JEE Advanced - Mathematics Questions

**Question 1:** If *x* and *y* are integers satisfying *x*2 *y*2 = 63, how many integer solutions exist?

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**Type:** Single Correct MCQ

# Options:

(a) 4

(b) 6

(c) 8

(d) 10

**Answer key:** (c) 8

**Solution:** We factorize *x*2 *y*2 = (*x y*)(*x* + *y*) = 63. The factor pairs of 63 are (1*,* 63)*,* (3*,* 21)*,* (7*,* 9). Solving for integer values of *x* and *y*, we get 8 valid solutions.

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**Subject:** Mathematics

**Chapter Name:** Quadratic Equations

**Topic Name:** Factorization and Number Theory

**Question 2:** Let *S* be the sum of all three-digit numbers that leave remain- der 2 when divided by 7. Find *S*.

**Type:** Numerical Answer

**Answer key:** 70707

**Solution:** The first term of the sequence is 101 and the last term is 995. The sequence follows an arithmetic progression with common difference 7. Using the sum formula for an arithmetic series:

*n*

*S* =  (*a* + *l*) 2

where *n* = 129, *a* = 101, *l* = 995, we get *S* = 70707.

**Subject:** Mathematics

**Chapter Name:** Sequences and Series

**Topic Name:** Arithmetic Progressions

**Question 3:** A function *f* : R R satisfies *f* (*x* + *y*) = *f* (*x*)*f* (*y*) for all real

*x, y*. If *f* (2) = 3, find *f* (4).

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**Type:** Single Correct MCQ

# Options:

(a) 6

(b) 9

(c) 12

(d) 15

**Answer key:** (b) 9

**Solution:** Setting *x* = *y* = 0, we find *f* (0) = 1. Setting *y* = 2, we get

*f* (4) = *f* (2)2 = 9.

**Subject:** Mathematics

**Chapter Name:** Functions

**Topic Name:** Functional Equations

**Question 4:** The sum of three distinct real numbers is 10. The sum of their squares is 36. The product of the three numbers is 20. Find the numbers.

**Type:** Numerical Answer

**Answer key:** (2, 4, 4)

**Solution:** Using Vieta’s formulas for a cubic equation:

*x* + *y* + *z* = 10*, x*2 + *y*2 + *z*2 = 36*, xyz* = 20

and solving the quadratic equation formed by eliminating one variable, we find (2*,* 4*,* 4).

**Subject:** Mathematics

**Chapter Name:** Algebra

**Topic Name:** Symmetric Expressions

**Question 5:** A square and a rectangle have the same perimeter. The area of the square is 196 square units, and the length of the rectangle is twice its width. Find the area of the rectangle.

**Type:** Numerical Answer

# Answer key: 168

**Solution:** The square’s side length is

196 = 14, so its perimeter is 56.

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Setting the rectangle’s perimeter as 2(*l* + *w*) = 56 and solving for area, we get 168.

**Subject:** Mathematics

**Chapter Name:** Geometry

**Topic Name:** Perimeter and Area

**Question 6:** Find the smallest positive integer *n* such that 2*n > n*5.

**Type:** Numerical Answer

# Answer key: 17

**Solution:** Checking values, we see that for *n* = 16, 216 *<* 165 but for *n* = 17, 217 *>* 175.

**Subject:** Mathematics

**Chapter Name:** Exponential and Logarithmic Functions

**Topic Name:** Growth Comparisons

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**Question 7:** Let *f* (*x*) = *x* + 2*x* . Find the number of points of discon- tinuity in [0*,* 5].

**Type:** Numerical Answer

# Answer key: 9

**Solution:** The function has discontinuities at integer and half-integer values.

Counting them gives 9.

**Subject:** Mathematics

**Chapter Name:** Calculus

**Topic Name:** Discontinuities

**Question 8:** Find the last two digits of 72025.

**Type:** Numerical Answer

# Answer key: 07

**Solution:** Using Euler’s theorem and the Chinese remainder theorem, 72025 07 (mod 100).

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**Subject:** Mathematics

**Chapter Name:** Number Theory

**Topic Name:** Modular Arithmetic

**Question 9:** The inradius of a right triangle with legs 12 and 16 is?

**Type:** Numerical Answer

# Answer key: 4

**Solution:** The hypotenuse is 20, so the inradius formula gives *r* = 12+16*−*20 =

2

4.

**Subject:** Mathematics **Chapter Name:** Geometry **Topic Name:** Inradius

**Question 10:** Find the number of onto functions from a set of 4 elements to a set of 2 elements.

**Type:** Numerical Answer

# Answer key: 14

**Solution:** Using the formula for surjective functions, we get 24 − 4 14 = 14.

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**Subject:** Mathematics

**Chapter Name:** Set Theory

**Topic Name:** Surjective Functions