TRB MATHS 2010

1. If $a_n = 1 + \frac{1}{1!} + \frac{1}{2!} + ... + \frac{1}{n!}$, then (a_n) is

   a. Strictly monotonic decreasing series b. monotonic decreasing series
   c. monotonic increasing series d. oscillating

2. The series $\sum(-1)^n \left[\sqrt{n^2+1-n}\right] is$

   a. absolutely convergent b. conditionally convergent
   c. divergent d. power series

3. The sequence $\left((-1)^n\right)$

   a. is convergent b. oscillates
   c. is not convergent d. is monotonic

4. The value of $\lim_{n\to\infty} \frac{1^2+2^2+...+n^2}{n^3}$ is

   a. ∞ b. 0 c. $\frac{1}{2}$ d. $\frac{1}{3}$

5. In R with usual metric, the incorrect statement is

   a. Z is closed b. Q is closed c. R is closed d. $\{a\}$ is closed, $a \in R$

6. If d is a metric on M, the incorrect statement is

   a. $\sqrt{d}$ is a metric on M b. $\frac{d}{1+d}$ is a metric on M
   c. d^2 is a metric on M d. nd is a metric on M, $n \in N$

7. The incorrect statement from the following is

   a. N is countable set b. Q is countable set
   c. Q^c is countable set d. Z is countable set

8. In R with usual metric, the incorrect statement is

a. $(0,1)$ is an open set   b. $\{0\}$ is an open set

c. $(0,\infty)$ is an open set   d. $(-\infty,0)$ is an open set

9. Which one of the following sets of vectors is linearly dependent?

a. $\{(1,4,-2),(-2,1,3),(-4,11,5)\}$ b. $\{(1,2,1),(2,1,0),(1,-1,2)\}$

c. $\{(1,0,0),(0,1,0),(1,1,0)\}$ d. $\{(0,0,0),(2,5,3),(-1,0,6)\}$

10. Which one of the following sets of vectors is not a basis for $V_3(R)$?

a. $\{(1,0,0),(1,1,0)\}$ b. $\{(1,0,0),(0,1,0)(0,0,1)\}$

c. $\{(1,0,0),(0,1,0)(1,1,1)\}$ d. $\{(1,1,0),(0,1,1)(1,0,1)\}$

11. Which one of the following is a vector space? $R\times R$ with usual addition and scalar multiplication defined by

a. $\alpha(a,b)=(0,\alpha b)$ b. $\alpha(a,b)=(\alpha a,\alpha^2 b)$

c. $\alpha(a,b)=(\alpha a,\alpha b)$ d. $\alpha(a,b)=(|\alpha|a,|\alpha|b)$

12. If A and B are two subspaces of a vector space V over a field F, then

a. $A\cup B$ is a subspace of V   b. $A\times B$ is a subspace of V

c. $A\cap B$ is a subspace of V   d. AB is subspace of V

13. The set $R=\left\{\begin{pmatrix} a & b \\ -b & a \end{pmatrix} \middle|\ a,b\in R\right\}$ is a ring under matrix addition and multiplication. The inverse of $\begin{pmatrix} a & b \\ -b & a \end{pmatrix}$ is

a. $\begin{pmatrix} -a & b \\ -b & a \end{pmatrix}$ b. $\begin{pmatrix} a & -b \\ -b & a \end{pmatrix}$ c. $\begin{pmatrix} a & +b \\ -b & -a \end{pmatrix}$ d. $\begin{pmatrix} -a & -b \\ b & -a \end{pmatrix}$

14. If a non – empty subset W of a vector space V over a field F is a subspace of V, then $\alpha,\beta\in F$ and $u,v\in W \Rightarrow$

a. $\alpha u+\beta v\notin W$ b. $\alpha u+\beta v\in W$ c. $\alpha u+\beta v\notin V$ d. $\alpha u\notin W$

15. If A and B are subgroups of an Abelian group G, then

a. $A\cup B$ is a subgroup of G   b. $A\times B$ is a subgroup of G

c. AB is a subgroup of G   d. A * B is a subgroup of G

16. If H is a subgroup of G and N is a normal subgroup of G, then
   a. HN is a subgroup of G
   b. H is a normal subgroup of G
   c. $H \cap N$ is a normal subgroup of G
   d. $H \cup N$ is a normal subgroup of G

