Exercise – I (JEE-Main Pattern)

SECTION–A

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : –1 in all other cases.

---

1. If the roots of the equation $x^2 - 5x + 16 = 0$ are α, β and the roots of the equation $x^2 + px + q = 0$ are $(\alpha^2 + \beta^2)$ and $\frac{\alpha\ \beta}{2}$, then -

(1) $p = 1$ and $q = 56$ (2) $p = 1$ and $q = -56$
(3) $p = -1$ and $q = 56$ (4) $p = -1$ and $q = -56$

MQE001

2. If the roots of the equation $x^2 + px + q = 0$ are 8 and 2 and the roots of $x^2 + rx + s = 0$ are 3 and 3, then roots of $x^2 + px + s = 0$ are

(1) $-1, -9$ (2) 1, 9 (3) 8, 3 (4) None

MQE002

3. If α and β be the roots of the equation $(x - a)(x - b) = c$ and $c \neq 0$, then roots of the equation $(x - \alpha)(x - \beta) + c = 0$ are -

(1) a and c (2) b and c (3) a and b (4) $a + b$ and $b + c$

MQE003

4. If $\alpha^2 = 5\alpha - 3, \beta^2 = 5\beta - 3, (\alpha \neq \beta)$ then the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ is-

(1) 19/3 (2) 25/3 (3) –19/3 (4) none of these

MQE004

5. The value of a for which one root of the quadratic equation $(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$ is twice as large as the other is

(1) – 2/3 (2) 1/3 (3) – 1/3 (4) 2/3

MQE005

6. If $(1 - p)$ is a root of quadratic equation $x^2 + px + (1 - p) = 0$ then its roots are-

(1) 0, – 1 (2) – 1, 1 (3) 0, 1 (4) –1, 2

MQE006

7. If $x^2 - A(x + 1) + C = 0$ has roots x_1 & x_2, then the value of $x_1^2 + x_2^2 + (2 + A)x_1x_2$, is-

(1) AC (2) $A^2 + AC$ (3) $A^2 - AC$ (4) $-AC$

MQE007

8. The quadratic $x^2 + ax + b + 1 = 0$ has roots which are positive integers, then $(a^2 + b^2)$ can be equal to -

(1) 50 (2) 17 (3) 29 (4) 53

MQE008

9. If equations $x^2 - 5x + 5 = 0$ and $x^3 + ax^2 + bx + 5 = 0$ have common root, then value of $a + b$ $(a, b \in \mathbb{Q})$ is -

(1) 4 (2) –4 (3) 0 (4) can't find

MQE009

10. If the equation $ax^2 + bx + c = 0$ has distinct real roots, both negative, then-

(1) a, b, c must be of same sign

(2) a, b must be of opposite sign

(3) a, c must be of opposite sign

(4) a, b must be of same sign and opposite to sign of c

MQE010

11. If $P(x) = x^2 - (2 - p)x + p - 2$ assumes both positive and negative value, then the complete set of values of 'p' is -

(1) $(-\infty, 2)$ (2) $(6, \infty)$ (3) (2,6) (4) $(-\infty, 2) \cup (6, \infty)$

MQE011

12. If $x^2 + 2ax + 10 - 3a > 0$ for all $x \in \mathbb{R}$, then

(1) $-5 < a < 2$ (2) $a < -5$ (3) $a > 5$ (4) $2 < a < 5$

MQE012

13. Let $g(x) = x^2 - (b + 1)x + (b - 1)$, where b is a real parameter. The largest natural number b satisfying $g(x) > -2 \; \forall \; x \in \mathbb{R}$, is -

(1) 1 (2) 2 (3) 3 (4) 4

MQE013

14. $y = x^2 - 6x + 5, x \in [2,4]$, then -

(1) least value of y is –3

(2) least value of y is 3

(3) greatest value of y is 4

(4) greatest value of y is –3

MQE014

15. Range of the expression $\frac{16x^2 - 12x + 9}{16x^2 + 12x + 9} : (x \in \mathbb{R})$ is-

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

MQE015

16. If the roots of equation $(4p - p^2 - 5)x^2 - (2p - 1)x + 3p = 0$ lie on either side of unity then the number of integral values of p is-

