118 PU Ph D Mathematics

1 of 100
146 PU_2016_118_E
The function *fz* = |z| is:-

- not differentiable anywhere
- differentiable on real axis
- differentiable only at the origin
- differentiable everywhere

2 of 100
162 PU_2016_118_E
Consider the linear map $T: (C[a,b], ||.||_\infty) \to (C[a,b], ||.||_\infty)$ defined as $T(f)(x) = \int_a^x f(t)dt$

- *T* is bounded and $||T||$ = *b-a*
- *T* in not bounded
- *T* is bounded and $||T||$ < *b-a*
- *T* is bounded and $||T||$ > *b-a*

3 of 100
203 PU_2016_118_E
In a Boolean algebra **B,** for a, b in **B,** a ≤ b is equivalent to:-

- *b* ≤ *a*
- $a \oplus b = 0$
- *a* ≤ *b*
- *a* * *b* = 1

4 of 100
183 PU_2016_118_E
Suppose f is continuous on [a,b] and differentiable on (a,b). If f(a)=f(b), then there is a \ point $c \in (a, b)$ with:-

- $f(b) = 0$
- $f'(c) \neq 0$
- $f(a) = 0$
- $f'(c) = 0$

5 of 100
164 PU_2016_118_E
Consider the linear transformation $T: R^2 \to R^3$ defined as $T(x_1,x_2) = (x_1, x_1+x_2, x_2)$, then the nullity of *T* is:-

- 1

- 3
- 2
- 0

6 of 100

184 PU_2016_118_E

If *f : [a,b]* → *R* and *g : [a,b]*→ *R* are both continuous on [a,b] and differentiable on (a,b), then there exists an $x_0 \in (a,b)$ such that:-

- $f(x_0)[g(b)-g(a)] = g'(x_0)[f(b)-f(a)]$
- $f'(x_0)[g(b)-g(a)] = g(x_0)[f(b)-f(a)]$
- $[g(b)-g(a)] = [f(b)-f(a)]$
- $f'(x_0)[g(b)-g(a)] = g'(x_0)[f(b)-f(a)]$

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129 PU_2016_118_E

Let f: G --> H be a group homomorphism.

- If N is a normal subgroup of G then f(N) is a normal subgroup of H.
- f^{1} (0) is a normal subgroup of G.
- If K is a normal subgroup of H then f^{1}(K) need not be a normal subgroup of G.
- *f*(G) is a normal subgroup of H.

8 of 100

168 PU_2016_118_E

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

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

9 of 100

202 PU_2016_118_E

An ideal A of a commutative ring R with unity is maximal <=> R/A is a:-

- prime ideal
- ring
- field
- integral domain

10 of 100
206 PU_2016_118_E

The value of the integral $\int_c \cos z \, dz$, where c is $|z+\frac{1}{2}|=1/3$ is:-

- -2πi
- ∞
- 2πi
- 0

11 of 100
126 PU_2016_118_E
Which one is not a correct statement?

- the center of a group G is abelian.
- the center of a group G is a normal subgroup of G.
- the center of a group G is non trivial when o(G) = 27.
- the center of a group G is always proper subgroup of G.

12 of 100
106 PU_2016_118_E
Let K be a field extension of F and L be a field extension of K.
Which one is not correct?

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

13 of 100
186 PU_2016_118_E
An operator T on a Hilbert space is self adjoint <=> for all *x*, *(T x, x)* is a:-

- $||x||^2$
- $||x||$
- real
- complex

14 of 100
122 PU_2016_118_E
Which one is a false? There exists a field having:-

- 125 elements

- 5 elements
- 16 elements
- 36 elements

15 of 100

204 PU_2016_118_E

Let G be a connected (p, q) - plane graph having r faces. Then p - q + r is:-

- 4
- 2
- 3
- 1

16 of 100

167 PU_2016_118_E

Let p be a positive number and let F_A be a fuzzy set with membership $\pi_A(x)$, $x \in A$. The fuzzy set on power p is defined as:-

- $F_A^p = \{(x, (\mu_A(x))^p)\}$
- $F_A^p = \{(x^p, \mu_A(x))\}$
- $F_A^p = \{(x, \mu_A(x))\}$
- $F_A^p = \{(x^p, (\mu_A(x))^p)\}$

17 of 100

102 PU_2016_118_E

If w is a primitive 11^{th} root of unity then the degree of Q(w) over Q is:-

- 2
- 11^2
- 10
- 11

18 of 100

207 PU_2016_118_E

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

- 1
- 3

- $\frac{1}{2}$
- 0

19 of 100

123 PU_2016_118_E

Which one is a false? There exists a vector space having:-

- 27 elements
- 125 elements
- 8 elements
- 36 elements

20 of 100

163 PU_2016_118_E

Let E be a nonempty subset of R. Let $m^*(E)$ denote the Lebesgue outer measure of E. Then, which of the following is TRUE?