17. If A and B are two finite subgroups of group G, then
   a. $[G:A] = [G:B[B:A]$
   b. $[G:B] = [G:A][A:B]$
   c. $|AB| = \frac{|A||B|}{|A \cap B|}$
   d. $|AB| = \frac{|A||B|}{|A \cup B|}$

18. Which of the following tables can represent a group?

A)

*	1	0
1	1	0
0	0	0

B)

*	1	-1
1	1	-1
-1	-1	1

C)

*	0	2
0	0	0
2	0	4

D)

*	3	4
3	9	12
4	12	16

19. The angle between the plans $2x - y + z = 6$ and $x + y + 2z = 7$ is
   a. 60 ° b. 90 ° c. 30 ° d. 0 °

20. $G = \left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} \middle| x \in R^* \right\}$ is a group under matrix multiplication. The identify element of G is
   a. $\begin{pmatrix} \frac{x}{4} & \frac{x}{4} \\ \frac{x}{4} & \frac{x}{4} \end{pmatrix}$
   b. $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$
   c. $\begin{pmatrix} \frac{1}{4} & \frac{1}{4} \\ \frac{1}{4} & \frac{1}{4} \end{pmatrix}$
   d. $\begin{pmatrix} \frac{x}{2} & \frac{x}{2} \\ \frac{x}{2} & \frac{x}{2} \end{pmatrix}$

21. The radius of the sphere $2x^2 + 2y^2 + 2z^2 + 2x + 2y - 4z - 5 = 0$ is
   a. 1 b. 5 c. 2 d. 4

22. If S = 0 and $S_1 = 0$ represent two spheres, then $S - S_1 = 0$ is
   a. sphere b. plane c. line d. circle

23. The equation of the sphere which has the line joining the points $(2,7,5)$ and $(8,-5,1)$ as diameter is

a. $x^2+y^2+z^2+10x-5=0$
b. $x^2+y^2+z^2-10x-2y-6z-14=0$
c. $x^2+y^2+z^2-2y-6z=0$
d. $x+y+z=0$

24. The point of intersection of the line $\frac{x-1}{2}=\frac{y-2}{-3}=\frac{z+3}{4}$ with the plane $2x+4y-z+1=0$ is

a. $\left(\frac{10}{3},\frac{-3}{2},\frac{5}{3}\right)$
b. $\left(\frac{20}{7},\frac{17}{2},\frac{-2}{3}\right)$
c. $(2,-3,4)$
d. $(1,2,3)$

25. $L\left(x^n\right)=$

a. $\frac{\Gamma(n+1)}{s^{n+1}}$
b. $\frac{\Gamma(n)}{s^n}$
c. $\frac{\Gamma(n+1)}{s^n}$
d. $\frac{\Gamma(n-1)}{s^{n-1}}$

26. If $L(f(x))=F(s)$, then $L(f(ax))=$

a. $F\left(\frac{s}{a}\right)$
b. $aF\left(\frac{s}{a}\right)$
c. $F(s+a)$
d. $\frac{1}{a}F\left(\frac{s}{a}\right)$

27. The value of $\int_0^1\int_0^2 xy^2dy\,dx=$

a. $\frac{8}{3}$
b. $\frac{4}{3}$
c. $\frac{2}{3}$
d. $\frac{1}{3}$

28. The line $\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}$ is parallel to the plane $ax+by+cz+d=0$ if

a. $xx_1+yy_1+zz_1=0$
b. $l^2+m^2+n^2=0$
c. $\frac{a}{l}=\frac{b}{m}=\frac{c}{n}$
d. $al+bm+cn=0$

29. If $\bar{f}=\left(x^2+y^2\right)\hat{i}+\left(x^2-y^2\right)\hat{j}$ along the curve $y=x^2$, the value of $\int_0^1\int_0^1 \bar{f}.d\bar{r}=$

a. 5
b. $\frac{9}{10}$
c. $\frac{7}{10}$
d. $\frac{3}{10}$

30. The unit normal to the surface $x^3-xyz+z^3=1$ at $(1,1,1)$ is

a. $\frac{2\hat{i}+2\hat{k}}{3}$
b. $\hat{i}+2\hat{j}$
c. $\hat{k}$
d. $\frac{2\hat{i}-\hat{j}+2\hat{k}}{3}$

