 2, x_1 = 3$:-

- $x_n = 3.2^n + 2.3^n$
- $x_n = 3.2^n - 3^n$
- $x_n = 3.2^n + 3^n$
- $x_n = 3.2^n - 2.3^n$

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The Bessel's function $\{J_0(\alpha_k x)\}_{k=1}^{\infty}$ with αk denoting the kth zero of $j_0(x)$ form an orthogonal system on [0,1] with respect to weight function:-

- x^2
- 1
- $\sqrt{x}$
- x

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Consider f: $R \rightarrow R$ defined as $(x) = \begin{cases} x^2 - 1 & if\ x\ is\ rational \\ 0 & if\ x\ is\ irrational \end{cases}$. Then:-

- f is discontinuous only at x = 1
- f is continuous nowhere on R
- f is discontinuous at x = -1 and x = 1
- f is discontinuous only at x = -1

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The value of $I_n = \int_{c_n} \frac{1}{z^3 \sin z} dz, \quad n = 0, 1, 2, \ldots$ where c_n is the circle $|z| = (n + \frac{1}{2})\pi$ is:-

- $\sum_{k=1}^{n} (-1)^k k^n$
- $\frac{4i}{\pi^2} \sum_{k=1}^{n} \frac{(-1)^k}{k^3}$

- $\frac{4i}{\pi^3}\sum_{k=1}^{n}\frac{(-1)^k}{k^3}$
- $\sum_{k=1}^{n}(-1)^k k^{2n}$

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Complete integral for the partial differential equation $z = px + qy - \sin(pq)$ is:-

- $z = ax + by + \sin(ab)$
- $z = ax + y + \sin(b)$
- $z = x + by + \sin(a)$
- $z = ax + by - \sin(ab)$

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The number of zeros of the complex polynomial $3z^9 + 8z^6 + z^5 + 2z^3 + 1$ in the annulus $1 \le |z| < 2$ is:-

- 7
- 9
- 5
- 3

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The value of $I = \frac{1}{2\pi i}\int_{|z|=1}\frac{(z+2)^2}{z^2(2z-1)}dz$ is:-

- 0
- $\frac{1}{2}$
- 2π
- $\frac{3}{4}$

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For the Sturm Liouville problems $(1+x^2)y'' + 2xy' + \lambda x^2 y = 0$ with $y'(1) = 0$ and $y'(10) = 0$ the eigen values, λ, satisfy:-

- $\lambda < 0$
- $\lambda \le 0$
- $\lambda \ne 0$
- $\lambda \ge 0$

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Consider $f: [-2, 1] \to R$ defined as $f(x) = |x|$ for all $x \in [-2, 1]$.
The total variation of f over $[-2, 1]$ is:-

- 0
- 2
- 1
- 3

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The number of the roots of the polynomial $z^4 + z^3 + 1$, in the quadrant $\{z = x + iy \mid x,y > 0\}$ is:-

- 1
- 3
- 0
- 4

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If $a_n = \sqrt[n]{4^{(-1)^n} + 2}$ for all $n \in N$, then:-

- $\limsup_{n\to\infty} a_n = 1$ and $\liminf_{n\to\infty} a_n = 0$
- $\limsup_{n\to\infty} a_n = 0$ and $\liminf_{n\to\infty} a_n = 0$
- $\limsup_{n\to\infty} a_n = 1$ and $\liminf_{n\to\infty} a_n = 1$
- $\limsup_{n\to\infty} a_n = 0$ and $\liminf_{n\to\infty} a_n = 1$

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The number of edges of a simple graph with n vertices and with ω components is:-

- $\geq \dfrac{(n-\omega)(n-\omega-1)}{2}$
- $\leq \dfrac{(n-\omega)(n-\omega+1)}{2}$
- $\dfrac{(n-\omega)(n-\omega+1)}{2}$
- $\geq \dfrac{(n-\omega)(n-\omega+1)}{2}$

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Let G be a group having p^n elements. Then:-

- Always there exists an element x in G, such that xg not equal to gx for some g in G
- For every x in G, xg = gx for every g in G
- There exists an element x in G, x not identity element, such that xg = gx for every g in G
- If for some x in G, xg = gx for every g in G then x = e, the identity element

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The value of $I = \int_{-\infty}^{\infty} \frac{dx}{1+x^{2n}}$ when *n* is a positive integer is:-

- $\frac{\pi}{\sin\left(\frac{\pi}{4n}\right)}$
- $\frac{\pi}{n\sin\left(\frac{\pi}{2n}\right)}$
- $\frac{\pi}{n\sin\left(\frac{\pi}{4n}\right)}$
- $\frac{3\pi}{4\sin\left(\frac{\pi}{2n}\right)}$

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Let $A = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

The general solution of the matrix differential equation $\frac{dX}{dt} = A \times B$ is:-

- $\sum_{i=0}^{3} \frac{t^i}{i!} A^i c_0 B^i$
- $\sum_{i=0}^{\infty} c_0 t^i AB$
- $\sum_{i=0}^{n} c_0 t^i AB^{-1}$
- $\sum_{i=0}^{n} t^i A c_0 B$

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The value of $I = \int_{-\infty}^{\infty} \frac{\sin x}{x(x-\pi)} dx$ is:-

- $\frac{\pi}{4}$
- 2
- -2
- π

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Which of the following satisfies the heat equation (without source term and with diffusion constant 1) in one space dimension?

- $\frac{e^{-x^2/4t}}{\sqrt{t}}$
- $x^2 - t$
- $e^t \sin x$
- $\sin\left[\frac{x^2}{4t}\right]$

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Consider $f: R^2 \to R$ defined as $f(x,y) = \begin{cases} \frac{xy}{x^2+y^2} \text{ if } (x,y) \neq (0,0) \\ 0 \text{ if } (x,y) = (0,0) \end{cases}$. Then:-

- f is continuously differentiable on R^2
- f is continuous $(0,0)$ but not differentiable at $(0,0)$
- f is not continuous at $(0,0)$
- f is differentiable at $(0,0)$

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If f (r,θ,φ) is a harmonic function in a domain D, where (r,θ,φ) are Spherical polar coordinates, then which of the following is also a harmonic function?

- $\frac{1}{r^2} f\left[\frac{1}{r^2},\theta,\varphi\right]$
- $\frac{1}{r} f(r,\theta,\varphi)$
- $\frac{1}{r^2} f\left[\frac{1}{r},\theta,\varphi\right]$
- $\frac{1}{r} f\left[\frac{1}{r},\theta,\varphi\right]$

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Let X be a complete metric space. If X is represented as a union of a sequence of subsets of X, then:-

- The closure of at least one of the subset in the sequence has a non empty interior
- The closure of each of the subset in the sequence has a non empty interior
- The interior of each of the subset in the sequence is empty
- The interior of at least one of the subset in the sequence is empty

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Let the sequence $a_0, a_1, \ldots$ be defined by the equation:

$$1 - x^2 + x^4 - x^6 + \cdots = \sum_{n=0}^{\infty} a_n (x-3)^n, \quad 0 < x < 1.$$

Then $\limsup_{n\to\infty} \left(|a_n|^{\frac{1}{n}}\right)$ is:-

- $\sqrt{10}$
- $\frac{1}{\sqrt{10}}$
- 10
- $\sqrt{2}$