- E is countable if and only if $m^*(E) = 0$.
- Every $F\sigma$- subset of R is measurable
- If E is non measurable then $m^*(E) = \infty$
- If $m^*(E) > 0$ then E must contain an interval of positive length

21 of 100

104 PU_2016_118_E

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

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

22 of 100

185 PU_2016_118_E

A bounded and entire function $f(z)$ is:-

- constant
- bijective
- surjective
- identity

23 of 100

189 PU_2016_118_E

An analytic function $f(z) = u(z) + iv(z)$ with constant modulus is:-

- constant
- identity
- continuous
- bounded

24 of 100

143 PU_2016_118_E

Let f(x) belong to F[x], where F is a field.

(i) If F is the field of rational numbers and f(x) is irreducible then f(x) has no multiple roots.
(ii) If the derivative of f(x) is a zero polynomial then f(x) is a constant.

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

25 of 100

142 PU_2016_118_E

Let f(x) belong to F[x], where F is a field.

(i) F(a) is isomorphic to F(b) for any two roots a,b of f(x) in some extension of F.
(ii) K and L are two smallest feild extensions of F having all the roots of f(x) then K is isomorphic to L.

- (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.

26 of 100

105 PU_2016_118_E

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

- 6
- 2
- 1
- 3

27 of 100

165 PU_2016_118_E

π_A (X) and π_B (X) are two fuzzy membership functions. The intersection of the membership function is equal to:-

- 0
- $1-\pi_A(X).\pi_B(X)$
- $\max\{\pi_A(X), \pi_B(X)\}$
- $\min\{\pi_A(X), \pi_B(X)\}$

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209 PU_2016_118_E

If $f(z) = \frac{z-\sin z}{z^3}$ then $z = 0$ is a:-

- simple pole
- a point of essential singularity
- double pole
- point of removable singularity

29 of 100

208 PU_2016_118_E

The function $f : \boldsymbol{C} \rightarrow \boldsymbol{C}$ defined as $f : (z) = sinz$ is:-

- Bounded but not periodic
- Both bounded and periodic
- Not bounded but periodic
- Neither bounded nor periodic

30 of 100

124 PU_2016_118_E

Let F subset of K subset of L be field extensions, where F having 4 elements. Then which one is possible:-

- L and K have 64 and 32 elements respectively
- L and K have 16 and 8 elements respectively
- L and K have 128 and 16 elements respectively
- L and K have 256 and 16 elements respectively

31 of 100

121 PU_2016_118_E

Let V be a n dimensional vector space and T be a linear transformation on V. Then T satisfies a polynomial over F:-

- always
- if rank T = n
- if T is right invertible

- if T is invertible

32 of 100

110 PU_2016_118_E

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

- at most n roots
- exactly n roots
- at least one root
- at least n roots

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125 PU_2016_118_E

In the following statements.

(i) a, b belong to same right coset of a subgroup H in G implies.

- $a^{-1}b$ belong to H
- $ab = e$, the identity element
- ab^{-1} belong to H
- $ab^{-1} = e$, the identity element

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201 PU_2016_118_E

Let T and J be two topologies on a nonempty set X. Which is a topology on X ?

- T - J
- J - T
- T ∩ J
- T ∪ J

35 of 100

103 PU_2016_118_E

$ax^8 + 2bx^2 + 2c$ is irreducible if:-

- 2 does not divide both a and b
- 2 divides a but does not divides c
- 2 divides both b and c
- 2 does not divide both a and c

36 of 100

127 PU_2016_118_E

Let G be a finite group, H be a subgroup and g belong to G. Then:-

- $gHg^{-1} = e$
- gHg^{-1} contained in H but gHg^{-1} need not be equal to H.

