1 of 100
140 PU_2015_372
The trace of a n x n invertible matrix A:-
- always non-zero
- n
- May be zero
- Always positive

2 of 100
116 PU_2015_372
The statement \(2^n < n!\):
- Is true for all positive integers n
- Is not true for all positive integers n
- Is true for finite number of positive integers
- Is not true for finite number of positive integers

3 of 100
145 PU_2015_372
\[
\begin{pmatrix}
  x + y & z + t \\
  x - t & x - y
\end{pmatrix} = \begin{pmatrix}
  20 & 8 \\
  4 & 12
\end{pmatrix}
\]
If, then \((x,y,z,t)\) is:-
- \((2,6,1,16)\)
- \((16,4,6,12)\)
- \((16,4,6,12)\)
- \((16,4,6,6,12)\)

4 of 100
123 PU_2015_372
If \(G\) is an infinite cyclic group then which one is not a correct answer?
- Every subgroup is cyclic
- Every subgroup is abelian
- Every subgroup is normal subgroup of \(G\)
- Every element of \(G\), which is not an identity element is a generator of \(G\)

5 of 100
108 PU_2015_372
The subset \(\{z \in \mathbb{C} \mid \text{Im}(z) > 1\}\) of the complex plane is:-
- Compact
- Disconnected
6 of 100
196 PU_2015_372
\[ x \frac{dy}{dx} = y + x^2, x > 0; y(0) = 0 \]

The initial value problem has:
- Infinitely many solutions
- Exactly two solutions
- A unique solution
- No solution

7 of 100
147 PU_2015_372
The number of ways of distributing 10 prizes to 6 students if each student can receive any number of prizes is:
- \(10^6\)
- \(6^{10}\)
- 60
- 6

8 of 100
149 PU_2015_372
Let A be a matrix and \(A^t\) denotes the transpose of A. Which one is not correct?
- \((A + B)^t = A^t + B^t\)
- \((AB)^t = A^tB^t\)
- \((A^t)^t = A\)
- \((kA)^t = kA^t\)

9 of 100
154 PU_2015_372
If a set A has \(n\) elements, then the total number of non-empty subsets of A is:
- \(2^n\)
- \(n\)
- \(2^n - 1\)
- \(n^2\)
\[
\lim_{x \to 0} \frac{\cot x + \cot 2x}{\cot 3x} =
\]

- \(\frac{9}{2}\)
- \(\frac{2}{3}\)
- 1
- 0

11 of 100
150 PU_2015_372
If \(f\) is a continuous function on \([a,b]\) and \(f'(c)\) is positive for all \(c\) in \((a,b)\), then \(f\) is:

- Constant
- f is always non-negative
- Decreasing
- Increasing

12 of 100
197 PU_2015_372
The maximum number of linearly independent solutions of the differential equation \(\frac{d^2y}{dx^2} = 0\), with the condition \(y(0) = 1\) is:

- 4
- 3
- 2
- 1

13 of 100
105 PU_2015_372
The solution of the initial value problem \(y' = -2xy, \ y(0) = 2\) is:

- \(2e^{-x^2}\)
- \(e^{-x} \cos x\)
- \(e^x \sin x\)
- \(e^x \cos x\)

14 of 100
155 PU_2015_372
If \(y = (x + 3)^2\), then \((-2x - 6)^2 =\)

- \(4y\)
15 of 100
121 PU_2015_372
If $K$ is kernel of a group homomorphism $f: G \rightarrow H$, then which statement is not true?
- $K$ is an abelian subgroup of $G$
- $K$ is a normal subgroup of $G$
- $K = \{e\}$ for some homomorphisms
- $K = G$ for some homomorphisms

16 of 100
113 PU_2015_372
The equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$, $2x + 3y + 4z = 5$ and the point (1,2,3) is:
- $4(x^2 + y^2 + z^2) - 2x - 3y - 5z - 2 = 0$
- $x^2 + y^2 + z^2 - 2x - 3y - 4z - 20 = 0$
- $3(x^2 + y^2 + z^2) - 2x - 3y - 4z - 22 = 0$
- $x^2 + y^2 + z^2 - 3x - 4y - 5z - 25 = 0$