(1) 4 (2) 2 (3) 3 (4) 1

MQE016

17. If exactly one root of the equation $2^k x^2 - 4^k x + 2^k - 1 = 0$ lies in [0,1), then complete range of k is-

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

MQE017

18. Let $f(x) = 2x^2 + px + 1$ is given. If $f(x)$ is negative integer for only one real value of x, then product of all possible values of p is -

(1) –3 (2) –16 (3) 5 (4) –7

MQE018

19. Let r_1, r_2, r_3 be roots of equation $x^3 - 2x^2 + 4x + 5074 = 0$, then the value of $(r_1 + 2)(r_2 + 2)(r_3 + 2)$ is

(1) 5050 (2) –5050 (3) –5066 (4) –5068

MQE019

20. Let $f(x) = x^3 + x + 1$ and $P(x)$ be a cubic polynomial such that $P(0) = -1$ and the roots of $P(x) = 0$ are the squares of the roots of $f(x) = 0$, then value of $P(9)$ is -

(1) 98 (2) 899 (3) 80 (4) 898

MQE020

SECTION–B

- This section contains **TEN** Questions. Attempt any five Questions. First five Questions Attempt will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct).
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4, if ONLY the correct numerical value is entered as answer.

Zero Marks : 0 in all other cases.

---

1. α, β are the roots of the equation $K(x^2 - x) + x + 5 = 0$. If K_1 & K_2 are the two values of K for which the roots α, β are connected by the relation $(\alpha/\beta) + (\beta/\alpha) = 4/5$. Find the value of $(K_1/K_2) + (K_2/K_1)$.

MQE021

2. Let the quadratic equation $x^2 + 3x - k = 0$ has roots a, b and $x^2 + 3x - 10 = 0$ has roots c, d such that modulus of difference of the roots of the first equation is equal to twice the modulus of the difference of the roots of the second equation. If the value of 'k' can be expressed as rational number in the lowest form as $\frac{m}{n}$ then find the value of $(m + n)$.

MQE022

3. The sum of all possible value(s) of m for which the quadratic equations $x^2 - 11x + m = 0$ and $x^2 - 14x + 2m = 0$ may have common root, is

MQE023

4. Let a, b be arbitrary real numbers. Find the smallest natural number 'b' for which the equation $x^2 + 2(a + b)x + (a - b + 8) = 0$ has unequal real roots for all $a \in \mathbb{R}$.

MQE024

5. Consider the quadratic polynomial $f(x) = x^2 - 4ax + 5a^2 - 6a$

Find the smallest positive integral value of 'a' for which $f(x)$ positive for every real x.

MQE025

6. We call 'p' a good number if the inequality $\frac{2x^2+2x+3}{x^2+x+1} \leq p$ is satisfied for any real x. Find the smallest integral good number.

MQE026

7. Number of integral values of 'a' for which $2x^2 - 2ax + a^2 - a - 6 = 0$ has roots of opposite sign is

MQE027

8. If '4' lies between the roots of the equation $x^2 - (3k-1)x + 5k = 0$, then minimum possible integral value of k is

MQE028

9. Let α, β and γ are the roots of the cubic $x^3 - 3x^2 + 1 = 0$. Find the value of $(\alpha - 2)(\beta - 2)(\gamma - 2)$.

MQE029

10. Find the product of the real roots of the equation, $x^2 + 18x + 30 = 2\sqrt{x^2+18x+45}$

MQE030

Exercise – II (JEE-Main PYQs)

1. Let for $\boldsymbol{a \neq a_1 \neq 0}$, $\boldsymbol{f(x) = ax^2 + bx + c}$, $\boldsymbol{g(x) = a_1x^2 + b_1x + c_1}$ and $\boldsymbol{p(x) = f(x) - g(x)}$. If $p(x) = 0$ only for $x = -1$ and $p(-2) = 2$, then the value of $p(2)$ is : **[AIEEE 2011]**

(1) 18 (2) 3 (3) 9 (4) 6

MQE031

2. Sachin and Rahul attempted to solve a quadratic equation. Sachin made a mistake in writing down the constant term and ended up in roots $(4, 3)$. Rahul made a mistake in writing down coefficient of x to get roots (3, 2). The correct roots of equation are: **[AIEEE 2011]**

