

Mathematics

1. **Question:** If z is a complex number such that $|z| = 2$, find the value of $|z^2 + \bar{z}^2|$.

Solution:

Let $z = re^{i\theta}$, where $r = |z| = 2$. Then $\bar{z} = re^{-i\theta}$.

$$|z^2 + \bar{z}^2| = |(re^{i\theta})^2 + (re^{-i\theta})^2| = |4e^{2i\theta} + 4e^{-2i\theta}| = |8\cos(2\theta)|$$

The maximum value of $|8\cos(2\theta)|$ is 8.

2. **Question:** Evaluate $\int_0^{\pi} \sin^2(x) dx$.

Solution:

$$\begin{aligned} \int_0^{\pi} \sin^2(x) dx &= \int_0^{\pi} \frac{1 - \cos(2x)}{2} dx \\ &= \frac{1}{2} \int_0^{\pi} (1 - \cos(2x)) dx \\ &= \frac{1}{2} \left[x - \frac{\sin(2x)}{2} \right]_0^{\pi} \\ &= \frac{1}{2} \left[\pi - \frac{\sin(2\pi)}{2} - \left(0 - \frac{\sin(0)}{2} \right) \right] \\ &= \frac{1}{2} (\pi - 0) = \frac{\pi}{2} \end{aligned}$$

3. **Question:** Solve the quadratic equation $x^2 - 5x + 6 = 0$.

Solution:

$$\begin{aligned} x^2 - 5x + 6 &= (x-2)(x-3) = 0 \\ x - 2 &= 0 \quad \text{or} \quad x - 3 = 0 \\ x &= 2, 3 \end{aligned}$$

4. **Question:** Find the sum of the first n terms of the series $1 + 2 + 3 + \dots + n$.

Solution:

$$S_n = \frac{n(n+1)}{2}$$

5. **Question:** If the equation $x^2 + px + q = 0$ has roots α and β , show that $\alpha + \beta = -p$.

Solution:

$$\begin{aligned} \text{By Vieta's formulas, } \alpha + \beta &= -\text{coefficient of } x / \text{coefficient of } x^2 \\ &= -p / 1 = -p \end{aligned}$$

Logical Reasoning

6. **Question:** A sequence is given as 2,6,12,20,...2, 6, 12, 20, \ldots2,6,12,20,.... Find the next term.

Solution:

Differences: $6-2=4$ $12-6=6$ $20-12=8$

The next difference is 10

Next term: $20+10=30$

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7. **Question:** If 4 cats catch 4 rats in 4 minutes, how many cats are required to catch 100 rats in 100 minutes?

Solution:

Each cat catches 1 rat in 4 minutes. In 100 minutes, each cat catches $100/4=25$ rats.

100 rats require $100/25=4$ cats.

Analytical Ability

8. **Question:** If $2x-3y=5$ and $3x+4y=7$, find x and y .

Solution:

Solve the equations simultaneously:

From $2x-3y=5$, $x=(3y+5)/2$. Substitute into the second equation.

$3((3y+5)/2)+4y=7$

Solve for y , then x .

Computer Awareness

9. **Question:** What is the binary equivalent of 25?

Solution:

Divide 25 by 2: 11001

10. **Question:** Which data structure works on the principle of FIFO?

Solution:

Queue.

English

11. **Question:** Correct the sentence: "He don't like coffee."

Solution: Correct form: "He doesn't like coffee."

12. **Question:** Find the synonym of "Abundant".

Solution: Plentiful.

Here are additional **NIMCET-style questions** with solutions to further enhance your preparation:

Mathematics

31. **Question:** If $x^2+y^2=25$ and $xy=12$, find x^4+y^4 .

Solution:

Using $(x^2+y^2)^2 = x^4 + y^4 + 2x^2y^2$
 $(x^2+y^2)^2 = x^4 + y^4 + 2x^2y^2$

$25^2 = x^4 + y^4 + 2(12)^2$

$625 = x^4 + y^4 + 288$

$x^4 + y^4 = 625 - 288 = 337$

32. **Question:** Evaluate $\sum_{k=1}^n k^2$.

