MATHS

BOOKS - CENGAGE

QUADRATIC EQUATIONS

Worked Examples

1. $8x^2 - 47 = 100 + 5x^2$

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2. $(x+5)(x-5)=39$

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3. Solve the following equation

$$\frac{x+2}{x-2}+\frac{x-2}{x+2}=\frac{5}{2}$$

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4. $(x+3)(x+4)+(x-2)(x-5)=30$

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5. $\sqrt{8x^2 - 12x + 29} = 3x - 2$

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6. Solve the following equation : $x^2 - 5x + 6 = 0$

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7. Solve the following equation : $ab(x^2 + 1) = (a^2 + b^2)x$

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8. Solve the following equation :

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

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9. Solve for $x \times x^2 - 5x + 6 = 0$ by completing the square.

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10. Solve the following by completing the square :

$(x + 4)(x + 5) = 3(x + 1)(x + 2) + 2x$

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11. Solve using the formula

$3x^2 = 2x + 1$

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12. Solve using the formula

$x^2 - x - 1 = 0$

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13. Solve the following reducing them to a quadratic equation.

$4x^4 - 25x^2 + 36 = 0$

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14. Solve the following reducing them to a quadratic equation.

$8x^{3/2} - 8x^{-3/2} = 63$

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15. Solve the following reducing them to a quadratic equation.

$4.2^{2x+1} - 9.2^{x} + 1 = 0$

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16. Solve the following reducing them to a quadratic equation.

$$\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = 2\frac{1}{6}$$

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17. Solve the following :

$x^2 - 12x + \sqrt{x^2 - 12x + 81} - 9$

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18. Solve the following :

$3x^4 - 20x^3 - 94x^2 - 20x + 3 = 0$

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19. Find the nature of the roots of

$x^2 - 5x - 2 = 0.$

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20. For what value of m will the equation $x^2 + mx - \left(m^2 + 3m - 32\right) = 0$ have equal roots ?

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21. If α and β are the roots of $lx^2 + mx + n = 0$, find the value of $\alpha^2 + \beta^2$ and $\alpha^3 + \beta^3$.

$\alpha^2 + \beta^2$

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22. If α and β are the roots of $lx^2 + mx + n = 0$, find the value of $\alpha^2 + \beta^2$ and $\alpha^3 + \beta^3$.

$\alpha^3 + \beta^3$

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23. If the roots of $x^2 - px + 1 = 0$ are two consecutive integers, prove that $p^2 = 4q + 1$.

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24. If α and β are the roots of the equation $4x^2 - 6x + 1 = 0$, find the following :

$\alpha\beta^3 + \alpha^3\beta$

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25. If α and β are the roots of the equation $4x^2 - 6x + 1 = 0$, find the following :

$\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$

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26. If α and β are the roots of the equation $4x^2 - 6x + 1 = 0$, find the following :

$\alpha^4 + \beta^4$

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27. Find two even positive consecutive integers whose product is 288.

Note :

(a) Any general even number is 2n.

(b) any general odd number is $2n + 1$ or $2n - 1$.

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28. Find the length and breadth of a rectangular field, whose perimeter is 40 m and area is $96 \ \mathrm{m}^2$.

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29. The digit in the tens place of a two - digit number is equal to the square of the digit in the units place. If 54 is subtracted from the number, its digits are interchanged. Find the number.

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30. The product of four consecutive natural numbers is 360. Find the numbers.

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Test Yourself Level 1

1. Solve the following equations :

$5x^2 - 8 = 37$

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2. Solve the following equations :

$2x^2 - 2 = 18 - 3x^2$

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3. Solve the following equations :

$(x + 3)(x - 3) = 7$

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4. Solve the following equations :

$(+ x)(6 - x) + (6 + x)(5 - x) = 0$

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5. Solve the following equations :

$$(x+3)(x+4)+(x-2)(x-5)=0$$

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6. Solve the following equations :

$$\sqrt{8x^2-12x+29}=3x-2$$

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7. Solve the following equations by factorisation:

$9x^2 + 15x - 14 = 0$

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8. Solve the following equations by factorisation:

$3x^2 + 16x + 5 = 0$

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9. Solve the following equations by factorisation:

$x + \frac{1}{x} = 5\frac{1}{5}$

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10. Solve the following equations by factorisation:

$ab(x^2 + 1) = (a^2 + b^2)x$

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11. Solve the following equations by factorisation:

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

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Test Yourself Level 2

1. Solve the equation:

$$\frac{x-a}{x-b}+\frac{x-b}{x-a}=\frac{a}{b}+\frac{b}{a}$$

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2. $\frac{16}{x^{3/2}}+\frac{x^{1/2}}{2}=\frac{6}{x^{1/2}}$

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3. Solve the following equations by completing the square :

$x^2 - 2x = 15$

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4. Solve the following equations by completing the square :

$x^2 + 10x = 24$

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5. Solve the following equations by completing the square :

$(x-1)(x-2)=20$

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6. Solve the following equations by completing the square :

$\frac{8-x}{2}-\frac{2x-11}{x-3}=\frac{x-2}{6}$

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7. Solve the following equations by completing the square :

$$\frac{(x-1)}{(x-2)} - \frac{x-3}{x-4} = \frac{x-5}{x^2-6x+5}$$

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8. Solve the following equations by completing the square :

$$ax(x-a) = (a-x)$$

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9. Solve the following equations by completing the square :

$x^2 - 2ax = 1 - a^2$

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10. Solve the following using formula :

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

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11. Solve the following using formula :

$x^2 = 4(x - 1)$

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12. Solve the following using formula :

$2x^2 + \frac{3}{4}x = \frac{5}{16}$

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13. Solve the following using formula :

$12x^2 + 9x = 9^2$

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14. Solve the following using formula :

$(a-b)^2x^2-(a-b)^2x-ab=0$

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15. Solve the following :

$9x^4-148x^2+64=0$

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16. Solve the following :

$$8\sqrt{\frac{x}{x+3}}+\sqrt{\frac{x+3}{x}}=6$$

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17. Solve the following :

$$x^{-2}-2x^{-1}=63$$

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18. Solve the following :

$$x^{2/3}-2x^{1/3}-15=0$$

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19. Solve the following :

$7^{x+1} + 7^{1-x} = 50$

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20. $2\left(x^2 + \frac{1}{x^2}\right) - 9\left(x + \frac{1}{x}\right) + 14 = 0$

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21. Solve the following :

$$6\left(x^2+\frac{1}{x^2}\right)-25\left(x-\frac{1}{x}\right)+12=0$$

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22. Solve the following :

$$(x+1)(x+2)(x+3)(x+4)=24$$

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23. Solve the following :

$$x(x+2)(x+3)(x+5)=72$$

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24. Solve the following :

$x(x+1)^2(x+2) = 72$

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25. Solve the following :

$x(2x+1)(x-2)(2x-3) = 63$

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26. Solve the following :

$\sqrt{2x+1}-\sqrt{x}=1$

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27. Solve the following :

$1-\sqrt{7x^2-9x+3}=x$

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28. Solve the following using identity :

$\sqrt{x^2-3x+36}-\sqrt{x^2-3x+9}=3$

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29. Form the quadratic equation whose roots are as follows :

$-2, \ -3$

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30. Form the quadratic equation whose roots are as follows :

$a, \ -a$

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31. Form the quadratic equation whose roots are as follows :

$\frac{9}{2}, \frac{9}{2}$

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32. Form the quadratic equation whose roots are as follows :

$1 \pm \sqrt{2}$

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33. Form the quadratic equation whose roots are as follows :

One of the roots is $2+\sqrt{3}$.

