



ATOMIC ENERGY EDUCATION SOCIETY

Anushaktinagar, Mumbai-400 094

2015 – Open Candidates Examination

Post – PGT (Mathematics)

Date – 27.09.2015

Time – 1 Hour 30 Minutes

Maximum Marks – 50

Instructions

1. There are 50 Multiple Choice Questions (MCQ) in this paper. Each question carries 1 mark. There will be negative marking of 0.25 per wrong answer.
2. Answer should be darkened/marked in the OMR answer sheet only.
3. Use of any electronic gadget (e.g. calculator, mobile phone, etc.) is not permitted, in the examination hall.
4. In case a candidate has not signed the Attendance Sheet or the OMR Answer Sheet is not signed by the Invigilator, it will be dealt with as a case of unfair means.
5. On completion of the test, the candidates MUST HAND OVER THE OMR ANSWER SHEET AND QUESTION PAPER TO THE INVIGILATOR in the room/hall.
6. The candidates should ensure that the OMR answer sheet is not folded or damaged.

To be filled by the candidate

Name of the Candidate: _____

Roll Number: _____

OMR Number: _____

No of printed pages –8

2015-Open Candidates- PGT (Mathematics) – QP

- Q.1 Equivalent matrices are obtained by:
- a) taking inverse
 - b) taking transposes
 - c) taking adjoints
 - d) taking finite number of elementary transformations
- Q.2 In a homogenous system $\rho(A) <$ the number of unknowns then the system has:
- (a) only trivial solution
 - (b) trivial solution and infinitely many solutions
 - (c) only non-trivial solutions
 - (d) no solution
- Q.3 Let \vec{u}, \vec{v} and \vec{w} be vectors such that $\vec{u} + \vec{v} + \vec{w} = \vec{0}$. If $|\vec{u}| = 3$, $|\vec{v}| = 4$ and $|\vec{w}| = 5$ then $\vec{u} \cdot \vec{v} + \vec{v} \cdot \vec{w} + \vec{w} \cdot \vec{u}$:
- (a) 25
 - (b) -25
 - (c) 5
 - (d) $\sqrt{5}$
- Q.4 The equation of the tangent to the curve $y = x^3$ at (1,1):
- (a) $x - 10y + 50 = 0$
 - (b) $3x - y - 2 = 0$
 - (c) $x + 3y - 4 = 0$
 - (d) $x + 2y - 7 = 0$
- Q.5 If $Z_1 = a + ib$, $Z_2 = -a + ib$ then $Z_1 - Z_2$ lies on:
- (a) real axis
 - (b) imaginary axis
 - (c) the line $y = x$
 - (d) the line $y = -x$
- Q.6 A matrix of order 3 X 3 has determinant. The value of $|3A|$:
- (a) 36
 - (b) 12
 - (c) 108
 - (d) 432
- Q.7 Which of the following statement is incorrect?
- (a) Initial velocity means velocity at $t = 0$
 - (b) Initial acceleration means acceleration at $t = 0$
 - (c) If the motion is upward, at the same maximum height, the velocity is not zero.
 - (d) If the motion is horizontal $v = 0$ when the particle comes to rest.
- Q.8 The value of $\int_0^\pi \sin^4 x dx$:
- (a) $\frac{3\pi}{16}$
 - (b) $\frac{3}{16}$
 - (c) 0
 - (d) $\frac{3\pi}{8}$