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

MQE032

3. If the equations $x^2 + 2x + 3 = 0$ and $ax^2 + bx + c = 0$, $a, b, c \in \mathbb{R}$, have a common root, then $a : b : c$ is: **[JEE Main 2013]**

(1) 1 : 2 : 3 (2) 3 : 2 : 1 (3) 1 : 3 : 2 (4) 3 : 1 : 2

MQE033

4. Let α and β be the roots of equation $x^2 - 6x - 2 = 0$. If $a_n = \alpha^n - \beta^n$, for $n \geq 1$, then the value of $\frac{a_{10} - 2a_8}{2a_9}$ is equal to: **[JEE Main 2015]**

(1) 3 (2) – 3 (3) 6 (4) – 6

MQE034

5. The sum of all real values of x satisfying the equation $\left(x^2 - 5x + 5\right)^{x^2 + 4x - 60} = 1$ is :- **[JEE Main 2016]**

(1) 5 (2) 3 (3) –4 (4) 6

MQE035

6. Let α and β be two roots of the equation $x^2 + 2x + 2 = 0$, then $\alpha^{15} + \beta^{15}$ is equal to : **[JEE Main 2019]**

(1) 512 (2) –512 (3) –256 (4) 256

MQE036

7. The number of all possible positive integral values of α for which the roots of the quadratic equation, $6x^2 - 11x + \alpha = 0$ are rational numbers is: **[JEE Main 2019]**

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

MQE037

8. Consider the quadratic equation $(c - 5)x^2 - 2cx + (c - 4) = 0$, $c \neq 5$. Let S be the set of all integral values of c for which one root of the equation lies in the interval (0,2) and its other root lies in the interval (2,3). Then the number of elements in S is: **[JEE Main 2019]**

(1) 11 (2) 18 (3) 10 (4) 12

MQE038

9. If λ be the ratio of the roots of the quadratic equation in x, $3m^2x^2 + m(m-4)x + 2 = 0$, then the least value of m for which $\lambda + \frac{1}{\lambda} = 1$, is: **[JEE Main 2019]**

(1) $2 - \sqrt{3}$ (2) $4 - 3\sqrt{2}$ (3) $-2 + \sqrt{2}$ (4) $4 - 2\sqrt{3}$

MQE039

10. Let α and β be the roots of the equation $x^2 - x - 1 = 0$. If $p_k = (\alpha)^k + (\beta)^k, k \geq 1$, then which one of the following statements is not true ? **[JEE Main 2020]**

(1) $(p_1 + p_2 + p_3 + p_4 + p_5) = 26$ (2) $p_5 = 11$

(3) $p_3 = p_5 - p_4$ (4) $p_5 = p_2 \cdot p_3$

MQE040

11. The least positive value of 'a' for which the equation $2x^2 + (a - 10)x + \frac{33}{2} = 2a$ has real roots is **[JEE Main 2020]**

MQE041

12. If $A = \{x \in \mathbb{R}: |x| < 2\}$ and $B = \{x \in \mathbb{R}: |x - 2| \geq 3\}$; then : **[JEE Main 2020]**

(1) $A \cup B = \mathbb{R} - (2, 5)$ (2) $A \cap B = (-2, -1)$

(3) $B - A = \mathbb{R} - (-2, 5)$ (4) $A - B = [-1, 2)$

MQE042

13. Let p and q be two positive numbers such that $p + q = 2$ and $p^4 + q^4 = 272$. Then p and q are roots of the equation : **[JEE Main 2021]**

(1) $x^2 - 2x + 2 = 0$ (2) $x^2 - 2x + 8 = 0$

(3) $x^2 - 2x + 136 = 0$ (4) $x^2 - 2x + 16 = 0$

MQE043

14. The value of $3+\cfrac{1}{4+\cfrac{1}{3+\cfrac{1}{4+\cfrac{1}{3+\ldots\infty}}}}$ is equal to **[JEE Main 2021]**

(1) $1.5+\sqrt{3}$ (2) $2+\sqrt{3}$ (3) $3+2\sqrt{3}$ (4) $4+\sqrt{3}$

MQE044

15. The minimum value of the sum of the squares of the roots of $x^2 + (3 - a)x + 1 = 2a$ is : **[JEE Main 2022]**

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

MQE045

16. Let $S=\left\{x\in[-6,3]-\{-2,2\}:\frac{|x+3|-1}{|x|-2}\geq 0\right\}$ and $T=\left\{x\in\mathbb{Z}:x^2-7|x|+9\leq 0\right\}$. Then the number of elements in S ∩ T is **[JEE Main 2022]**

