DEPARTMENT OF MATHEMATICS
FACULTY OF PHYSICAL SCIENCES
UNIVERSITY OF BENIN, BENIN CITY

FIRST SEMESTER EXAMINATIONS 2023/2024 SESSION

MTH110

NAME_____ MAT. NO._____

1. Which of the following is correct? (a) $1-\tan^2\theta = Sec^2\theta$ (b) $1+\tan^2\theta = Sec^2\theta$ (c) $1-Cot^2\theta = Sec^2\theta$ (d) $1+Cot^2\theta = Sec^2\theta$ (e) None of the above
2. Which of the following is correct? (a) $1-\tan^2\theta = Cosec^2\theta$ (b) $1+\tan^2\theta = Cosec^2\theta$ (c) $1-Cot^2\theta = Cosec^2\theta$ (d) $1+Cot^2\theta = Cosec^2\theta$ (e) None of the above
3. $Tan(A+B)$ is equal to (a) $\frac{\tan A+\tan B}{1-\tan A\tan B}$ (b) $\frac{\tan A+\tan B}{1+\tan A\tan B}$ (c) $\frac{\tan A-\tan B}{1-\tan A\tan B}$ (d) $\frac{\tan A-\tan B}{1+\tan A\tan B}$ (e) None of the above
4. Evaluate $Sin2A-Cos2A$ (a) $-2Sin^2A+2SinACosA+1$ (b) $-2Cos^2A+2SinACosA-1$ (c) $2Sin^2A+2SinACosA-1$ (d) $2SinACosA$ (e) None of the above
5. Express $Sin3\theta$ only in terms of powers of $Sin\theta$ (a) $3Sin\theta-4Sin^3\theta$ (b) $4Sin^3\theta-3Sin\theta$ (c) $4Cos^3\theta-3Cos\theta$ (d) $3Cos\theta-4Cos^3\theta$ (e) None of the above
6. Express $Cos3\theta$ only in terms of powers of $Cos\theta$. (a) $3Sin\theta-4Sin^3\theta$ (b) $4Sin^3\theta-3Sin\theta$ (c) $4Cos^3\theta-3Cos\theta$ (d) $3Cos\theta-4Cos^3\theta$ (e) None of the above
7. If $SinA=\frac{2t}{1+t^2}$ and $CosA=\frac{1-t^2}{1+t^2}$, find $\tan A$ (a) $\frac{t}{1+t^2}$ (b) $\frac{t}{1-t^2}$ (c) $\frac{2t}{1+t^2}$ (d) $\frac{2t}{1-t^2}$ (e) None of the above
8. Evaluate $Sin(A+B)+Sin(A-B)$ (a) $SinACosB$ (b) $2SinACosB$ (c) $SinASinB$ (d) $2SinASinB$ (e) None of the above
9. If $Sin\theta=\frac{3}{5}$, find $Sin2\theta$ (a) $24/25$ (b) $12/25$ (c) $6/25$ (d) $8/25$ (e) None of the above
10. If $Sin\theta=\frac{3}{5}$, find $Cos3\theta$ (a) $256/125$ (b) $12/25$ (c) $44/125$ (d) $-44/125$ (e) None of the above
11. If $SinA=\frac{3}{5}$ and $SinB=\frac{12}{13}$, find $Sin(A+B)$ (a) $33/65$ (b) $-15/65$ (c) $48/65$ (d) $-48/65$ (e) None of the above
12. Solve the equation $8Cosx+15Sinx=17/2$. (a) $x=1^0 56'$ or $121^0 56'$ (b) $x=10^0 58'$ or $111^0 58'$ (c) $x=15^0 58'$ or $106^0 58'$ (d) $x=15^0 56'$ or $120^0 56'$ (e) None of the above
13. Evaluate $Sin3\theta+Cos3\theta$ (a) $-4(Cos^3\theta-Sin^3\theta)+3(Sin\theta+Cos\theta)$ (b) $4(Cos^3\theta-Sin^3\theta)+3(Sin\theta-Cos\theta)$ (c) $-3(Sin\theta-Cos\theta)+2(Cos^3\theta-Sin^3\theta)$ (d) $24Cos^3\theta+8Sin^3\theta-CosSin\theta$ (e) None of the above
14. If $Sin\theta=\frac{2t}{1+t^2}$, evaluate $8Sin\theta Cos\theta-\tan\theta$ (a) $\frac{14t(1-2t^2+t^4)}{(1-t^2)(1+t^2)^2}$ (b) $\frac{2t(7-18t^2+7t^4)}{(1-t^2)(1+t^2)^2}$ (c) $\frac{7-18t^2-7t^4)}{(1+t^2)^2}$ (d) $\frac{9t(2-2t^2+t^4)}{(1+t^2)^2}$ (e) None of the above

15. If $Sin\frac{\theta}{2}=\frac{t}{\sqrt{1+t^2}}$ and $Cos\frac{\theta}{2}=\frac{t}{\sqrt{1+t^2}}$, find $Sin\theta-2Sin\frac{\theta}{2}Cos\frac{\theta}{2}$ (a) 0 (b) $\frac{t}{\sqrt{1+t^2}}$ (c) $\frac{2t}{\sqrt{1+t^2}}$ (d) $\frac{1-t^2}{1+t^2}$ (e) None of the above

16. Which of the following is not correct? (a) $Sin(A+B)=SinACosB+CosASinB$ (b) $Cos(A+B)=CosACosB-SinASinB$ (c) $Sin(A-B)=SinACosB-CosASinB$ (d) $Cos(A-B)=CosACosB+SinASinB$ (e) None of the above