31. For any constant vector $\bar{a},\nabla\left(\bar{a},\bar{r}\right)=$

a. $\overline{r}$ b. $\overline{a}$ c. a d. r

32. If $\overline{f} = (ax+3y+4z)\hat{i}+(x-3y+3z)\hat{j}+(3x+2y-z)\hat{k}$ is solenoidal, the value of a is

a. 2 b. 4 c. 3 d. 0

33. $L\left(x^2e^{-ax}\right)=$

a. $\frac{2}{(s+a)^3}$ b. $\frac{2}{(s+a)^2}$ c. $\frac{1}{(s+a)^3}$ d. $\frac{1}{(s+a)^2}$

34. The particular integral of $\left(D^2-2D+2\right)y=e^x\sin x$ is

a. $\frac{e^x\cos x}{2}$ b. $-\frac{xe^x\cos x}{2}$ c. $\frac{xe^x\cos x}{2}$ d. $-\frac{x\cos x}{2}$

35. The particular solution of $\left(D^2-4\right)y=e^{2x}+e^{-4x}$

a. $y=\frac{xe^{2x}}{4}+\frac{e^{-4x}}{12}$ b. $y=\frac{e^x}{4}+\frac{e^{-4x}}{12}$ c. $y=e^x+e^{-4x}$ d. $y=\frac{e^{-x}}{5}$

36. The equation $Pdx+Qdy+Rdz=0$ is integrable if

a. $P\left(\frac{\partial Q}{\partial y}-\frac{\partial R}{\partial x}\right)+Q\left(\frac{\partial R}{\partial y}-\frac{\partial P}{\partial z}\right)+R\left(\frac{\partial P}{\partial x}-\frac{\partial Q}{\partial y}\right)=0$

b. $P\left(\frac{\partial Q}{\partial z}-\frac{\partial R}{\partial y}\right)+Q\left(\frac{\partial R}{\partial x}-\frac{\partial P}{\partial z}\right)+R\left(\frac{\partial P}{\partial y}-\frac{\partial Q}{\partial x}\right)=0$

c. $P\left(\frac{\partial Q}{\partial x}-\frac{\partial R}{\partial y}\right)+Q\left(\frac{\partial R}{\partial z}-\frac{\partial P}{\partial x}\right)+R\left(\frac{\partial P}{\partial y}-\frac{\partial Q}{\partial z}\right)=0$

d. $P\left(\frac{\partial Q}{\partial z}-\frac{\partial R}{\partial y}\right)+Q\left(\frac{\partial R}{\partial x}-\frac{\partial P}{\partial z}\right)+R\left(\frac{\partial P}{\partial y}-\frac{\partial Q}{\partial x}\right)=0$

37. Clairaut's form of differential equation is

a. $y=f\left(x,p\right)$ b. $y=px+f(p)$ c. $x=f(y,p)$ d. $Mdx+Ndy=0$

38. The Particular solution of $\left(D^2+9\right)y=\cos 3x$ is

a. $y=\frac{\cos x}{2}$ b. $y=\frac{\sin 3x}{6}$ c. $y=\frac{x\sin 3x}{6}$ d. $y=\frac{x^2\sin 3x}{6}$

39. Solution of $p^2 - 9p + 18 = 0$ is

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

c. $y-6x-c=0$ d. $(y-6x-c)(y-3x-c)=0$

40. The general solution of $(D^2 - 5D + 6)y = 0$ is

a. $y = C_1 e^{3x} + C_2 e^{x}$ b. $y = C_1 e^{2x} + C_2$

c. $y = C_1 e^{3x} + C_2 e^{2x}$ d. $y = C_1 e^{x} + e^{2x}.C_2$

41. If $I = \int \sec^3 x\, dx$, then 21 =

a. $\sec x \tan x$ b. $\sec^4 x$ c. $\frac{\sec^4 x}{4}$ d. $\sec x \tan x + \log(\sec x + \tan x)$

42. If $M\ dx + N\ dy = 0$ is of the form $yf(xy)dx + xg(xy)dy = 0, f(xy) \neq g(xy)$,

a. $\frac{1}{Mx - Ny}$ b. $\frac{1}{Mx + Ny}$ c. $e^{\int p dx}$ d. $\frac{1}{f(xy) + g(xy)}$

