2015

Booklet No.   TEST CODE: QMA

Forenoon

Questions: 30   **Time: 2 hours**

- On the answer booklet write your Name, Registration number, Test
  Centre, Test Code and the Number of this Booklet in the appropriate
  places on the Answer-sheet.

- This test has 30 questions. **ANSWER ALL QUESTIONS.** All
  questions carry equal (4) marks.

- For each of the 30 questions, there are four suggested answers. Only
  one of the suggested answers is correct. You will have to identify the
  correct answer to get full credit for that question. Indicate your choice
  of the correct answer by darkening the appropriate oval completely on
  the answer-sheet.

- You will get:

  4 marks for each **correctly** answered question,
  0 marks for each **incorrectly** answered question, and
  1 mark for each **unanswered** question.

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1. Let $x_1, x_2, ...$ be positive integers which are in arithmetic progression (A.P)., such that $x_1 + x_2 + x_3 = 12$ and $x_4 + x_6 = 14$. Then x_5 is

   (a) 7

   (b) 1

   (c) 4

   (d) None of the above

2. I sold 2 books for Rs.30 each. My profit on one was 25% and the loss on the other was 25%. Then, on the whole, I

   (a) neither gained nor lost

   (b) lost Rs.5

   (c) lost Rs.4

   (d) gained Rs.4

3. For any real number x let $g(x)$ denote the determinant of the matrix
   $$\begin{bmatrix} x & 2 & 0 & 0 \\ 2 & 5 & 0 & 0 \\ 0 & 0 & 5 & x \\ 0 & 0 & x & 2 \end{bmatrix}$$ The solutions of $g(x) = 0$ are

   (a) $(\frac{4}{5}, -10, 10)$

   (b) $(\frac{5}{4}, \sqrt{10}, -\sqrt{10})$

   (c) $(4, \sqrt{10}, -\sqrt{10})$

   (d) $(\frac{4}{5}, \sqrt{10}, -\sqrt{10})$

4. A car whose original value is Rs.25,600 decreases in value by Rs.90 per month. In how many months the car's value falls below Rs.15,000?

   (a) 115 months
   (b) 117 months
   (c) 119 months
   (d) 121 months

5. A manufacturer determines that the number of drills it can sell is given by the form $D = -3P^2 + 180P - 285$ where P is the price of a drill in Rs. What is the maximum number of drills that can be sold?

   (a) 2145
   (b) 2415
   (c) 2225
   (d) 2445

6. A balloon takes off from a location that is 24ft above sea level. It rises 45ft/min. Choose an equation to model the balloon's elevation "h" as a function of time "t" (in minutes).

   (a) h = 24t + 45
   (b) h = 24t - 45
   (c) h = 45t + 24
   (d) h = 45t - 24

7. A multiple choice test has 10 questions. Each question has 4 choices; A, B, C, D. In how many ways can the test be answered?

   (a) $10 + 4$
   (b) 10×4
   (c) 10^4
   (d) 4^{10}

8. Let α, β be the roots of the equation $x^2 - px + r = 0$ and $\alpha/2$ and 2β be the roots of the equation $x^2 - qx + r = 0$. Then the value of r is

   (a) 2(p-q)(2q-p)/9
   (b) 2(q-p)(2p-q)/9
   (c) 2(2p-q)(2q-p)/9
   (d) 2(q-2p)(2q-p)/9

9. The value of $\lim\limits_{x\to 0} \frac{\cos 3x - \cos x}{x^2}$ is equal to

    (a) 4

    (b) 1

    (c) -1

    (d) -4

10. If $\log 2, \log(2^x - 1)$ and $\log(2^x + 3)$ are in AP then x is equal to

    (a) $\frac{5}{2}$

    (b) $\log_2 5$

    (c) $\log_3 2$

    (d) $\frac{3}{2}$

11. The value of $\int_0^{1.5}[x^2]dx$, where [y] denotes the greatest integer less than or equal to y, is

    (a) 2

    (b) $2 - \sqrt{2}$

    (c) $2 + \sqrt{2}$

    (d) None of the above

12. Three prizes are to be distributed among six persons. The number of ways in which this can be done if no person gets all the prizes is

    (a) 120

    (b) 216

    (c) 1140

    (d) None of the above

13. Let $\widehat{a}$ and $\widehat{b}$ be unit vectors. If $\widehat{a} - \widehat{b}$ is a unit vector then the angle between $\widehat{a}$ and $\widehat{b}$ is