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Test Yourself Level 3

1. If α and β are roots of the equation $4x^2-6x+1=0$, find the following :

$\alpha^3+\beta^3$

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2. If α and β are roots of the equation $4x^2 - 6x + 1 = 0$, find the following :

$\alpha^4\beta^5 + \alpha^5\beta^4$

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3. Find the quadratic equation whose roots are α and β having given the following :

$\alpha + \beta = 9, \alpha\beta = -5$

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4. Find the quadratic equation whose roots are α and β having given the following :

$\alpha + \beta = 5, \frac{1}{\alpha} + \frac{1}{\beta} = 8$

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5. If α and β are roots of $x^2 - 5x + 6 = 0$, form the equation whose roots are as follows :

α^2, β^2

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6. If α and β are roots of $x^2 - 5x + 6 = 0$, form the equation whose roots are as follows :

$\frac{1}{\alpha}, \frac{1}{\beta}$

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7. If α and β are roots of $x^2 - 5x + 6 = 0$, form the equation whose roots are as follows :

$\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$

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8. If α and β are roots of $x^2 - 5x + 6 = 0$, form the equation whose roots are as follows :

α^3, β^3

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9. If α and β are roots of $x^2 - 5x + 6 = 0$, form the equation whose roots are as follows :

$\frac{1}{\alpha^2}, \frac{1}{\beta^2}$

View Text Solution

10. If α and β are roots of $x^2 - 5x + 6 = 0$, form the equation whose roots are as follows :

$$\frac{\alpha^2}{\beta}, \frac{\beta^2}{\alpha}$$

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11. Solve the following :

$$2^{2x+3} - 57 = 65(2^x - 1)$$

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12. Solve the following :

$3^{x+2} + 3^{-x} + 10 = 0$

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13. Solve the following :

$5^{x+1} + 5^{2-x} = 5^3 + 1$

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14. Solve the following :

$\sqrt{2x+7} + \sqrt{3x-18} = \sqrt{7x+1}$

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15. Solve the following :

$$\sqrt{x+5}+\sqrt{x+12}=\sqrt{2x+41}$$

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16. Solve the following :

$$\sqrt{3x^2+7x+2}-\sqrt{2x^2+7x+11}=x-3$$

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17. Solve the following :

$$\sqrt{x^2 - 11x + 30} - \sqrt{2x^2 - 21x + 55} = x - 5$$

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18. Discuss the nature of the roots of the following :

$7x^2 - 11x + 4$

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19. Discuss the nature of the roots of the following :

$6x^2 - 13x - 15 = 0$

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20. Discuss the nature of the roots of the following :

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

View Text Solution

21. Discuss the nature of the roots of the following :

$x^2 + 9x + 27 = 0$

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22. Discuss the nature of the roots of the following :

$4x^2 - 12x + 15 = 0$

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23. For what value of k will $18x^2 - kx + 2 = 0$ have equal roots ?

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24. If p and q are the roots of $x^2 - ax + b = 0$, find the value of $\frac{1}{p^3} + \frac{1}{q^3}$.

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25. Find the quadratic equation one of whose roots is $p + \sqrt{q}$.

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26. The sum of the squares of two consecutive natural numbers is 145. Find the numbers.

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27. The length of a rectangle is greater than twice its breadth by 2 cm. The length of its diagonal is 13 cm. Find the length and breadth of the rectangle.

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28. In a rectangular mango grove, the number of trees lengthwise is 5 more than the number of trees breadthwise. If the total number of trees is 1400, find the number of trees lengthwise and breadthwise.

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29. The sum of the reciprocals of two consecutive odd natural numbers is $\frac{12}{35}$. Find the numbers.

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30. A car covers a distance of 300 km with the same speed, it will cover the same distance in 1 hour less if its speed is increased by 10 km/h. Find the speed of the car.

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31. A cistern can be filled by two pipes in $33\frac{1}{3}$ minutes, if the larger pipe takes 15 minutes less tha the smaller to fill the cistern, find in what time it will be filled by each pipe separately.

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32. One - fourth of a herd of camels was seen in the forest. Twice the square root of the herd had gone to mountains and the remaining 15 camels were seen on the bank of a river. Find the total number of camels.

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33. a motorboat, whose speed in still water is 15 km/h, goes 30 km downstream and returns to the

starting point in a total time of 4 hours 30 minutes. Find the speed of the stream.

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34. A passenger train takes 3 hours less for a journey of 360 km. If its speed is increased by 10 km/h from its usual speed, what is the usual speed ?

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35. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/h and the time of flight increased by 30 minutes. Find the duration of flight.