17. If $Cos\theta=\frac{3}{7}$, find $2Sin\theta\tan\theta-5Cos\theta$ (a) $-77/35$ (b) $77/35$ (c) $48/35$ (d) $-125/35$ (e) None of the above

18. If $Sec\theta=\frac{5}{4}$, find $5\frac{Sin\theta}{Cot\theta}-3Cosec\theta$ (a) 1 (b) -1 (c) 2 (d) -2 (e) None of the above

19. If $Sec\theta=\frac{5}{4}$, find $1+\tan^2\theta$ (a) $5/4$ (b) $25/4$ (c) $25/16$ (d) $-25/4$ (e) None of the above

20. If $Cosec\theta=\frac{5}{3}$, find $1+Cot^2\theta$ (a) $9/25$ (b) $-9/25$ (c) $-25/9$ (d) $29/9$ (e) None of the above

21. Evaluate i^4 (a) $-i$ (b) -1 (c) i (d) 1 (e) None of the above

22. Evaluate i^{37} (a) $-i$ (b) -1 (c) i (d) 1 (e) None of the above

23. Evaluate $(1-i)^2$ (a) i (b) $2i$ (c) $-2i$ (d) $-i$ (e) None of the above

24. Evaluate $\frac{1-i}{i}$ (a) $1+i$ (b) $1-i$ (c) $-1+i$ (d) $-1-i$ (e) None of the above

25. Evaluate $\frac{(1-i)^2}{1+i}$ (a) $1+i$ (b) $1-i$ (c) $-1+i$ (d) $-1-i$ (e) None of the above

26. Evaluate $(1+i)^2$ (a) $2i$ (b) $-2i$ (c) $1+2i$ (d) $1-2i$ (e) None of the above

27. If $Z_1=1+3i$ and $Z_2=7+2i$, find Z_1+Z_2 (a) $8+5i$ (b) $6+i$ (c) $-8-5i$ (d) $-6-i$ (e) None of the above

28. If $Z_1=1+3i$ and $Z_2=7+2i$, find Z_1Z_2 (a) $20+35i$ (b) $41+23i$ (c) $20-12i$ (d) $40-23i$ (e) None of the above

29. Evaluate $\frac{5-3i}{2+9i}$ (a) $\frac{17}{85}+\frac{51}{85}i$ (b) $\frac{-17}{85}+\frac{51}{85}i$ (c) $\frac{-17}{85}-\frac{51}{85}i$ (d) $\frac{17}{85}-\frac{51}{85}i$ (e) None of the above

30. Evaluate $\frac{2+3i}{4-5i}$ (a) $\frac{22}{41}-\frac{7}{41}i$ (b) $\frac{7}{41}-\frac{22}{41}i$ (c) $\frac{7}{41}+\frac{22}{41}i$ (d) $\frac{-7}{41}+\frac{22}{41}i$ (e) None of the above

31. Evaluate $\frac{3-4i}{2-7i}$ (a) $\frac{34}{53}+\frac{13}{53}i$ (b) $\frac{34}{53}-\frac{13}{53}i$ (c) $\frac{-34}{53}-\frac{13}{53}i$ (d) $\frac{-34}{53}+\frac{13}{53}i$ (e) None of the above

32. Express $\frac{(1+3i)^2}{2+i}$ in the form $a+ib$ (a) $1+i$ (b) $-1+2i$ (c) $-2+4i$ (d) $-2-4i$ (e) None of the above

33. Express $(2-i)^4$ in the form $a+ib$ (a) $-7-24i$ (b) $7-24i$ (c) $7+24i$ (d) $-7+24i$ (e) None of the above

34. If $Z=2-i$, express Z^2+2Z+3 in the form $x+iy$ (a) $5-3i$ (b) $5+3i$ (c) $10-6i$ (d) $10+6i$ (e) None of the above

35. If $z = 2 - i$, express $Z + \frac{1}{Z}$ in the form $x + iy$ (a) $\frac{6-2i}{5}$ (b) $\frac{12}{5} - \frac{4}{5}i$ (c) $\frac{-6}{5} - \frac{2}{5}i$
(d) $\frac{-12}{5} - \frac{4}{5}i$ (e) None of the above

36. If $Z_1 = 3 - 4i$ and $Z_2 = 7 + 5i$, find $Z_1 Z_2$ (a) $41 - 13i$ (b) $-41 - 13i$ (c) $-41 + 13i$
(d) $41 + 13i$ (e) None of the above

37. If $Z_1 = 5 + 3i$ and $Z_2 = 4 - 5i$, find $\overline{Z_1 Z_2}$ (a) $-36 - 13i$ (b) $36 + 13i$ (c) $36 - 13i$
(d) $-36 + 13i$ (e) None of the above

38. Express $1 + \sqrt{3}i$ in polar form (a) $Z = 2(Cos60^0 + iSin60^0)$ (b) $Z = \sqrt{3}(Cos60^0 + iSin60^0)$
(c) $Z = 4(Cos30^0 + iSin30^0)$ (d) $Z = 2(Cos30^0 + iSin30^0)$ (e) None of the above

39. Express $-1 - \sqrt{3}i$ in polar form (a) $Z = 2(Cos240^0 + iSin240^0)$ (b) $Z = 2(Cos60^0 + iSin60^0)$
(c) $Z = 2(Cos30^0 + iSin30^0)$ (d) $Z = \sqrt{3}(Cos240^0 + iSin240^0)$ (e) None of the above