43. The value of $\int_0^{\pi/2} \sin^6 x\, dx =$

a. $\frac{5\pi}{32}$ b. $\frac{\pi}{32}$ c. 2π d. $\frac{\pi}{2}$

44. The value of $\int_0^{\pi/2} \sin^6 x \cos^5 x\, dx =$

a. $\frac{8}{406}$ b. $\frac{\pi}{2}$ c. $\frac{8}{693}$ d. $\frac{\pi}{32}$

45. The centre of curvature at $\left(\frac{1}{2}, \frac{1}{4}\right)$ on $y = x^2$ is

a. $(3,2)$ b. $(0,1)$ c. $(2,4)$ d. $\left(-\frac{1}{2}, \frac{5}{4}\right)$

46. The value of $\int_0^{\pi/2} \cos^5 x\, dx$ =

a. $\frac{5\pi}{32}$ b. $\frac{8}{15}$ c. 2π d. $\frac{\pi}{2}$

47. The radius of curvature for $y = e^x$ at the point where it crosses the *y-axis* is

A. $4\sqrt{2}$ B. 2 C. $2\sqrt{2}$ D. $\sqrt{2}$

48. The n[th] differential coefficient of xe^x is

A. $e^x.n$ B. $e^x(n+x)$ C. xe^x D. e^x

49. The value of C of Lagrange's mean value theorem for $f(x) = (x^2-4)^{1/2}$ in (2, 3) is

A. 2 B. 3 C. $\pm\sqrt{5}$ D. $\pm\sqrt{8}$

50. $\dfrac{d^n \log(ax+b)}{dx^n} =$

A. $(-1)^{n-1} a^n (n-1)!(ax+b)^{-n}$ B. $(-1)^{n-1}(n-1)!(ax+b)^{-n}$

C. $(-1)^{n-1} a^n (ax+b)^{-n}$ D. $(-1)^{n-1} a^n (n-1)!(ax+b)^n$

51. The Rolle's constant for the function $f(x) = x^2 \, in [-1, 1]$ is

A. 0 B. -1 C. +1 D. $\dfrac{1}{\sqrt{3}}$

52. The maximum value of the function $f(x) = x^3 - 9x^2 + 15x$ is

A. 7 B. 10 C. 5 D. 1

53. $\cos(\sin x) =$

A. $1+\dfrac{x^2}{2}$ B. $1+\dfrac{x}{2}$ C. $1+\dfrac{x^2}{4}$ D. $1-\dfrac{x^2}{2}$

54. If $\dfrac{\sin\theta}{\theta} = \dfrac{863}{864}$ nearly $\theta =$

A. $\dfrac{1}{8}$ B. $\dfrac{1}{4}$ C. $\dfrac{1}{12}$ D. $\dfrac{1}{6}$

55. The values of $(-1)^{1/10} =$

A. $\cos\dfrac{2k\pi}{10} + i\sin\dfrac{2k\pi}{10}, k = 1......9$

B. $\cos\dfrac{2k\pi}{10} + i\sin\dfrac{k\pi}{10}, k = 1......9$

C. $\cos\dfrac{(k+1)\pi}{10} + i\sin\dfrac{(k+1)\pi}{10}, k = 1......9$

D. $\cos\frac{(2k+1)\pi}{10}+i\sin\frac{(2k+1)\pi}{10}, k=1......9$

56. $\tan 4\theta =$

A. $\frac{4\tan\theta+4\tan^2\theta}{1-6\tan^2\theta+\tan^4\theta}$
B. $\frac{4\tan\theta-4\tan^2\theta}{1-6\tan^2\theta+\tan^4\theta}$
C. $\frac{4\tan^2\theta}{1-\tan^4\theta}$
D. $\frac{4\tan^2\theta}{1+\tan^4\theta}$

57. If $z=\cos\theta+i\sin\theta, \frac{z^2-1}{z^2+1}=$

A. $i\sin\theta$ B. $i\cos\theta$ C. $i\tan\theta$ D. $i\cot\theta$

58. $\sin^2\theta\cos^3\theta=$

A. $-\frac{1}{16}[\cos 5\theta+\cos 3\theta-2\cos\theta]$
B. $\frac{1}{8}[\cos 5\theta+\cos 3\theta-2\cos\theta]$
C. $\frac{1}{16}[\sin 5\theta+\sin 3\theta-2\sin\theta]$
D. $\frac{1}{4}[\sin 5\theta+\sin 3\theta-2\sin\theta]$