(1) 7 (2) 5 (3) 4 (4) 3

MQE046

17. 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- **[JEE Main 2022]**

MQE078

18. Let α, β $(\alpha > \beta)$ 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 ____. **[JEE Main 2022]**

MQE079

19. The number of integral values of k, for which one root of the equation $2x^2 - 8x + k = 0$ lies in the interval $(1, 2)$ and its other root lies in the interval $(2, 3)$, is : **[JEE Main 2023]**

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

MQE047

20. Let $S = \left\{\alpha : \log_2(9^{2\alpha-4} + 13) - \log_2\left(\frac{5}{2}.3^{2\alpha-4} + 1\right) = 2\right\}$. Then the maximum value of β for which the equation $x^2 - 2\left(\sum_{\alpha \in S} \alpha\right)^2 x + \sum_{\alpha \in S} (\alpha+1)^2 \beta = 0$ has real roots, is ___ . **[JEE Main 2023]**

MQE048

21. If the value of real number $a > 0$ for which $x^2 - 5ax + 1 = 0$ and $x^2 - ax - 5 = 0$ have a common real roots is $\frac{3}{\sqrt{2\beta}}$ then β is equal to ____. **[JEE Main 2023]**

MQE080

22. Let $a \in R$ and let α, β be the roots of the equation $x^2 + 60^{\frac{1}{4}} x + a = 0$. If $\alpha^4 + \beta^4 = -30$, then the product of all possible values of a is ____. **[JEE Main 2023]**

MQE081

Exercise – III (JEE-Advanced Pattern)

SECTION-I

- This section contains **THIRTEEN** questions.
- Each question has **FOUR** options for correct answer(*s*). **ONE OR MORE THAN ONE** of these four option(*s*) is (are) correct option(*s*).
- For each question, choose the correct option(*s*) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 if only (all) the correct option(*s*) is (are) chosen.
Partial Marks : +3 if all the four options are correct but ONLY three options are chosen.
Partial Marks : +2 if three or more options are correct but ONLY two options are chosen, both of which are correct options.
Partial Marks : +1 if two or more options are correct but ONLY one option is chosen and it is a correct option.
Zero Marks : 0 if none of the options is chosen (i.e. the question is unanswered).
Negative Marks : –2 in all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(*s*) (second option in this case), with or without selection of any correct option(*s*) will result in –2 marks.

---

1. If α and β are the roots of the equation $x^2 - x + 1 = 0$, then $\alpha^{2009} + \beta^{2009}$ is greater than or equal to

(A) –2 (B) –1 (C) 1 (D) 2

MQE049

2. The value(s) of m for which the equation $(1 + m^2)x^2 - 2(1 + 3m)x + (1 + 8m) = 0$ has no real root is/are :

(A) $\frac{1}{2}$ (B) 0 (C) 3 (D) 1

MQE050

3. The integral value(s) of α such that equation $x^2 - \alpha x + \alpha + 1 = 0$ has integral roots, is/are -

(A) –1 (B) 4 (C) 3 (D) 5

MQE051

4. Let $p(x)$ be a quadratic polynomial such that $p(0) = 1$. If $p(x)$ leaves remainder 4 when divided by $x - 1$ and it leaves remainder 6 when divided by $x + 1$; then :

(A) $p(2) = 19$ (B) $p(-2) = 19$ (C) $p(-2) = 11$ (D) $p(2) = 15$

MQE052

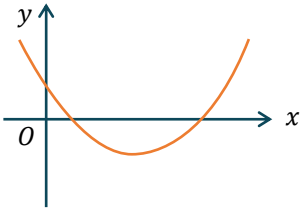
5. If $b > a$ and $\alpha, \beta (\alpha < \beta)$ are the roots of the equation, $(x-a)(x-b)-1=0$, then -

