MATHS

JEE (MAIN AND ADVANCED) MATHEMATICS

THEORY OF EQUATIONS

Solved Examples

1. Write down the relations between the roots and the coefficients of the bi-quadratic equation

$x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$

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2. If -1,2 and α are the roots of

$2x^3 + x^2 - 7x - 6 = 0$, then find α

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3. Find the sum of the squares and the sum of the cubes of the roots of the equations $x^3 - px^2 + qx - r = 0$ in terms of p,q,r

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4. Let α, β, γ be the roots of

$x^3 + ax^2 + bx + c = 0$ then find $\sum \alpha^2\beta + \sum \alpha\beta^2$

.

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5. If α, β, γ are the roots of $x^3 - 3ax + b = 0$

prove that $\sum (\alpha - \beta)(\alpha - \gamma) = 9a.$

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6. solve $x^3 - 3x^2 - 16x + 48 = 0$

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7. Find the roots of $x^4 - 16x^3 + 86x^2 - 176x + 105 = 0$

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8. solve $x^3 - 7x^2 + 36 = 0$ given one root being twice the other .

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9. Solve $4x^3 - 24x^2 + 23x + 18 = 0$,givne that the roots of this equation are in arithmetic progression

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10. solve $x^3 - 7x^2 + 14x - 8 = 0$ given that the roots are in geometric progression.

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11. If the roots of $27x^4 - 195x^3 + 494x^2 - 520x + 192 = 0$ are in G.P. then the roots are

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12. Solve the equation $6x^3 - 11x^2 + 6x - 1 = 0$ the roots being in H.P

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13. Find the condition in order that the equation $ax^4 + 4bx^3 + 6cx^2 + 4dx + e = 0$ may have a pair of equal roots .

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14. Prove that the sum of any two of the roots of the equation $x^4 + px^3 + qx^2 + rx + s = 0$ is equal to

the sum of the remaining two roots of the equation iff $p^3 - 4pq + 8r = 0$

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15. Show that $x^5 - 5x^3 + 5x^2 - 1 = 0$ has three equal roots and find this root.

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16. Find the polynomial equation whose roots are the reciprocals of the roots of $x^5 + 11x^4 + x^3 + 4x^2 + 13x + 6 = 0$

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17. Find the equation whose roots multiplied by 2 of those of $x^5 - 2x^4 + 3x^3 - 2x^2 + 4x + 3 = 0$

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18. Find the equation whose roots are squares of the roots of $x^4 + x^3 + 2x^2 + x + 1 = 0$

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19. Solve the equation ,

$3x^5 - 4x^4 - 42x^3 + 56x^2 + 27x - 36 = 0$ given

that $\sqrt{2} + \sqrt{5}$ is one of its roots .

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20. Remove second term (second higher power of x)

from the equation

$x^3 + 6x^2 + 4x + 4 = 0$

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21. Remove the fractional coefficients from the following equations such that the coefficient of the leading term remains unity .

$$x^4 + \frac{3}{10}x^2 + \frac{13}{25}x + \frac{77}{1000} = 0$$

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22. Remove the fractional coefficients from the following equations such that the coefficient of the leading term remains unity .

$$x^4 + \frac{3}{10}x^2 + \frac{13}{25}x + \frac{77}{1000} = 0$$

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23. Find the cubic equation whose roots are the squares of the roots of the equation $x^3 + p_1 x^2 + p_2 x + p_3 = 0$

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24. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$, then form the cubic equation whose roots are $\alpha(\beta + \gamma), \beta(\gamma + \alpha), \gamma(\alpha + \beta)$

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25. If α, β, γ are the roots of $x^3 - 7x + 6 = 0$ then find the equation whose roots are $(\alpha - \beta)^2, (\beta - \gamma)^2, (\gamma - \alpha)^2$

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26. Find the equation whose roots are the translates of the roots of $x^4 - 5x^3 + 7x^2 - 17 = 0$ by -2

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27. Find the polynomial equation whose roots are the translates of the roots of the equation .

$x^4 - x^3 - 10x^2 + 4x + 24 = 0$ by 2 .

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28. Find the transformed equation of $x^3 - 6x^2 + 5x + 8 = 0$ in which x^2 term is absent.

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29. Remove the second term from the equation $x^4 + 4x^3 + 2x^2 - 4x - 2 = 0$

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30. Remove the third term from the equation $x^4 + 2x^3 - 12x^2 + 2x - 1 = 0$

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31. Show that $2x^3 + 5x^2 + 5x + 2 = 0$ is a reciprocal equation of class one .

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32. Solve $6x^5 - x^4 - 43x^3 + 43x^2 + x - 6 = 0$

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Examples

1. Find the quotient and remainder when $x^4 + 8x^3 + x - 5$ is divided by x+2.

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2. Divide $2x^5 - 3x^4 + 5x^3 - 7x^2 + 3x - 4 \text{by} x - 2.$

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3. Find quotient and the remainder when $2x^5 - 3x^4 + 5x^3 - 3x^2 + 7x - 9$ is divided by

$x^2 - x - -3$

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4. Find the quotient and remainder when $x^4 - 11x^3 + 44x^2 - 76x + 48$ is divided by $x^2 - 7x + 12$

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5. f(x) $= 2x^3 - 6x + p$ then find the interval in which p lies so that the equation f(x) =0 has 3 real and distinct roots .

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Exercise 2 1 Very Short Answer Questions

1. Form the polynomial equation of degree 3 whose roots are 2,3 and 6.

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2. find the (monic) polynomial equation of lowest degree whose roots are

$1, 3, 5, 7$

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3. Find the polynomial with rational coefficients and whose roots are

$0, 0, 2, 2, -2, -2$

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4. Find the polynomial with rational coefficients and whose roots are

$1 \pm 2i, 4, 2$

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5. Find the polynomial with rational coefficients and whose roots are

$1 \pm \sqrt{3}, 2, 5$

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6. Find the polynomial with rational coefficients and whose roots are

$0, 1, -3/2, 5/2$

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7. Find the polynomial with rational coefficients and whose roots are

$a+b, a-b, \ -a+b, \ -a-b$

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8. Find the values of $a, b, c, d,$ if 1,2,3,4 are the roots of $x^4+ax^3+bx^2+cx+d=0$

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9. Find the relation between the roots and the coefficients of the cubic equation .

$3x^3 - 10x^2 + 7x + 10 = 0$

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10. Find the relation between the roots and the coefficients of the cubic equation .

$3x^3 - 10x^2 + 7x + 10 = 0$

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11. Find the roots of

$x^4 - 16x^3 + 86x^2 - 176x + 105 = 0$

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12. If $8x^4 - 2x^3 - 27x^2 + 6x + 9 = 0$ then s_1, s_2, s_3, s_4 are

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13. If 1,-2 and 3 are roots of $x^3 - 2x^2 + ax + 6 = 0$, then find a .

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14. If $1, -2, 3$ are the roots of $x^3 - 6x^2 + 9x - 4 = 0$ then find $'\alpha'$

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15. If α, β and 1 are the roots of $x^3 - 2x^2 - 5x + 6 = 0$, then find α and β

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16. If the product of the roots of $4x^3 + 16x^2 - 9xa = 0$ is 9, then find a .