17 of 100
114 PU_2015_372
Ten points are given in a plane where no three are collinear. Then the number of different line segments that can be formed by joining these points is:
- $\binom{10}{2}$
- $\binom{10}{3}$
- $0$
- $10!$

18 of 100
190 PU_2015_372
Let $H$ be a finite subset of a group $G$ and has 4 elements. Then $H$ is not a subgroup of $G$ if:
- $G$ is an infinite group
- $o(G) = 26$
- $o(G) = 4$
- $G$ is isomorphic to a permutation group $S_n$, $n \geq 4$
If $T: U \rightarrow V$ is a linear transformation which of the following is true?

- Rank of $T$ - Nullity of $T = \dim U$
- Rank of $T + $ Nullity of $T = \dim V$
- Rank of $T + $ Nullity of $T = \dim U$
- Rank of $T + $ Nullity of $T = \dim (U + V)$

What is the period of $\sinh(x + iy)$?

- $\pi$
- $\pi i$
- $2\pi$
- $2\pi i$

The number of tangents that can be drawn from $(0, 0)$ to the circle $x^2 + y^2 + 2x + 6y - 15$ is:

- One
- Two
- Infinite
- Zero

The value of the integral of $\frac{dz}{(z - a)^1}$ (where $C$ is the circle $|Z - a| = 1$) is:

- $0$
- $2\pi i$
- $2$
- $\pi$

If $(l_1, m_1, n_1)$ and $(l_2, m_2, n_2)$ represents the direction cosines of two lines which are perpendicular then:

- $l_1l_2 + m_1m_2 + n_1n_2 = 0$
A binary operator on a set $S$ is:

- A one-to-one but need not be onto function from $S \times S$ to $S$
- An onto but need not to be a one-to-one function from $S \times S$ to $S$
- A bijective function from $S \times S$ to $S$
- A function from $S \times S$ to $S$

Which of the following iterative formula denote Euler's method?

- $Y_{n+1} = y_n + h f(x_n, y_n)$
- $Y_{n+1} = y_n - h f(x_n, y_n)$
- $Y_{n+1} = y_n + \frac{h}{2} f(x_n, y_n)$
- $Y_{n+1} = y_n - \frac{h}{2} f(x_n, y_n)$

Let $X$ and $Y$ be two non-empty sets and let $f : X \rightarrow Y$. If $A_i \subseteq X$ and $B_i \subseteq Y$, then:

- $f(\bigcap_i A_i) = \bigcap_i f(A_i)$
- $\bigcap_i f(A_i) \subseteq f(\bigcap_i A_i)$
- $\bigcap_i f(A_i)$ and $f(\bigcap_i A_i)$ are not related
- $f(\bigcap_i A_i) \subseteq \bigcap_i f(A_i)$

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

- $\alpha = \frac{3}{2}, \beta = 1$
28 of 100
173 PU_2015_372

If \( f(2a-x) = -f(x) \) for all \( x \in [0,2a] \), then \( \int_0^{2a} f(x) \, dx = \)

- \( 2a \)
- \( a \)
- 0
- \( a^2 \)

29 of 100
115 PU_2015_372
How many permutations of the letter a,b,c,d,e,f,g does not contain 'bgf' ?

- \( 7! - 4! \)
- \( 7! - 5! \)
- \( 7! \)
- \( \frac{7!}{4!} \)
- \( \frac{7!}{5!} \)

30 of 100
153 PU_2015_372
If \( |x - 2| + |x - 3| = 7 \), then \( x = \)

- 7
- 8
- 6 or -1
- -2

31 of 100
198 PU_2015_372
If \( D = \frac{d}{dx}\) then the value of \( \frac{1}{(xD+1)(x^{-1})} \) is:-
The value of \( k \) if the line passing through the points (1,4) and (6, \( k \)) and is parallel to the line \( 5x - y = 3 \). 

