Sample Task **Questions**

Questions with Answer Keys **MathonGo**

Q1

Let α and β be the roots of the equation $x^2 + ax + 1 = 0,\ a \neq 0$. Then the equation whose roots are $-\left(\alpha + \frac{1}{\beta}\right)$ and $-\left(\frac{1}{\alpha} + \beta\right)$ is

(1) $x^2 = 0$

(2) $x^2 + 2ax + 4 = 0$

(3) $x^2 - 2ax + 4 = 0$

(4) $x^2 - ax + 1 = 0$

Q2

If the roots of the quadratic equation $ax^2 + bx + c = 0$ are $\frac{k+1}{k}$ and $\frac{k+2}{k+1}$, then the value of $(a + b + c)^2$ is equal to

(1) $2b^2 - ac$

(2) Σa^2

(3) $b^2 - 4ac$

(4) $b^2 - 2ac$

Q3

The possible values of n for which the equation $nx^2 + (2n - 1)x + (n - 1) = 0$ has roots of opposite sign is/are given by

(1) no values of n

(2) all values of n

(3) $-1 < n < 0$

(4) $0 < n < 1$

Q4

Consider the equation $x^2 + 2x - n = 0$, where $n \in N$ and $n \in [5, 100]$. The number of different values of n so that the given equation has integral roots, is

Q5

If $-\pi < \theta < \pi$, the equation $(\cos 3\theta + 1)x^2 + (2\cos 2\theta - 1)x + (1 - 2\cos\theta) = 0$ has more than two roots for

(1) no value of θ

(2) one value of θ

(3) two value of θ

(4) all values of θ

Q6

Let α and β are the roots of equation $ax^2 + bx + c = 0$ $(a \neq 0)$. If $1, \alpha + \beta, \alpha\beta$ are in arithmetic progression and $\alpha, 2, \beta$ are in harmonic progression, then the value of $\frac{\alpha^2+\beta^2-2\alpha^2\beta^2}{2\left(\alpha^2+\beta^2\right)}$ is equal to

(1) 0

(2) 0.5

(3) 1

(4) 1.5

Q7

The number of quadratic equations that are unchanged by squaring their roots is

(1) 2

(2) 4

(3) 6

(4) 8

Q8

If α, β are roots of the equation $x^2 + 5(\sqrt{2})x + 10 = 0$, $\alpha > \beta$ 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

Q9

Let α, β are the roots of the quadratic equation $2x^2 - 5x + 1 = 0$. If $S_n = (\alpha)^{2n} + (\beta)^{2n}$ then find the value of $\frac{4S_{2021} + S_{2019}}{S_{2020}}$.

Q10

If $f(x) = \prod_{k=1}^{999}\left(x^2 - 47x + k\right)$, then product of all real roots of $f(x) = 0$ is

(1) 550!

(2) 551!

(3) 552!

(4) 999!

Q11

If $-3 < \frac{x^2 - \lambda x - 2}{x^2 + x + 1} < 2$ for all $x \in R$, then the value of λ belongs to

(1) (-1,7)

(2) (-6,2)

(3) (-1,2)

(4) (-6,7)

Q12

For the equation $\left|x^2 - 2x - 3\right| = b$, which of the following statements is true?

(1) For $b < 0$, there are no solutions

(2) For $b = 0$, there are three solutions

(3) For $0 < b < 4$, there are two solutions

(4) For $b = 4$, there are four solutions

Q13

If a, b, c are real numbers satisfying the condition $a + b + c = 0$, then the roots of the quadratic equation $3ax^2 + 5bx + 7c = 0$ are

(1) Positive

(2) negative

(3) real and equal

(4) distinct but not imaginary

Q14

If $a + b + c > \frac{9c}{4}$ and the equation $ax^2 + 2bx - 5c = 0$ has non-real complex roots, then

(1) $a > 0,\ c > 0$

(2) $a > 0,\ c < 0$

(3) $a < 0,\ c < 0$

(4) $a < 0,\ c > 0$

Q15

If the graph of the function $y = (a - b)^2x^2 + 2(a + b - 2c)x + 1$ ($\forall a \neq b$) is strictly above the x-axis, then

(1) $a < b < c$

(2) $a < c < b$

(3) $b < a < c$

(4) $c < b < a$

Q16

The quadratic equations $x^2 - 6x + a = 0$ and $x^2 - cx + 6 = 0$ have one root in common. The other roots of the first equation and the second equation are integers in the ratio $4:3$. Then the common root is

(1) 4

(2) 3

(3) 2

(4) 1

Q17

The value of k for which both the roots of the equation $4x^2 - 20kx + \left(25k^2 + 15k - 66\right) = 0$ are less than 2, lies in