(A) $\alpha \in [b, \infty)$ (B) $\alpha \in (-\infty, a)$

(C) $\beta \in (b, \infty)$ (D) $\alpha \in [a, b]$ & $\beta \in [a, b]$

MQE053

6. The graph of $y = ax^2 + bx + c$ is shown. Which of the following hold(s) good ?



(A) $ab^2c^3 > 0$ (B) $ab^3c^2 < 0$ (C) $ab^3c^5 > 0$ (D) $b^2 > 4ac$

MQE054

7. The subset of the set of all real numbers x for which $x^2 - |x+2| + x > 0$, is/are –

(A) $(-\infty, -2) \cup (2, \infty)$ (B) $(-\infty, -\sqrt{2}) \cup (\sqrt{2}, \infty)$

(C) $(-\infty, -1) \cup (1, \infty)$ (D) $(\sqrt{2}, \infty)$

MQE055

8. For the equation $|x|^2 + |x| - 6 = 0$, the correct statement (s) is (are) :

(A) sum of roots is 0 (B) product of roots is – 4

(C) there are 4 real roots (D) there are only 2 real roots

MQE056

9. If α, β are the roots of $ax^2 + bx + c = 0$, and $\alpha + h, \beta + h$ are the roots of $px^2 + qx + r = 0$, (where $h \neq 0$), then

(A) $\frac{a}{p} = \frac{b}{q} = \frac{c}{r}$ (B) $h = \frac{1}{2}\left(\frac{b}{a} - \frac{q}{p}\right)$ (C) $h = \frac{1}{2}\left(\frac{b}{a} + \frac{q}{p}\right)$ (D) $\frac{b^2-4ac}{a^2} = \frac{q^2-4pr}{p^2}$

MQE057

10. If a and b are non-zero real numbers and α, β the roots of $x^2 + ax + b = 0$, then

(A) α^2, β^2 are the roots of $x^2 - (2b - a^2)x + a^2 = 0$

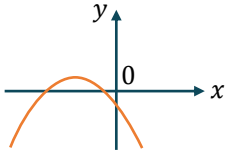
(B) $\frac{1}{\alpha}, \frac{1}{\beta}$ are the roots of $bx^2 + ax + 1 = 0$

(C) $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$ are the roots of $bx^2 + (2b - a^2)x + b = 0$

(D) $(\alpha - 1), (\beta - 1)$ are the roots of the equation $x^2 + x(a+2) + 1 + a + b = 0$

MQE058

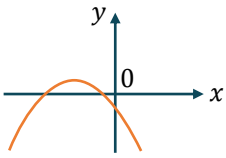
11. The graph of the quadratic polynomial $y = ax^2 + bx + c$ is as shown in the figure. Then :

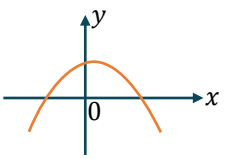


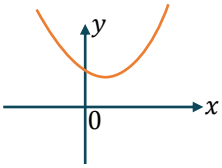
(A) $b^2 - 4ac > 0$ (B) $b < 0$ (C) $a > 0$ (D) $c < 0$

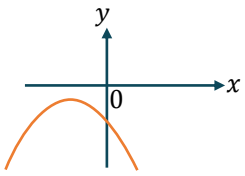
MQE059

12. For which of the following graphs of the quadratic expression $y = ax^2 + bx + c$, the product abc is negative?

(A) 

(B) 

(C) 

(D) 

MQE060

13. $x^2 + x + 1$ is a factor of $ax^3 + bx^2 + cx + d = 0$, then the real root of above equation is $(a, b, c, d \in R)$

(A) $-\frac{d}{a}$ (B) $\frac{d}{a}$ (C) $\frac{(b-a)}{a}$ (D) $\frac{(a-b)}{a}$

MQE061

SECTION–II

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO/THREE** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 if only the bubble corresponding to the correct answer is darkened.

Zero Marks : 0 in all other cases.

Comprehension # 1 (Q. No. 14 - 16)

Consider the expression $y = ax^2 + bx + c$, $a \neq 0$ and $a, b, c \in \mathbb{R}$ then the graph between x, y is always a parabola. If $a > 0$ then the shape of the parabola is concave upward and if $a < 0$ then the shape of the parabola is concave down ward. If $y > 0$ or $y < 0$ then discriminant $D < 0$.