- Q.9 The differential equation of the family of lines $y = mx$:
- (a) $\frac{dy}{dx} = m$ (b) $y dx - x dy = 0$
(c) $\frac{d^2y}{dx^2} = 0$ (d) $y dx + x dy = 0$
- Q.10 If $u = \sin^{-1}\left(\frac{x^4+y^4}{x^2+y^2}\right)$ and $f = \sin u$ then f is a homogenous function of degree
- (a) 0 (b) 1
(c) 2 (d) 4
- Q.11 The curve $ay^2 = x^2(3a - x)$ cuts the y - axis at:
- (a) $x = -3a, x = 0,$ (b) $x = 0, x = 3a$
(c) $x = 0, x = a$ (d) $x = 0$
- Q.12 Which of the following curve is concave down?
- (a) $y = -x^2$ (b) $y = x^2$
(c) $y = e^x$ (d) $y = x^2 + 2x - 3$
- Q.13 The length of the semi major and length of the minor axis of the ellipse $\frac{x^2}{144} + \frac{y^2}{169} = 1$ are:
- (a) 26, 12 (b) 13, 24
(c) 12, 26 (d) 13, 12
- Q.14 The function $f(x) = x^2 - 5x + 4$ is increasing in:
- (a) $(-\infty, 1)$ (b) $(1, 4)$
(c) $(4, \infty)$ (d) everywhere
- Q.15 A particular integral of $(D^2 - 4D + 4)y = e^{2x}$ is:
- (a) $\frac{x^2}{2} e^{2x}$ (b) xe^{2x}
(c) xe^{-2x} (d) $\frac{x}{2} e^{-2x}$
- Q.16 If 2 cards are drawn from a well shuffled pack of 52 cards, the probability that they are of the same colour is:
- (a) $\frac{1}{2}$ (b) $\frac{26}{51}$
(c) $\frac{25}{51}$ (d) $\frac{25}{102}$

- Q.17 If x is normally distributed with mean 6 and standard deviation 5 and z is the corresponding normal variate. The $p(0 \leq x \leq 8)$:
- (a) $P(-1.2 < z < .04)$ (b) $P(-0.12 < z < .4)$
(c) $P(-1.2 < z < 0.4)$ (d) $P(-0.12 < z < .04)$

- Q.18 $(1 + i\sqrt{3})^n + (1 - i\sqrt{3})^n$:
- (a) $2^{n+1} \cos \frac{n\pi}{3}$ (b) $2^{n+1} \sin \frac{n\pi}{3}$
(c) $2^{n-1} \cos \frac{n\pi}{3}$ (d) $2^{n-1} \sin \frac{n\pi}{3}$

- Q.19 If $A = [2 \ 0 \ 1]$, then rank of AA^T :
- (a) 1 (b) 2
(c) 3 (d) 0

- Q.20 The value of 'c' on Rolle's Theorem for the function $f(x) = \cos \frac{x}{2}$ on $[\pi, 3\pi]$
- (a) 0 (b) 2π
(c) $\frac{\pi}{2}$ (d) $\frac{3\pi}{2}$

- Q.21 For any vector \vec{a} , $\vec{i} \times (\vec{a} \times \vec{i}) + \vec{j} \times (\vec{a} \times \vec{j}) + \vec{k} \times (\vec{a} \times \vec{k})$ is:
- (a) $2\vec{i}$ (b) $2\vec{j}$
(c) $2\vec{k}$ (d) $2\vec{a}$

- Q.22 An asymptote to the curve $y^2 (a + 2x) = x^2(3a - x)$ is:
- (a) $x = 3a$ (b) $x = -\frac{a}{2}$
(c) $x = \frac{a}{2}$ (d) $x = 0$

- Q.23 In the set of real numbers R , an operation $*$ is defined by $a * b = \sqrt{a^2 + b^2}$. Then the value of $(3 * 4) * 5$:
- (a) 5 (b) $5\sqrt{2}$
(c) 25 (d) 50

- Q.24 The two positive numbers whose product is 100 and whose sum is minimum:
- (a) 20,5 (b) 10,10
(c) 4, 25 (d) 2, 50