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17. If α, β, γ are the roots of $x^3 - px^2 + qx - r = 0$ and $r \neq 0$ then find $\frac{1}{\alpha^2} + \frac{1}{\beta^2} + \frac{1}{\gamma^2}$ in terms of p,q ,r

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18. If α, β, γ are the roots of $4x^3 - 6x^2 + 7x + 3 = 0$ then find the value of $\alpha\beta + \beta\gamma + \gamma\alpha.$

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Exercise 2 1 Short Answer Questions

1. If α, β and γ are the roots of

$x^3 - 2x^2 + 3x - 4 = 0$, then find

(i) $\sum \alpha^2\beta^2 (ii) \sum \alpha\beta(\alpha + \beta)$

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2. If α, β and γ are the roots of

$x^3 - 2x^2 + 3x - 4 = 0$, then find

(i) $\sum \alpha^2\beta^2 (ii) \sum \alpha\beta(\alpha + \beta)$

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3. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$

then find

$$\sum \frac{1}{\alpha}$$

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4. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$

then find

$$\sum \alpha^2$$

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5. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$

then find

$$\sum \alpha^2 \beta^2$$

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6. $\sum \frac{1}{\alpha^2 \beta^2}$

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7. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$

then find

$$\sum \alpha^3$$

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8. If α, β, γ are roots of the equation $x^3 + px^2 + qx + r = 0$, then $(\alpha + \beta)(\beta + \gamma)(\gamma + \alpha)$ =

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9. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ then find $(\beta + \gamma - 3\alpha)(\gamma + \alpha + \beta - 3\gamma)$

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10. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$

then find

$$\sum \alpha^2\beta + \sum \alpha\beta^2$$

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11.

$$\frac{\beta^2+\gamma^2}{\beta\gamma} + \frac{\gamma^2+\alpha^2}{\gamma\alpha} + \frac{\alpha^2+\beta^2}{\alpha\beta} \text{ or } \sum \frac{\beta^2+\gamma^2}{\beta\gamma}$$

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12. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$ prove that

$(\alpha+\beta)(\beta+\gamma)(\gamma+\alpha)=r-pq$

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13. If α, β, γ are the roots of $x^4-4x^2-x+2=0$ find the values of $\sum \alpha^2\beta$ and $\sum \frac{1}{\alpha^2}$

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14. If $alpah, \beta, \gamma$ are the roots of the equation $x^3+qx+r=0$ find the value of

$(\beta-\gamma)^2+(\gamma-\alpha)^2+(\alpha-\beta)^2$

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15. If $alpah, \beta, \gamma$ are the roots of the equation $x^3 + qx + r = 0$ find the value of

$$(\beta + \gamma)^{-1} + (\gamma + \alpha)^{-1} + (\alpha + \beta)^{-1}$$

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16. Show that $\frac{a^2}{x - \alpha} + \frac{b^2}{x - \beta} + \frac{c^2}{x - \gamma} - x + \delta = 0$ has only real roots if $a, b, c, \alpha, \beta, \gamma, \delta$ are all real .

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Exercise 2 2 Very Short Answer Questions

1. Find the quotient and the remainder when $x^4 - 6x^3 + 3x^2 + 26 - 24$ is divided by $x - 4$

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2. Given that 2 is a root of $x^3 - 6x^2 + 3x + 10 = 0$, find the other roots .

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3. find the condition that $x^3 - px^2 + qx - r = 0$ may have two roots equal in magniude but of opposite sign

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4. Find the condition that $x^3 - px^2 + qx - r = 0$ may have the sum of its roots zero .

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5. solve $x^3 - 3x^2 - 16x + 48 = 0$

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6. solve the following equations

$4x^3 + 16x^2 - 9x - 36 = 0$ given that the sum of

two roots is zero.

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Exercise 2 2 Short Answer Questions

1. Solve $9x^3 - 15x^2 + 7x - 1 = 0$, given that two of its roots are equal .

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2. If the two roots of $4x^3 + 20x^2 - 23x + 6 = 0$ are equal then find all the roots .

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3. Given that one root of $2x^3 + 3x^2 - 8x + 3 = 0$ is double of another root , find the roots of the equation.

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4. Solve $x^3 - 7x^2 + 36 = 0$ given one root being twice the other .

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5. solve $x^3 - 9x^2 + 14x + 24 = 0$ given that two of the roots are in the ratio 3:2

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6. show that the condition that the roots of $x^3 + 3px^2 + 3qx + r = 0$ may be in

$A.\ P$ is$2p^3 - 3pq + r = 0$

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7. show that the condition that the roots of $x^3 + px^2 + qx + r = 0$ may be in

G.P is $p^3r = q^3$

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8. show that the condition that the roots of $x^3 + 3px^2 + 3qx + r = 0$ may be in

h.P is $2q^3 = r(3pq - r)$

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9. Solve the following equation ,given that the root of each are in A.P .

(i) $8x^3 - 36c^2 - 18x + 81 = 0$

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10. solve the equations

$32x^3 - 48x^2 + 22x - 3 = 0$, the roots being in A.P.

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11. solve the equations

$x^3 - 3x^2 - 6x + 8 = 0$

the roots being in A.P

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12. Solve $18x^3 + 81x^2 + 121x + 60 = 0$ given that one roots is equal to half the sum of the remainging roots .

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13. If the roots of $x^4 - 2x^3 - 21x^2 + 22x + 40 = 0$ are in A.P. then the roots are

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14. Find the condition that $x^3 - px^2 + qx - r = 0$ may have the roots in G.P .

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15. Solve the equation

$3x^3 - 26x^2 + 52x - 24 = 0$

the roots being in G.P

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16. Solve the equation

$15x^3 - 23x^2 + 9x - 1 = 0$

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17. Solve the equation

$$6x^3 - 11x^2 + 6x - 1 = 0$$

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18. find the multiple roots of

$$8x^3 + 20x^2 + 6x - 9 = 0$$

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19. find the multiple roots of

$$12x^3 + 40x^2 + 39x + 9 = 0$$

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Exercise 2 2 Long Answer Questions

1. Solve the equation $x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$ the sum of two of roots being zero.

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2. Solve$8x^4 - 2x^3 - 27x^2 + 6x + 9 = 0$ given that two roots have the same absolute value , but are opposite in sign.

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3. Solve $x^4 + x^3 - 16x^2 - 4x + 48 = 0$ given that the product of two of the roots is 6.

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4. Solve $x^4 - 5x^3 + 5x^2 + 5x - 6 = 0$ given that the product of two of its roots is 3

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5. Solve the equation $x^4 + 4x^3 - 2x^2 - 12x + 9 = 0$ given that it has pairs of equal roots

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6. Find the multiple roots of

$$x^4 - 6x^3 + 13x^2 - 24x + 36 = 0$$

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7. solve the following equation , given that they have multiple roots .

$$3x^4 + 16x^3 + 24x^2 - 16 = 0$$

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8. Solve the equation given that it has multiple root

$$x^4 + 2x^3 - 3x^2 - 4x + 4 = 0$$

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9. Find the repeated roots of

$$x^5 - 3x^4 - 5x^3 + 27x^2 - 32x + 12 = 0$$

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Exercise 2 3 Very Short Answer Questions

1. Form the polynomial equation whose root are

$2, 1 \pm 3i$

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2. Form the polynomial equation whose root are

$1, 3 - \sqrt{-2}$

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3. From the polynomial equation whose roots are

1+I,1-I,-1+I,-1-I

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4. From the polynomial equation whose roots are 3,2,1+I,,1-I

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5. From the polynomial equation whose roots are 1+I,1-I,1+I,1-I

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6. Form the polynomial equation whose root are

$4 \pm \sqrt{3}, 2 \pm i$

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7. Form the polynomial with rational coefficients whose roots are

$1 + 5i, 5 - i$

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8. Form the polynomial with rational coefficients whose roots are

$4\sqrt{3}, 5 + 2i$

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9. Form the polynomial with rational coefficients whose roots are

$i - \sqrt{5}$

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10. Form the polynomial equation with rational coefficients whose roots are $-\sqrt{3} + i\sqrt{2}$

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11. Find the transformed equation whose roots are the negatives of the roots of the equation

$x^4 + 5x^3 + 11x + 3 = 0$

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12. Find the polynomial equation whose roots are the negatives of the roots of the equation

$x^4 - 6x + 7x^2 - 2x + 1 = 0$

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13. Find the equation whose roots are the reciprocals of the roots of

$x^4 + 3x^3 - 6x^2 + 2x - 4 = 0$

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14. Find the equation whose roots are the reciprocals of the roots of

$x^4 - 3x^3 + 7x^2 + 5x - 2 = 0$

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15. Find the equation whose roots are

3 times the roots of $x^3 + 2x^2 - 4x + 1 = 0$

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16. Find the equation whose roots are

3 times the roots of $6x^4 - 7x^3 + 8x^2 - 7x + 2 = 0$

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17. Find the equation whose roots are

2 times the roots of

$x^5 - 2x^4 + 3x^3 - 2x^2 + 4x + 3 = 0$

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18. Find the equation whose roots are the squares of the roots of

$x^3 + 3x^2 - 7x + 6 = 0$

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19. Find the equation whose roots are the squares of the roots of

$x^4 + x^3 + 2x^2 + x + 1 = 0$

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20. Find the equation whose roots are the cubes of the roots of $x^3 + 3x^2 + 2 = 0$

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Exercise 2 3 Short Answer Questions

1. Solve the equation $x^3 - 6x^2 + 7x + 2 = 0$ one root being $2 + \sqrt{5}$

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2. Solve the equation

$3x^3 - 4x^2 + x + 88 = 0$ given that $2 - \sqrt{-7}$ is a root .