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36. Find the roots of the following, drawing the graphs in two ways :

$x^2 + 4x - 12 = 0$

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37. Find the roots of the following, drawing the graphs in two ways :

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

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38. Find the roots of the following, drawing the graphs in two ways :

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

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39. Find the roots of the following, drawing the graphs in two ways :

$x^2 + x - 6 = 0$

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40. Find the roots of the following, drawing the graphs in two ways :

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

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41. Find the minimum value of the following and find the value of x for which the expression takes the minimum value :

$4x^2 + 8x + 25$

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42. Find the minimum value of the following and find the value of x for which the expression takes the minimum value :

$9x^2 - 8x - 8$

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43. Find the minimum value of the following and find the value of x for which the expression takes the minimum value :

$16x^2 - 24x - 26$

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Test Yourself Multiple Choice Questions

1. Sum of roots of the equation $4^x - 3\left(2^{x+3}\right) + 128 = 0$, is

A. 0

B. 7

C. 5

D. 8

Answer: B

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2. If α and β are the zeros of the polynomial $f(x) = x^2 - 5x + k$ such that $\alpha - \beta = 1$, find the value of k.

A. 8

B. 4

C. $13/2$

D. 6

Answer: D

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3. If $p(x) = ax^2 + bx + c$ and $Q(x) = -ax^2 + dx + c$, where $ac \neq 0$, then $P(x) \times Q(x) = 0$ has at least

A. four real roots

B. two real roots

C. four imaginary roots

D. only one real root

Answer: B

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4. If roots of the equation $(q-r)x^2+(r-p)x+(p-q)=0$ are equal, then p,q and r are in

A. AP

B. GP

C. HP

D. AGP

Answer: A

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5. If $3p^2 = 5p + 2$ and $3q^2 = 5q + 2$ where $p \neq q$, then pq is equal to

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

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

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

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

Answer: B

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6. If α and β are the roots of the quadratic equation $x^2 + bx - c = 0$, then the equation whose roots are b and c, is

A. $x^2 + \alpha x - \beta = 0$

B. $x^2 - [(\alpha + \beta) + \alpha\beta]x - \alpha\beta(\alpha - \beta) = 0$

C. $x^2 + [(\alpha + \beta) + \alpha\beta]x + \alpha\beta(\alpha + \beta) = 0$

D. $x^2 + [(\alpha + \beta) + \alpha\beta]x - \alpha\beta(\alpha + \beta) = 0$

Answer: C

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7. Let $p, q \in \{1, 2, 3, 4\}$. The number of equations of the form $px^2 + qx + 1 = 0$ having real roots, is

A. 15

B. 9

C. 8

D. 7

Answer: D

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8. Find the number of rational roots of the equation $(x+2)(x+3)(x+8)(x+12) = 4x^2$

A. 4

B. 2

C. 0

D. 1

Answer: B

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9. Solutions of the equation $(6-x)^4+\left(8^4-x\right)^4=16$ are

A. 8,6

B. $-8,\ -6$

C. 8,9

D. $-8, 6$

Answer: A

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10. Solution of the equation

$\sqrt{2x^2+5x-2}-\sqrt{2x^2+5x-9}=1$ are

A. $-2, 9/2$

B. $2, \ -9/2$

C. $-2, \ -9/2$

D. $2, 9/2$

Answer: B

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11. Solutions of the equation $64 \times 9^x - 84 \times 12^x + 27 \times 16^x = 0$ are

A. $-1, -2$

B. $-1, 2$

C. 2,3

D. 1,2

Answer: D

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12. Let α, β be the roots of the equation $x^2 - x + p = 0$ and γ, δ be the roots of the equation $x^2 - 4x + 9 = 0.$

If $\alpha, \beta, \gamma\ \delta$ are in GP then the integral value of p and q, respectively, are

A. $-2, \ -32$

B. $-2, 3$

C. $-6, 3$

D. $-6, \ -32$

Answer: A

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13. If α, β are the roots of the equation $x^2 - 3x + 5 = 0$ and γ, δ are the roots of the equation $x^2 + 5x - 3 = 0,$ then the equation whose roots are $\alpha\gamma + \beta\delta$ and $\alpha\delta + \beta\gamma,$ is