40. Express $2(Cos220^0 + iSin220^0)$ in the form $a + ib$ (a) $1.54 + 1.28i$ (b) $1.54 - 1.28i$
(c) $-1.54 + 1.28i$ (d) $-1.54 - 1.28i$ (e) None of the above

41. Express $10(Cos290^0 + iSin290^0)$ (a) $3.42 - 9.4i$ (b) $-3.42 - 9.4i$ (c) $-3.42 + 9.4i$
(d) $3.42 + 9.4i$ (e) None of the above

42. Evaluate $\frac{5(Cos150^0 + iSin150^0)}{3(Cos30^0 + iSin30^0)}$ (a) $\frac{3}{5}(Cos120^0 + iSin120^0)$ (b) $\frac{3}{5}(Cos120^0 - iSin120^0)$
(c) $\frac{5}{3}(Cos120^0 + iSin120^0)$ (d) $\frac{5}{3}(Cos120^0 - iSin120^0)$ (e) None of the above

43. Evaluate $(Cos\theta + iSin\theta)^m$ (a) $\frac{Cos\theta - iSin\theta}{(Cos\theta - iSin\theta)^m}$ (b) $Cos\theta - iSin\theta$ (c) $Cos\theta + iSin\theta$
(d) $Cosm\theta - iSinm\theta$ (e) None of the above

44. If $Z = 2 + 3i$, find Z in polar form (a) $0.2(Cos168.9^0 + iSin168.9^0)$
(b) $0.02(Cos168.9^0 + iSin168.9^0)$ (c) $0.2(Cos191.1^0 + iSin191.1^0)$
(d) $0.02(Cos191.1^0 + iSin191.1^0)$ (e) None of the above

45. Find the cube root of $27(Cos\frac{2\pi}{6} + iSin\frac{2\pi}{6})$ in the form $a + ib$
(a) $3\left[Cos\left(\frac{5\pi + 12\pi k}{18}\right) + iSin\left(\frac{5\pi + 12\pi k}{18}\right)\right]$ (b) $3\left[Cos\left(\frac{5\pi - 12\pi k}{18}\right) + iSin\left(\frac{5\pi - 12\pi k}{18}\right)\right]$
(c) $\sqrt{3}\left[Cos\left(\frac{5\pi + 12\pi k}{18}\right) + iSin\left(\frac{5\pi + 12\pi k}{18}\right)\right]$ (d) $\sqrt{3}\left[Cos\left(\frac{5\pi - 12\pi k}{18}\right) + iSin\left(\frac{5\pi - 12\pi k}{18}\right)\right]$
(e) None of the above

46. If $Z = Cos\theta + iSin\theta$, find Z^{-1} (a) $\frac{1}{Cos\theta - iSin\theta}$ (b) $Cos\theta - iSin\theta$ (c) $2iSin\theta$ (d)
$2Cos\theta$ (e) None of the above

47. If $Z = Cos\theta - iSin\theta$, find $Z^n + \frac{1}{Z^n}$ (a) $2iSin\,n\theta$ (b) $2iSin\theta$ (c) $2Cos\,n\theta$ (d) $2Cos\theta$
(e) None of the above

48. Express $Cos^3\theta$ in terms of cosines of multiple angles (a) $2Cos3\theta + 6Cos\theta$
(b) $\frac{1}{4}(Cos3\theta + 3Cos\theta)$ (c) $4(Cos3\theta + 3Cos\theta)$ (d) $\frac{1}{8}(Cos3\theta + 3Cos\theta)$ (e) None of the above

49. Express $Z = e^{\frac{2i\pi}{6}}$ in the form $a + ib$ (a) $6.4 - 3.7i$ (b) $64 - 3.7i$ (c) $0.64 - 0.37i$
(d) $0.64 + 0.37i$ (e) None of the above

0. Which of the following is not correct? (a) $e^{i\theta} = Cos\theta + iSin\theta$ (b) $e^{-i\theta} = Cos\theta - iSin\theta$
(c) $Cos\theta = \frac{e^{i\theta} + e^{-i\theta}}{2}$ (d) $Sin\theta = \frac{e^{i\theta} + e^{-i\theta}}{2i}$ (e) None of the above

51. The set $A = \{x / x \text{ is an integer}, 2 < x < 3\}$ (a) a singleton set (b) a set with two elements (c) an empty set (d) the universal set (e) None of the above

52. Find x if $|x + 3| = 2$ (a) 1, 5 (b) 1, -5 (c) -1, -5 (d) -1, 5 (e) None of the above

53. Find x if $|x + 3| > 5$ (a) $x < 2, x > -8$ (b) $x > 2, x < -8$ (c) $-8 < x < 2$ (d) $x < 2, x < -8$ (e) None of the above

54. Find y if $\left|\frac{y-3}{y+1}\right| < 2$ (a) $y > \frac{1}{3}, y < -5$ (b) $y < \frac{1}{3}, y > -5$ (c) $y > -\frac{1}{3}, y < -5$
(d) $y > \frac{1}{3}, y < 5$ (e) None of the above

55. Evaluate u_r for the following sequence 0, 7, 26, 63, 124, . . . (a) 7(r-1) (b) $r^3 - 1$
(c) 7r (d) $r^3 - 1$ (e) None of the above

56. Evaluate the first 5 terms of the sequence whose u_r is given as follows $\left(-\frac{1}{3}\right)^{r-1}$
(a) $-1, \frac{1}{3}, -\frac{1}{9}, \frac{1}{27}, -\frac{1}{81}$ (b) $-1, -\frac{1}{3}, -\frac{1}{9}, -\frac{1}{27}, -\frac{1}{81}$ (c) $1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \frac{1}{81}$
(d) $1, -\frac{1}{3}, \frac{1}{9}, -\frac{1}{27}, \frac{1}{81}$ (e) None of the above