14. Let $x^2 + 2ax + 10 - 3a > 0$ for every real value of x, then –

(A) $a > 5$ (B) $a < -5$ (C) $-5 < a < 2$ (D) $2 < a < 5$

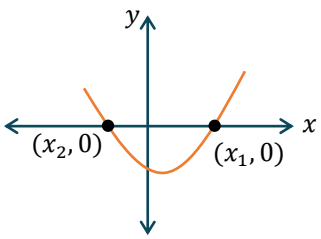
MQE062

15. The value of $x^2 + 2bx + c$ is positive if –

(A) $b^2 - 4c > 0$ (B) $b^2 - 4c < 0$ (C) $c^2 < b$ (D) $b^2 < c$

MQE063

16. The diagram shows the graph of $y = ax^2 + bx + c$ then –

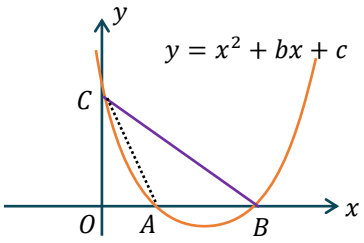


(A) $a < 0$ (B) $c < 0$ (C) $b^2 - 4ac < 0$ (D) $b^2 - 4ac = 0$

MQE064

Comprehension # 2 (Q. No. 17 & 18)

In the given figure ΔOBC is an isosceles right triangle in which AC is a median, then answer the following questions :



17. Sum of roots of $y = 0$ is

MQE065

18. Minimum value of the quadratic expression corresponding to the quadratic equation whose roots are $(\alpha + \beta)$ & $(\alpha - \beta)$, where α, β $(\alpha > \beta)$ are roots obtained in previous question occurs at $x =$

MQE066

SECTION–III

- This section contains **ONE** question.
- **Each question has matching lists.** The codes for the lists have choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 If only correct answer is given.
Zero Marks : 0 If no answer is given.
Negative Marks : –1 For incorrect answer

19.

	List– I	List– II
(P)	If $\alpha, \alpha + 4$ are two roots of $x^2 - 8x + k = 0$, then possible value of k is	(1) 2
(Q)	Number of real roots of equation $x^2 - 5\|x\| + 6 = 0$ are 'n', then value of $\frac{n}{2}$ is	(2) 3
(R)	If $3 - i$ is a root of $x^2 + ax + b = 0$ $(a, b \in \mathbb{R})$, then b is	(3) 12
(S)	If both roots of $x^2 - 2kx + k^2 + k - 5 = 0$ are less than 5, then 'k' may be equal to	(4) 10

(A) (P) → (3), (Q) → (1), (R) → (4), (S) → (2)
(B) (P) → (1), (Q) → (2), (R) → (3), (S) → (4)
(C) (P) → (3), (Q) → (2), (R) → (3), (S) → (2)
(D) (P) → (4), (Q) → (3), (R) → (2), (S) → (1)

MQE067

SECTION–IV

- This section contains **ONE** question.
- Each question contains two columns, Column-I and Column-II.
- Column-I has four entries (A), (B), (C) and (D).
- Column-II has four entries (p), (q), (r), (s).
- Match the entries in Column-I with the entries in Column-II.
- For each question, marks will be awarded in one of the following categories:

Full Marks	: +4	If only correct answer is given.
Zero Marks	: 0	If no answer is given.
Negative Marks	: –1	For incorrect answer

---

20. Let $f(x)=\frac{x^2-6x+5}{x^2-5x+6}$

Match the expressions/statements in Column I with expressions/statements in Column II.

	Column-I		**Column-II**
(A)	If $-1 < x < 1$, then $f(x)$ satisfies	(p)	$0 < f(x) < 1$
(B)	If $1 < x < 2$, then $f(x)$ satisfies	(q)	$f(x) < 0$
(C)	If $3 < x < 5$, then $f(x)$ satisfies	(r)	$f(x) > 0$
(D)	If $x > 5$, then $f(x)$ satisfies	(s)	$f(x) < 1$

MQE068

Exercise - IV (JEE-Advanced PYQs)

1. The smallest value of k, for which both the roots of the equation, $x^2 - 8kx + 16(k^2 - k + 1) = 0$ are real, distinct and have values at least 4, is

[JEE 2009]

MQE069

2. Let p and q be real numbers such that $p \neq 0$, $p^3 \neq q$ and $p^3 \neq -q$. If α and β are nonzero complex numbers satisfying $\alpha + \beta = -p$ and $\alpha^3 + \beta^3 = q$, then a quadratic equation having $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ as its roots is **[JEE 2010]**