-29
-28
29
28

Which of the following statement is a tautology?

- \( p \lor q \)
- \( p \land q \)
- \( p \lor \neg p \)
- \( q \lor \neg q \)

The area of the region bounded by the curves \( y^2 = x - 1 \) and \( y = x - 3 \) is:

\( \frac{9}{2} \)
\( \frac{2}{9} \)
\( \frac{3}{7} \)
\( \frac{7}{3} \)

A sphere is inscribed in the tetrahedron whose faces are \( x=0, y=0, z=0, 2x+6y+3z=14 \). Then the radius of the sphere is:
Which of the following statements is true?

- In an infinite group every element is of infinite order
- If in a group every element is of finite order, then the group must be a finite group
- In a finite group every element is of finite order
- If every proper subgroup of a group is cyclic, then the group must be cyclic

---

Cosh²x + sinh²x =

- 1
- 0
- Cosh²x
- Sinh²x

---

What is the distance between the two planes 2x - 3y + 6z + 12 = 0 and the plane 2x - 3y + 8z = 0?

- \( \frac{2}{\sqrt{6}} \)
- \( \frac{2}{7} \)
- 0
- Cannot be determined

---

Which of the following is false?

- The set of all natural numbers and the set of all integers have same cardinality
- The set of all rational numbers and the set of all integers have same cardinality
The cardinality of the set of real numbers is greater than that of the set of real numbers in the interval (0,1).

The cardinality of the power set of integers is greater than that of the set of integers.

40 of 100
109 PU_2015_372
Which of the following defines a metric on \( \mathbb{R} \)?

- \( d(x,y) = (x-y)^2 \)
- \( d(x,y) = |x-y| \)
- \( d(x,y) = \frac{|x-y|}{1+|x-y|} \)
- \( d(x,y) = |x| + |y| + 1 \)

41 of 100
179 PU_2015_372
\[ \sin^{-1} x + \cos^{-1} x = \]

- 1
- 0
- \( \pi \)
- \( \pi/2 \)

42 of 100
120 PU_2015_372
If \( H \) is a normal subgroup of \( G \), then:

- \( N(H) = \{e\} \), the trivial subgroup
- \( N(H) = H \)
- \( N(H) = G \)
- A proper subgroup of \( H \)

43 of 100
212 PU_2015_372
If \( f: \mathbb{R} \to \mathbb{R} \) and \( \alpha \in \mathbb{R} \) is such that \( f(\alpha) = 0 \) and \( f'(\alpha) = 6 \) then \( \lim_{h \to 0} \frac{f(\alpha+h)}{2h} = \)

- 3
- 2
Which of the following cannot be the degree sequence of any graph?

1. {1,1,2,3,1,1,2,5,6,5}
2. {1,1,1,1,1,1,1,7}
3. {1,2,2,2,2,1}
4. {6,6,6,6,6,6}

The value of \( \int_C \frac{1}{2z+3} \, dz \) where \( C \) is \( |Z|=2 \) is:

1. \( 2\pi i \)
2. \( \pi i \)
3. 0
4. 1

The value of \( k \in (0,1) \) such that the area under \( y = x^2 \) from 0 to \( k \) is equal to the area under the same curve from \( k \) to 1.