57. The sum of the first n terms of a series is given as $S_n = n^3 - 2n$ for all values of n, find the formula for the rth term (a) $3r^2 + 3r + 1$ (b) $3r^2 + 3r - 1$ (c) $3r^2 - 3r + 1$
(d) $3r^2 - 3r - 1$ (e) None of the above

58. Find the three arithmetic means between -5 and 59. (a) 27 (b) 32 (c) 11, 27, 43
(d) 27, 32, 37 (e) None of the above

59. The second term of a geometric sequence is 24 and the fifth term is 81, find the seventh term.
(a) $\frac{729}{4}$ (b) 81 (c) 729 (d) $\frac{81}{4}$ (e) None of the above

60. Evaluate $\sum_{r=1}^{n}(2 - 3r)$ (a) $\frac{n(1+3n)}{2}$ (b) $\frac{n(3n-1)}{2}$ (c) $\frac{n(1-3n)}{2}$ (d) $-\frac{n(1-3n)}{2}$
(e) None of the above

61. The third term of an arithmetic progression is 18 and the seventh term is 30, find the sum of the first thirty three terms (a) 1890 (b) 720 (c) 1980 (d) 1800 (e) None of the above

62. The third term of a geometric sequence is -1 and the seventh term is -81, find the ninth term.
(a) -729 (b) 729 (c) -81 (d) 81 (e) None of the above

Express $\frac{25 - 11x}{(x+1)(x-2)(x-3)}$ into partial fraction
(a) $\frac{2}{x+1} - \frac{3}{x-2} + \frac{1}{x-3}$
(b) $\frac{3}{x+1} - \frac{1}{x-2} - \frac{2}{x-3}$ (c) $\frac{3}{x+1} - \frac{1}{x-2} + \frac{2}{x-3}$ (d) $\frac{3}{x+1} + \frac{1}{x-2} - \frac{2}{x-3}$ (e) None of the above.

63. Solve the inequalities $3x + 12 > 0$ and $8 - 4x > 0$ (a) $-2 < x < 4$ (b) $-4 < x < 2$ (c) $-4 < x < -2$ (d) $-2 < x < 2$ (e) None of the above

64. The first term of an arithmetic sequence is 7 and the last term is 70 and the sun is 385. Find the number of terms. (a) 7 (b) 8 (c) 9 (d) 10 (e) None of the above

65. If a and r are both positive, find the sum of the series

$\log ar + \log ar^2 + \log ar^3 + \ldots + \log ar^{n-1}$ (a) $n \log ar^{\frac{n+1}{2}}$ (b) $(n-1)\log ar^{\frac{n+1}{2}}$

(c) $(n+1)\log ar$ (d) $(n+1)\log ar^{\frac{n+1}{2}}$ (e) None of the above

66. Evaluate $\sum_{r=1}^{n}(3r + 2)$ (a) $\frac{n(3n+3)}{2}$ (b) $\frac{n(3n-7)}{2}$ (c) $\frac{n(3n+7)}{2}$ (d) $\frac{n(3n-3)}{2}$

(e) None of the above

67. Evaluate $\sum_{r=1}^{n}(2 - 3r)$ (a) $\frac{n(1+3n)}{2}$ (b) $\frac{n(1-3n)}{2}$ (c) $\frac{n(3n-1)}{2}$ (d) $\frac{n(5-3n)}{2}$

(e) None of the above

68. Find the sum of the first 2n terms of the sequence $5 + 11 + 17 + 23 + \ldots$ (a) $n(10n+4)$ (B) $n(12n+4)$ (c) $n(12n+8)$ (d) $n(12n-4)$ (e) None of the above

69. Find the sum of the first 2n terms of the sequence $a + 3b + 2a + 6b + 3a + 9b + \ldots$ (a) $n(2n+1)(a+3b)$ (b) $(2n+1)(a+3b)$ (c) $n(n+1)(a+3b)$ (d) $2n(n+1)(a+3b)$ (e) None of the above

70. The product of three numbers in geometric progression is -64 and their sum is 13, find the second term (a) 4 (b) -4 (c) $\frac{1}{4}$ (d) $-\frac{1}{4}$ (e) None of the above

71. The third term of a geometric sequence is -1 and the seventh term is -81, find the ninth term. (a) 729 (b) -729 (c) -81 (d) 81 (e) None of the above

72. Find the sum to infinity the series $\frac{1}{2} + \frac{1}{3} + \frac{2}{9} + \ldots$ (a) $1\frac{1}{3}$ (b) $\frac{3}{2}$ (c) $1\frac{2}{3}$ (d) $\frac{2}{3}$

(e) None of the above

73. Evaluate $1 + \sqrt{3} + 3 + 3\sqrt{3} + \ldots + 81\sqrt{3}$ (a) $242(1+\sqrt{3})$ (b) $\frac{242}{1+\sqrt{3}}$ (c) $121(1+\sqrt{3})$

(d) $-\frac{242}{1+\sqrt{3}}$ (e) None of the above

74. The first and last term of a geometric progression are 3 and 768 respectively, if the sum of the series is 1533, find common ratio (a) 2 (b) 3 (c) 4 (d) 5 (e) None of the above