(A) $(p^3 + q)x^2 - (p^3 + 2q)x + (p^3 + q) = 0$

(B) $(p^3 + q)x^2 - (p^3 - 2q)x + (p^3 + q) = 0$

(C) $(p^3 - q)x^2 - (5p^3 - 2q)x + (p^3 - q) = 0$

(D) $(p^3 - q)x^2 - (5p^3 + 2q)x + (p^3 - q) = 0$

MQE070

3. Let α and β be the roots of $x^2 - 6x - 2 = 0$, with $\alpha > \beta$. If $a_n = \alpha^n - \beta^n$ for $n \geq 1$, then the value of $\frac{a_{10} - 2a_8}{2a_9}$ is **[JEE 2011]**

(A) 1 (B) 2 (C) 3 (D) 4

MQE071

4. A value of b for which the equations

$$x^2 + bx - 1 = 0$$
$$x^2 + x + b = 0,$$

have one root in common is - **[JEE 2011]**

(A) $-\sqrt{2}$ (B) $-i\sqrt{3}$ (C) $i\sqrt{5}$ (D) $\sqrt{2}$

MQE072

5. Let S be the set of all non-zero numbers α such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots x_1 and x_2 satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is(are) a subset(s) of S ?

[JEE Advanced 2015]

(A) $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$ (B) $\left(-\frac{1}{\sqrt{5}}, 0\right)$ (C) $\left(0, \frac{1}{\sqrt{5}}\right)$ (D) $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$

MQE073

PARAGRAPH

Let p, q be integers and let α, β be the roots of the equation, $x^2 - x - 1 = 0$, where $\alpha \neq \beta$. For $n = 0,1,2,\ldots.$, let $a_n = p\alpha^n + q\beta^n$.

FACT : If a and b are rational numbers and $a + b\sqrt{5} = 0$, then $a = 0 = b$.

6. If $a_4 = 28$, then $p + 2q =$

[JEE Advanced 2017]

(A) 14 (B) 7 (C) 12 (D 21

MQE074

7. $a_{12} =$

[JEE Advanced 2017]

(A) $2a_{11} + a_{10}$ (B) $a_{11} - a_{10}$ (C) $a_{11} + a_{10}$ (D) $a_{11} + 2a_{10}$

MQE075

8. Suppose a, b denote the distinct real roots of the quadratic polynomial $x^2 + 20x - 2020$ and suppose c, d denote the distinct complex roots of the quadratic polynomial $x^2 - 20x + 2020$. Then the value of $ac(a - c) + ad(a - d) + bc(b - c) + bd(b - d)$ is

[JEE Advanced 2020]

(A) 0 (B) 8000 (C) 8080 (D) 16000

MQE076

9. For $x \in \mathbb{R}$, then number of real roots of the equation $3x^2 - 4|x^2 - 1| + x - 1 = 0$ is ___.

[JEE Advanced 2021]

MQE077

ANSWER KEY

Exercise – I (JEE – Main Pattern)

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	4	2	3	1	4	1	1	1	2	1
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	4	1	2	4	1	2	4	2	2	2
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	254	191	24	5	7	4	4	3	3	20

Exercise – II (JEE – Main PYQs)

Question	1	2	3	4	5	6	7	8	9	10
Answer	1	2	1	1	2	3	3	1	2	4
Question	11	12	13	14	15	16	17	18	19	20
Answer	8.00	3	4	1	3	4	272	16	3	25
Question	21	22								
Answer	13	45								

Exercise – III (JEE – Advanced Pattern)

Section-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,B,C	C,D	A,D	B,D	B,C	A,B,D	A,B,D	A,B,D	B,D	B,C,D
	Q.	11	12	13							
	A.	A,B,D	A,B,C,D	A,D							
Section-II	Q.	14	15	16	17	18					
	A.	C	D	B	3.00	2.00					
Section-III	Q.	19									
	A.	A									
Section-IV	Q.	20									
	A.	A → p, r, s ; B → q, s ; C → q, s ; D → p, r, s									

Exercise – IV (JEE – Advanced PYQs)

Question	1	2	3	4	5	6	7	8	9
Answer	2	B	C	B	A,D	C	C	D	4