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3. Solve the equation

$x^3 + 6x + 20 = 0$ one root being $l + 3i$

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4. Solve the equation

$3x^3 - 23x^2 + 72x - 70 = 0$ one root being $33 + \sqrt{-5}$

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5. Solve the equation

$x^4 - 5x^3 + 4x^2 + 8x - 8 = 0$ given that $1 - \sqrt{5}$ is a

root

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6. Solve the equation

$6x^4 - 13x^3 - 35x^2 - x + 3 = 0$ given that $2 + \sqrt{3}$

is a root

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7. Solve the equation

$x^4 - 9x^3 + 27x^2 - 29x + 6 = 0$ given that $2 - \sqrt{3}$

is a root.

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8. Solve the equation

$x^4 + 2x^3 - 5x^2 + 6x + 2 = 0$ given that $1 + i$ is a root

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9. Solve the equation

$x^4 - 6x^3 + 18x^2 - 30x + 25 = 0$ given that 2+I is a root

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10. Solve the equation

$x^4 + 4x^3 + 5x^2 + 2x - 2 = 0$ given that $-1 + \sqrt{-1}$ is a root

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11. Solve the equation

$x^4 + x^3 - 25x^2 + 41x + 66 = 0$ given that $3 + I\sqrt{2}$ is a root

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12. Solve the equation

$x^4 - 4x^2 + 8x + 35 = 0$ given that $2 + I\sqrt{3}$ is a root

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13. Solve the equation $x^5 - x^4 + 8x^2 - 9x + 15 = 0$ two of its roots being $-\sqrt{3}, 1 - 2\sqrt{-1}$

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14. Find the equation whose roots of m times the roots of the equation of

$x^3 + \frac{1}{4}x^2 - \frac{1}{16}x + \frac{1}{72} = 0$ and deduce the case when $m = 12$

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Exercise 2 3 Long Answer Questions

1. If α, β, γ are the roots of $x^3 - 6x^2 + 11x - 6 = 0$ then find the equation whose roots are

$\alpha^2 + \beta^2, \beta^2 + \gamma^2, \gamma^2 + \alpha^2$

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2. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ form the equation whose roots are $\alpha\beta, \beta\gamma, \gamma\alpha$

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3. Find the algebraic equation of degree 4 whose roots are the translates of the roots $4x^4 + 32x^3 + 83x^2 + 76x + 21 = 0$ by 2.

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4. Find the polynomial equation whose roots are the translates of the roots of the equation .

$x^4 - x^3 - 10x^2 + 4x + 24 = 0$ by 2 .

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5. Find the equation whose are the translates of the roots of

$x^5 - 4x^4 + 3x^2 - 4x + 6 = 0$ by -3

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6. Find the equation whose are the translates of the roots of

$x^5 + 4x^3 - x^2 + 11 = 0$ by -3

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7. Find the equation whose are the translates of the roots of

$3x^5 - 5x^3 + 7 = 0$ by 4

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8. Remove second term (second higher power of x) from the equation

$x^3 + 6x^2 + 4x + 4 = 0$

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9. Remove second term (second higher power of x)

from the equation

$x^3 - 6x^2 + 4x - 7 = 0$

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10. Remove second term (second higher power of x)

from the equation

$x^3 - 6x^2 + 10x - 3 = 0$

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11. Transform eanc of the following equations into ones in which of the coefficients of the second highest power of x is zero and also find their transformed equations

$x^4 + 4x^3 + 2x^2 - 4x - 2 = 0$

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12. Remove second term (second higher power of x) from the equation

$x^4 + 8x^3 + x - 5 = 0$

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13. Transform each of the following equations into ones in which the coefficients of the third highest power of x is zero . $x^3 + 2x^2 + x + 1 = 0$

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14. Solve the following equations

$4x^3 - 13x^2 - 13x + 4 = 0$

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15. Solve the equation

$6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0\,.$

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16. Solve the following equations .

$x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$

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17. Solve the following equations

$2x^5 + x^4 - 12x^3 - 12x^2 + x2 = 0$

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18. Solve the following equations

$$x^5 - 5x^4 + 9x^3 - 9x^2 + 5x - 1 = 0$$

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19. Solve the equation

$$6x^6 - 25x^5 + 31x^4 - 31x^2 + 25x - 6 = 0$$

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Additional Exercise

1. If the cubic equation $3x^3 + px + 5 = 0$ has exactly one real root then show that $p > 0$

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2. If α, β, γ are the roots of$x^3 - 3x^2 + 3x + 7 = 0$ then show that $\frac{\alpha - 1}{\beta - 1} + \frac{\beta - 1}{\gamma - 1} + \frac{\gamma - 1}{\alpha - 1} = 3\omega^2$ where ω is complex cube of unity .

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3. If α, β, γ are the roots of $x^3 + qx + r = 0$ then $\frac{1}{\alpha + \beta - \gamma} + \frac{1}{\beta + \gamma - \alpha} + \frac{1}{\gamma + \alpha - \beta} =$

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4. Show that the roots of the equation

$x^3 + px^2 + qx + r = 0$ are in

A.P $2p^3 - 9pq + 27r = 0$

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5. Show that the roots of the equation

$x^3 + px^2 + qx + r = 0$ are in

G.P $p^3 r = q^3$

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6. Show that the roots of the equation

$x^3 + px^2 + qx + r = 0$ are in

H.P $2p^3 = 9r(pq - 3r)$

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7. If α, β, γ are roots of $x^3 + ax^2 + bx + ab = 0$ find the equation whose roots are $\alpha^3, \beta^3, \gamma^3$

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8. If the sum of two roots of the equation $x^4 + px^3 + qx^2 + rx + s = 0$ equals the sum of the

other two ,prove that $p^3 + 8r = 4pq$

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9. Find the roots of

$x^4 - 16x^3 + 86x^2 - 176x + 105 = 0$

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Exercise I

1. The quotient obtained when

$x^4 + 11x^3 - 44x^2 + 76x + 48$ is divided by

$x^2 - 2x + 1$ is

A. $x^2 - 13x + 5$

B. $x^2 + 13x - 19$

C. $x^2 - 13x + 19$

D. $x^2 + 13x + 25$

Answer: B

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2. Find quotient and the remainder when $2x^5 - 3x^4 + 5x^3 - 3x^2 + 7x - 9$ is divided by $x^2 - x - \ - 3$

A. $33x + 4$

B. $41x + 3$

C. $47x + 21$

D. $33x - 4$

Answer: B

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3. The equation whose roots are $1 \pm 2I, 0, 1$ is

A. $x\left(\hat{}\ 3 + 3x^2 - 7x + 4\right) = 0$

B. $x\left(x^3 - 3x^2 + 7x - 5\right) = 0$

C. $x\left(x^3-3x^2-7x+4\right)=0$

D. $x\left(x^3-3x^2+7x-4\right)=0$

Answer: B

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4. The biquadratic equation, two of whose roots are 1 + i , 1 - $\sqrt{2}$ is

A. $x^4-4x^3+5x^2-2x-2=0$

B. $x^4-4x^3-5x^2+2x+2=0$

C. $x^4+4x^3-5x^2+2x-2=0$

D. $x^4 + 4x^3 - 5x^2 - 2x + 2 = 0$

Answer: A

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5. The equation of lowest degree with rational coeficients having a root $\sqrt{3} + \sqrt{2}i$ is

A. $x^4 + 2x^2 - 25 = 0$

B. $x^4 - 2x^2 + 25 = 0$

C. $x^4 + 10x^2 + 1 = 0$

D. $x^4 + 2x^2 + 25 = 0$

Answer: B

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6. If $\alpha, \beta, 1$ are roots of $x^3 - 2x^2 - 5x + 6 = 0 (\alpha > 1)$ then $3\alpha + \beta =$

A. 7

B. 5

C. 14

D. 10

Answer: A

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7. If product of two roots of $4x^3 + 16x^2 + kx - 36 = 0$ is -6 then k=