75. Find the sum to which the following series converge $1 - x + x^2 - x^3 + \ldots \quad |x| < 1$

(a) $\frac{1}{1-x}$. (b) $\frac{1}{1-x^2}$. (c) $\frac{x}{1-x^2}$. (d) $\frac{1}{1+x}$. (e) None of the above

76. Evaluate $\frac{1}{5} + \frac{1}{25} + \frac{1}{125} + \ldots$ (a) $\frac{5}{4}$. (b) $\frac{1}{5}$. (c) $\frac{1}{4}$. (d) $\frac{4}{5}$.(e) None of the above

77. Express 0.232323... (*recurring*) as a fraction (a) $\frac{23}{100}$ (b) $\frac{232}{1000}$ (c) $\frac{2323}{10000}$ (d) $\frac{23}{99}$

(e) None of the above

78. Evaluate ${}^nC_r + {}^nC_{r+1}$ (a) ${}^{n+1}C_r$, (b) ${}^nC_{r+1}$ (c) ${}^nC_r$, (d) ${}^{n+1}C_{r+1}$ (e) None of the above

79. Evaluate ${}^{n}C_{r} + {}^{n}C_{r-1}$ (a) ${}^{n+1}C_{r}$ (b) ${}^{n}C_{r-1}$ (c) ${}^{n}C_{r}$ (d) ${}^{n+1}C_{r-1}$ (e) None of the above

80. Expand $(2+x)^5$ (a) $32+60x^1+60x^2+40x^3+10x^4+x^5$
(b) $16+80x^1+80x^2+40x^3+10x^4+x^5$ (c) $32+60x^1+60x^2+30x^3+10x^4+x^5$
(d) $32+80x^1+80x^2+40x^3+10x^4+x^5$ (e) None of the above

81. Find the coefficient of x^4 in the expansion of $\left(x^2+\frac{2y}{x}\right)^{10}$ (a) $210y^4$ (b) $6300y^4$
(c) $3360y^4$ (d) $1360y^4$ (e) None of the above

82. A box containing 2 yellow and 3 blue cards, in how many ways can 3 cards be chosen if at least one card must be blue (a) 9 (b) 20 (c) 10 (d) 6 (e) None of the above

83. In how many ways can the letters of the word PENCIL be arranged if the arrangement must begin with E and end with P (a) 120 (b) 24 (c) 60 (d) 6 (e) None of the above

84. How many three digit numbers can be formed using the digit 4, 5, 6 if any digit can be used more than once. (a) 12 (b) 18 (c) 27 (d) 6 (e) None of the above

85. In how many ways can the letters of the word CALCULUS be arranged (a) 8! (b) 7!
(c) 6! (d) 5! (e) None of the above

86. How many 3 or 4 digit numbers can be formed using the digit 1, 6, 7, 8, 9 if repetition is not allowed? (a) 60 (b) 120 (c) 180 (d) 240 (e) None of the above

87. Find the values of x which satisfy $2x^2-7x+9<x^2-2x+3$ (a) $x<2, x>3$
(b) $3<x<4$ (c) $-2<x<3$ (d) $2<x<3$ (e) None of the above

88. For what values of x is $\frac{1}{x-3}<1$ (a) $3<x<4$ (b) $-3<x<4$ (c) $x>3, x<4$
(d) $x<3, x>4$ (e) None of the above

89. For what values of x is $\frac{2x-1}{x+3}\le\frac{2}{3}$ (a) $-3\le x\le\frac{9}{4}$ (b) $-3\le x\le-\frac{9}{4}$
(c) $-\frac{9}{4}\le x\le 3$ (d) $\frac{9}{4}\le x\le 3$ (e) None of the above

90. Find x if $|x+3|\le 1$ (a) $-2<x<4$ (b) $-4<x<2$ (c) $-4<x<-2$
(d) $-2<x<2$ (e) None of the above

91. Resolve the following into partial fractions $\frac{6x-10}{x^2-2x-3}$ (a) $\frac{2}{x-3}-\frac{4}{x+1}$
(b) $\frac{2}{x+3}+\frac{4}{x-1}$ (c) $\frac{2}{x-3}+\frac{4}{x+1}$ (d) $\frac{2}{x-3}-\frac{4}{x-1}$ (e) None of the above

92. Resolve the following into partial fractions $\frac{x^3-x^2-4}{x^2-1}$ (a) $\frac{3}{x+1}-\frac{2}{x-1}$
(b) $x-1+\frac{3}{x+1}-\frac{2}{x-1}$ (c) $x-1-\frac{3}{x+1}-\frac{2}{x-1}$ (d) $x-1-\frac{3}{x+1}+\frac{2}{x-1}$
(e) None of the above

93. Resolve the following into partial fractions $\frac{x^2+4x-7}{(x+1)(x^2+4)}$ (a) $\frac{x-7}{(x^2+4)}-\frac{1}{x+1}$

(b) $\frac{3x-1}{(x^2+4)}+\frac{2}{x+1}$ (c) $\frac{x+1}{(x^2+4)}+\frac{2}{x+1}$ (d) $\frac{3x+7}{(x^2+4)}-\frac{1}{x+1}$ (e) None of the above

94. Resolve the following into partial fractions $\frac{x^2}{(x+1)^3}$ (a) $\frac{1}{x+1}-\frac{2}{(x+1)^2}+\frac{1}{(x+1)^3}$

(b) $\frac{1}{x+1}+\frac{1}{(x+1)^2}+\frac{1}{(x+1)^3}$ (c) $\frac{1}{x+1}-\frac{2}{(x+1)^2}-\frac{1}{(x+1)^3}$ (d) $\frac{1}{x+1}+\frac{2}{(x+1)^2}-\frac{1}{(x+1)^3}$

