

Q1. JEE Main 2026 (21 January Shift 2)

Let α and β be the roots of the equation $x^2 + 2ax + (3a + 10) = 0$ such that $\alpha < 1 < \beta$. Then the set of all possible values of a is :

- (1) $(-\infty, -\frac{11}{5})$ (2) $(-\infty, -2) \cup (5, \infty)$
(3) $(-\infty, -3)$ (4) $(-\infty, -\frac{11}{5}) \cup (5, \infty)$

Q2. JEE Main 2026 (23 January Shift 1)

A building construction work can be completed by two masons A and B together in 22.5 days. Mason A alone can complete the construction work in 24 days less than mason B alone. Then mason A alone will complete the construction work in :

- (1) 30 days (2) 36 days (3) 24 days (4) 42 days

Q3. JEE Main 2026 (23 January Shift 1)

If α and β ($\alpha < \beta$) are the roots of the equation $(-2 + \sqrt{3})(|\sqrt{x} - 3|) + (x - 6\sqrt{x}) + (9 - 2\sqrt{3}) = 0, x \geq 0$, then $\sqrt{\frac{\beta}{\alpha}} + \sqrt{\alpha\beta}$ is equal to :

- (1) 8 (2) 11 (3) 9 (4) 10

Q4. JEE Main 2026 (24 January Shift 2)

The smallest positive integral value of a , for which all the roots of $x^4 - ax^2 + 9 = 0$ are real and distinct, is equal to

- (1) 4 (2) 9 (3) 3 (4) 7

Q5. JEE Main 2026 (22 January Shift 2)

Let α, β be the roots of the quadratic equation $12x^2 - 20x + 3\lambda = 0, \lambda \in \mathbf{Z}$. If $\frac{1}{2} \leq |\beta - \alpha| \leq \frac{3}{2}$, then the sum of all possible values of λ is :

- (1) 1 (2) 6 (3) 3 (4) 4

Q6. JEE Main 2026 (23 January Shift 2)

The sum of all the real solutions of the equation

$\log_{(x+3)}(6x^2 + 28x + 30) = 5 - 2\log_{(6x+10)}(x^2 + 6x + 9)$ is equal to

- (1) 2 (2) 1 (3) 0 (4) 4

Q7. JEE Main 2026 (21 January Shift 1)

The sum of all the roots of the equation $(x - 1)^2 - 5|x - 1| + 6 = 0$, is :

- (1) 1 (2) 5 (3) 3 (4) 4

Q8. JEE Main 2026 (28 January Shift 1)

Let $S = \{x^3 + ax^2 + bx + c : a, b, c \in \mathbb{N} \text{ and } a, b, c \leq 20\}$ be a set of polynomials. Then the number of polynomials in S , which are divisible by $x^2 + 2$, is

- (1) 10 (2) 20 (3) 6 (4) 120

Q9. JEE Main 2026 (28 January Shift 1)

If α, β , where $\alpha < \beta$, are the roots of the equation $\lambda x^2 - (\lambda + 3)x + 3 = 0$ such that $\frac{1}{\alpha} - \frac{1}{\beta} = \frac{1}{3}$, then the sum of all possible values of λ is

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

ANSWERS AND SOLUTIONS

1. (1) 2. (2) 3. (4) 4. (4) 5. (3) 6. (3) 7. (4) 8. (1)
9. (2)

1. (1) Let $f(x) = x^2 + 2ax + (3a + 10)$. For $\alpha < 1 < \beta$, since the leading coefficient is positive, we need $f(1) < 0$.

$$f(1) = 1 + 2a + 3a + 10 = 5a + 11 < 0$$

$$a < -\frac{11}{5}$$

When $f(1) < 0$ with positive leading coefficient, the parabola is negative at $x = 1$, so 1 lies strictly between the two real roots. Discriminant is automatically positive.

$$a \in \left(-\infty, -\frac{11}{5}\right).$$

2. (2) Let A take a days and B take $a + 24$ days.

$$\text{Together: } \frac{1}{a} + \frac{1}{a+24} = \frac{1}{22.5} = \frac{2}{45}.$$

$$\frac{2a+24}{a(a+24)} = \frac{2}{45}$$

$$45(2a + 24) = 2a(a + 24)$$

$$90a + 1080 = 2a^2 + 48a$$

$$a^2 - 21a - 540 = 0$$

$$(a - 36)(a + 15) = 0 \Rightarrow a = 36.$$

Mason A alone completes the work in 36 days.

3. (4) Let $t = \sqrt{x} \geq 0$. The equation becomes $(-2 + \sqrt{3})|t - 3| + (t^2 - 6t) + (9 - 2\sqrt{3}) = 0$.

Since $t^2 - 6t + 9 = (t - 3)^2$, we get $(t - 3)^2 + (\sqrt{3} - 2)|t - 3| - 2\sqrt{3} = 0$.