- $gHg^{-1} = H$
- gHg^{-1} and H have same number of elements

37 of 100

147 PU_2016_118_E

Let f:[a, b] $\rightarrow R$ be a bounded function where a,b $\in R$ with $a < b$. Then f is Riemann integrable if and only if f is continuous everywhere on [a,b] except on:-

- a set of positive measure
- a set measure zero
- a countably infinite number of points
- a finite number of points

38 of 100

101 PU_2016_118_E

Let G be a nonabelian group of order 6. Then the number of 2-Sylow subgroups is:-

- 0
- 3
- 1
- 2

39 of 100

190 PU_2016_118_E

The residue of $\frac{z^2}{z^2+a^2}$ at $z = ai$ is:-

- $\frac{ia}{2}$
- 0
- ia
- 1

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107 PU_2016_118_E

Let K be an extension of F.

- If [F(a): F] is finite then a is not be algebraic over F
- For any element a in K every element of F(a) algebraic over 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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100 PU_2016_118_E

Let G be a group of order 28. Then which one of the following statements is not True?

- G has no subgroup of order 4
- There exists only one subgroup of order 7
- Any subgroup of order 7is a normal subgroup
- G is not simple

42 of 100

144 PU_2016_118_E

The number of elements in a finite field is:-

- a square of a prime number
- a positive integer greater than one.
- a positive power of a prime number
- a square of an integer greater than one.

43 of 100

188 PU_2016_118_E

The order of the symmetric group S_n is:-

- n^n
- $(n + 1)\,!$
- $n\,!$
- n

44 of 100

109 PU_2016_118_E

Which one is the correct statement?

- All polynomial with zero derivative over a field of characteristic p have distinct roots
- Irreducible polynomials over a field of characteristic p have distinct roots
- Irreducible polynomials over finite fields have distinct roots
- All the polynomials over a field of characteristic zero have distinct roots

45 of 100

210 PU_2016_118_E

The value of $\oint_{|z|=1} \frac{\sin^2 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ is:-

- πi
- $2\pi i$
- 0
- $\frac{\pi i}{6}$

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170 PU_2016_118_E

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 the condition _____.

- $\pi_A(X) \leq \pi_B(X)$
- $\pi_B(X) = \pi_A(X)$
- $\pi_B(X) \leq \pi_A(X)$
- $\pi_A(X) > \pi_B(X)$

47 of 100

181 PU_2016_118_E

The series $\sum_{n=1}^{\infty} \frac{1}{n^2}$ is:-

- Bounded above by 0
- Oscillating series
- Convergent
- Divergent

48 of 100

148 PU_2016_118_E

Let *E* be the set of rational numbers *p* such that *2 < p2 < 3*. Then *E* is:-

- not compact in *Q*
- closed but not bounded in *Q*
- compact in *Q*
- bounded but not closed in *Q*

49 of 100

150 PU_2016_118_E

Let $f_n(x) = \frac{1}{1+nx}$ for all $x \in [0,1]$ and for all $n \in N$. Then the sequence of functions $(f_n)_{n=1}^{\infty}$

- Pointwise bounded but not uniformly bounded on [0,1]

- the sequence $(f_n)_{n=1}^{\infty}$ is not uniformly convergent on [0,1] but it has a subsequence which is uniformly convergent on [0,1]
- the sequence $(f_n)_{n=1}^{\infty}$ converge uniformly on [0,1]
- Pointwise convergent but not uniformly convergent on [0,1]

50 of 100

149 PU_2016_118_E

Let *A* be the set of points in the interval [0,1] representing the numbers whose expansion as infinite decimals do not contain the digit 7 then the measure of *A* is:-

- ∞
- $\frac{1}{2}$
- 0
- 1

51 of 100

145 PU_2016_118_E

The function $f(x,y) = (e^x \cos y, e^x \sin y)$ from R^2 to $R^2$is:-

- such that some neighbourhood of any point surjects on to R^2
- one to one on some neighbourhood of any point in R^2
- One to one on all of R^2
- an Onto Map

52 of 100

141 PU_2016_118_E

Let F be a field and a, b are in some field extension K of F. If a and b are algebraic over F. Then which is not a correct statement.

- $a + b$ is algebraic over F
- $ka + lb$ is algebraic over F for every l, k belong to K.
- ab is algebraic over F
- $a^2 + b^2$ is algebraic over F

53 of 100

166 PU_2016_118_E

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

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

54 of 100

128 PU_2016_118_E

Let N be a subgroup of G. Then the binary operation defined as aN.bN = abN is need not be well defined:-

- if N is a proper subgroup of G.
- if G is an abelian group.
- if N is a normal subgroup of G.
- if N is a center of G.

