### Exercises [A–2]

In exercises 1–6 find (**a**) the nature of the roots, (**b**) the sum of the roots, (**c**) the product of the roots.

1. $3x^2 - 10x + 9 = 0$
2. $12x = 3 + 8x^2$
3. $2.25x^2 = 6x - 4$
4. $2t(1 - t) = 1$
5. $3x^2 + 1.2 = 4.5x$
6. $2x^2 + 6kx + 3k^2 = 0$
7. Show that $2x^2 - 8x + 8$ has equal zeros, and sketch the graph of the function defined by $y = 2x^2 - 8x + 8$.
8. Find the value of $k$ for which $4x^2 + 5x + k$ is a trinomial square.
9. Solve the equation $3x^2 - 5x + 3 = 0$. Use the sum and product of the roots as a check.
10. Solve the equation $4x(x + 2) = -1$. Use the sum and product of the roots as a check.



11. The equation $\dfrac{x^2}{x-1} = \dfrac{b^2}{b-1}$ has an obvious solution $x = b$. Use the product of the roots of the equation to obtain the other root, and check by considering the sum of the roots.
12. Is $x = 2$ a solution of the equation $\dfrac{x^2}{4} = \dfrac{x+a}{2+a}$? Complete the solution and check as in exercise 11.
13. If $a$ and $c$ have opposite signs in the equation $ax^2 + bx + c = 0$, what may be deduced about the roots of the equation?
14. State the condition which ensures that $ax^2 + bx + c$ shall have linear factors with rational coefficients.
15. State the sum of the roots of $x^2 - 5x + k = 0$. If the difference of the roots is 1, find the roots and the value of $k$.
16. State the sum of the roots of $2x^2 + 7x + k = 0$. If the roots differ by 1.5, find the roots and the value of $k$.
17. If the roots of $3x^2 - 8x + k = 0$ are in the ratio 3 : 1, find $k$.
18. Show that the discriminant of $(k + 1)x^2 + 4kx + 2 = 0$ defines a quadratic function of $k$. Find the zeros of this function and make a sketch of its graph. For what values of $k$ are the roots of the given equation (**a**) equal, (**b**) real and unequal?
19. Show that the roots of $4x^2 + 4mx + 2m - 1 = 0$ are real for all values of $m$. Solve the equation using the value of $m$ which makes the roots equal.
20. Show that the roots of $k^2(x^2 - 1) + 2kx + 10 = 0$ are real except for values of $k$ between $-3$ and 3.
21. Find the values of $k$ for which the roots of $(kx + 1)^2 = (k + 1)x$ are (**a**) equal, (**b**) real and unequal.

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| | a | b | c |
|---|---|---|---|
| 1. | Conjugate imaginary nos. | $3\frac{1}{3}$ | 3 |
| 2. | Real, unequal, irrational | $1\frac{1}{2}$ | $\frac{3}{8}$ |
| 3. | Equal, rational | $\frac{8}{3}$ | $\frac{16}{9}$ |
| 4. | Conjugate imaginary nos. | 1 | $\frac{1}{2}$ |
| 5. | Real, unequal, irrational | 1.5 | 0.4 |
| 6. | Real, unequal, irrational | $-3k$ | $\frac{3}{2}k^2$ |

7. $D = 0$

8. $k = \frac{25}{16}$

9. $\left\{\frac{5}{6} + \frac{i\sqrt{11}}{6}, \frac{5}{6} - \frac{i\sqrt{11}}{6}\right\}$

10. $\{-1 + \frac{1}{2}\sqrt{3}, -1 - \frac{1}{2}\sqrt{3}\}$

11. Other root, $\frac{b}{b - 1}$;

    product $= \frac{b^2}{b - 1}$; sum $= \frac{b^2}{b - 1}$

12. Yes; other root, $\frac{-2a}{2 + a}$

13. They have opposite signs

14. $b^2 - 4ac = k^2$, $k$ rational

15. 5; $\{3, 2\}$; $k = 6$

16. $-3.5$; $\{-1, -2.5\}$; $k = 5$

17. $k = 4$

18. $D = 16k^2 - 8k - 8$;

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

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

    b. $\{k \mid k < -\frac{1}{2}\} \cup \{k \mid k > 1\}$

19. $D = 16(m - 1)^2$;

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

20. $D = 4k^2(k^2 - 9)$

21. a. $\{\frac{1}{3}, -1\}$

    b. $\{k \mid -1 < k < \frac{1}{3}, k \neq 0\}$