A. 9

B. -9

C. 8

D. -8

Answer: B

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8. The condition that the product of two of the roots $x^3 + px^2 + qx + r = 0$ is -1 is

A. $r^2 + pr + q + 1 = 0$

B. $q^2 + pq + q + 1 = 0$

C. $p^2pq + p + 1 = 0$

D. $r^2 - pr - q + 1 = 0$

Answer: A

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9. If the sum of the two roots of $x^3 + px^2 + qx + r = 0$ is zero then pq=

A. $-r$

B. r

C. $2r$

D. $-2r$

Answer: B

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10. If one of $x^3 + 3x^2 + 5x + k = 0$ is sum of the other two roots then k=

A. $\frac{11}{4}$

B. $\frac{17}{6}$

C. $\frac{25}{9}$

D. $\frac{33}{8}$

Answer: D

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11. If one root of $x^3 - 12x^2 + kx - 18 = 0$ is thrice the sum of remaining two roots then k=

A. 29

B. -29

C. 19

D. 15

Answer: A

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12. If the roots of $32x^3 - 48x^2 + 22x - 3 = 0$ are in A.P then the middle root is

A. 2

B. $\frac{1}{2}$

C. 4

D. $\frac{1}{4}$

Answer: B

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13. If the roots of the equation $4x^3 - 12x^2 + 11x + k = 0$ are in arithmetic progression then k=

A. -3

B. 1

C. 2

D. 3

Answer: A

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14. If the roots of $6x^3 - 11x^2 + 6x = 0$ are in H.P then one of the roots is

A. $\frac{1}{2}$

B. $-\frac{1}{2}$

C. 2

D. -2

Answer: A

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15. If the roots of $54x^3 - 39x^2 - 26x^2 - 26x + 16 = 0$ are in G.P then one root is

A. $-\frac{2}{3}$

B. $\frac{2}{3}$

C. $\frac{3}{2}$

D. $-\frac{3}{2}$

Answer: A

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16. IF the roots of $x^3 - 13x^2 + kx - 27 = 0$ are in G.P then k=

A. -30

B. 30

C. 39

D. -39

Answer: C

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17. If the roots of $x^3 - 42x^2 + 336x - 512 = 0$, are in increasing geometric progression, its common ratio is

A. 2

B. 3

C. 4

D. 6

Answer: C

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18. The condition that the roots of $x^3 - bx^2 + cx - d = 0$ are in G.P is

A. $c^3 = b^3 d$

B. $c^2 = b^2 d$

C. $c = bd^3$

D. $c = bd^2$

Answer: A

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19. The roots of the equation $x^3 - 3x - 2 = 0$ are

A. $-1, \ -1, 2$

B. $-1, 1, \ -2$

C. $-1, 2-3$

D. $-1, \ -1, \ -2$

Answer: A

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20. If one root of $24x^3 - 14x^2 - 63x + 45 = 0$ is the double the other then the roots are

A. $-1, \frac{1}{2}, 2$

B. $2, 2, -1$

C. $\frac{3}{4}, \frac{3}{2}, -\frac{5}{3}$

D. $-\frac{3}{2}, -\frac{3}{4}, -\frac{1}{3}$

Answer: C

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21. For the equilibrium $x^3 + 3x^2 - x - 2 = 0$ if s_1, s_2, s_3 have their usual notaion then

A. $s_1 <_3 < s_2$

B. $s_1 < s_2 < s_3$

C. $s_2 < s_1 < s_3$

D. $s_3 < s_1 < s_2$

Answer: B

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22. The repeated root of the equation $4x^3 - 12x^2 - 15x - 4 = 0$ is

A. $\frac{5}{2}$

B. $-\frac{1}{2}$

C. $\frac{1}{3}$

D. $-\frac{1}{3}$

Answer: B

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23. The non - repeated root of $x^3 + 4x^2 + 5x + 2 = 0$ is

A. $-\frac{5}{3}$

B. -2

C. -1

D. 1

Answer: B

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24. If $f(x) = 0$ has a repreated root α then another equation having α as root is

A. $f(2x) = 0$

B. $f(3x) = 0$

C. $f(x') = 0$

D. $f(4x) = 0$

Answer: C

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25. If α, β, γ are roots of the equation $x^3 + ax^2 + bx + c = 0$ then $\alpha^{-1} + \beta^{-1} + \gamma^{-1} =$

A. $\frac{a}{c}$

B. $-\frac{b}{c}$

C. $\frac{c}{a}$

D. $\frac{b}{a}$

Answer: B

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26. If α, β, γ are the roots of $x^3 + px^2 + qx - r = 0$ then $\alpha^2 + \beta^2 + \gamma^2 =$

A. $p^2 - 2q$

B. $p^3 - 3pq + 3r$

C. $p^4 - 3p^2q + 2q^2$

D. $2q$

Answer: A

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27. If α, β, γ are the roots of the equation $x^3 - 6x^2 + 11x + 6 = 0$ then $\sum \alpha^2\beta =$

A. 80

B. 94

C. 90

D. -84

Answer: B

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28. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$ then $\sum \alpha^2(\beta + \gamma) =$

A. $p^2 - 2q$

B. $-p^3+3pq-3r$

C. $p^4-4p^2q+4pr+2q^2$

D. $3r-pq$

Answer: D

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29. If α, β, γ are the roots of $x^3+2x^2-3x-1=0$ then $\alpha^{-2}+\beta^{-2}+\gamma^{-2}=$

A. 12

B. 13

C. 14

D. 15

Answer: B

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30. If $f(x) = x^4 + 3x^2 - 6x - 2$ then the coefficient of x^3 in $f(x+1)$ is

A. 24

B. -24

C. 4

D. -4

Answer: C

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31. The equation whose roots are multiplied by 3 of those of $2x^3 - 3x^2 + 4x - 5 = 0$ is

A. $2x^3 - 9x^2 + 36 - 135 = 0$

B. $2x^3 - 9x^2 - 36x + 135 = 0$

C. $x^3 - 9x^2 + 36x + 135 = 0$

D. $2x^3 - 9x^2 + 36x + 135 = 0$

Answer: A

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32. If α, β, γ are the roots of $x^3 + 2x^2 - 4x - 3 = 0$ then the equation whose roots are $\alpha/3, \beta/3, \gamma/3$ is

A. $x^3 + 6x^2 - 36x - 81 = 0$

B. $9x^3 + 6x^2 - 4x - 1 = 0$

C. $9x^3 + 6x^2 + 4x + 1 = 0$

D. $x^3 - 6x^2 + 36x + 81 = 0$

Answer: B

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33. The equation whose roots are those of equation $x^4 - 3x^3 + 5x^2 - 2 = 0$ with contrary sign is

A. $x^4 + 3x^3 + 5x^2 - 2 = 0$

B. $x^4 + 3x^3 + x^2 + 7x - 2 = 0$

C. $x^4 - 3x^3 + 8x^2 + 4 = 0$

D. $10x^4 - 13x^2 + 40 = 0$

Answer: A

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34. If α, β, γ are the roots of $x^3 + x^2 + 2x + 3 = 0$ then the equation whose roots $\beta + \gamma, \gamma + \alpha, \alpha + \beta$ is

A. $x^3 + 2x^2 + 3x - 1 = 0$

B. $x^3 + 2x^2 + 3x + 1 = 0$

C. $x^3 + 2x^2 + 3x + 1 = 0$

D. $x^3 - 2x^2 + 3x - 1 = 0$

Answer: A

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35. If α, β, γ are the roots of $x^3 + 3x^2 - 4x + 2 = 0$ then the equation whose roots are $\frac{1}{\alpha\beta}, \frac{1}{\beta\gamma}, \frac{1}{\gamma\alpha}$ is

A. $4x^3 - 6x^2 + 4x + 1 = 0$

B. $4x^3 + 6x^2 - 4x - 1 = 0$

C. $4x^3 + 6x^2 - 4x + 1 = 0$

D. $4x^3 - 6x^2 - 4x - 1 = 0$

Answer: D

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36. to remove the 2^{nd} term of the equation $x^4 - 10x^3 + 35x^2 - 50x^2 - 50x + 24 = 0$, diminish the roots by