A. $x^2 - 15x - 158 = 0$

B. $x^2 + 15x - 158 = 0$

C. $x^2 - 15x + 158 = 0$

D. $x^2 + 15x + 158 = 0$

Answer: D

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14. If $\cos^4\theta + p, \sin^4\theta + p$ are the roots at the equation $x^2 + a(2x + 1) = 0$ and

$\cos^2\theta + q, \sin^2\theta + q$ are the roots of the equation $x^2 + 4x + 2 = 0$ then a is equal to

A. -2

B. $-1/2$

C. 1

D. 2

Answer: D

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15. If α and β roots of the equation $x^2 - p(x+1) - c = 0$ hen $\frac{\alpha^2 + 2\alpha + 1}{\alpha^2 + 2\alpha + c} + \frac{\beta^2 + 2\beta + 1}{\beta^2 + 2\beta + c} =$

A. 1

B. -1

C. 2

D. 3

Answer: A

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16. The quadratic equation, product of whose roots x_1 and x_2 is equal to 4 and are related as $\frac{x_1}{x_1 - 1} + \frac{x_2}{x_2 - 1} = 2$, is

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

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

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

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

Answer: C

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17. If one root of the equation $x^2 - dx + 12 = 0$ is even prime, while $x^2 + dx + \mu = 0$ has equal roots then μ is

A. 8

B. 20

C. 32

D. 16

Answer: D

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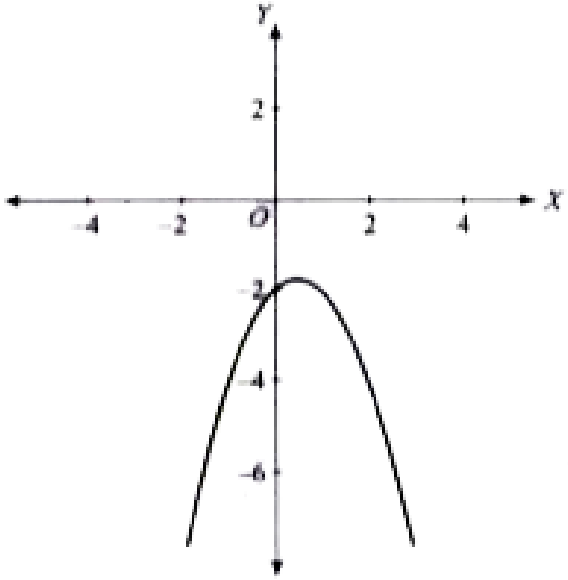
18. The graph of a quadratic polynomial $y = ax^2 + bx + c, a, b, c \in R$ is as shown.



Which one of the is NOT correct ?

A. $b^2 - 4ac < 0$

B. $\frac{c}{a} < 0$

C. c is negative

D. abscissa corresponding to the vertex is

$$\left(\frac{-b}{2a}\right)$$

Answer: B

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19. If $x + \frac{1}{x} = 5$ then $x^3 - 5x^2 + x + \frac{1}{x^3} - \frac{5}{x^2} + \frac{1}{x} =$

A. -5

B. 0

C. 5

D. 10

Answer: B

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20. If $\left(a^2-1\right)x^2+(a-1)x+\left(a^2-4a+3\right)=0$ is an identity in x, then the value of a is/are

A. -1

B. 3

C. 1

D. $-1, 1, 3$

Answer: C

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21. If α and β are the roots of $ax^2 + bx + c = 0$, then which of the following are the roots of the equation $ax^2 - bx(x-1) + c(x-1)^2 = 0$?