1. \( \frac{1}{2\sqrt{3}} \)
2. \( \frac{1}{\sqrt{2}} \)
3. \( \frac{1}{\sqrt{3}} \)
4. \( \frac{1}{3\sqrt{2}} \)
A function $f(x)$ is an even function if:

- $f(x) = f(x^2)$
- $f(x) = f(-x^2)$
- $f(-x) = f(-x)$
- $f(x) = -f(-x)$

The binary operation $*$ is defined on a set of ordered pairs of real numbers as $(a, b) * (c, d) = (ad + bc, bd)$ and $*$ is associative. Then, $(1, 2) * (3, 5) * (3, 4)$ is:

- $(32, 40)$
- $(23, 11)$
- $(74, 30)$
- $(7, 11)$

A student must answer exactly eight questions out of ten on a final examination. In how many ways can she choose the questions to answer so that she must answer the first three questions?
52 of 100
122 PU_2015_372
If a finite group G has two elements a,b having orders 6 and 15, then:
- 90 divides o(G)
- 30 divides o(G) but 90 need not divide o(G)
- 3 divides o(G) but 30 need not divide o(G)
- 3 does not divide o(G)

53 of 100
106 PU_2015_372
If f(z) = u(x, y) + iv(x, y) is analytic, then f'(z) is:
- \(\frac{\partial u}{\partial x} - i \frac{\partial v}{\partial x}\)
- \(\frac{\partial u}{\partial x} + i \frac{\partial u}{\partial y}\)
- \(\frac{\partial u}{\partial x} - i \frac{\partial v}{\partial y}\)
- \(\frac{\partial u}{\partial y} - i \frac{\partial v}{\partial x}\)

54 of 100
209 PU_2015_372
For the function \(\frac{e^z}{z^2 + 4}\),
- \(z = 0\) is a simple pole
- \(z = 0\) is a removable singularity
- \(z = 0\) is a removable singularity and \(z = 2i\) is the only simple pole
- \(z = 0\) is a removable singularity and \(z = \pm 2i\) are simple pole

55 of 100
144 PU_2015_372
If \(|A| = 20\), \(|B| = 10\) and \(|A \cup B| = 30\), then, \(|A \cap B|\) is:
If \( \binom{n}{i} \), then \( n \) is:

- 5
- 6
- 7
- 8

Let \( H \) and \( K \) be finite subgroups of a group \( G \). Then, \( O(HK) \) is:

- \( O(G)O(K) \)
- \( O(H \cap K) \)
- \( O(H)O(K) \)
- \( O(H \cap K) \)
- \( O(H \cup K) \)

Evaluate \( \int_{-a}^{a} x^2 \sqrt{a^2 - x^2} \, dx \).

- \( a^3 \)
- \( 2a^3 \)
- 0
- \( 5a^5 \)

If \( f(x) = 0 \) is a reciprocal equation of second type and even degree, then one of the standard reciprocal equations that can be obtained from \( f(x) \) is:
The function \( f(x) = \sin \frac{1}{x} \) on \((0,1)\) is:

- Continuous
- Uniformly Continuous
- Discontinuous
- Piecewise Continuous

60 of 100
170 PU_2015_372

Which regular \( n \)-sided polygon has three times as many diagonals as sides?

- 6
- 7
- 8
- 9

61 of 100
225 PU_2015_372

If \( \omega \) be an imaginary cube root of unity then

\[
(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5
\]

is:

- 64
- 32
- 16
- 8

62 of 100
240 PU_2015_372

If \( a, b, c \) are the intercepts of a plane which meet the coordinate axes at A,B,C respectively, then the volume of the tetrahedron OABC is given by:-
If \( f(z) \) is an entire function, then its Taylor series is:

- Convergent for all \( z \)
- Divergent for all \( z \)
- Divergent if \(|z| > 1\)
- Constant

If \( f(x, y) = y^2 \left( e^{-x^2 + y^2} + xy \sin(x^2 + y^2) \right) \), then the value of \( \frac{\partial f}{\partial x} \) at the point \((\pi, 0)\) is:

- \( \pi \)
- \( \frac{\pi}{2} \)
- 0
- 1

Consider \( f: [0,1] \to R \) defined as \( f(x) = \begin{cases} x & \text{if } x \text{ is rational} \\ 0 & \text{if } x \text{ is irrational} \end{cases} \). The upper and lower Riemann integrals of \( f \) over \([0,1]\) are given by:

- \( \int_0^1 f(x) \, dx = 0 = \int_0^1 f(x) \, dx \)
- \( \int_0^1 f(x) \, dx = 0 \) and \( \int_0^1 f(x) \, dx = \frac{1}{2} \)
- \( \int_0^1 f(x) \, dx = \frac{1}{2} \) and \( \int_0^1 f(x) \, dx = 1 \)
- \( \int_0^1 f(x) \, dx = 1 = \int_0^1 f(x) \, dx \)
Suppose $f: \mathbb{R} \to \mathbb{R}$ is differentiable and $\lim_{x \to \infty} f'(x) = 0$. Then $\lim_{x \to \infty} [f(x + 1) - f(x)] = \circ \quad 1$
\circ \quad \text{Does not exist}
\circ \quad 0
\circ \quad -1

In how many ways is it possible to make 7 persons A, B, C, D, E, F, H sit at a round table if B, D and H insist on sitting together?

\begin{align*}
&\circ \quad 3!4! \\
&\circ \quad \frac{3!}{7!} \\
&\circ \quad \frac{3!}{7!} \\
&\circ \quad \frac{4!}{7!} \\
&\circ \quad 3!5!
\end{align*}

If $f: \mathbb{R} \to \mathbb{R}$ is defined as $f(x) = \begin{cases} xe^{x^2} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$, then $f'(0) =$

\begin{align*}
&\circ \quad 1 \\
&\circ \quad 3 \\
&\circ \quad -1 \\
&\circ \quad 0
\end{align*}

The real part of $e^{i\theta}$ is:-

\begin{align*}
&\circ \quad e^{\cos \theta} \\
&\circ \quad e^{\cos \theta} \sin(\sin \theta) \\
&\circ \quad e^{\cos \theta} \cos(\sin \theta) \\
&\circ \quad e^{\cos \theta} \sin(\cos \theta)
\end{align*}
If \( -1 + i \sqrt{3} = re^{i\theta} \), then:

- \( r = 2, \theta = \pi/3 \)
- \( r = 2, \theta = 2\pi/3 \)
- \( r = 3, \theta = \pi \)
- \( r = 3, \theta = \pi/3 \)

Consider the functions \( f \) and \( g \), both from \( R \) to \( R \) defined as

\[
 f(x) = \frac{1 + x}{1 + x^2} \quad \text{and} \quad g(x) = e^{-x}
\]

for all \( x \in R \). Then:

- \( f \) is bounded but \( g \) is unbounded
- \( f \) is unbounded but \( g \) is bounded
- Both \( f \) and \( g \) are bounded
- Both \( f \) and \( g \) are unbounded

The value of the limit,

\[
 \lim_{n \to \infty} \left( \sqrt{n^2 + n} - \sqrt{n^2 + 1} \right)
\]

is:

- \( \frac{1}{3} \)
- \( \frac{1}{4} \)
- \( \frac{1}{2} \)
- \( \frac{1}{5} \)

Let \( x \) and \( y \) be limits of two subsequences of a bounded sequence \( (a_n) \) of real numbers. Consider the following statements.

(i) \( x = y \) if the sequence \( (a_n) \) is increasing sequence
(ii) \( x = y \) if the sequence \( (a_n) \) is decreasing sequence
(iii) \( x = y \) if the sequence \( (a_n) \) is convergent sequence

Then:

- All the statements i), ii) and iii) are true
- Only iii) is true
75 of 100
246 PU_2015_372
When an edge is removed from a graph, the number of components:
- Increase by at least one
- Increase by at most one
- Decrease by at least one
- Decrease by at most one

76 of 100
241 PU_2015_372
If \( z = a \) is an isolated singularity of \( f \) and \( f(z) = \sum_{n=-\infty}^{\infty} a_n (z - \alpha)^n \) is its Laurent series expansion in annulus \( 0 < |a| < r \) then if \( a_n = 0 \) for \( n < -1 \), we say \( z = a \), we say \( z = a \) is:
- A pole of order \( n \)
- A simple pole
- A removable singularity
- An essential singularity