A. $\frac{2}{5}$

B. $-\frac{2}{5}$

C. $\frac{5}{2}$

D. $-\frac{5}{2}$

Answer: C

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37. The transformed equation of $x^4 + 8x^3 + x - 5 = 0$ by eliminating second term is

A. $x^4 - 24x^2 + 65x - 55 = 0$

B. $x^4 + 24x^2 + 65x + 55 = 0$

C. $x^4 - 24x^2 - 65x + 55 = 0$

D. $x^4 + 24x^2 + 65x - 55 = 0$

Answer: A

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38. Each of the roots of the equation $x^3 - 6x^2 + 6x - 5 = 0$ are increased by k so that the new transformed equation does not contain x^2 term. Then k =

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. 1

D. -2

Answer: D

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39. If the roots of $x^4 + 5x^3 - 30x^2 - 40x + 64 = 0$ are in G.P then roots of $x^4 - 5x^3 - 30x^2 + 40x + 64 = 0$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: B

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40. If 1, -2, 3 are the roots of $ax^3 + bx^2 + cx + d = 0$ then the roots of $ax^3 + 3bx^2 + 9cx + 27d = 0$ are

A. $2, 4, 6$

B. $3, 4, 5$

C. $\frac{1}{2}, 1, \frac{3}{2}$

D. $-1, 0, 1$

Answer: A

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41. IF the roots of $ax^3 + bx^2 + cx + d = 0$ are in G.P then the roots of $ay^3 + bky^2 + ck^2y + dk^3 = 0$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: B

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42. If 1,3,4,0 are the roots of $ax^4 + bx^3 + cx^2 + dx + e = 0$ then the roots of $a(x+3)^4 + b(x+3)^3 + c(x+3)^2 + d(x+3) + e = 0$ are

A. $3, 9, 0, 12$

B. $4, 6, 3, 7$

C. $\frac{1}{3}, 1, 0, \frac{4}{3}$

D. $-2, 0, 1, -3$

Answer: D

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43. The reciprocal equation is

A. $2x^3 + 4x^2 + 2x + 2 = 0$

B. $2x^3 + 4x^2 + 4x + 2 = 0$

C. $2x^3 + 4x^2 + 2x + 4 = 0$

D. $2x^3 + 2x^2 + 4x - 4 = 0$

Answer: B

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44. The equation x^4 + 3x^3 -3x -1=0` is a reciproca, equation of

A. class one and odd order

B. class two and even order

C. class one and even order

D. class two and odd order

Answer: B

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45. The reciprocal equation is

A. class one and x=1 is a root

B. class one and x=-1 is a root

C. class two and $x = \pm 1$ are roots

D. class two and x=1 is a root but not x=-1

Answer: C

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46. If α is a positive root of the equation $x^4 + x^3 - 4x^2 + x + 1 = 0$ then $\alpha + \frac{1}{\alpha}$

A. 2

B. -2

C. 3

D. 4

Answer: A

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47. If 2,3 are two roots of the reciprocal equation $6x^5 - 29x^4 + 2x^3 + 2x^2 - 29x + 6 = 0$ then the other roots are

A. $1, -2, 3$

B. $-1, -2, -3$

C. $-1, \frac{1}{2}, \frac{1}{3}$

D. $1, \frac{1}{2}, \frac{1}{3}$

Answer: C

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Exercise Ii

1. The value of k so that $x^4 - 3x^3 + 5x^2 - 33x + k$ is divisible by $x^2 - 5x + 6$ is

A. 45

B. 48

C. 51

D. 54

Answer: D

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2. If $f(x) = 2x^4 - 13x^2 + ax + b$ is divisible by $x^2 - 3x + 2$ then $(a, b) =$

A. $(-9, -2)$

B. $(6, 4)$

C. $(9, 2)$

D. $(2, 9)$

Answer: C

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3. Let $a \neq 0$ and $p(x)$ be a polynomial of degree greater than 2. If P(x) leaves remainder a and -a when divided respectively by x+a and x-a then the remainder when p(X) is divided by $x^2 - a^2$ is

A. 2x

B. $-2x$

C. x

D. $-x$

Answer: D

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4. If f(x) is is a polynomial of degree n with rational coefficients and $1+2I, 2-\sqrt{3}$ and 5 are roots of f(x) =0 then the least value of n is

A. 5

B. 4

C. 3

D. 6

Answer: A

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5. If $\frac{1+I\sqrt{3}}{2}$ is a root of the equation $x^4 - x^3 + x - 1 = 0$ then its real roots are

A. $1, 1$

B. $-1, -1$

C. $1, 2$

D. $1, -1$

Answer: D

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6. If the roots of the equation

$x^4 - 10x^3 + 50x^2 - 130x + 169 = 0$ are of the form

$a \pm ib$ and $b \pm ia$ then (a,b)=

A. $(3, 2)$

B. $(2, 1)$

C. $(-3, 2)$

D. $(-3, -2)$

Answer: A

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7. If 1,2,3 and 4 are the roots of the equation $x^4 + ax^3 + bx^2 + cx + d = 0$ then $a + 2b + c =$

A. -25

B. 0

C. 10

D. 24

Answer: C

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8. If $\sqrt{3}+1$ is a root of the equation $3x^3+ax^2+bx+12=0$ where a and b are rational numbers then (a,b)=

A. $12, -6$

B. $-12, 6$

C. $-12, -6$

D. $6, 12$

Answer: B

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9. If the roots of $x^3 - 9x^2 + kx + l = 0$ are in A.P with common difference 2 then (k,l) =

A. $(15 - 15)$

B. $(23, -15)$

C. $(15, -23)$

D. $(-15, 23)$

Answer: B

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10. The roots of the equation $x^3 - 14x^2 + 56x - 64 = 0$ are in ..... progression

A. $A.\ G.\ P$

B. H.P

C. A.P

D. G.P

Answer: D

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11. The roots of $48x^3 - 44x^2 + 12x - 1 = 0$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: C

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12. The difference between two roots of the equation $x^3 - 13x^2 + 15x + 189 = 0$ is 2 then the roots of the equation are

A. $-3, 7, 9$

B. $-3, -1, -9$

C. $3, 5, 7$

D. $-3, -1, 9$

Answer: A

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13. If two roots of $x^3 - 9x^2 + 14x + 24 = 0$ are in the ratio 3:2 then the roots are

A. $6, 4, -1$

B. $3, 2, 4$

C. $\frac{1}{2}, \frac{1}{3}. \frac{49}{6}$

D. $6, 4, 2$

Answer: A

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14. If - 1 + i is a root of $x^4 + 4x^3 + 5x^2 + 2x + k = 0$ then k =

A. $-1, -1$

B. $-\frac{1}{2}, -\frac{3}{2}$

C. $-1 \pm \sqrt{2}$

D. $1 \pm \sqrt{2}$

Answer: C

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15. If the roots of $x^4 - 8x^3 + 14x^2 + 8x - 15 = 0$ are in A.P then the roots are

A. $-1, 1, 3, 5$

B. $1, 1, -3, -5$

C. $1, 3, 5, 7$

D. $1, 2, 3, 4$

Answer: A

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16. If the roots of $x^4 + 5x^3 - 30x^2 - 40x + 64 = 0$ are in G.P then roots of $x^4 - 5x^3 - 30x^2 + 40x + 64 = 0$ are in

A. $1, 2, 4, 8$

B. $\pm 1, 2, 3$

C. $\pm 2i, 2, 3$

D. $\frac{3}{2}, -\frac{1}{3}, 2 \pm \sqrt{3}$

Answer: A

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17. If the sum of two of the roots of $x^4 - 2x^3 - 3x^2 + 10x - 10 = 0$ is zero then the roots are

A. $\pm\sqrt{5}, 1 \pm i$

B. $\pm\sqrt{5}, 1, -1$

C. $\frac{1}{2}, -\frac{1}{5} \pm 1$

D. $a\sqrt{2}, \sqrt{5}, \pm 2$

Answer: A

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18. the roots of the equation $x^4 - 6x^3 + 18x^2 - 30x + 25 = 0$ are of the form $a \pm Ib$ and b $\pm$ ia then $(a, b) =$

