## SOUTHERN RAILWAY

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**Question paper for selection to the post of Teacher Grade II / Maths**

Date : 07.09.2012 Total Marks : 100 Duration : 3 hours

**INSTRUCTION TO CANDIDATES**

1. Ensure the answer booklet contains 12 sheets duly stamped and signed in each page.
2. Electronics gadgets such as Cell Phones, Pagers, Calculators etc. are not permitted inside the Examination Hall.
3. Use only Black or Blue Pens to write the answers.
4. Hand writing should be neat and legible.
5. Corrections or overwriting of any type in the answers of Objective Type Questions are not permitted.
6. Do not write your name or mark any signs in any part of answer booklet except in the space provided in the Fly Leaf at cover page.

**TEACHER GRADE – II SELECTION EXAMINATION**
**MATHEMATICS**

**Time : 3 hours** **Max.Marks : 100**

**SECTION – A**

**Answer ALL the questions** **(50x1=50)**

**Choose the correct answer.**

1. If $n(A)=20, n(B)=25$ *and* $n(A\cup B)=40$, then $n(A\setminus B)$ is equal to
   a) 15 b) 5 c) 20
2. For any two sets $A$ *and* $B, \{(A\setminus B)\cup(B\setminus A)\}\cap(A\cap B)=$
   a) $\emptyset$ b) $A\cup B$ c) $A\cap B$
3. $A=\{1,3,4,7,11\}, B=\{-1,1,2,7\}$ *and* $f: A\to B$ is given by $f=\{(1,-1),(3,2),(4,1),(7,2),(11,7)\}$. Then $f$ is
   a) one to one b) onto c) bijective
4. If $f: A\to B$ is onto and if $n(A)=5$, then $n(B)$ is
   a) $\leq 5$ b) $=5$ c) $\geq 5$
5. If the 3rd term of a G.P is 2, then the product of first 5 terms is
   a) $5^2$ b) $2^5$ c)10
6. If $a,b,c$ are in A.P, then $\frac{b-a}{c-a}=$
   a) 1 b) $\frac{1}{2}$ c) 2
7. If $2+3+\ldots+n=k$, then $1^3+2^3+3^3+\ldots+n^3=$
   a) $\left\{\frac{n(n-1)}{2}\right\}^2$ b) $k^2$ c) $(k+1)^2$
8. $\sum_{k=1}^{n}(2k-1)=$
   a) $\frac{n(n+1)}{2}$ b) $n^2$ c) $\frac{n(n+1)}{4}$
9. If the system $6x-2y=3,\ kx-y=2$ has unique solution, then
   a) $k=3$ b) $k-3\neq 0$ c) $k\neq 4$
10. The quadratic equation whose roots are reciprocals of the roots of the equation $4x^2-3x-1=0$ is
    a) $x^2+3x-4=0$ b) $4x^2+3x+1=0$ c) $x^2-3x+4=0$
11. If $x^2+5kx+16=0$ has no real roots, then
    a) $k>\frac{8}{5}$ b) $\frac{-8}{5}<k<\frac{8}{5}$ c) $0<k<\frac{8}{5}$
12. The GCD of $x^2-2xy+y^2$ *and* $x^4-y^4$ is
    a) $x^2-y^2$ b) $x+y$ c) $x-y$

13. Which of the following is incorrect.

a) $(A+B)^T = B^T + A^T$ b) $(A^T)^T = A$ c) $(AB)^T = A^T B^T$

14. If $A \times \begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix} = (1 \quad 2)$, then the order of A is

a) $2 \times 1$ b) $1 \times 2$ c) $2 \times 2$

15. Which of the following statements is not true

a) A diagonal matrix is a square matrix
b) A scalar matrix is a diagonal matrix
c) A diagonal matrix is a scalar matrix

16. If the line segment joining the points (3,4) and (14, $-3$) meet the x-axis at P, then the ratio in which P divides the segment AB is

a) 4 : 3 b) 2 : 3 c) 3 : 4

17. The equation of line through the point $(-3, 4)$ and parallel to y axis is

a) $y+3=0$ b) $x+3=0$ c) $x-4=0$

18. The two straight lines $a_1x+b_1y+c_1=0$ *and* $a_2x+b_2y+c_2=0$ are parallel if

a) $\frac{a_1}{b_1} = \frac{a_2}{b_2}$ b) $\frac{a_2}{a_1} = \frac{b_1}{b_2}$ c) $a_1a_2 + b_1b_2 = 0$

19. Area of the triangle whose vertices are (1, 2), $(-3, 4)$ and $(-5,-6)$ is

a) $-22$ b) 44 c) 22

20. The centre of a circle is $(-6, 4)$. If one end of a diameter is $(-12, 8)$, then the other end is

a) $(-9, 2)$ b) (0, 6) c) (0, 0)