Let $u = |t - 3| \geq 0$: $u^2 + (\sqrt{3} - 2)u - 2\sqrt{3} = 0$.

Discriminant $= (\sqrt{3} - 2)^2 + 8\sqrt{3} = 7 + 4\sqrt{3} = (2 + \sqrt{3})^2$.

$u = \frac{(2 - \sqrt{3}) \pm (2 + \sqrt{3})}{2}$, giving $u = 2$ or $u = -\sqrt{3}$ (rejected).

$|t - 3| = 2 \Rightarrow t = 5$ or $t = 1$, so $x = 25$ or $x = 1$.

$$\alpha = 1, \beta = 25.$$

$$\sqrt{\beta/\alpha} + \sqrt{\alpha/\beta} = \sqrt{25} + \sqrt{25} = 5 + 5 = 10.$$

4. (4) Let $t = x^2$, so the equation becomes $t^2 - at + 9 = 0$.

For all four roots of the original equation to be real and distinct, both roots of this quadratic must be positive and distinct.

Discriminant > 0 : $a^2 - 36 > 0 \Rightarrow |a| > 6$. Since $a > 0$, we need $a > 6$.

Product of roots $= 9 > 0$ and sum of roots $= a > 0$, so both roots are positive.

The smallest positive integer satisfying $a > 6$ is $a = 7$.

5. (3) For $12x^2 - 20x + 3\lambda = 0$: $\alpha + \beta = \frac{5}{3}$, $\alpha\beta = \frac{\lambda}{4}$.

$$|\beta - \alpha| = \frac{\sqrt{25 - 9\lambda}}{3}$$

Given $\frac{1}{2} \leq \frac{\sqrt{25-9\lambda}}{3} \leq \frac{3}{2}$

$\frac{9}{4} \leq 25 - 9\lambda \leq \frac{81}{4}$

From left: $\lambda \leq \frac{91}{36} \approx 2.53$

From right: $\lambda \geq \frac{19}{36} \approx 0.53$

Since $\lambda \in \mathbb{Z}$: $\lambda \in \{1, 2\}$. Sum = 3.

6. (3) Note $6x^2 + 28x + 30 = 2(3x + 5)(x + 3)$,

$x^2 + 6x + 9 = (x + 3)^2$,

$6x + 10 = 2(3x + 5)$.

Let $a = \log_{(x+3)}[2(3x + 5)]$. Then LHS = $a + 1$ and $\log_{2(3x+5)}(x + 3)^2 = \frac{2}{a}$.

Equation becomes $a + 1 = 5 - \frac{4}{a}$, i.e., $a^2 - 4a + 4 = 0 \Rightarrow a = 2$.

So $\log_{(x+3)}[2(3x + 5)] = 2 \Rightarrow (x + 3)^2 = 6x + 10 \Rightarrow x^2 = 1 \Rightarrow x = 1$ or $x = -1$.

Both satisfy domain conditions (bases $> 0, \neq 1$; arguments > 0).

Sum = $1 + (-1) = 0$.

7. (4) Let $t = |x - 1|$ where $t \geq 0$.

Equation becomes $t^2 - 5t + 6 = 0$.

$(t - 2)(t - 3) = 0$ gives $t = 2$ or $t = 3$.

For $|x - 1| = 2$: $x = 3$ or $x = -1$.

For $|x - 1| = 3$: $x = 4$ or $x = -2$.

Sum of roots = $3 + (-1) + 4 + (-2) = 4$.

8. (1) If $x^2 + 2$ divides $x^3 + ax^2 + bx + c$, write $x^3 + ax^2 + bx + c = (x^2 + 2)(x + k)$.

Expanding: $x^3 + kx^2 + 2x + 2k$.

Comparing coefficients: $a = k, b = 2, c = 2a$.

Constraints: $a \in \mathbb{N}$, $a \leq 20$, and $c = 2a \leq 20 \Rightarrow a \leq 10$.

So $a \in \{1, 2, 3, \dots, 10\}$, giving 10 polynomials.

9. (2) $\alpha + \beta = \frac{\lambda+3}{\lambda}, \alpha\beta = \frac{3}{\lambda}$.

$\frac{1}{\alpha} - \frac{1}{\beta} = \frac{\beta - \alpha}{\alpha\beta} = \frac{1}{3}$, so $\beta - \alpha = \frac{\alpha\beta}{3} = \frac{1}{\lambda}$.

$(\beta - \alpha)^2 = (\alpha + \beta)^2 - 4\alpha\beta$:

$\frac{1}{\lambda^2} = \frac{(\lambda+3)^2}{\lambda^2} - \frac{12}{\lambda}$

$1 = (\lambda + 3)^2 - 12\lambda = \lambda^2 - 6\lambda + 9$

$\lambda^2 - 6\lambda + 8 = 0 \Rightarrow \lambda = 2$ or $\lambda = 4$.

Both values satisfy $\alpha < \beta$ (verified). Sum = $2 + 4 = 6$.