(e) None of the above

95. Resolve the following into partial fractions $\frac{4x+11}{(x^2+4x-5)}$ (a) $\frac{1}{2}\left(\frac{3}{x+5}-\frac{5}{x-1}\right)$

(b) $\frac{1}{2}\left(\frac{3}{x-5}+\frac{5}{x+1}\right)$ (c) $\frac{1}{2}\left(\frac{3}{x-5}+\frac{5}{x-1}\right)$ (d) $\frac{1}{2}\left(\frac{3}{x+5}+\frac{5}{x-1}\right)$ (e) None of the above

96. Resolve the following into partial fractions $\frac{x^2+2}{(2x+1)(x^2+2x+3)}$

(a) $\frac{1}{2x+1}-\frac{1}{x^2+2x+3}$ (b) $\frac{1}{2x+1}+\frac{1}{x^2+2x+3}$ (c) $\frac{1}{2x+1}-\frac{3}{x^2+2x+3}$

(d) $\frac{1}{2x+1}-\frac{4}{x^2+2x+3}$ (e) None of the above

97. Resolve the following into partial fractions. $\frac{7x+2}{(2x-3)(x+1)^2}$ (a) $\frac{2}{2x-3}-\frac{1}{x+1}-\frac{1}{(x+1)^2}$

(b) $\frac{2}{2x-3}+\frac{1}{x+1}+\frac{1}{(x+1)^2}$ (c) $\frac{2}{2x-3}+\frac{1}{x+1}-\frac{1}{(x+1)^2}$ (d) $\frac{2}{2x-3}-\frac{1}{x+1}+\frac{1}{(x+1)^2}$

(e) None of the above

Determine n and r if ${}^nP_r = \frac{10!}{4!}$ (a) $n=10,\ r=4$ (b) $n=10,\ r=6$

(c) $n=6,\ r=4$ (d) $n=10,\ r=10$ (e) None of the above

98. How many 4 digit even numbers can be formed using the digit 1, 6, 7, 8, 9 if repetition is not allowed? (a) 80 (b) 120 (c) 60 (d) 48 (e) None of the above

99. A committee of three boys and 4 girls is to be formed from5 boys and 6 girls, how many committees are possible? (a) 420 (b) 60 (c) 25 (d) 360 (e) None of the above

100. The set $A=\{x \mid x \text{ is an integer}, 2<x<3\}$ is (a) a singleton set (b) a set with two elements (c) an empty set (d) the universal set (e) None of the above

101. If a set A has n elements, then A has (a) 2^n subsets (b) $2^{(n-1)}$ subsets (c) $2^{(n+1)}$ subsets (d) $2n$ subsets (e) None of the above

102. If the set $A = \{a,b,c\}$, then the power set of A has (a) three elements (b) eight elements (c) seven elements (d) six elements (e) None of the above

103. Which of the following is false (a) 0 is an integer (b) 0 is a natural number (c) 0 is a real number (d) 0 is a rational number (e) None of the above

104. List the elements of the following set $\{x^2+1 | x \text{ is an integer and } 1 < x < 5\}$ (a) {2, 5, 10, 17,26} (b) {5, 10, 17, 26} (c) {2, 5, 10, 17} (d) {5, 10, 17} (e) None of the above

105. Let the universal set $u = \{x | 1 \le x \le 20, x \text{ is an integer}\}$ $P = \{x-1 | 10 \le x \le 18, \ x \text{ is even}\}$ $Q = \{x | 2 < x \le 15, \ x \text{ is odd}\}$. Find $P \cap Q'$ (a) {17} (b) {12, 17} (c) {17, 18} (d) ϕ (e) None of the above

106. Let $P = \{x-1 | 10 \le x \le 18, \ x \text{ is even}\}$, $Q = \{x | 2 < x \le 15, \ x \text{ is odd}\}$ and $R = \{x | 1 < x \le 20, \ x \text{ is a multiple of } 3\}$. Find $P \cap (Q \cap R)$ (a) {3, 9, 15} (b) {9, 15} (c) ϕ (d) {3, 6, 9, 15} (e) None of the above

107. Find $B - A$ for the following pairs of sets $A = \{3,1\}$ and $B = \{4,1,6,3\}$ (a) {3,1} (b) {4,6} (c) {4, 1} (d) {4, 3} (e) None of the above

108. If $A = \{1, 2, 3, 4\}$ and $B = \{2, 4\}$ then $A \cup B =$ (a) {2, 4} (b) {1, 2, 2, 3, 4, 4} (c) {1, 2, 3, 4} (d) ϕ (e) None of the above

109. Given that $U = \{a,b,c,d,e,f,g\}$, $P = \{a,b,d,f\}$ and $Q = \{a,c,d,g\}$. Find $P \cup Q'$ (a) $\{b,e,f\}$ (b) $\{a,b,d,e\}$ (c) $\{a,b,d,f\}$ (c) $\{a,b,d,e,f\}$ (e) None of the above

110. Given that $P = \{a,b,d,f\}$, $Q = \{a,c,d\}$ and $R = \{f,c,a,d\}$. Find $P \cup Q \cup R$ (a) $\{a,b,c,d,f\}$ (b) $\{a,a,b,c,d\}$ (c) $\{a,b,c,c,f\}$ (d) $\{a,b,c,d,d\}$ (e) None of the above