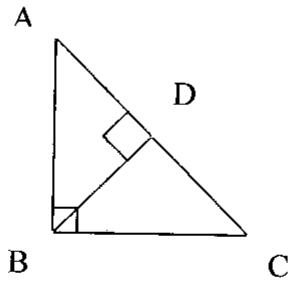
21. If the points (2, 5), (4, 6) and (a, a) are collinear, then the value of a is

a) 8 b) 4 c) $-8$

22. In triangle PQR, RS is the bisector of $\angle R$. If PQ = 6 cm, QR = 8 cm and RP = 4 cm, then PS =

a) 4 cm b) 2 cm c) 3 cm

23. From the figure given below, identify the wrong statement

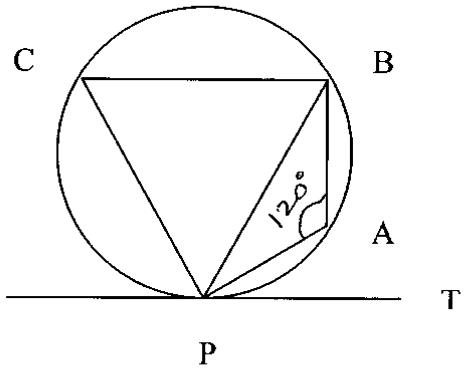



a) $\Delta$ ABD ~ $\Delta$ ABC b) $\Delta$ BDC ~ $\Delta$ ABC c) $\Delta$ ADB ~ $\Delta$ BDC

24. The perimeter of two similar triangles are 24 cm and 18 cm respectively. If one side of the first triangle is 8 cm, then the corresponding side of the other triangle is

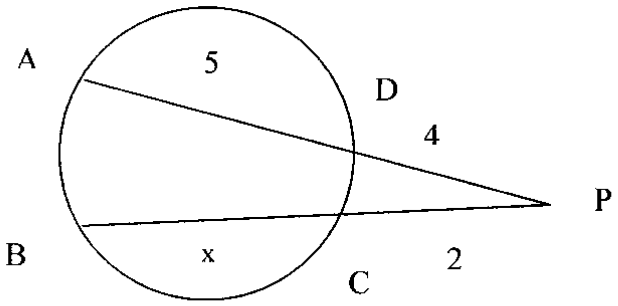
a) 6 cm b) 3 cm c) 9 cm

25. In the following figure $\angle BPT =$




a) 120° b) 30° c) 60°

26. The value of x in the following diagram is




a) $\frac{5}{2}$ b) 10 c) 16

27. $1-\frac{\sin^2\theta}{1+\cos\theta} =$

a) $\sin\theta$ b) $\cos\theta$ c) $\tan\theta$

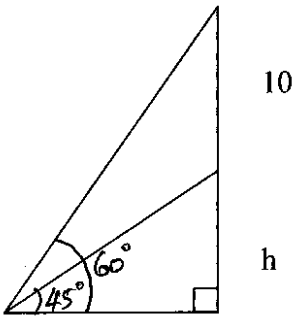
28. $\cos^4 x - \sin^4 x =$

a) $2\sin^2 x - 1$ b) $2\cos^2 x + 1$ c) $1 - 2\sin^2 x$

29. $(1+\tan^2\theta)(1-\sin\theta)(1+\sin\theta) =$

a) $\cos^2\theta - \sin^2\theta$ b) $\sin^2\theta + \cos^2\theta$ c) $\sin^2\theta - \cos^2\theta$

30. The value of h in the following figure is




a) $5(\sqrt{3}+1)$ b) $\sqrt{3}$ c) $\frac{10}{\sqrt{3}+1}$

31. The total surface area of a solid right circular cylinder whose radius is half of its height is equal to

a) $\frac{3}{2}\pi h$ sq.units b) $\frac{3}{2}\pi h^2$ sq.units c) $\frac{2}{3}\pi h^2$ sq.units

32. If the volumes of two spheres are in the ratio 27 : 125, then the ratio of their surface areas is

a) 25 : 9 b) 3 : 5 c) 9 : 25

33. The surface area of a sphere is 24 $cm^2$. If the sphere is divided into two hemispheres, then the total surface area of one hemisphere is

a) 18 $cm^2$ b)16 $cm^2$ c) 12 $cm^2$

34. Two right circular cones have equal radii. If their slant heights are in the ratio 4 : 3, then their respective curved surface areas are in the ratio