A. $(3, 2)$

B. $(2, 1)$

C. $(-3, 6)$

D. $(-3, -2)$

Answer: B

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19. Assertion (A) : If 1,2,3 are the roots of $ax^3 + bx^2 + cx + d = 0$ then the roots of $ax^3 + 2bx^2 + 4cx + 8d = 0$ are =0 are $2, 4, 6$

Reason (R) : the equation whose roots are k times the roots of the equation $f(x) = 0$ is $f\left(\frac{x}{k}\right) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not the correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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20. If the product of two of the roots of $x^4 - 5x^3 + 5x^2 + 5x - 6 = 0$ is 2 then the roots are

A. $1, -2, 4, -8$

B. $\pm 1, 2, 3$

C. $\pm 2i, 2, 3$

D. $-\frac{3}{2}, -\frac{1}{2}, 2 \pm \sqrt{3}$

Answer: B

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21. The equation $x^3 - 3qx + 2r = 0$ has a repeated root then

A. $q^2 = r^3$

B. $q = r^2$

C. $q^3 = r$

D. $q^3 = r^2$

Answer: D

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22. If there is a multiple root of order 3 for the equation $x^4 - 2x^3 + 2x - a = 0$ then the other root is

A. -1

B. 0

C. 1

D. 2

Answer: A

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23. The difference of the irrational roots of the equation $x^5 - 5x^4 + 9x^3 - 9x^2 + 5x - 1 = 0$ is

A. $\sqrt{5}$

B. 0

C. 1

D. 2

Answer: D

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24. If α, β, γ are the roots of $x^3 + 2x^2 + 3x + 8 = 0$ then $(3-\alpha)(3-\beta)(3-\gamma)$=

A. 52

B. 62

C. 65

D. 67

Answer: B

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25. If α, β, γ are the roots of the equation $x^3 - px^2 + qx + r = 0$ then $(\alpha + \beta)(\beta + \gamma)(\gamma + \alpha) =$

A. $2\left(p^2 - 3q\right)$

B. $r - pq$

C. $qp + r$

D. $\frac{p^2 - 2q}{r^2}$

Answer: C

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26. If α, β, γ are the roots of the equation $x^3 + 4x + 1 = 0$, then $(\alpha + \beta)^{-1} + (\beta + \gamma)^{-1} + (\gamma + \alpha)^{-1}$ is equal to

A. 2

B. 3

C. 4

D. 5

Answer: C

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27. If α, β, γ are the roots of $2x^3 - 2x - 1 = 0$ the $\sum(\alpha\beta)^2$ =

A. -1

B. 1

C. 2

D. 3

Answer: B

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28. $\sum \frac{1}{\alpha^2\beta^2}$

A. $\frac{q^2 - 2pr}{r^2}$

B. $q^3 - 3pqr + 3r^2$

C. $\frac{p^2 - 2q}{r^2}$

D. $\frac{pq}{r - 3}$

Answer: C

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29. If α, β, γ are the roots of $x^3 + qx + r = 0$ then $\frac{1}{\alpha + \beta - \gamma} + \frac{1}{\beta + \gamma - \alpha} + \frac{1}{\gamma + \alpha - \beta} =$

A. $\frac{q}{2r}$

B. $\frac{q}{r}$

C. $\frac{2q}{r}$

D. $-\frac{2q}{r}$

Answer: A

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30. If $f(x) = 5x^3 + 4x^2 - 13x - 25$ and $f(x-3) = 5x^3 - 41x^2 + 98x + k$ then $k =$

A. 85

B. -85

C. 105

D. -105

Answer: B

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31. The equation whose roots exceed by 2 than the roots of $4x^4 + 32x^3 + 83x^2 + 76x + 21 = 0$ is

A. $4x^4 + 13x^2 + 9 = 0$

B. $4x^4 - 13x^2 + 9 = 0$

C. $4x^4 + 12x^2 - 9 = 0$

D. $4x^4 + 12x^2 - 9 = 0$

Answer: B

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32. Find the polynomial equation whose roots are the squares of the roots of $x^4 + x^3 + 2x^2 + x + 1 = 0$

A. $x^4 - 3x^3 + 4x^2 + 3x + 1 = 0$

B. $x^4 + 3x^3 + 4x^2 + 3x + 1 = 0$

C. $x^4 - 3x^3 - 4x^2 + 3x + 1 = 0$

D. $x^4 - 3x^3 - 4x^2 - 3x + 1 = 0$

Answer: B

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33. Form the polynomial equation whose roots are cubes of the roots of $x^3 + 3x^2 + 2 = 0$

A. $x^3 + 33x^2 + 12x + 8 = 0$

B. $x^3 + 33x^2 - 12x - 8 = 0$

C. $x^3 - 33x^2 + 12x - 8 = 0$

D. $x^3 + 33x^2 + 12x - 8 = 0$

Answer: A

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34. If 1,2,3 are the roots of $ax^3 + bx^2 + cx + d = 0$ then the roots of $ax\sqrt{x} + bx + c\sqrt{x} + d = 0$ are

A. 2,3,4

B. 1,4,9

C. $2, 4, 6$

D. $1, \sqrt{2}, \sqrt{3}$

Answer: B

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35. If α, β, γ are the roots of $x^3 - 6x - 4 = 0$ then the equation whose roots are $\left(\beta\gamma + \frac{1}{\alpha}\right), \left(\gamma\alpha + \frac{1}{\beta}\right), \left(\alpha\beta + \frac{1}{\gamma}\right)$ is

A. $4x^3 - 30x^2 + 125 = 0$

B. $x^3 + 15x^2 - 120 = 0$

C. $4x^3 + 30x^2 - 125 = 0$

D. $4x^3 - 30x^2 - 125 = 0$

Answer: C

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36. If α, β, γ are the roots of $x^3 + 4x + 1 = 0$ then the equation whose roots are $\frac{\alpha^2}{\beta+\gamma}, \frac{\beta^2}{\gamma+\alpha}, \frac{\gamma^2}{\alpha+\beta}$ is

A. $x^3 - 4x - 1 = 0$

B. $x^3 - 4x + 1 = 0$

C. $x^3 + 4x - 1 = 0$

D. $x^3 + 4x + 1 = 0$

Answer: C

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37. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$ then $\sum \alpha^2(\beta + \gamma) =$

A. 2q

B. $q^2 + pr$

C. $p^2 - qr$

D. $r(pq - r)$

Answer: B

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38. Remove the third term from the equation $x^4 + 2x^3 - 12x^2 + 2x - 1 = 0$

A. 0

B. 1

C. 2

D. 3

Answer: C

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39. Number of transformed equations of $x^3 + 2x^2 + x + 1 = 0$ by eliminating third term is

A. 4

B. 3

C. 2

D. 1

Answer: C

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40. The transformed equation

$x^3 - \frac{5}{2}x^2 - \frac{7}{18}x + \frac{1}{108} = 0$ by removing fractional coefficients is

A. $x^3 - 3x^2 - x + 12 = 0$

B. $x^3 - 3x^2 - x + 6 = 0$

C. $x^3 - 3x^2 - 24x - 216 = 0$

D. $x^3 - 15x^2 - 14x + 2 = 0$

Answer: D

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41. The transformed equation with integer co-effcients whose roots are multipled by some constant of those of $x^4 - \frac{1}{2}x^3 + \frac{3}{4}x^2 - \frac{5}{4}x + \frac{1}{16} = 0$ is

A. $y^4 - y^3 + 3y^2 - 10y + 1 = 0$

B. $y^4 - 24y^2 + 9y - 24 = 0$

C. $y^4 - 2y^3 + 6y - 6 = 0$

D. $y^4 - 5y^3 + 3y^2 - 9y + 27 = 0$

Answer: A

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42. If the equation whose roots are p times the roots of $x^4 + 2x^3 + 46x^2 + 8x + 16 = 0$ is a reciprocal equation then p=

A. 2

B. 3

C. $\pm \frac{1}{2}$

D. $\pm \frac{1}{3}$

Answer: C

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43. Let $\alpha \neq 1$ be a real root of the equation $x^3 - ax^2 + ax - 1 = 0$, where a $\neq$ - 1 is a real number, then a root of this equation, among the following , is :

A. α^2

B. $-\frac{1}{\alpha^2}$

C. $\frac{1}{\alpha}$

D. $\frac{1}{\alpha^2}$

Answer: C

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44. Assertion (A) : If 1,2,3 are the roots of $ax^3 + bx^2 + cx + d = 0$ then the roots of $ax^3 + 2bx^2 + 4cx + 8d = 0$ are =0 are $2, 4, 6$

Reason (R) : the equation whose roots are k times the roots of the equation $f(x) = 0$ is $f\left(\frac{x}{k}\right) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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45. Assertion (A) : if $x^4 - x^3 - 6x^2 + 4x + 8 = 0$ has a multiple root then the equation having the same root is $4x^3 - 3x^2 - 12x + 4 = 0$

Reason (R) : If α is repeated root of $f(x) = 0$ then α is also a root of $f^1(x) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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46. Assertion (A) : If α, β, γ are the roots of $x^3 - x - 1 = 0$ then $\alpha^3 + \beta^3 + \gamma^3 = 1$

Reason (R): If a +b+c=0 then $a^3 + b^3 + c^3 = 3abc$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: D

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47. Assertion (A) : the number of roots of $x^4 + 2x^3 - 7x^2 - 8x + 12 = 0$

Reason (R) : Every algebraic equation of degree n has n roots and nomore .