(1) $\left(\frac{4}{5}, 2\right)$

(2) $(0,\ 2)$

(3) $\left(-1, -\frac{4}{5}\right)$

(4) $(-\infty,\ -1)$

Q18

The range of a for which the equation $x^2 + ax - 4 = 0$ has its smaller root in the interval $(-1,\ 2)$ is

(1) $(-\infty, -3)$

(2) $(0, 3)$

(3) $(0, \infty)$

(4) $(-\infty, -3) \cup (0, \infty)$

Q19

If $f(x)$ is a polynomial of degree four with the leading coefficient one satisfying $f(1) = 1, f(2) = 2$ and $f(3) = 3$, then $\left[\frac{f(-1)+f(5)}{f(0)+f(4)}\right]$ (where $[\cdot]$ represents the greatest integer function) is equal to

(1) 4

(2) 5

(3) 6

(4) 7

Q20

Sum of the squares of all integral values of a for which the inequality $x^2 + ax + a^2 + 6a < 0$ is satisfied for all $x \in (1,2)$ must be equal to

(1) 90

(2) 89

(3) 88

(4) 91

Q21

The equations $kx^2 + x + k = 0$ and $kx^2 + kx + 1 = 0$ have exactly one root in common for

(1) $k = -\frac{1}{2}, 1$

(2) $k = 1$

(3) $k = -\frac{1}{2}$

(4) $k = \frac{1}{2}$

Q22

If the quadratic equations $k\left(6x^2 + 3\right) + rx + 2x^2 - 1 = 0$ and $6k\left(2x^2 + 1\right) + px + 4x^2 - 2 = 0$ have both the roots common, then $2r - p$ is equal to

(1) 0

(2) 1

(3) 2

(4) None of these

Q23

If α, β and γ are the roots of the equation $x^3 - 13x^2 + 15x + 189 = 0$ and one root exceeds the other by 2, then the value of $|\alpha| + |\beta| + |\gamma|$ is equal to

(1) 23

(2) 17

(3) 13

(4) 19

Q24

If equations $x^2 + ax + b = 0\left(a, b \in R\right)$ & $x^3 + 3x^2 + 5x + 3 = 0$ have two common roots, then value of $\frac{b}{a}$ is equal to

Q25

If x is rational and $4\left(x^2 + \frac{1}{x^2}\right) + 16\left(x + \frac{1}{x}\right) - 57 = 0,$ then the product of all possible values of x is

(1) 4

(2) 3

(3) 2

(4) 1

Q26

The sum of all real values of x satisfying the equation $\left(x^2 - 5x + 5\right)^{x^2+4x-60} = 1$ is

(1) 6

(2) 5

(3) 3

(4) -4

Q27

If α and β are the real roots of $\left(\log_x 10\right)^3 - \left(\log_x 10\right)^2 - 6\left(\log_x 10\right) = 0$, then the value of $\left|\frac{1}{\log_{10}\alpha\beta}\right|$ is

Q28

The sum of the roots of the equation $2^{(33x-2)} + 2^{(11x+2)} = 2^{(22x+1)} + 1$ is

(1) $\frac{1}{11}$

(2) $\frac{2}{11}$

(3) $\frac{3}{11}$

(4) $\frac{4}{11}$

Q29

The number of real roots of the equation $e^{4x} - e^{3x} - 4e^{2x} - e^{x} + 1 = 0$ is equal to

Q30

If the equation in x given by $\left(2\left(\frac{1}{\cos^{-1}x}\right)\right)^{2\pi} - \left(a + \frac{1}{2}\right)\left(2\left(\frac{1}{\cos^{-1}x}\right)\right)^{\pi} - a^2 = 0$ has only one real solution then exhaustive set of values of 'a' is

(1) (-3 ,1)

(2) $(-\infty, -3] \cup [1, \infty)$

(3) $(-\infty, -3) \cup (1, \infty)$

(4) $[-3, \infty)$

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Answer Key

Q1 (3)	**Q2** (3)	**Q3** (4)	**Q4** (8)
Q5 (1)	**Q6** (4)	**Q7** (2)	**Q8** (1)
Q9 (21)	**Q10** (3)	**Q11** (3)	**Q12** (1)
Q13 (4)	**Q14** (2)	**Q15** (2)	**Q16** (3)
Q17 (4)	**Q18** (1)	**Q19** (2)	**Q20** (4)
Q21 (3)	**Q22** (1)	**Q23** (4)	**Q24** (1.50)
Q25 (1)	**Q26** (3)	**Q27** (6)	**Q28** (2)
Q29 (2)	**Q30** (2)		