Solution:

The formula is $\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$

$\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$

33. **Question:** If A and B are sets such that $A = \{1, 2, 3\}$ and $B = \{3, 4, 5\}$, find $A \cap B$.

Solution:

$$A \cap B = \{3\} \quad A \cap B = \{3\}.$$

34. **Question:** Solve $\tan^2(x) = 3$ in $[0, 2\pi]$.

Solution:

$$\tan(x) = \pm\sqrt{3} \Rightarrow \tan(x) = \pm\sqrt{3}.$$

$$\text{Solutions: } x = \pi/3, 2\pi/3, 4\pi/3, 5\pi/3 = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}.$$

35. **Question:** If $|x| + |x-1| = 3$, find all possible values of x .

Solution:

Break into cases:

- $x \geq 1$: $x + (x-1) = 3 \Rightarrow x = 2$
 - $0 \leq x < 1$: $x - (x-1) = 3 \Rightarrow x = -1$ (Not possible)
 - $x < 0$: $-x - (x-1) = 3 \Rightarrow x = -1$
- Values: $x = -1, 2$.
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36. **Question:** Find the derivative of $f(x) = e^{2x} \sin(x)$.

Solution:

Use the product rule:

$$f'(x) = e^{2x}(2\sin(x) + \cos(x))$$

37. **Question:** Compute the value of $\int_0^{\pi} \cos^2(x) dx$.

Solution:

$$\cos^2(x) = \frac{1 + \cos(2x)}{2}$$

$$\int_0^{\pi} \cos^2(x) dx = \int_0^{\pi} \frac{1 + \cos(2x)}{2} dx = \frac{1}{2} \int_0^{\pi} 1 dx + \frac{1}{2} \int_0^{\pi} \cos(2x) dx = \frac{1}{2} \pi + \frac{1}{2} \left[\frac{\sin(2x)}{2} \right]_0^{\pi} = \frac{\pi}{2} + 0 = \frac{\pi}{2}$$

38. **Question:** Solve $x^3 - 3x^2 + 4 = 0$ for real roots.

Solution:

Use trial values: $x = -1$ is a root.

$$\text{Factorize: } (x+1)(x^2 - 4x + 4) = 0 \Rightarrow (x+1)(x-2)^2 = 0$$

Roots: $x = -1, 2$ (double root).

39. **Question:** If $a_n = 2^n + 3^n$, find $a_{n+1} - a_n$.

Solution:

$$a_{n+1} - a_n = 2^{n+1} + 3^{n+1} - 2^n - 3^n = 2^n(2-1) + 3^n(3-1) = 2^n + 2 \cdot 3^n$$

$$a_{n+1} - a_n = 2^n + 2 \cdot 3^n = 2^n(2-1) + 3^n(3-1) = 2^n + 2 \cdot 3^n$$

$$a_{n+1} - a_n = 2^n + 2 \cdot 3^n = 2^n(2-1) + 3^n(3-1) = 2^n + 2 \cdot 3^n$$

Logical Reasoning

40. **Question:** Find the missing term in the series: 1, 1, 2, 3, 5, 8, ?, 1, 2, 3, 5, 8, ?, 1, 2, 3, 5, 8, ?.

Solution:

Fibonacci series: 131313.

41. **Question:** If AAA is twice as fast as BBB and AAA can complete a task in 6 days, how long will they take working together?

Solution:

Work rates: $A = \frac{1}{6}$, $B = \frac{1}{12}$

Together: $\frac{1}{6} + \frac{1}{12} = \frac{2}{12} + \frac{1}{12} = \frac{3}{12} = \frac{1}{4}$

Time: 4 days.

42. **Question:** A train crosses a platform of length 200 m in 30 seconds at a speed of 20 m/s. Find the train's length.

Solution:

Distance = Speed \times Time: $20 \times 30 = 600$

Train's length = $600 - 200 = 400$ m.

43. **Question:** What is the angle between the diagonals of a square?

