1. If the sum of the squares of the reciprocals of the roots α and β of the equation $3x^2+\lambda x-1=0$ is 15, then $6\left(\alpha^3+\beta^3\right)^2$ is equal to

(1) 46 (2) 36

(3) 24 (4) 18

2. The sum of all integral values of $k(k\neq 0)$ for which the equation $\frac{2}{x-1}-\frac{1}{x-2}=\frac{2}{k}$ in x has no real roots, is_____.

3. If $\alpha,\beta\in R$ are such that $1-2i$ (here $i^2=-1$) is a root of $z^2+\alpha z+\beta=0$, then $(\alpha-\beta)$ is equal to:

(1) -7 (2) 7

(3) -3 (4) 3

4. The value of $3+\frac{1}{4+\frac{1}{3+\frac{1}{4+\frac{1}{3+\ldots\infty}}}}$ is equal to

(1) $1.5+\sqrt{3}$ (2) $2+\sqrt{3}$

(3) $3+2\sqrt{3}$ (4) $4+\sqrt{3}$

5. Let $p,\ q\in\ Q$. If $2-\sqrt{3}$ is a root of the quadratic equation $x^2+px+q=0$, then

(1) $p^2-4q+12=0$ (2) $q^2+4p+14=0$

(3) $p^2-4q-12=0$ (4) $q^2-4p-16=0$

6. Let α be a root of the equation $1+x^2+x^4=0$. Then the value of $\alpha^{1011}+\alpha^{2022}-\alpha^{3033}$ is equal to:

(1) 1 (2) α

(3) $1+\alpha$ (4) $1+2\alpha$

7. Let $\alpha,\ \beta$ be the roots of the quadratic equation $x^2+\sqrt{6}x+3=0$. Then $\frac{\alpha^{23}+\beta^{23}+\alpha^{14}+\beta^{14}}{\alpha^{15}+\beta^{15}+\alpha^{10}+\beta^{10}}$ is equal to

(1) 81 (2) 9

(3) 72 (4) 729

8. If α and β are the roots of the equation $375\,x^2-25x-2=0$, then $\lim\limits_{n\to\infty}\sum_{r=1}^{n}\alpha^r+\lim\limits_{n\to\infty}\sum_{r=1}^{n}\beta^r$ is equal to:

(1) $\frac{1}{12}$ (2) $\frac{21}{346}$

(3) $\frac{7}{116}$ (4) $\frac{29}{358}$

9. Let $\alpha,\beta(\alpha>\beta)$ be the roots of the quadratic equation $x^2-x-4=0$. If $P_n=\alpha^n-\beta^n, n\in\mathbb{N}$, then $\frac{P_{15}P_{16}-P_{14}P_{16}-P_{15}^2+P_{14}P_{15}}{P_{13}P_{14}}$ is equal to _____.

10. If α,β are roots of the equation $x^2+5\left(\sqrt{2}\right)x+10=0, \alpha>\beta$ and $P_n=\alpha^n-\beta^n$ for each positive integer n, then the value of $\left(\frac{P_{17}P_{20}+5\sqrt{2}P_{17}P_{19}}{P_{18}P_{19}+5\sqrt{2}P_{18}^2}\right)$ is equal to

11. The sum of all the roots of the equation $\left|x^2-8x+15\right|-2x+7=0$ is

(1) $9-\sqrt{3}$ (2) $9+\sqrt{3}$

(3) $11-\sqrt{3}$ (4) $11+\sqrt{3}$

12. The number of the real roots of the equation $(x+1)^2+\left|x-5\right|=\frac{27}{4}$ is ________.

13. Let α,β be the roots of the equation $x^2-\sqrt{2}x+\sqrt{6}=0$ and $\frac{1}{\alpha^2}+1,\ \frac{1}{\beta^2}+1$ be the roots of the equation $x^2+ax+b=0$. Then the roots of the equation $x^2-(a+b-2)x+(a+b+2)=0$ are :

(1) non-real complex numbers (2) real and both negative

(3) real and both positive (4) real and exactly one of them is positive

14. Let α,β be the roots of the equation $x^2-4\lambda x+5=0$ and α,γ be the roots of the equation $\mathrm{x}^2-\left(3\sqrt{2}+2\sqrt{3}\right)\mathrm{x}+7+3\lambda\sqrt{3}=0$. If $\beta+\gamma=3\sqrt{2}$, then $(\alpha+2\beta+\gamma)^2$ is equal to