- Q.25 The Cartesian equation of the plane passing through the points (2,2,-1), (3,4,2) and (7,0,6) is:
- (a) $5x + 2y - 3z = 17$ (b) $5x + 3y - 2z = 17$
(c) $2x + 5y - 3z = 17$ (d) $-3x + 5y + 2z = 17$
- Q.26 The centre and radius of the sphere $|2\vec{r} + (3\vec{i} - \vec{j} + 4\vec{k})| = 4$:
- (a) centre= $(\frac{3}{2}, \frac{-1}{2}, 2)$ and radius=2 (b) centre= $(\frac{-3}{2}, \frac{1}{2}, -2)$ and radius=2
(c) centre= $(\frac{3}{2}, \frac{-1}{2}, 2)$ and radius=1 (d) centre= $(\frac{-3}{2}, \frac{-1}{2}, 2)$ and radius=1
- Q.27 If $x = a \sin pt$ and $y = b \cos pt$, then the value of $\frac{d^2y}{dx^2}$ at $t = 0$:
- (a) $-\frac{b}{a^2}$ (b) $-\frac{a}{b^2}$
(c) $\frac{a}{b^2}$ (d) $\frac{b}{a^2}$
- Q.28 If a, b, c are in A.P. then the determinant
- $$\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$$
- is :
- (a) 1 (b) 0
(c) x (d) $2x$
- Q.29 The direction cosines of a line which makes equal angles with the coordinate axes are:
- (a) $(0, \frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$ (b) $(1, 0, 1)$
(c) $(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}})$ or $(\frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}})$ (d) $(\frac{-9}{11}, \frac{6}{11}, \frac{-2}{11})$
- Q.30 Let L_1 and L_2 be two parallel lines with equation $\vec{r} = \vec{a}_1 + \lambda\vec{b}$ and $r = \vec{a}_2 + \lambda\vec{b}$ respectively. The shortest distance between them is:
- (a) $d = \left| \frac{\vec{b} \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|} \right|$ (b) $d = \left| \frac{\vec{b} \cdot (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|} \right|$
(c) $d = \left| \frac{\vec{a}_1 \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|} \right|$ (d) $d = \left| \frac{\vec{a}_2 \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|} \right|$
- Q.31 If A and B are two events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$ then A and B are:
- (a) *not independent events* (b) *mutually exclusive events*
(c) *independent events* (d) *complementary events*

Q.32 $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^2 x \, dx$ is:

- (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$
(c) π (d) 0

Q.33 The area under the given curve and given lines:

$y = x^4$, $x = 1$, $x = 5$ and x - axis

- (a) $\frac{3124}{3}$ sq. units (b) $\frac{3124}{7}$ sq. units
(c) $\frac{3124}{5}$ sq. units (d) $\frac{3124}{9}$ sq. units

Q.34 The total length of the curve $x^{2/3} + y^{2/3} = a^{2/3}$:

- (a) $3a$ (b) $4a$
(c) $6a$ (d) $8a$

Q.35 Let $f(x) = \tan^{-1}\left(\frac{1+\cos x}{\sin x}\right)$ and $g(x) = \tan^{-1}\left(\frac{\sin x}{1-\cos x}\right)$.

$$\int (f(x) + g(x)) dx =$$

- (a) $\frac{\pi x}{2} - \frac{x^2}{4} + c$ (b) $\pi x - \frac{x^2}{2} + c$
(c) $\pi x + \frac{x^2}{4} + c$ (d) $\pi x + \frac{x^2}{2} + c$

Q.36 Let a relation R on the Set A of real numbers be defined as

$(a, b) \in R \Rightarrow 1 + ab > 0$ for all $a, b \in A$. The Relation R is:

- (a) *Reflexive* (b) *Symmetric*
(c) *transitive* (d) *Reflexive and Symmetric*

Q.37 A Parallelepiped is formed by planes drawn parallel to co-ordinate axes through the point $A=(1, 2, 3)$ and $B=(9, 8, 5)$. The volume of parallelepiped is equal to (in cubic units)

- (a) 192 (b) 48
(c) 32 (d) 96

Q.38 There are n locks and n matching keys. If all the locks and keys are to be perfectly matched, then maximum number of trials is equal to:

- (a) ${}^n C_2$ (b) ${}^{n-1} C_2$
(c) ${}^{n+1} C_2$ (d) $n!$

- Q.39 The number of terms in $(a_1 + a_2 + a_3 + a_4)^3$ is:
(a) 64 (b) 81
(c) 30 (d) 20
- Q.40 $\lim_{x \rightarrow 1} \frac{x^{n+1} - (n+1)x + n}{(x-1)^2}$
(a) $n(n+1)$ (b) $\frac{n(n+1)}{2}$
(c) $n+1$ (d) $\frac{3n}{2}$
- Q.41 If f is an increasing function and g is a decreasing function such that $g(f(x))$ exist, then:
(a) $g(f(x))$ is an increasing function
(b) $g(f(x))$ is a decreasing function
(c) $g(f(x))$ is a constant function
(d) nothing can be said
- Q.42 B and C are fixed points having co-ordinates $(3,0)$ and $(-3,0)$ respectively. If the vertical angle BAC is 90° , then the locus of the centroid of the ΔABC has the equation:
(a) $x^2 + y^2 = 1$ (b) $x^2 + y^2 = 2$
(c) $9(x^2 + y^2) = 1$ (d) $9(x^2 + y^2) = 4$
- Q.43 A vertical tower stands on a declivity which is inclined at 15° to the horizon from the foot of the tower a man ascends the declivity for 80 feet. And then finds that the tower subtends an angle of 30° . The height of the tower in feet:
(a) 80 (b) 160
(c) $80\sqrt{3}$ (d) $40(\sqrt{6} - \sqrt{2})$
- Q.44 If α and β are the roots of the equation $x^2 + x + 1 = 0$ then $\alpha^2 + \beta^2$ is equal to:
(a) 2 (b) 1
(c) -1 (d) -2
- Q.45 The sum of all natural numbers lying between 100 and 1000 which are multiples of 5:
(a) 98450 (b) 179
(c) 8450 (d) 995

- Q.46 The sum of the product of the corresponding terms of the sequence 2, 4, 8, 16, 32 and 128, 32, 8, 2, $\frac{1}{2}$:
- (a) 946 (b) 496
(c) 649 (d) 780
- Q.47 The points $(a, 0)$, $(0, b)$, and $(1, 1)$ are collinear if: $\frac{1}{a} + \frac{1}{b} =$
- (a) 2 (b) 3
(c) 1 (d) 0
- Q.48 a_1, a_2, \dots, a_{24} are in A.P. and $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 300$ the sum of first 24 terms of the A.P.
- (a) 1800 (b) 1200
(c) 600 (d) 900
- Q.49 The equation of the curve passing through point $(0, \frac{\pi}{4})$ whose differential equation is $\sin x \cos y dy + \cos x \sin y dx = 0$:
- (a) $\sin x \cos y = \sqrt{2}$ (b) $\sin x \sin y = c$
(c) $\cos x \cos y = 2$ (d) $\sec x \sec y = \sqrt{2}$
- Q.50 A perpendicular distance of a corner of a unit cube from a diagonal not passing through it is:
- (a) $\sqrt{\frac{3}{2}}$ (b) $\sqrt{\frac{2}{3}}$
(c) $\sqrt{\frac{3}{4}}$ (d) $\sqrt{\frac{4}{3}}$

OPEN ADVERTISEMENT CANDIDATE EXAM-2015

PGT (MATHEMATICS)

ANSWERS KEY

- | | |
|-------|-------|
| 1. D | |
| 2. B | |
| 3. B | 26. B |
| 4. B | 27. A |
| 5. A | 28. B |
| 6. C | 29. C |
| 7. C | 30. A |
| 8. D | 31. C |
| 9. B | 32. B |
| 10. C | 33. C |
| 11. D | 34. C |
| 12. A | 35. B |
| 13. B | 36. D |
| 14. C | 37. D |
| 15. A | 38. C |
| 16. C | 39. D |
| 17. C | 40. B |
| 18. A | 41. B |
| 19. A | 42. D |
| 20. B | 43. D |
| 21. D | 44. C |
| 22. B | 45. A |
| 23. B | 46. B |
| 24. B | 47. C |
| 25. A | 48. B |
| | 49. A |
| | 50. B |