Solution:

90°

Computer Awareness

44. **Question:** Convert $(45)_{10}$ to binary.

Solution:

Divide 45 by 2: $(101101)_2$

Question: Identify the output:

perl

Copy code

```
int x = 10;
```

```
printf("%d", ++x);
```

45. **Solution:**

Output: 111111.

46. **Question:** What is the time complexity of Quick Sort in the best case?

Solution:

$O(n \log n)$ $O(n \log n)$ $O(n \log n)$.

47. **Question:** What is a stack data structure?

Solution:

A stack is a **LIFO (Last In, First Out)** data structure.

English

48. **Question:** Find the synonym of "Expedite."

Solution:

Hasten.

49. **Question:** Find the antonym of "Compulsory."

Solution:

Optional.

50. **Question:** Correct the sentence: "She is more smarter than her friend."

Solution:

Correct form: "She is smarter than her friend."

Mathematics

51. **Question:** Solve $2x+1=82^{\{x+1\}} = 82x+1=8$.

Solution:

Rewrite $2x+1=232^{\{x+1\}} = 2^{\{32x+1\}}=23$.

$x+1=3x + 1 = 3x+1=3$.

$x=2x = 2x=2$.

52. **Question:** Find the roots of $x^2+5x+6=0x^2 + 5x + 6 = 0x^2+5x+6=0$.

Solution:

Factorize: $(x+2)(x+3)=0(x+2)(x+3) = 0(x+2)(x+3)=0$.

Roots: $x=-2, -3x = -2, -3x=-2, -3$.

53. **Question:** Evaluate $\int_0^1(3x^2+2x+1)dx \int_0^1(3x^2 + 2x + 1) dx \int_0^1(3x^2+2x+1)dx$.

Solution:

$\int(3x^2+2x+1)dx=x^3+x^2+x \int(3x^2 + 2x + 1) dx = x^3 + x^2 + x \int(3x^2+2x+1)dx=x^3+x^2+x$.

Substituting limits:

$[1^3+1^2+1]-[0+0+0]=3[1^3 + 1^2 + 1] - [0 + 0 + 0] = 3[1+1+1]-[0+0+0]=3$.

54. **Question:** If $x^2+px+16=0x^2 + px + 16 = 0x^2+px+16=0$ has equal roots, find p.

Solution:

For equal roots, discriminant = 0:

$p^2-4(1)(16)=0p^2 - 4(1)(16) = 0p^2-4(1)(16)=0$.

$p^2=64p^2 = 64p^2=64$.

$p=\pm 8p = \pm 8p=\pm 8$.

55. **Question:** Compute $\log_2(32)\log_2(32)\log_2(32)$.

Solution:

Rewrite $32=2^532 = 2^532=25$.

$\log_2(32)=5\log_2(32) = 5\log_2(32)=5$.

56. **Question:** Solve $\sin(x)=0.5\sin(x) = 0.5\sin(x)=0.5$ in $[0, 2\pi][0, 2\pi][0, 2\pi]$.

Solution:

$x=\frac{\pi}{6}, \frac{5\pi}{6}x = \frac{\pi}{6}, \frac{5\pi}{6}x=6\pi, 65\pi$.

57. **Question:** If the sum of the first n natural numbers is 300300300, find n .

Solution:

$$\text{Formula: } n(n+1)/2 = 300300300 \implies n(n+1) = 600600600.$$

$$n(n+1) = 600600600 \implies n = 244710.$$

$$n = 244710 \implies n = 244710.$$

58. **Question:** If $A = \{x : x \text{ is a prime number less than } 10\}$, find $A \cup A$.

Solution:

$$A = \{2, 3, 5, 7\} \implies A \cup A = \{2, 3, 5, 7\}.$$

59. **Question:** Find the value of $\int_0^1 x^3 dx$.

Solution:

$$\int_0^1 x^3 dx = \left[\frac{x^4}{4} \right]_0^1 = \frac{1^4}{4} - \frac{0^4}{4} = \frac{1}{4}.$$

60. **Question:** Solve $(x+1)^3 = 27$.