77 of 100
245 PU_2015_372
Given that \( \sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6} \). The sum of the series \( \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} \) is:
- \( \frac{\pi^2}{8} \)
- \( \frac{\pi^2}{3} \)
- \( \frac{\pi^2}{2} \)
- \( \frac{\pi^2}{4} \)

78 of 100
227 PU_2015_372
All the permutation groups \( S_n \) are:
- Finite
- Non-abelian
The Cantor set is:
- Open in \( \mathbb{R} \)
- Closed in \( \mathbb{R} \)
- Dense in \([0,1]\)
- A connected subset of \( \mathbb{R} \)

The number of integer solutions of
\[
\begin{pmatrix} 7 \\ 5 \\ 2 \\ 4 \\ 2 \\ 7 \\ 3 \end{pmatrix}
\]

Which of the following is false?
- There exists a continuous function mapping \((0,1)\) onto \([0,1]\)
- There exists a continuous function mapping \((0,1)\) onto \(\mathbb{R}\)
- There exists a continuous function mapping \([0,1] \cup [2,3]\) onto \([0,1]\)
- There exists a continuous function mapping \([0,1]\) onto \((0,1)\)

The partial differential equation
\[
x^2 \frac{\partial^2 z}{\partial x^2} - (y^2 - 1)x \frac{\partial^2 z}{\partial x \partial y} + y(y - 1)^2 \frac{\partial^2 z}{\partial y^2} + x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = 0
\]
is hyperbolic in a region in the XY-plane, if:
- \( x \neq 0 \) and \( y = 1 \)
- \( x = 0 \) and \( y \neq 1 \)
For the power series
\[
\sum_{n=0}^{\infty} \frac{n!}{n^n} z^n
\]
the radius of convergence is:
- \(e\)
- \(1\)
- \(\infty\)
- \(0\)

The expression \(\frac{1}{Dx^2 - Dv^2} \sin(x - y)\) is equal to:
- \(\frac{x}{2} \cos(x - y)\)
- \(-\frac{x}{2} \sin(x - y) + \cos(x - y)\)
- \(-\frac{x}{2} \cos(x - y) + \sin(x - y)\)
- \(\frac{3x}{2} \sin(x - y)\)

The value of the integral \(\int_{x^2 + y^2 \leq 1} e^{-(x^2 + y^2)}\) is:
- \(\pi \left(1 + \frac{1}{e}\right)\)
- \(\pi \left(1 - \frac{1}{e}\right)\)
- \(\pi \left(1 + \frac{1}{e^2}\right)\)
- \(\pi \left(1 - \frac{1}{e^2}\right)\)
Define \( f : \mathbb{Z} \rightarrow \mathbb{Z} \) by \( f(x) = 3x^3 - x \). Then \( f \) is:

- Both one-to-one and onto
- One-to-one but not onto
- Onto but not one-to-one
- Neither one-to-one nor onto

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275 PU_2015_372

\[
\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) =
\]

- \( 1 \)
- \( \frac{\pi}{2} \)
- \( \frac{\pi}{3} \)
- \( \frac{\pi}{4} \)

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293 PU_2015_372

The general solution of the partial differential equation \( \frac{\partial^2 z}{\partial x \partial y} = x + y \) is of the form:

- \( \frac{1}{2} xy(x + y) + F(x) + G(y) \)
- \( \frac{1}{2} xy(x - y) + F(x) + G(y) \)
- \( \frac{1}{2} xy(x - y) + F(x)G(y) \)
- \( \frac{1}{2} xy(x + y) + F(x)G(y) \)

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269 PU_2015_372

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

- \( a^2 - 2b \)
- \( a^2 + 2b \)
- \( b^2 - 2c \)
In a group G with identity element e, the equation:

(i) \(x^2 = e\) has unique solution in G.
(ii) \(x^2 = x\) has unique solution in G.