59. With usual notations if a pair of conjugate diameters meet the hyperbola and its conjugate in P and D, then $CP^2 - CD^2 =$

A. $a^2 - b^2$ B. $a^2 + b^2$ C. a^2b^2 D. $\sqrt{a^2-b^2}$

60. The perpendicular line to $p=r\cos(\theta-\alpha)\, is\, p^1 =$

A. $r\cos(\alpha-\theta)$
B. $r\cos\left(\frac{\pi}{4}+\alpha-\theta\right)$
C. $r\sin\left(\frac{\pi}{2}+\theta-\alpha\right)$
D. $r\cos\left(\frac{\pi}{2}+\theta-\alpha\right)$

61. The eccentric angles of the ends of a pair of conjugate diameters of an ellipse differ by

A. 90° B. 45° C. 80° D. 60°

62. With usual notations the points of intersection of the conjugate diameter and the conjugate hyperbola are

A. $(\pm ai\tan\theta, \pm bi\sec\theta)$
B. $(\pm i\tan\theta, \pm i\sec\theta)$
C. $(\pm a\tan\theta, \pm b\sec\theta)$
D. $(\pm i\cos\theta, \pm i\sin\theta)$

63. The locus of the poles of chords of parabola subtending a right angle at the vertex is

A. $x+2a=0$ B. $x+a=0$ C. $x-a=0$ D. $x+4a=0$

64. The lines $y = mx$ and $y = m_1 x$ are conjugate diameters of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ if $mm_1 =$

A. $\frac{b^2}{a^2}$ B. $\frac{-b^2}{a^2}$ C. $\frac{a^2}{b^2}$ D. $\frac{-a^2}{b^2}$

65. A skew Hermitian matrix is

A. $\begin{pmatrix} ib & c+id \\ -c+id & ib \end{pmatrix}$ B. $\begin{pmatrix} 0 & -a+ib \\ a+ib & ib \end{pmatrix}$

C. $\begin{pmatrix} ia & c+id \\ -c+id & 0 \end{pmatrix}$ D. $\begin{pmatrix} 0 & a+ib \\ ia & 0 \end{pmatrix}$

66. The rank of $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 7 \end{pmatrix}$ is

A. 3 B. 2 C. 1 D. 0

67. The characteristic roots of the matrix $\begin{pmatrix} \cos\theta & -\sin\theta \\ -\sin\theta & -\cos\theta \end{pmatrix}$ are

A. 1, 0 B. 0, -1 C. 1, -1 D. 2, -1

68. A unitary matrix is

A. $\begin{pmatrix} 0 & i \\ 0 & 0 \end{pmatrix}$ B. $\begin{pmatrix} 0 & -i \\ 0 & 0 \end{pmatrix}$ C. $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ D. $\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$

69. The smallest degree of an equation with rational coefficients, one of whose roots is $\sqrt{2}+\sqrt{3}$ is

A. 4 B. 2 C. 1 D. 5

70. The Highest Common Factor (H.C.F) of $2x^3+5x^2+x-2$ and $2x^2-3x+1$ is

A. $x-1$ B. $2x-1$ C. $x+1$ D. $2x+1$

71. Sum of the series $\log_3 e - \log_9 e + \log_{27} e - \log_{81} e + \ldots$ is

A. $\log_e 2$ B. $\log_e 3$ C. $\frac{\log_e 2}{\log_e 3}$ D. $\frac{\log_e 3}{\log_e 2}$

72. If X is large, nearly $\sqrt{X^2+16}-\sqrt{X^2+9} =$

A. $\frac{1}{2X}$ B. $\frac{3}{2X}$ C. $\frac{7}{4X}$ D. $\frac{7}{2X}$

73. The smallest divisor, greater than 1 of any integer greater than 1 is
A. odd number B. composite number
C. prime number D. even number

74. If $X > 0, \frac{X-1}{X+1} + \frac{1}{2}\frac{X^2-1}{(X+1)^2} + \frac{1}{3}\frac{X^2-1}{(X+1)^3} \ldots\ldots =$
A. $\log X^2$ B. $\log X$ C. $\log \sqrt{X}$ D. $\log 2X$

75. A particle is projected with a velocity of 24 m/sec at an angle of 30°. The time of flight is
A. $\frac{24}{g}$ B. $\frac{12}{g}$ C. $\frac{12}{g^2}$ D. $\frac{36}{g}$