a) 16 : 9 b) 3 : 4 c) 4 : 3

35. The graph of $y = 2x^2$ is symmetrical about

a) the line x = 0 b) the x-axis c) the line x = y

36. The graph of $y = -3x^2$ does not lie

a) above the x-axis b) below the x-axis c) to the right of the y-axis

37. When the variables are in indirect variation, the graph is

a) a parabola b) a circle c) a rectangular hyperbola

38. For any collection of n terms $\left(\sum x\right)-\bar{x} =$

a) $n\bar{x}$ b) $(n-1)\bar{x}$ c) 0

39. The variance of first 11 natural numbers is

a) 10 b) $\sqrt{10}$ c) $5\sqrt{2}$

40. The standard deviation of a data is $2\sqrt{2}$. If each value is multiplied by 3, then the standard deviation of the new data is

a) $\sqrt{12}$ b) $2\sqrt{6}$ c) $6\sqrt{2}$

41. If t is the standard deviation of x, y, z, then the standard deviation of x+3, y+3, z+3 is

a) $t-3$ b) $3t$ c) $t$

42. Given $\sum(x-\bar{x})^2 = 48$, $\bar{x} = 20$ *and* $n = 12$, the coefficient of variation is

a) 20 b) 10 c) 1000

43. If A and B are any two events, then $P(A \cap \bar{B}) =$

a) $P(B) - P(A \cap B)$ b) $P(A) - P(A \cap B)$ c) $P(A \cup B) - P(A \cap B)$

44. If P(A) = 0.25, P(B) = 0.50 and $P(A \cap B) = 0.14$, then P( neither A nor B) =

a)0.39 b) 0.61 c) 0.25

45. The probability of a non-leap year will have 53 Sundays and 53 Mondays is

a) $\frac{1}{7}$ b) $\frac{2}{7}$ c) 0

**Fill in the blanks**

46. Hindi Day is celebrated every year on _____
47. Number of languages enlisted in the eighth schedule of the constitution is _____
48. The official language of Union of India is _____
49. The first chairman of the Official Language Commission is _____
50. As per the constitution the authority who is translating the statutory rules, regulations and orders is _____

**SETION – B**

**Answer any FIVE questions** **(5x10=50)**

51. a) Find value of 1+11+111+...to 20 terms (5)

b) If $S_1, S_2$ *and* $S_3$ are the sum of first n, 2n and 3n terms of a geometric series respectively, then show that $S_1(S_3 - S_2) = (S_2 - S_1)^2$ (5)

52. a) Two trains leave a railway station at the same time. The first train travels due West and the second train due North. The first train travels 5 km/hr faster than the second train. If after two hours, they are 50 km apart, find the average speed of each train. (5)

b) If $\alpha$ *and* $\beta$ are the roots of the equation $3x^2 - 4x + 1 = 0$, form the equation whose roots are $\frac{\alpha^2}{\beta}$ *and* $\frac{\beta^2}{\alpha}$. (5)

53. a) Find the coordinates of the foot of the perpendicular from the origin on the straight line $3x + 2y = 13$. (4)

b) Find the equations of the straight lines each passing through the point $(6, -2)$ and whose sum of intercepts is 5. (6)

54. a) D is the mid point of the side BC of triangle ABC. If P and Q are points on AB and on AC such that DP bisects $\angle BDA$ and DQ bisects $\angle ADC$, prove that PQ is parallel to BC. (5)

b) If all sides of a parallelogram touch a circle, show that the parallelogram is a rhombus. (5)

55. a) Prove that $(1+\cot\theta-\operatorname{cosec}\theta)(1+\tan\theta+\sec\theta)=2$. (5)

b) A straight highway leads to the foot of a tower. A man standing on the top of the tower spots a van at an angle of depression of 30°. The van is approaching the tower with a uniform speed. After 6 minutes, the angle of depression of the van is found to be 60°. How many more minutes will it take for the van to reach the tower. (5)

56. a) An iron right circular cone of diameter 8 cm and height 12 cm is melted and recast into spherical lead shots each of radius 4 mm. How many lead shots can be made. (4)

b) The mean and variance of 20 items are found to be 10 and 4 respectively. At the time of checking it was found that an item 12 was wrongly entered as 8. Calculate the correct mean and variance. (6)

57. a) A basket contains 20 apples and 10 oranges out of which 5 apples and 3 oranges are rotten. If a person takes out one fruit at random, find the probability that the fruit is either an apple or a good fruit. (5)

b) Match the following:

| | |
|---|---|
| 1. The year in which the Official Languages rules was passed | A. 1955 |
| 2. A state in which Urdu is declared as official language | B. Jammu & Kashmir |
| 3. A state with official language as English | C. 1976 |
| 4. In compliance of Article 344 the Official Languages Commission was formed in the year | D. Andhra Pradesh |
| 5. The state in which Sections 6 & 7 of Official Languages Act 1963 do not apply | E. Arunachal Pradesh |

(5)

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