111. If $A = \{1,2,3,6,8\}$ and $C = \{4,5,6,8\}$, find $A \Delta C$ (a) {1,2,3,4,5,6} (b) {1,2,3,4,5} (c) {1,2,3,4,5,8} (d) ϕ (e) None of the above

112. If $A = \{1,2,3,6,8\}$, $B = \{2,5,6,7,9\}$ and $C = \{4,5,6,8\}$, find $(A \Delta B) \Delta C$ (a) {1,3,7,9} (b) {4,6} (c) {1,3,4,6,7,9} (d) {1,3,7,8,9,5} (e) None of the above

113. If $A = \{1,2,3,6,8\}$, $B = \{2,5,6,7,9\}$ and $C = \{4,5,6,8\}$, find $A \cap (B \Delta C)$ (a) {2,7,9} (b) {4,7,8} (c) {7,9} (d) {2,8} (e) None of the above

114. If $A = \{1,2,3,6,8\}$, $B = \{2,5,6,7,9\}$ and $C = \{4,5,6,8\}$, find $C \cup (A \Delta B)$ (a) {1,3,4,5,6,7,8,9} (b) {1,2,3,6,8,9} (c) {1,4,5,6,7,8,9} (d) {3,4,5,6,7,8,9} (e) None of the above

115. If A and B are any two sets then $(A \cap B)' =$ (a) $A' \cap B'$ (b) $A' \cup B'$ (c) $A \cup B'$ (d) $A' \cap B$ (e) None of the above

116. If A and B are any two sets then $(A \cup B)' =$ (a) $A \cup B'$ (b) $A' \cup B'$ (c) $A' \cap B'$ (d) $A' \cap B$ (e) None of the above

117. If $\cup$ is the universal set and A is any set then $A \Delta \cup =$ (a) A (b) ϕ (c) $\cup$ (d) A' (e) None of the above

118. For two sets A and B, $n(A \cup B) =$ (a) $n(A) + n(B) - n(A \cap B)$ (b) $n(A) + n(B) - n(A \cup B)$ (c) $n(A) + n(B) + n(A \cap B)$ (d) $n(A) + n(B) + n(A \cup B)$ (e) None of the above

119. In a certain gathering of 200 students, 60% of them like Economics while 77% of them like History. How many students like both History and Economics? (a) 37 (b) 74 (c) 40 (d) 23 (e) None of the above

120. In a class of 125 students 4 belong to Music and Press clubs only, 5 belong to Press and Drama clubs only while 20 are members of Music and Drama clubs. The Press club has

65members and no student participates in only Music club. Given that the number in Press club only is the square of those in all three clubs. How many belong to only Drama if 10 students are not members of any of the clubs? (a) 49 (b) 13 (c) 37 (d) 22 (e) None of the above

121. In a class of 125 students 4 belong to Music and Press clubs only, 5 belong to Press and Drama clubs only while 20 are members of Music and Drama clubs. The Press club has 65members and no student participates in only Music club.. Given that the number in Press club only is the square of those in all three clubs. What is the probability that a student in the class is in the drama club? (a) $\frac{37}{125}$ (b) $\frac{62}{115}$ (c) $\frac{37}{115}$ (d) $\frac{62}{125}$ (e) None of the above

122. The operation $\bullet$ is defined by the relation $p \bullet q = \frac{(p-q)^2}{p+q}$ on the set of real numbers. Evaluate $2 \bullet 5$ (a) $\frac{9}{7}$ (b) $\frac{-9}{7}$ (c) $\frac{3}{7}$ (d) $\frac{-3}{7}$ (e) None of the above

123. The operation Δ is defined by the relation $r \Delta s = |r-s|$ on the set of real numbers. Evaluate $2 \Delta 9$ (a) -7 (b) 7 (c) 11 (d) -11 (e) None of the above

124. The operation $\bullet$ is defined by the relation $a \bullet b = \max(a, b-1)$ on the set of real numbers. Evaluate $4 \bullet 10$ (a) 10 (b) 4 (c) 9 (d) 3 (e) None of the above

125. The operation $\bullet$ is defined by the relation $u \bullet v = u^2 + v + 2$. Evaluate $3 \bullet 0$ (a) 2 (b) 3 (c) 5 (d) 11 (e) None of the above

126. The operation ∇ is defined by the relation $p \nabla q = \frac{p-q}{pq}$. Evaluate $6 \nabla 2$ (a) $\frac{1}{3}$ (b) $\frac{-1}{3}$ (c) 3 (d) -3 (e) None of the above

127. The set $k = \{-1, 0, 1\}$ is closed under (a) + (b) × (c) - (d) ÷ (e) None of the above

128. The operation $\bullet$ is defined by the relation $p \bullet q = \frac{(p-q)^2}{p+q}$. Evaluate $(4 \bullet 2) \bullet 3$ (a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{49}{33}$ (d) $\frac{33}{49}$ (e) None of the above

129. For the set of integers Z determine the identity element under + (a) does not exist (b) ½ (c) 1 (d) 0 (e) None of the above

130. For the set of integers Z determine the identity element under × (a) 1 (b) does not exist (c) 0 (d) ½ (e) None of the above

131. Find the inverse of the real number 7 under + (a) $\frac{1}{7}$ (b) -7 (c) $\frac{-1}{7}$ (d) does not exist (e) None of the above

132. Find the inverse of the real number 7 under × (a) -7 (b) $\frac{-1}{7}$ (c) $\frac{1}{7}$ (d) does not exist (e) None of the above