55 of 100

108 PU_2016_118_E

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

- n/ [F(a) :F]
- [F(a) :F] ≤ n but need not be equal to n
- [F(a) :F] = n
- [F(a): F] need not be finite

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169 PU_2016_118_E

Let p and q be any two propositions whose truth value belong to the truth value set {0, 1}. The implication is defined by:-

- p→ q = min{1,1 + q - p}
- p→ q = max{1,1 + q + p}
- p→ q = max{1,1 + q - p}
- p→ q = min{1,1 + q + p}

57 of 100

182 PU_2016_118_E

Let $\{a_n\}$, $\{b_n\}$ and $\{x_n\}$ be sequences such that $a_n \le x_n \le b_n$, $\forall n \in N$. Suppose that $\{a_n\}$ and $\{b_n\}$ are convergent sequences and $Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$. Then $\{x_n\}$ converges:-

- $Lt_{n\to\infty} x_n \neq Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$
- $Lt_{n\to\infty} x_n > Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$
- $Lt_{n\to\infty} x_n < Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$
- $Lt_{n\to\infty} x_n = Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$

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187 PU_2016_118_E

The n[th] - Legendre polynomial $p_n(x)$ is such that $\int_{-1}^{1} p_n(x)^2 \, dx$ is :-

- $\frac{2}{2n-1}$
- π
- $\frac{2}{2n+1}$
- $\sqrt{\frac{\pi}{2}}$

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205 PU_2016_118_E

The residue of $\frac{ze^z}{(z-a)^3}$ at $z=a$ is:-

- a
- $\frac{1}{2}e^a(a+z)$
- $a + z$
- e^a

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161 PU_2016_118_E

Consider the linear map $T: (l_2, ||.||_2) \to (l_2, ||.||_2)$ defined as $T(x_1, x_2, x_3, \dots) = \left(x_1, \frac{x_2}{2}, \frac{x_3}{3}, \frac{x_4}{4}, \dots\right)$. Then:-

- T in not bounded

- *T* is bounded and $||T||$<1
- *T* is bounded and $||T||$ = 1
- *T* is bounded and $||T||$>1

61 of 100

224 PU_2016_118_A

The value of the constant "a" so that $u(x,y) = ax^2 - y^2 + xy$ is harmonic:-

- 1
- 2
- 0
- -1

62 of 100

249 PU_2016_118_A

The first approximation for the solution of the following simultaneous equations:-

$20x + y - 2z = 17$
$3x + 20y - z = -18$
$2x - 3y + 20z = 25$
by Jacobi's method with initial values $x_0 = y_0 = z_0 = 0$ is:-

- 0.95, -0.9, 1.20
- 0.85, -0.9, 1.25
- .6, 0.9, 1.25
- 0.86, -0.80, 1.20

63 of 100

243 PU_2016_118_A

If G is regular bipartite graph then:-

- G has a cut vertex
- G is 2-factorable
- G is 1-factorable
- G has a cut edge

64 of 100

223 PU_2016_118_A

A complex number represented by the point (0,1,0) is:-

- i
- -i
- -1
- 1

65 of 100

242 PU_2016_118_A

Which of the following is false?

- All projections are both open and closed
- All projections are closed but may not be open
- All projections are neither open nor closed
- All projections are open but may not be closed

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247 PU_2016_118_A

Match the list I and List II:-

List I	List II
(I) Newton-Raphson	(P) Integration
(II) Runge Kutta	(Q) Root Finding
(III) Gauss Seidel	(R) Ordinary Differential Equations
(IV) Simpson's Rule	(S) System of Linear equations

- I-Q, II-S, III-R, IV-P
- I-Q, II-R, III-S, IV-P
- I-P, II-Q, III-R, IV-S
- I-Q, II-R, III-P, IV-S

67 of 100

220 PU_2016_118_A

If p is a prime and (a,p) =1 then:-

- $p^a \equiv 1 \pmod{a}$
- $a^p \equiv 1 \pmod{p}$
- $a \equiv 1 \pmod{p \bmod p}$
- $a^{p-1} \equiv 1 \pmod{p}$

68 of 100

227 PU_2016_118_A

When will pointwise convergence imply uniform convergence of a sequence of real valued functions $\{f_n\}$ defined on [a,b].

