1. Solve the following quadratic equations using factor method.
(a) \((4x - 5)^2 - 36 = 0\)  
(b) \(64 - (3x - 1)^2 = 0\)

(c) \((3x - 7)(3x - 5) = 8\)  
(d) \(5(5 - 2x) = 2x(5 - 2x)\)

(e) \((8x + 3)^2 = (3x - 7)(8x + 3)\)  
(f) \((4x + 1)(3x - 1) - (2x + 3)(1 - 3x) = 0\)

2. Solve the following quadratic equations by taking square roots.
(a) \(5(x - 2)^2 = 10\)  
(b) \(x^2 + 9x + 17 = 0\)

(c) \(4x^2 + 9x + 3 = 0\)

3. Solve the following quadratic equations by quadratic formula. (Express answers as simplest surds or \(a\pm bi\))
(a) \(x + 63 = 20x^2\)  
(l) \(3(x^2 + 10) = -23x\)

(c) \(2x^2 + 5x + 7 = 0\)  
(d) \(3x^2 + 4x + 8 = 0\)

(e) \(\frac{4 - x^2}{2} = x\)  
(f) \(\frac{2(1-x)}{3} = x(2 - x)\)

(g) \((3 - x)(x + 3) = \frac{(x + i)(x + 9)}{2}\)
4. It is given that \( 1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2} \), where \( n \) is a positive integer. If \( 1 + 2 + 3 + \cdots + n = 120 \), find the value of \( n \).

5. The perimeter of a rectangle is 50 cm.
   (a) If the length of the rectangle is \( l \) cm, express the width of the rectangle in terms of \( l \).
   (b) If the area of the rectangle is 154 cm\(^2\), find the length and width of the rectangle.

6. The sum of the digits of a two-digit number is 6. Let \( x \) be the units digit.
   (a) Express the value of the number in terms of \( x \).
   (b) If the two-digit number is equal to three times the product of its tens and units digits, find the number.

7. In the figure, a solid consists of a right cylinder and a hemisphere with the radius of \( r \) cm. The height of the solid is \( 2r + 3 \) cm and the total surface area is 216\( \pi \) cm\(^2\).

   (a) Find the value of \( r \).
   (b) Find the total volume of the solid. (Express the answer in terms of \( \pi \)).

8. Find the discriminant and hence determine the nature of roots of the equations.
   (a) \( 6x^2 + 1 = 0 \)
   (b) \( 16x^2 - 8x + 1 = 0 \)
   (c) \( 8 - 3x^2 = 5x \)
   (d) \( 20x - 4x^2 = 45 \)
9. If each of the following quadratic equations has a double real root and \( k \) is a constant, find the values of \( k \).
(a) \( 2x^2 + 6x - (k + 2) = 0 \)
(b) \( (k - 3)x^2 - 3kx + 36 = 0 \)

10. If each of the following quadratic equations has two distinct real roots and \( k \) is a constant, find the range of values of \( k \).
(a) \( 5x^2 - 6x - 2(k - 1) = 0 \)
(b) \( (k - 1)x^2 - 2kx + (k + 2) = 0 \)

11. It is given that \( 2 = 5x - (k^2 + 4)x^2 \) is an equation in \( x \). Prove that the equation has no real roots for all real numbers \( k \).

12. Find a quadratic equation in \( x \) with each of the following sets of roots.
(a) \( 2, 9 \)
(b) \(-0.5, -5, 5 \)
(c) \( -\frac{1}{3}, 0 \)
(d) a double root \( \frac{3}{4} \)
(e) \( 4 + \sqrt{5} \) and \( 4 - \sqrt{5} \).

13. Let \( m \) be a constant. If \( \frac{3}{2} \) is a root of the equation \( 4x^2 - mx + 15 = 0 \),
(a) find the other root.
(b) find the value of \( m \).

14. Let \( k \) be a constant. If the product of roots of the quadratic equation \( kx^2 + 5x - (12 - k) = 0 \) is \(-3\), find the value of \( k \).
15. If $\alpha$ and $\beta$ are the roots of the equation $3x^2 - 2x + 8 = 0$, find the value of each of the following.

(a) $(1 + 2\alpha)(1 + 2\beta)$

(b) $(\alpha - \frac{1}{\beta})(\beta - \frac{1}{\alpha})$

16. It is given that $\alpha$ and $\beta$ are the roots of the equation $x^2 + kx - 2 = 0$, where $k > 0$. If $\alpha^2 + \beta^2 = 13$, find the value of $k$.

(b) Find a quadratic equation in $x$ with roots $\alpha^3$ and $\beta^3$.

17. Let $k$ be a constant. It is given that $\alpha$ and $\beta$ are the roots of the equation $x^2 - kx + 3 = 0$.

(a) Prove that $\alpha^2 = kx - 3$.

(b) Express $\alpha^2 + k\beta$ in terms of $k$.

18. Mandy is 35 years younger than her father and 28 years younger than her mother.

(a) If Mandy is currently $x$ years old, express the ages of her father and mother in terms of $x$.

(b) After 5 years, the sum of the ages of Mandy's father and mother is the square of Mandy's age. What is the current age of Mandy?

**Answers**

1. (a) $\frac{5}{2}$  (b) $\frac{7}{3}$  (c) 1  (d) 3  (e) $\frac{5}{2}$  (f) $-\frac{7}{3}$  (g) $-\frac{7}{3}$  (h) $\frac{1}{3}$  (i) $\frac{2}{3}$  (j) $2$  (k) $\sqrt{2}$  (l) $2 - \sqrt{2}$  (m) $-\frac{9 \pm \sqrt{13}}{2}$  (n) $\frac{-9 \pm \sqrt{13}}{2}$  (o) $\frac{-9 + \sqrt{13}}{2}$  (p) $\frac{9 \pm \sqrt{13}}{2}$  (q) $\frac{9 \pm \sqrt{13}}{2}$  (r) $\frac{-7}{4}$  (s) $\frac{6}{3}$  (t) $-6$  (u) $\frac{5}{4}$  (v) $\frac{5}{4}$  (w) $\frac{5}{4}$  (x) $\frac{5}{4}$  (y) $\frac{5}{4}$  (z) $\frac{5}{4}$  (A) $12 - 12$  (B) $12 - 12$  (C) $\frac{12}{12}$  (D) $\frac{12}{12}$  (E) $\frac{12}{12}$  (F) $\frac{12}{12}$  (G) $\frac{12}{12}$  (H) $\frac{12}{12}$  (I) $\frac{12}{12}$  (J) $\frac{12}{12}$  (K) $\frac{12}{12}$  (L) $\frac{12}{12}$  (M) $\frac{12}{12}$  (N) $\frac{12}{12}$  (O) $\frac{12}{12}$  (P) $\frac{12}{12}$  (Q) $\frac{12}{12}$  (R) $\frac{12}{12}$  (S) $\frac{12}{12}$  (T) $\frac{12}{12}$  (U) $\frac{12}{12}$  (V) $\frac{12}{12}$  (W) $\frac{12}{12}$  (X) $\frac{12}{12}$  (Y) $\frac{12}{12}$  (Z) $\frac{12}{12}$

(b) Length = 11 cm, width = 14 cm; length = 16 cm, width = 11 cm

(b) Father: $x + 35$, mother: $x + 28$, (b) 4