A. $\frac{\alpha}{\alpha+1}, \frac{\beta}{\beta+1}$

B. $\frac{\alpha+1}{\alpha} + \frac{\beta+1}{\beta}$

C. $\frac{\alpha}{\alpha-1}, \frac{\beta}{\beta-1}$

D. $\frac{\alpha-1}{\alpha}, \frac{\beta-1}{\beta}$

Answer: A

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22. The equation for $x: 3\sqrt{2x-1}+3\sqrt{x-1}=1$ is

A. 0

B. 0, 1

C. 1

D. None of these

Answer: C

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Olympiad And Ntse Level Exercises

1. If $a, b, c \in Q$ then roots of the equation $(b+c-2a)x^2+(c+a-2b)x+(a+b-2c)=0$ are

A. irrational

B. non-real

C. rational

D. equal

Answer: C

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2. Solutions of the equation $(12x-1)(6x-1)(4x-1)(3x-1)=5$ are

A. $-\frac{1}{12}, \frac{1}{2}$

B. $-\frac{1}{12}, -\frac{1}{2}$

C. $\frac{1}{12}, \frac{1}{2}$

D. $\frac{1}{12}, -\frac{1}{2}$

Answer: A

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3. If α, β be the roots of the equation $3x^2 + 2x + 1 = 0$, then find value of $\left(\frac{1-\alpha}{1+\alpha}\right)^3 + \left(\frac{1-\beta}{1+\beta}\right)^3$

A. 10

B. -9

C. 9

D. -10

Answer: D

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4. The square of difference of the roots of the equattion $x^2 + px + 45 = 0$ is 144. The roots are

A. $-3, \ -15$

B. 2,5

C. $-12, 12$

D. $18, \ -18$

Answer: A

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5. Read the following statements.

Stetaments 1 : If $\sqrt{\sqrt{\sqrt{\sqrt{x}}}} = 4\sqrt{4\sqrt{4\sqrt{3x^4+4}}}$ then the value of x^4 is 4.

Statements 2: If a and b are positive numbers and each of the equations $x^2 + ax + 2b = 0$ and $x^2 + 2bx + a = 0$ has real roots then the smallest posible value of $(a+b)$ is 10.

A. Both Statement a and Statement 2 are true.

B. Statement 1 is true and Statement 2 is false.

C. Statement 1 is false and Statement 2 is true.

D. Both Statements 1 and Statement 2 are false.

Answer: B

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6. If $x, y \in R$ satisfy the equation $x^2 + y^2 - 4x - 2y + 5 = 0$ then the value of the

expression

$$\frac{\left(\sqrt{x}-\sqrt{y}\right)^2+4\sqrt{xy}}{x+\sqrt{xy}}$$ is

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7. If one root of the equation $x^2+px+12=0$ is 4, while the equation $x^2+px+q=0$ has equal roots then the value of q is

A. 4

B. $49/4$

C. $4/49$

D. None of these

Answer: B

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8. If α, β are the roots of $x^2 - 2x + 4 = 0$, then $\alpha^5 + \beta^5$ is :

A. 32

B. 64

C. 16

D. None of these

Answer: A

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9. Match the following columns :

(a)	If a, b, c and d are four non-zero real numbers such that $(d+a-b)^2 + (d+b-c)^2 = 0$ and the roots of the equation $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ are real and equal then	(p)	$a+b+c=0$
(b)	If a, b and c are non-zero positive real numbers such that $\log a$, $\log b$ and $\log c$ are in A.P. then	(q)	a, b, c are in AP
(c)	If the equation $ax^2 + bx + c = 0$ and $x^3 - 3x^2 + 3x - 1 = 0$ have a common real root then	(r)	a, b, c are in GP
(d)	If a, b and c are positive real numbers such that the expression $bx^2 + \left(\sqrt{(a+c)^2 + 4b^2}\right)x + (a+c)$ is non-negative $\forall\, x \in R$ then	(s)	a, b, c are in HP

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10. Column I contains rational algebraic expression and column II contains posible integers which lie in their ranges. Match the columns.

Column I		Column II	
(a)	$y=\frac{x^2-2x+4}{x^2+2x+4}, x \in R$	(p)	1
(b)	$y=\frac{x^2-3x-2}{2x-3}, x \in R$	(q)	4
(c)	$y=\frac{2x^2-2x+4}{x^2-4x+3}, x \in R$	(r)	-3
(d)	$x^2-(a-3)x+2<0, \forall x \in (-2,3)$	(s)	-10

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