Solution:

$$\text{Take cube root: } x+1 = \sqrt[3]{27} = 3 \implies x = 2.$$

$$x = 2 \implies x = 2.$$

13. **Question:** If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, find $\det(A)$.

Solution:

$$\det(A) = (1)(4) - (2)(3) = 4 - 6 = -2.$$

$$\det(A) = (1)(4) - (2)(3) = 4 - 6 = -2.$$

14. **Question:** Solve for x : $\log_2(x) + \log_2(x-2) = 3$.

Solution:

$$\text{Use the logarithmic property: } \log_2(x(x-2)) = 3 \implies x(x-2) = 2^3 = 8.$$

$$x(x-2) = 8 \implies x^2 - 2x - 8 = 0.$$

$$\text{Solve: } x^2 - 2x - 8 = 0 \implies (x-4)(x+2) = 0.$$

$$\text{Factorize: } (x-4)(x+2) = 0 \implies x = 4 \text{ or } x = -2.$$

$$\text{Since } x > 0, x = 4.$$

15. **Question:** Find the area under the curve $y=x^2$ from $x=0$ to $x=2$.

Solution:

$$\int_0^2 x^2 dx = \left[\frac{x^3}{3} \right]_0^2 = \frac{8}{3} - 0 = \frac{8}{3}$$

Logical Reasoning

61. **Question:** Complete the series: 2, 6, 12, 20, 30, ?, 42, 54, 66, 80, 96, ?

Solution:

Differences: +4, +6, +8, +10, +12, +14, +16, +18, +20, +22, +24

Next: 42, 54

62. **Question:** If AAA can do a job in 6 hours, and BBB can do the same job in 8 hours, how long will it take them working together?

Solution:

Combined rate: $\frac{1}{6} + \frac{1}{8} = \frac{7}{24}$

Time: $24 \div 7 \approx 3.43$ hours.

63. **Question:** A man walks 3 km north, then 4 km east. How far is he from the starting point?

Solution:

Use Pythagoras theorem:

$$\sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5 \text{ km.}$$

64. **Question:** In a code language, if "CAT" is written as "DBU," how is "DOG" written?

Solution:

Each letter is shifted +1:

"DOG" → "EPH".

65. **Question:** If AAA is the brother of BBB, and BBB is the father of CCC, how is AAA related to CCC?

Solution:

AAA is CCC's uncle.

Computer Awareness

66. **Question:** What is the binary representation of $(25)_{10}$?

Solution:

$25 \div 2 = 12 \text{ remainder } 1$
 $12 \div 2 = 6 \text{ remainder } 0$
 $6 \div 2 = 3 \text{ remainder } 0$
 $3 \div 2 = 1 \text{ remainder } 1$
 $1 \div 2 = 0 \text{ remainder } 1$
Output: 1100110011001.

Question: What is the output of the following code?

c

Copy code

```
int x = 5;
```

```
printf("%d", x++ + ++x);
```

67. **Solution:**

$x++ = 5$, $x = 6$, $++x = 7$, $6 + 7 = 13$.

Output: 13.

68. **Question:** Identify the odd one out: ROM, RAM, HDD, SSD, ROM, RAM, HDD, SSD, RAM, HDD, SSD.

Solution:

RAM, RAM, RAM, as it is volatile.

69. **Question:** What is the time complexity of Binary Search?

Solution:

$O(\log n)$.

70. **Question:** Which data structure is used in a Breadth-First Search?

Solution:

Queue.

English

71. **Question:** Find the synonym of "Obsolete."

Solution:
Outdated.

72. **Question:** Find the antonym of "Impartial."

Solution:
Biased.

73. **Question:** Fill in the blank: "She is fond ___ painting."

Solution:
"She is fond **of** painting."

74. **Question:** Rearrange the sentence: "Rain / is expected / later in the day."

Solution:
"Rain is expected later in the day."

75. **Question:** Choose the correct spelling:

- A) Accomodate
- B) Accommodate

Solution:
B) Accommodate.