- $\{f_n\}$ are uniformly bounded on [0,1]
- $\{f_n\}$ are uniformly continuous on [0,1]
- $\{f_n\}$ are continuous on [0,1]
- $\{f_n\}$ are equi-continuous on [0,1]

69 of 100

246 PU_2016_118_A
In Newton-Raphson method, nth approximation is given by:-

- $x_n = x_{n-1} - \frac{f(x_{n-1})}{f'(x_{n-1})}$
- $x_n = x_{n-1} + \frac{f(x_{n-1})}{f'(x_{n-1})}$
- $x_n = x_{n-1} + \frac{f'(x_{n-1})}{f(x_{n-1})}$
- $x_n = x_{n-1} - \frac{f'(x_{n-1})}{f(x_{n-1})}$

70 of 100

221 PU_2016_118_A
The remainder when 41^{75} is divided by 3 is:-

- 3
- 1
- 2
- 5

71 of 100

228 PU_2016_118_A
If G is k-critical, then:-

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

72 of 100

225 PU_2016_118_A

Let $f_n(x) = \frac{x^n}{1+x^n}$ $(0 \leq x \leq 1)$. Which of the following is wrong?

- $\{f_n\}$ is pointwise bounded on [0,1].
- $\{f_n\}$ is pointwise convergent on [0,1].
- $\{f_n\}$ is uniformly convergent on [0,1].
- $\{f_n\}$ is uniformly bounded on [0,1].

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244 PU_2016_118_A
Every convergent sequence in a topological space X has a unique limit if:-

- X is a compact space
- X is a second countable space
- X is a T_1-space
- X is a Hausdorff space

74 of 100

241 PU_2016_118_A

Let X be the set of all real number with the topology consisting of the empty set together with all subsets of X whose complements are finite. Then any infinite subset of X is:-

- closed
- dense
- open
- compact

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229 PU_2016_118_A

If G is a tree with n vertices then the number of ways to properly color G using λ colors is:-

- $(\lambda - 1)^{n-1}$
- $(\lambda)^{n-1}$
- $(\lambda - 1)\lambda^{n-1}$
- $\lambda (\lambda - 1)^{n-1}$

76 of 100

245 PU_2016_118_A

The maximum error associated with the composite Simpson's rule is:-

- $-\frac{h^4}{180}(b-a)f^4(\xi)$
- $-\frac{h^4}{90}(b-a)f^4(\xi)$
- $-\frac{h^5}{90}f^4(\xi)$
- $-\frac{h^5}{180}(b-a)f^4(\xi)$

77 of 100

222 PU_2016_118_A

An integer is prime if and only if it satisfies:-

- $(p-1)! \equiv -1 \pmod p$
- $(p-1)!\ 1 \equiv \pmod p$
- $p!1 \equiv \pmod p$

- (p+1)! ≡ -1 (mod p)

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226 PU_2016_118_A

Consider the series $\sum_{n=0}^{\infty} x(1-x)^n, (0 \le x \le 1)$. Then the series:-

- converges pointwise on [0,1]
- has a continuous limit on [0,1]
- has a uniformly convergent subsequence on [0, 1]
- converges uniformly on [0,1]

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230 PU_2016_118_A

Let $M = \begin{bmatrix} 1 & 3 & 3 \\ 0 & 4 & 5 \\ 0 & 0 & 9 \end{bmatrix}$. Then:-

- neither M nor M^2 is diagonalizable
- M is diagonalizable but not M^2
- M^2 is diagonalizable but not M
- both M and M^2 are diagonalizable

80 of 100

248 PU_2016_118_A

The second approximation for the root of the equation 3x = Cos x + 1 between 0 and 1 with $x_0 = 0.6$ by Newton Raphson method is:-

- 0.607
- 0.517
- 0.350
- 0.606

81 of 100

263 PU_2016_118_D

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

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

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283 PU_2016_118_D

If **u** is the velocity of an incompressible fluid flow in a domain D then **u** is:-

- curl free in D
- arbitrary in D
- divergence free in D
- both divergence and curl free

83 of 100

288 PU_2016_118_D

In the Couette flow with velocity (0,A/r + Br,0) the vorticity is given by:-

- (0,0,2B)
- (0,0,2A)
- (0,A.B)
- (0,0,0)