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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48. Assertion (A) : the roots $x^4 - 5x^2 + 6 = 0$ are $\pm\sqrt{2},\ \pm\sqrt{3}$

Reason (R) : the equation having the roots $\alpha_1, \alpha_2, \ldots\ldots, \alpha_n$ is $(x - \alpha_1)(x - \alpha_2)\ldots(x - \alpha_n) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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49. For $k > 0$ if $k\sqrt{-1}$ is a root of the equation $x^4 + 6x^3 - 16x^2 + 24x - 80 = 0$ then k^2 =

A. 2

B. 3

C. 4

D. 6

Answer: C

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50. If the roots of the equation $x^3 + 3px^2 + 3qx - 8 = 0$ are in a geometric progression , then $\frac{q^3}{p^3}$=

A. 1

B. -2

C. 4

D. -8

Answer: D

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51. If the roots of the equation

$$x^3 - 7x^2 + 14x - 8 = 0$$

are in geometric progression, then the difference between the largest and the smallest roots is

A. $\frac{1}{2}$

B. 2

C. 3

D. 4

Answer: C

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52. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ then the value of $(1+\alpha^2)(1+\beta^2)(1+\gamma^2)$ is

A. $(r+p)^2 + (q+1)^2$

B. $(r-p)^2 + (q-1)^2$

C. $(1+p)^2 + (1+q)^2$

D. $(r-p)^2 + (r-q)^2$

Answer: B

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53. If the equation

$$x^5 - 3x^4 - 5x^3 + 27x^2 - 32x + 12 = 0$$

has repeated roots , then the prime number that divides the non repeated root of this equation is

A. 7

B. 5

C. 3

D. 2

Answer: C

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54. If α, β are the roots of $x^2 - 3x + a = 0$ and γ, δ are the roots of $x^2 - 12x + b = 0$ and $\alpha, \beta, \gamma, \delta$ in that order from a geometric progression increasing order with common ration $r > 1$ then $a + b =$

A. 16

B. 28

C. 34

D. 42

Answer: C

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Exercise Iii

1. The quotient obtained when $3x^4 - x^3 + 2x^2 - 2x - 4$ is divided by $x^2 - 4$ is

A. $3X^2 - 7X + 16$

B. $3x^2 + x + 14$

C. $3x^2 - x - 14$

D. $3x^2 - x + 14$

Answer: D

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2. The value of k so that $x^4 - 4x^3 + 5x^2 - 2x + k$ is divisible by $x^2 - 2x + 2$ is

A. 0

B. -2

C. -1

D. 2

Answer: B

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3. The equation whose roots are $1, 2 \pm 3i$ is

A. $x^3 - 4x^2 + x + 6 = 0$

B. $x^3 - x^2 - 3x + 3 = 0$

C. $x^3 - 4x^2 - 8x + 8 = 0$

D. $x^3 - 5x^2 + 17x - 13 = 0$

Answer: D

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4. The polynomial equation of the lowest degree having roots $1, \sqrt{3}i$ is

A. $x^3 + x^2 + 3x + 3 = 0$

B. $x^3 - x^2 + 3x - 3 = 0$

C. $x^3 + x^2 - 3x - 3 = 0$

D. $x^2 - \left(1 + \sqrt{3}i\right)x + \sqrt{3}i = 0$

Answer: B

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5. The equation of lowest degree with rational coefficient having a root $\sqrt{3} + \sqrt{2}$ is

A. $x^4 - 2x^2 + 1 = 0$

B. $x^4 + 10x^2 + 1 = 0$

C. $x^4 - 10x^2 + 1 = 0$

D. $x^4 + 10x^2 - 1 = 0$

Answer: C

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6. If one root of $x^3 - 6x^2 + 3x + 10 = 0$ is 2 then the remaining two roots are

A. $2, -\frac{5}{2}$

B. $5, -1$

C. $-5, 1$

D. $2, \frac{5}{2}$

Answer: B

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7. If one root of $10x^3 - x^2 - 278x + 165 = 0$ is 5 then product of the remaining two roots is

A. 33

B. $-\frac{33}{5}$

C. $-\frac{33}{10}$

D. $\frac{33}{10}$

Answer: C

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8. If the product of two of the roots of $x^3 + kx^2 - 3x + 4 = 0$ is -1 then k=

A. $\frac{7}{2}$

B. $\frac{9}{2}$

C. $-\frac{7}{2}$

D. $-\frac{9}{2}$

Answer: C

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9. The condition for one root of $x^3 + ax^2 + bx + c = 0$ is sum of the other two roots , is

A. a^3=4(ab-c)

B. a^3=4(ab-2c)

C. a^3=ab-c

D. a^3=ab-2c

Answer: A

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10. If one of the roots of $18x^3 + 81x^2 + 121x + 60 = 0$ is equal to half the sum of the other two then one of its roots is

A. $-\frac{3}{2}$

B. $\frac{3}{2}$

C. $\frac{2}{3}$

D. $-\frac{2}{3}$

Answer: A

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11. If the roots of the equation $x^3 - 9x^2 + 23x - 15 = 0$ are in A.P then common difference of that A.P is

A. 3

B. 1

C. 2

D. 4

Answer: C

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12. If the roots of $24x^3 - 26x^2 + 9x - 1 = 0$ are in H.P then the roots are

A. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$

B. $1, \frac{1}{3}, \frac{1}{8}$

C. $\frac{1}{8}, \frac{1}{3}, \frac{1}{3}$

D. $2, 3, 4$

Answer: A

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13. If α, β, γ are the roots of $x^3 - 3ax^2 + 3bx - c = 0$ which are in H.P then $\beta =$

A. $\frac{c}{b}$

B. $-\frac{b}{a}$

C. $\frac{b}{c}$

D. b

Answer: A

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14. If the root of $kx^3 - 18x^2 - 36x + 8 = 0$ are in H.P then k=

A. 81

B. 63

C. 64

D. 56

Answer: A

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15. If the roots of $x^3 - 14x^2 + 56x - 64 = 0$ are in G.P then the middle root is

A. 4

B. -4

C. 6

D. 8

Answer: A

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16. If $x^4 - 12x^3 + 52x^2 - 96x + 64 = 0$ have pairs of equal roots then the roots are

A. $1, 1, 5, 5$

B. $2, 2, 4, 4$

C. $3, 3, 3, 3$

D. $-5, -1, -5, -1$

Answer: B

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17. If the roots of $x^4 - 2x^3 - 21x^2 + 22x + 40 = 0$ are in A.P then the roots are

A. $\frac{2}{3}, -\frac{1}{2}, 1, 2$

B. $1, \pm 2, -3$

C. $\pm\sqrt{3}, \frac{3}{4}, -\frac{1}{2}$

D. $-4, -1, 2, 5$

Answer: D

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18. If the roots of $27x^4 - 195x^3 + 494x^2 - 520x + 192 = 0$ are in G.P. then the roots are

A. $-1, 1, 3, 5$

B. $1, 1, -3, -5$

C. $\frac{8}{9}, \frac{4}{3}, 2, 3$

D. $-2, \frac{1}{2}, 3, 1$

Answer: C

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19. The roots of $x^3 - 13x^2 + 39x - 27 = 0$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: B