133. If x_1 and x_2 are the two roots of the quadratic equation $x^2 + \frac{b}{a}x + \frac{c}{a} = 0$ then sum of roots is (a) $\frac{a}{b}$ (b) $\frac{-a}{b}$ (c) $\frac{b}{a}$ (d) $\frac{-b}{a}$ (e) None of the above

134. If x_1 and x_2 are the two roots of the quadratic equation $x^2 + \frac{b}{a}x + \frac{c}{a} = 0$ then product of roots is (a) $\frac{c}{a}$ (b) $\frac{-c}{a}$ (c) $\frac{a}{c}$ (d) $\frac{-a}{c}$ (e) None of the above

135. If the equation $px^2 + 3x - 9 = 0$ has equal roots what is the value of p? (a) $\frac{1}{4}$ (b) $\frac{-1}{4}$ (c) $\frac{1}{3}$ (d) $\frac{-1}{3}$ (e) None of the above

136. If α and β are the roots of the equation $2x^2+6x-5=0$ form the equation whose roots are $\alpha+\frac{1}{\beta}, \beta+\frac{1}{\alpha}$ (a) $10x^2-18x+9=0$ (b) $10x^2+18x+9=0$ (c) $10x^2+18x-9=0$ (d) $10x^2-18x-9=0$ (e) None of the above

137. If α and β are the roots of the equation $2x^2+6x-5=0$ form the equation whose roots are $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$ (a) $5x^2-28x+5=0$ (b) $5x^2+28x-5=0$ (c) $5x^2-28x-5=0$ (d) $5x^2+28x+5=0$

138. If α and β are the roots of the equation $2x^2+6x-5=0$ form the equation whose roots are α^3, β^3 (a) $8x^2+396x-125=0$ (b) $8x^2-396x-125=0$ (c) $8x^2+396x+125=0$ (d) $8x^2-396x+125=0$ (e) None of the above

139. If α and β are the roots of a quadratic equation, find the quadratic equation given that $\alpha-\beta=3$ and $\alpha^2-\beta^2=6$ (a) $4x^2-8x+5=0$ (b) $4x^2-8x-5=0$ (c) $4x^2+8x-5=0$ (d) $4x^2+8x+5=0$ (e) None of the above

140. Find the values of a for which the equation $(3a+1)x^2+(a+2)x+1=0$ has equal roots (a) $a=0$ or $a=8$ (b) $a=0$ or $a=-8$ (c) $a=8$ or $a=2$ (d) $a=8$ or $a=-2$ (e) None of the above

141. Find the values of λ for which the roots of the equation $x^2-(3\lambda+1)x+\lambda^2-1=5\lambda$ are real (a) $\lambda\le 5$ or $\lambda\ge\frac{1}{3}$ (b) $\lambda\le -5$ or $\lambda\ge -\frac{1}{3}$ (c) $\lambda\ge 5$ or $\lambda\ge\frac{1}{3}$ (d) $\lambda\ge -5$ or $\lambda\le -\frac{1}{3}$ (e) None of the above

142. Find the maximum value of $5+6x-x^2$ (a) 6 (b) 5 (c) 3 (d) 11 (e) None of the above

143. Find the minimum value of $12x^2+24x+13$ (a) 12 (b) 24 (c) 13 (d) -1 (e) None of the above

144. For the function $y=2x^2-x-10=0$ determine the turning point using the method of completing the square (a) $\left(\frac{1}{4},\frac{-81}{8}\right)$ (b) $\left(\frac{-1}{4},\frac{-81}{8}\right)$ (c) $\left(\frac{-1}{4},\frac{81}{8}\right)$ (d) $\left(\frac{1}{4},\frac{81}{8}\right)$ (e) None of the above

145. For the function $y=14-3x-2x^2$ (a) $\left(\frac{-3}{4},\frac{-121}{8}\right)$ (b) $\left(\frac{-3}{4},\frac{121}{8}\right)$ (c) $\left(\frac{3}{4},\frac{121}{8}\right)$ (d) $\left(\frac{3}{4},\frac{-121}{8}\right)$ (e) None of the above

146. If α and β are the roots of the equation $ax^2+bx+c=0$, obtain in terms of a,b and c the value of $\alpha^2+\beta^2$ (a) $\frac{b^2+2ac}{a^2}$ (b) $\frac{b^2-2ac}{a^2}$ (c) $\frac{b^2+2ac}{a}$ (d) $\frac{b^2-2ac}{a}$ (e) None of the above

147. If α and β are the roots of the equation $ax^2+bx+c=0$, obtain in terms of a,b and c the value of $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}$ (a) $\frac{b^2-2ac}{ac}$ (b) $\frac{b^2+2ac}{ac}$ (c) $\frac{a^2+2ac}{bc}$ (d) $\frac{c^2-2ac}{ab}$ (e) None of the above

148. Show by mathematical induction that if n is a positive integer $1+2+3+4+\ldots+n=$ (a) $\frac{n(n-1)}{2}$ (b) $\frac{n(n+1)}{2}$ (c) $n(n-1)$ (d) $n(n+1)$ (e) None of the above

149. Show using mathematical induction that $3^{2n+1} + 2^{n+2}$ is divisible by 7 and for $n = k + 1$ it is equal to (a) $7(3^{2k+1}) + [3^{2k+1} + 2^{k+2}]$ (b) $7(3^{2k+1}) - [3^{2k+1} + 2^{k+2}]$ (c) $7(3^{2k+1}) + 2[3^{2k+1} + 2^{k+2}]$ (d) $7(3^{2k+1}) - 2[3^{2k+1} + 2^{k+2}]$ (e) None of the above