15. Let m and n be the numbers of real roots of the quadratic equations $x^2-12x+[x]+31=0$ and $x^2-5|x+2|-4=0$ respectively, where $[x]$ denotes the greatest integer $\leq x$. Then m^2+mn+n^2 is equal to

16. If $x^2+9y^2-4x+3=0,\ x,y\in R$, then x and y respectively lie in the intervals

(1) $\left[-\frac{1}{3},\frac{1}{3}\right]$ and $\left[-\frac{1}{3},\frac{1}{3}\right]$
(2) $[1,\ 3]$ and $\left[-\frac{1}{3},\frac{1}{3}\right]$
(3) $\left[-\frac{1}{3},\frac{1}{3}\right]$ and $[1,\ 3]$
(4) $[1,\ 3]$ and $[1,\ 3]$

17. The minimum value of the sum of the squares of the roots of $x^2+(3-a)x=2a-1$ is

(1) 6
(2) 4
(3) 5
(4) 8

18. The probability of selecting integers $a\in[-5,30]$ such that $x^2+2(a+4)x-5a+64>0$, for all $x\in R$, is:

(1) $\frac{7}{36}$
(2) $\frac{2}{9}$
(3) $\frac{1}{6}$
(4) $\frac{1}{4}$

19. If for some $p,q,r\in R$, not all have same sign, one of the roots of the equation $(p^2+q^2)x^2-2q(p+r)x+q^2+r^2=0$ is also a root of the equation $x^2-2x-8=0$, then $\frac{q^2+r^2}{p^2}$ is equal to-

20. Let $a,b\in R$ be such that the equation $ax^2-2bx+15=0$ has repeated root α and if α and β are the roots of the equation $x^2-2bx+21=0$, then $\alpha^2+\beta^2$ is equal to:

(1) 37
(2) 58
(3) 68
(4) 92

21. Let $f(x)$ be a quadratic polynomial with leading coefficient 1 such that $f(0)=p, p\neq 0$, and $f(1)=\frac{1}{3}$. If the equations $f(x)=0$ and $fofofof(x)=0$ have a common real root, then $f(-3)$ is equal to ______.

22. The set of all real values of λ for which the quadratic equation $(\lambda^2+1)x^2-4\lambda x+2=0$ always have exactly one root in the interval $(0,\ 1)$ is :

(1) $(-3,\ -1)$
(2) $(0,\ 2)$
(3) $(1,\ 3]$
(4) $(2,\ 4]$

23. The sum of 162^{th} power of the roots of the equation $x^3-2x^2+2x-1=0$ is ______.

24. Let

$S=\left\{x : x\in\mathbb{R} \text{ and } \left(\sqrt{3}+\sqrt{2}\right)^{x^2-4}+\left(\sqrt{3}-\sqrt{2}\right)^{x^2-4}=10\right\}$. Then $n(S)$ is equal to

(1) 2
(2) 4
(3) 6
(4) 0

25. Let

$S=\left\{\alpha : \log_2\left(9^{2\alpha-4}+13\right)-\log_2\left(\frac{5}{2}\cdot 3^{2\alpha-4}+1\right)=2\right\}$. Then the maximum value of β for which the equation

$x^2-2\left(\sum_{\alpha\in s}\alpha\right)^2x+\sum_{\alpha\in s}(\alpha+1)^2\beta=0$ has real roots, is ______.

26. If $a+b+c=1, ab+bc+ca=2$ and $abc=3$, then the value of $a^4+b^4+c^4$ is equal to:

27. The number of points, where the curve $f(x)=e^{8x}-e^{6x}-3e^{4x}-e^{2x}+1, x\in\mathbb{R}$ cuts x-axis, is equal to...........

28. The equation $e^{4x}+8e^{3x}+13e^{2x}-8e^x+1=0, x\in R$ has :

(1) four solutions two of which are negative
(2) two solutions and both are negative
(3) no solution
(4) two solutions and only one of them is negative

29. Let $\alpha_1,\alpha_2,\ldots,\alpha_7\alpha_1,\alpha_2,\ldots,\alpha_7$ be the roots of the equation $x^7+3x^5-13x^3-15x=0$ and $|\alpha_1|\geq|\alpha_2|\geq\ldots\geq|\alpha_7|$. Then, $\alpha_1\alpha_2-\alpha_3\alpha_4+\alpha_5\alpha_6$ is equal to ______

30. The number of pairs (a, b) of real numbers, such that whenever α is a root of the equation $x^2 + ax + b = 0$, $\alpha^2 - 2$ is also a root of this equation, is :

(1) 6
(2) 8
(3) 4
(4) 2