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

If \( f(x, y) = x^2 - xy \) and \( C \) is the line segment from (1,1) to the point (0,0) then the value of the line integral \( \int_C f \cdot d\vec{r} \) is:-

- 0
- 1
- -1
- 2
- 1/2

If \( f: R \to R \) is defined as

\[
f(x) = \begin{cases} 
x^2 \sin \frac{1}{x} & \text{if } x \neq 0 \\
0 & \text{if } x = 0
\end{cases}
\]

then:-

- \( f \) is not continuous at 0
- \( f \) is continuous at 0 but not differentiable at 0
- \( f \) is differentiable but its derivative \( f' \) is not continuous at 0
- \( f \) is differentiable and its derivative \( f' \) is continuous at all points

A cube has edges of length \( a \). The distance between a diagonal and a skew edge is:-

- \( a^2 + 2a \)
- \( \sqrt{2}a \)
- \( \frac{a}{2} \)
In how many ways can the integer 1 through 9 be permuted such that exactly four of the nine integers are in their natural positions? (D_n denotes the number of derangement of n symbols)

- \( \binom{9}{5} D_5 \)
- \( \binom{10}{4} D_4 \)
- \( \binom{9}{5} D_5 \)
- \( \binom{10}{4} D_4 \)
- \( \binom{9}{4} D_5 \)
- \( \binom{10}{4} D_4 \)

For what values of a it is true that

\[
\lim_{n \to \infty} \frac{a^n}{n!} = 0
\]

- For all \( a \in \mathbb{R} \)
- Only if \( |a| < 1 \)
- Only if \( |a| = 1 \)
- Only if \( |a| > 1 \)

Consider \( R \) with the discrete metric \( d \). Then which of the following is true?

- The sequence \( \{\frac{1}{n}\}_{n=1}^{\infty} \) is a Cauchy sequence
- The map \( f: (R, d) \to (R, d) \) defined as \( f(x) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ 0 & \text{if } x \text{ is irrational} \end{cases} \) is nowhere continuous on \( R \)
- Finite sets are the only compact subsets of \( X \)
- \([0,1]\) is connected in \((R, d)\)
If \((x_n, y_n)\) are sequences of real numbers with limit points \(x\) and \(y\), \(x < y\) only if:

- \(x_n \leq y_n\) for all \(n\)
- \(x_n \leq y_n\) for infinitely many \(n\)
- \(x_n \geq y_n\) for finitely many \(n\)
- \(x_n \geq y_n\) for infinitely many \(n\)

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If \(V\) is the solid in \(\mathbb{R}^3\) bounded by the cylinder \(x^2 + y^2 = 1\) and the planes \(z = 0\) and \(z = 1\), then the value of \(\iiint_V \, dx \, dy \, dz\)

is:-

- \(4\pi\)
- \(2\pi\)
- \(\pi\)
- \(\pi/2\)

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If \(a_n = \frac{1}{n^2 + 1}\) and \(b_n = \frac{n}{3^n}\) for all \(n \in \mathbb{N}\) then:

- Both \(\sum_{n=1}^{\infty} a_n\) and \(\sum_{n=1}^{\infty} b_n\) are convergent.
- \(\sum_{n=1}^{\infty} a_n\) is convergent but \(\sum_{n=1}^{\infty} b_n\) is divergent.
- \(\sum_{n=1}^{\infty} a_n\) is divergent but \(\sum_{n=1}^{\infty} b_n\) is convergent.
- Both \(\sum_{n=1}^{\infty} a_n\) and \(\sum_{n=1}^{\infty} b_n\) are divergent.

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If \(y = \sum_{m=0}^{\infty} c_m x^{r+m}\) is assumed to be a solution of the differential equation \(x^2 y'' - xy' - 3(1 + x^2)y = 0\) then, the value of \(r\) are:

- 1 and 3
- -1 and 3
- 1 and -3