

FREE SAMPLE: THE FIRST 3 QUESTIONS

JEE MAIN — PAPER 1 — 75 QUESTIONS

Mathematics · Physics · Chemistry · 300 marks · 180 minutes

Work through each subject in turn. In Section A choose one option; in Section B write your integer answer. Wrong answers lose 1 mark, so do not guess blindly.

Mathematics — Section A (20 multiple-choice questions)

Choose one correct option. Correct +4, wrong -1, unanswered 0.

1. The number of relations on a set containing 4 elements that are both reflexive and symmetric is

- A 16
- B 64
- C 4096
- D 65536

2. The modulus of the complex number $(5 + 12i)^2$ is

- A 13
- B 26
- C 168
- D 169

3. If α and β are the roots of $2x^2 + 4x - 16 = 0$, then the value of $1/\alpha + 1/\beta$ is

- A -2
- B $-\frac{1}{4}$
- C $\frac{1}{4}$
- D 4

THE WORKED ANSWERS TO THOSE 3 QUESTIONS

1. The number of relations on a set containing 4 elements that are both reflexive and symmetric is [Sets, relations and functions]

Correct answer: B — 64

- A relation on a set A is a subset of $A \times A$, which has $4 \times 4 = 16$ ordered pairs.
- Reflexive forces the diagonal pairs in. The $n(n-1)/2$ off-diagonal pairs of pairs are free, each in or out: $2^{n(n-1)/2}$.
- For $n = 4$ the exponent is 6, so the number is $2^6 = 64$.
- Why the other options are wrong:
 - A (16): Only the diagonal choices were counted.
 - C (4096): Forgot that a symmetric pair is chosen together.
 - D (65536): That counts all relations without the condition.

LOS: Mathematics · Sets, relations and functions

KEY TAKEAWAY

Count a relation by deciding in or out for each ordered pair, then apply the condition to reduce the free pairs.

2. The modulus of the complex number $(5 + 12i)^2$ is [Complex numbers]

Correct answer: D — 169

- For any complex numbers $|z_1 z_2| = |z_1| |z_2|$, so $|z^n| = |z|^n$.

- $|5 + 12i| = \sqrt{5^2 + 12^2} = \sqrt{169} = 13$.
- Hence $|z|^2 = 13^2 = 169$.
- Why the other options are wrong:
- A (13): Forgot to raise to the power n .
- B (26): The modulus is raised to a power, not multiplied.
- C (168): A near miss from an arithmetic slip; it does not match the result of the steps above.

LOS: Mathematics · Complex numbers

KEY TAKEAWAY

$|z^n| = |z|^n$: the modulus of a power is the power of the modulus.

3. If α and β are the roots of $2x^2 + 4x - 16 = 0$, then the value of $1/\alpha + 1/\beta$ is [Quadratic equations]

Correct answer: C — $\frac{1}{4}$

- $\alpha + \beta = -2$, $\alpha\beta = -8$.
- $1/\alpha + 1/\beta = \frac{\alpha + \beta}{\alpha\beta} = -2/-8$.
- So the value is $\frac{1}{4}$.
- Why the other options are wrong:
- A (-2): Forgot to divide by the product.
- B ($-\frac{1}{4}$): Sign error.
- D (4): Inverted the fraction.

LOS: Mathematics · Quadratic equations

KEY TAKEAWAY

$1/\alpha + 1/\beta = (\alpha + \beta)/\alpha\beta = \frac{-b}{c}$.