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20. If $x^3 - 3x^2 + 4 = 0$ has a multiple root then that multiple root is

A. 0

B. 2

C. 1

D. 3

Answer: B

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21. The multiple roots of $x^4 - 2x^3 - 11x^2 + 12x + 36 = 0$ are

A. $1, 2$

B. $-1, 2$

C. $2, 3$

D. $-2, 3$

Answer: D

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22. If α, β, γ are the roiots of $x^3 - 10x^2 + 6x - 8 = 0$ then $\alpha^2 + \beta^2 + \gamma^2$ =

A. -88

B. 88

C. -7

D. 1

Answer: B

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23. If α, β, γ are roots of $x^3 + px^2 + qx + r = 0$ then $\sum \frac{1}{\alpha^2}$ =

A. $\frac{q^2 - 2pr}{r^2}$

B. $q^3 - 3pqr + 3r^2$

C. $\frac{p^2 - 2q}{r^2}$

D. $\frac{pq}{r} - 3$

Answer: A

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24. If α, β and γ are the roots of

$x^3 - 2x^2 + 3x - 4 = 0$, then find

(i) $\sum \alpha^2\beta^2 (ii) \sum \alpha\beta(\alpha + \beta)$

A. 6

B. -6

C. 7

D. -7

Answer: B

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25. If α, β, γ are the roots of $x^3 + qx + r = 0$ then $\sum(\beta + \gamma)^{-1}$=

A. $\frac{q}{r}$

B. $\frac{r}{q}$

C. $-\frac{q}{r}$

D. $-\frac{r}{q}$

Answer: A

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26. If α, β, γ are roots of $x^3 - 2x^2 + 3x - 4 = 0$, then $\sum a^2\beta^2$ =

A. 7

B. -7

C. 6

D. -6

Answer: B

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27. If α, β, γ are the roots of the equation $x^3 + 4x^2 - 5x + 3 = 0$ then $\sum \frac{1}{\alpha^2 \beta^2} =$

A. $-\frac{9}{2}$

B. $-\frac{38}{49}$

C. $\frac{26}{9}$

D. 98

Answer: C

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28. If α, β, γ are the roots of $x^3 + 2x^2 + 3x + 8 = 0$ then $(\alpha + \beta)(\beta + \gamma)(\gamma + \alpha)$=

A. -4

B. 4

C. -2

D. 2

Answer: D

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29. If α, β, γ are the roots of $x^3 - 7x + 6 = 0$ the equation whose roots are $\alpha + \beta, \beta + \gamma, \gamma + \alpha$ is

A. $x^3 + 7x + 6 = 0$

B. $x^3 + 7x - 6 = 0$

C. $x^3 - 7x - 12 = 0$

D. $x^3 - 7x - 6 = 0$

Answer: D

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30. If α, β, γ are the roots of $x^3 - 3x + 1 = 0$ then the equation whose roots are $\alpha - \frac{1}{\beta\gamma}, \beta - \frac{1}{\gamma\alpha}, \gamma - \frac{1}{\alpha\beta}$ is

A. $x^3 - 3x + 8 = 0$

B. $x^3 - 6x + 8 = 0$

C. $x^3 - 9x + 8 = 0$

D. $x^3 - 12x + 8 = 0$

Answer: D

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31. The equation whose roots are squares of the roots of $x^3 + 2x^2 - x + 3 = 0$ is

A. $x^3 - 6x^2 - 11x - 9 = 0$

B. $x^3 - 6x^2 - 11x + 9 = 0$

C. $x^3 + 6x - 11x - 9 = 0$

D. $x^3 + 6x^2 + 11x + 9 = 0$

Answer: A

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32. The equation whose roots are cubes of the roots $x^3 + 2x^2 + 3 = 0$ is

A. $x^3 + 6x^2 - 36x + 27 = 0$

B. $x^3 - 5x^3 - 11x + 3 = 0$

C. $x^3 - 23x^2 + 13x - 36 = 0$

D. $x^3 + 17x^2 + 27x + 27 = 0$

Answer: D

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33. If $f(x) = x^3 + x^2 + x + 1$ then the coefficient of x in $f(x + 5)$ is

A. 86

B. 76

C. 64

D. 97

Answer: A

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34. The equation whose roots are opposite in sign and equal to magnitude of the roots of $x^4 - 5x^3 + 11x + 3 = 0$ is

A. $x^4 + 5x^3 - 11x - 3 = 0$

B. $x^4 + 5x^3 - 11x + 3 = 0$

C. $x^4 + 5x^3 - 11x + 6 = 0$

D. $x^4 + 5x^3 - 9x + 3 = 0$

Answer: B

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35. To remove the 2^{nd} term of the equation $x^4 - 8x^3 + x^2 - x + 3 = 0$, diminish the roots by

A. 8

B. -8

C. -2

D. 2

Answer: D

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36. The transformed equation of $x^3 - 6x^2 + 5x + 8 = 0$ by eliinatin second term is

A. $x^3 + 7x + 2 = 0$

B. $x^3 - 7x + 2 = 0$

C. $x^3 + 5x + 2 = 0$

D. $x^3 - 5x + 2 = 0$

Answer: B

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37. If the roots of $ax^3 + bx^2 + cx + d = 0$ are in G.P then the roots of $dx^3 - cx^2 + bx - a = 0$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: B

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38. If 2,5,7,-4 are the roots of $ax^4 + bx^3 + cx^2 + dx + e = 0$ then the roots of $ax^4 - bx^3 + cx^2 - dx + e = 0$ are

A. $2, 5, 7, -4$

B. $-2, -5, -7, 4$

C. $2, 5, 7, 4$

D. $2, -5, 7, -4$

Answer: B

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39. If the roots of $ax^3 + bx^2 + cx + d = 0$ are in G.P then the roots of $ak^3x^3 + bk^2x^2 + ckx + d = 0$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: B

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40. If the roots of $ax^3 + bx^2 + cx + d = 0$ are in A.P then the roots of $a(x+k)^3 + b(x+k)^2 + c(x+k) + d = 0$ are in

A. G.P

B. A.P

C. H.P

D. A.G.P

Answer: B

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41. solve $x^5 - 5x^4 + 9x^3 - 9x^2 + 5x - 1 = 0$

A. 1^{st} type and x=1 is a solution

B. 1^{st} type and x=-1 is a solution

C. 2^{nd} type and x=1 is a solution

D. 2^{nd} type and x=-1 is a solution

Answer: C

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42. The equation $x^6 - 2x^5 + 3x^4 - 3x^2 + 2x - 1 = 0$ is R.E . Of the

A. 1^{st} type and x=1 is a solution

B. 1^{st} type and x=-1 is a solution

C. 2^{nd} type and $x^2 = 1$ is a solution

D. 1^{st} type and $x^2 = -1$ is a solution

Answer: C

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43. The equation $6x^5 + 7x^4 + 12x^3 + 12x^2 + 7x + 6 = 0$ is a reciprocal equation of

A. class one and odd order

B. class two and odd order

C. class one and even order

D. Class two and even order

Answer: A

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44. Assertion (A) : The equation whose roots are the squeares of the roots of $x^4 + x^3 + 2x^2 + x + 1 = 0$ is $x^4 + 3x^3 + 4x^2 + 3x + 1 = 0$

Reason (R) : the equation whose roots are the squares of the roots of f (x) =0 is obtained by eliminating squares root from $f\left(\sqrt{x}\right) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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45. Assertion (A) : the equation whose roots are exceed by 2 then those of $2x^3 + 3x^2 - 4x + 5 = 0$ is

$2x^3 - 9x^2 + 8x + 9 = 0$

Reason (R) : the equation whose roots are exceed by h than those of $f(x) = 0$ is $f(x - h) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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46. Assertion (A) : the equation whose roos are multipled of by 2 of those of $x^5 - 2x^4 + 3x^3 - 2x^2 + 4x + 3 = 0$ is $x^5 - 4x^4 + 12x^3 - 16x^2 + 64x + 96 = 0$

Reason (R) : the equation whose roots are muliplied by k of those of $f(x) = 0$ is $f\left(\frac{x}{k}\right) = 0$

A. both A and R are true R is the correct explanation of A

B. both A and R are true and R is not correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A

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