76. A stone is dropped into a well and reaches the bottom with a velocity 30 m/sec and the sound of the splash on the water reaches the top of the well in $3\frac{182}{981}$ second from the time the stone starts. The velocity of sound =
A. 150 m/sec B. 360 m/sec C. 260 m/sec D. 300 m/sec

77. The time of flight on the inclined plane of angle α inclined at an angle β is
A. $\frac{u\sin\alpha}{g}$ B. $\frac{2u\sin(\alpha-\beta)}{g}$ C. $\frac{u\sin(\alpha-\beta)}{g}$ D. $\frac{2u\sin(\alpha-\beta)}{g\cos\beta}$

78. The range on the inclined plane of angle α inclined at an angle β is
A. $\frac{2u^2\sin(\alpha-\beta)}{g\cos^2\beta}$ B. $\frac{2u^2\sin(\alpha-\beta)}{g\cos\beta}$
C. $\frac{u^2\sin(\alpha-\beta)}{g\cos\beta}$ D. $\frac{2u^2\cos\alpha\sin(\alpha-\beta)}{g\cos^2\beta}$

79. The coefficient of x^n in the series $1+\frac{b+ax}{1!}+\frac{(b+ax)^2}{2!}+\ldots\ldots$ is
A. $\frac{e^b a^n}{n!}$ B. $\frac{a^n}{n!}$ C. a^n D. $\frac{e^b}{n!}$

80. If p is a prime and p/a^2+b^2 and p/b^2+c^2 then
A. p/a^2 B. p/c^2 C. p/a^2+c^2 D. p/a^2-c^2

81. If the greatest height attained by the particle is a quarter of its range on the horizontal plane, the angle of projection is

A. 45° B. 30° C. 60° D. 90°

82. The horizontal range of a projectile is maximum when angle of projection is

A. 60° B. 90° C. 45° D. 30°

83. Time taken by the projectile to reach the greatest height is

A. $\frac{u\cos\alpha}{g}$ B. $\frac{u^2\sin 2\alpha}{g}$ C. $\frac{u\sin\alpha}{g^2}$ D. $\frac{u\sin\alpha}{g}$

84. The time of flight of a projectile is

A. $\frac{u\sin\alpha}{g}$ B. $\frac{2u\sin\alpha}{g}$ C. $\frac{u^2\sin 2\alpha}{g}$ D. $\frac{u^2\sin^2\alpha}{2g}$

85. If two velocities are equal in magnitude, then magnitude of resultant velocity is

A. $2V\sin\frac{\alpha}{2}$ B. $2V\cos\frac{\alpha}{2}$ C. $2V^2\cos\frac{\alpha}{2}$ D. $V\cos\frac{\alpha}{2}$

86. The acceleration component in the normal direction is

A. $\frac{V}{r}$ B. r^{θ} C. $\frac{r^2}{\rho}$ D. r

87. If force $\vec{P}$ and $\vec{Q}$ are at right angles to each other, then the magnitude of their resultant $\vec{R}$ is

A. $R=\sqrt{P^2+Q^2}$ B. $R=\sqrt{P^2+Q^2+2PQ}$

C. $R=2P$ D. $R=P+Q$

88. A uniform ladder rests with one of its ends on a rough ground (μ - coefficient of friction) and the other end on a smooth wall. The angle which it makes with the horizontal is

A. $\tan^{-1}\mu$ B. $\tan^{-1}2\mu$ C. $\tan^{-1}\frac{\mu}{2}$ D. $\tan^{-1}\left(\frac{1}{2\mu}\right)$

89. If μ is the coefficient of friction as the equilibrium is limiting, then

A. $\frac{F}{R}<\mu$ B. $\frac{F}{R}=\mu$ C. $F=\mu$ D. $\frac{F}{R}>\mu$

90. Two parallel forces $\vec{P}$ and $\vec{Q}$ act at the points A and B, then their resultant $\vec{R}$ passes through a point C which divides $\overline{AB}$ in the ratio
A. $2Q:P$ B. $Q:2P$ C. $Q:P$ D. $P:Q$

91. ABC is a triangle and O is the incentre of the triangle. Force $\vec{P},\vec{Q},\vec{R}$ acting along the lines $\overline{OA}$, $\overline{OB}$,$\overline{OC}$ are in equilibrium P : Q : R =
A. $\cos\frac{A}{2}:\cos\frac{B}{2}:\cos\frac{C}{2}$ B. a : b : c
C. $\sin A:\sin B:\sin C$ D. OA : OB : OC