    (a) 60°

    (b) 120°

    (c) 90°

    (d) None of the above

14. If $A^2 - A + I = O$, then the inverse of the non singular square matrix A is

   (a) A - I
   (b) I - A
   (c) A + I
   (d) A

15. One side of an equilateral triangle is 24cm. The mid-points of its sides are joined to form another triangle whose mid-points are in turn joined to form still another equilateral triangle. This process continues indefinitely. The sum of the perimeters of all triangles is

   (a) 144cm
   (b) 169cm
   (c) 400cm
   (d) 625cm

16. The total number of three digit even numbers that can be composed from the digits 1, 2, 3, ..., 9, when the repetition of digits is not allowed

   (a) 224
   (b) 280
   (c) 324
   (d) 405

17. If the three successive coefficients in the Binomial expansion of $(1+x)^n$ are 28, 56 and 70 respectively, then n equals

   (a) 4
   (b) 6
   (c) 8
   (d) 10

18. The last two digits of the number 3^{400} are

   (a) 39
   (b) 29
   (c) 01
   (d) 43

19. The value of $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + ... + \frac{1}{\log_{43} n}$ is

(a) $\frac{1}{\log_{43!} n}$

(b) $\frac{1}{\log_{43} n}$

(c) $\frac{1}{\log_{43} n!}$

(d) $\frac{1}{\log_{42} n}$

20. If $a_1, a_2, ..., a_n$ are all positive numbers and are in Harmonic progression, then

$\frac{a_1}{(a_2+a_3+...+a_n)}, \frac{a_2}{(a_1+a_3+...+a_n)}, \frac{a_n}{(a_1+a_2+...+a_{n-1})}$, are in

(a) Arithmetic Progression

(b) Geometric Progression

(c) Harmonic Progression

(d) None of the above

21. If $x = \sum_{n=0}^{\infty} a^n, y = \sum_{n=0}^{\infty} b^n, z = \sum_{n=0}^{\infty} c^n$, where a, b, c are in AP, such that $|a| < 1, |b| < 1$ and $|c| < 1$, then x, y, z are in

(a) Arithmetic Progression

(b) Geometric Progression

(c) Harmonic Progression

(d) None of the above

22. The number of divisors of $(6!)^{3!}$ is

(a) 364

(b) 9100

(c) 2275

(d) 7^5

23. The value of the determinant $\begin{vmatrix} a+2 & a+3 & a+2x \\ a+3 & a+4 & a+2y \\ a+4 & a+5 & a+2z \end{vmatrix}$ when x, y and z are in Arithmetic progression is

(a) 1

(b) 0

(c) 2a

(d) 4a

24. The value of $\lim\limits_{x \to 1} x^{\frac{1}{1-x}}$ is equal to

    (a) 1
    (b) $\frac{1}{e}$
    (c) e
    (d) None of the above

25. If $a^2 + b^2 + c^2 = 1$ then $bc + ca + ab$ lies in the interval

    (a) $[-\frac{1}{2}, 3]$
    (b) $[-1, 2]$
    (c) $[-\frac{1}{2}, 1]$
    (d) $[-1, \frac{1}{2}]$

26. Two boys A and B play a game where each is asked to select a number between 1 and 30. If the selected numbers match, they both win a prize; otherwise no prize is given. In a single trial of this game, the probability that no prize is won is

    (a) $\frac{1}{30}$
    (b) $\frac{29}{30}$
    (c) $\frac{2}{30}$
    (d) None of the above

27. Let $\{a_i\}$ be a sequence such that $\sum_{r=1}^{n} a_r = n^2$, then $\frac{1^3}{a_1} + \frac{1^3+2^3}{a_1+a_2} + \frac{1^3+2^3+3^3}{a_1+a_2+a_3} + \dots$ upto 16 terms is

    (a) 346
    (b) 446
    (c) 546
    (d) None of the above

28. Mumbai Rajdhani Express going from New Delhi to Mumbai stops at four intermediate stations. Ten passengers enter the train during the journey with ten different tickets either of III AC or II AC. The number of different sets of tickets they may have is

    (a) $^{30}C_{10}$
    (b) $^{20}C_{10}$
    (c) $^{10}C_5$
    (d) $^{15}C_{10}$

29. Let $x_1 < -1$, and define $x_{n+1} = \frac{x_n}{1+x_n}$ for $n \geq 1$. Then

    (a) $x_n \to 1$ as $n \to \infty$

    (b) $x_n \to -1$ as $n \to \infty$

    (c) $x_n \to 0$ as $n \to \infty$

    (d) $x_n \to \infty$ as $n \to \infty$

30. The value of $\int_1^\infty \frac{x^2-2}{x^3\sqrt{x^2-1}}dx$ is

    (a) $\frac{4}{3}$

    (b) $\frac{2}{3}$

    (c) 0

    (d) None of the above