84 of 100

287 PU_2016_118_D

For the pde $\mathbf{v_t - v_x} = 0$, the characteristics are:-

- hyperbolas
- circles
- arbitrary curves
- straight lines

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The equation $(a\,xy^3 + y\cos x)\,dx + (x^2 y^2 + \beta \sin x)\,dy = 0$ is exact for:-

- $\alpha = 1, \beta = \frac{2}{3}$
- $\alpha = \frac{3}{2}, \beta = 1$

- $\alpha = \frac{2}{3}, \beta = 1$
- $\alpha = 1, \beta = \frac{3}{2}$

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Let $f = y^x$. What is $\frac{\partial^2 f}{\partial x \partial y}$ at x=2, y=1?

- log2
- 0
- 1
- $\frac{1}{log2}$

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In Poiseuille flow in a pipe of radius **a** the mass flow rate is proportional to:-

- $\mathbf{a}^3$
- **a**
- $\mathbf{a}^2$
- $\mathbf{a}^4$

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If the Helmholtz-Hodge decomposition gives **w** =**u** + grad(p), in a domain **D** then:-

- **u** is normal to the boundary
- **u** is curl free
- **u** is arbitrary
- **u** is divergence free and is parallel to the boundary

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The general solution of $y' + \frac{x}{1+x} y = 1 + x$ where C is an arbitrary constant is:-

- *y(x)* = 1 + x + C

- $y(x) = e^{-x}\,(x + \frac{x^2}{2} + C)(1 + x)$
- $y(x) = (1 + C\,e^{-x})\,(1 + x)$
- $y(x) = C\,(1 + x)$

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Which p (t) is a solution of the Differential Equation $\frac{dp}{dt} = p\,(1 - p)$?

- $p\,(t) = \frac{e^t}{1+e^{-t}}$
- $p\,(t) = \frac{e^t}{1+e^t}$
- $p\,(t) = \frac{1}{1+e^{-t}}$
- $p\,(t) = \frac{e^{-t}}{1+e^t}$

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$\tanh^{-1} x =$

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

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The Laplace transform H(p) of the Heaviside function is given by:-

- p^2
- $1/p^2$
- $1/p$
- p

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If **W** is the specific enthalpy, p the pressure, $\mathbb{P}$ the density then d**W** is equal to:-

- dp / ℙ g
- d ℙ
- d (p + ℙ)
- dp

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The partial differential equation obtaining by eliminating a and b from *z = ax + (1 - a) y + b* is:-

- $\left(\frac{\partial z}{\partial x}\right) = \left(\frac{\partial z}{\partial y}\right)$
- $\left(\frac{\partial z}{\partial x}\right)\left(\frac{\partial z}{\partial y}\right) = 1$
- $\left(\frac{\partial z}{\partial x}\right) - \left(\frac{\partial z}{\partial y}\right) = 1$
- $\left(\frac{\partial z}{\partial x}\right) + \left(\frac{\partial z}{\partial y}\right) = 1$

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In the Plane Poiseuille flow the velocity profile is a:-

- ellipse
- straight line
- parabola
- hyperbola

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Which of the following differential equations are equivalent to $\frac{d(e^x y)}{dx} = e^x x$?

- $\frac{dy}{dx} = x$
- $\frac{dy}{dx} = x - y$
- $\frac{dy}{dx} = x + y - 1$
- $\frac{dy}{dx} = x + y$

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The complete solution of $\left(\frac{\partial z}{\partial x}\right)\left(\frac{\partial z}{\partial y}\right) = 1$ is:-

- z = ax+by+c
- $z = ax+\frac{y}{a}+c$
- $z=\frac{x}{a}+\frac{y}{b}+c$
- $z = ax+\frac{y}{b}+c$

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If **D** is the deformation tensor of an incompressible fluid flow then the trace of **D** is

- an arbitrary function of position and time
- an arbitrary constant
- one always
- zero always

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The sum of the squares of the roots of $x^3 + ax^2 - bx + c = 0$ is:-

- $b^2 - 2c$
- $a^2 - 2b$
- $a^2 + 2b$
- $a^2 + 2c$

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If J (**x**,t) is the Jacobian of the fluid flow map of an incompressible fluid in a domain D then:-

- J = 0 in D
- J is arbitrary
- J = 1 in D
- J is arbitrary but constant