92. When one body in contact with another is in equilibrium, the friction exerted is just sufficient to maintain equilibrium and is called
A. statical friction B. dynamical friction
C. limiting friction D. cone of friction

93. The resultant of two equal forces P, P at an angle α is
A. $2P\cos\frac{\alpha}{2}$ B. $2\cos\frac{\alpha}{2}$ C. 2P D. $2P\sin\frac{\alpha}{2}$

94. The resultant of two forces P and Q is R. If Q is doubled, R is doubled. R is also doubled when Q is reversed. Then P : Q : R =
A. $\sqrt{3}:\sqrt{2}:\sqrt{2}$ B. $\sqrt{2}:\sqrt{3}:\sqrt{2}$
C. $\sqrt{2}:\sqrt{2}:\sqrt{3}$ D. $\sqrt{3}:\sqrt{2}:\sqrt{3}$

95. The singular point for $f(z)=\frac{z+1}{z^2(z^2+1)}$ are
A. $0,i,-i$ B. $0,i$ C. $1,i,-i$ D. $0,-i$

96. Any two harmonic conjugates of a given harmonic function $u(x,y)$ differ by
A. x B. y C. xy D. constant

97. If the resultant of two forces 3P and 5P is 7P, the angle between the forces is
A. 30° B. 45° C. 60° D. 90°

98. G is the centroid of ΔABC and P is any point in the plane of the triangle. Then $\overline{PA}+\overline{PB}+\overline{PC}=$
A. $2\overline{PG}$ B. $\overline{PG}$ C. $\overline{PA}$ D. $3\overline{PG}$

99. The Taylor's series for $\frac{1}{z}$ about $z=1$ is

A. $1+\frac{z}{1!}+\frac{z^2}{2!}+.....$ B. $1-(z-1)+(z-1)^2-(z-1)^3+.....$

C. $1+(z-1)+(z-1)^2+.....$ D. $1+z+z^2+z^3+....$

100. The residue of $\frac{z+1}{z^2-2z}$ at $z=2$ is

A. $-\frac{1}{2}$ B. $\frac{3}{2}$ C. 0 D. $\frac{4}{5}$

101. The image of the circle $|z-3i|=3$ under the map $w=\frac{1}{z}$ is a

A. circle B. straight line C. square D. rectangle

102. The value of $\int_c \frac{e^z}{z^n}dz, c$ is the circle $|z|=1$ is

A. $2\pi i$ B. 2π C. $\frac{2\pi}{(n-1)!}$ D. $\frac{2\pi i}{(n-1)!}$

103. The value of $\lim_{z\to 2}\frac{z^2-4}{z-2}$ is

A. 2 B. 4 C. 1 D. 8

104. The angle of rotation at $z=1+i$ under the map $w=z^2$ is

A. $\frac{\pi}{4}$ B. $\frac{\pi}{2}$ C. 0 D. π

105. The function $f(z)=|z|^2$ is

A. differentiable at z=0 B. differentiable at $z\neq 0$

C. nowhere differentiable D. not harmonic

106. If the function $f(z)=\frac{z}{1+z}, u(x,y)+iv(x,y)=$

A. $\frac{x}{x^2+y^2}-\frac{iy}{x^2+y^2}$ B. $\frac{x^2+x+y^2}{(x+1)^2+y^2}+\frac{iy}{(x+1)^2+y^2}$

C. $(x^2+5)+i7y$ D. $\frac{x^2+y^2}{(x+1)^2+y^2}+\frac{iy}{(x+1)^2+y^2}$

107. The series $\sum\frac{n^2+1}{5^n}$

A. oscillates B. diverse to $+\infty$

C. diverges to $-\infty$ D. converges

108. If $f(z)=a(x^2-y^2)+ibxy+c$ is differential at every point, the constant

A. 2b = a B. 4b = a C. 2a = b D. a = b

109. $\sum \frac{(1-1)^{n-1}x^n}{n}$ converges if

A. $|x|<1$ B. $|x|=0$ C. $|x|>1$ D. $|x|\geq 1$

110. The series $\sum \frac{(-1)^n}{n^p}$ is absolutely convergent if

A. $p > 1$ B. $p < 1$ C. $p = 1$ D. $p < 0$