Chapter 4: Quadratic Equations
Complete Board PYQs Question Bank

Exercise Set 4.2 (NCERT Core Selections)

Question 1

Solution:
Let the smaller integer be x.
The consecutive positive integer is $(x+1)$.
Product: $x(x+1) = 306 \implies x^2 + x - 306 = 0$.

Formula / Hints:
Consecutive integers always have a difference of 1.

Question 2

Solution:
Let John have x marbles. Jivanti has $(45 - x)$ marbles.
After losing 5 each: John has $(x-5)$, Jivanti has $(40-x)$.
Product: $(x-5)(40-x) = 124 \implies 40x - x^2 - 200 + 5x = 124$
$\implies x^2 - 45x + 324 = 0$.

Formula / Hints:
Total = 45. Remaining marbles after subtraction models the product.

Question 3

Solution:
Let base = x cm. Height = $(x - 7)$ cm.
By Pythagoras theorem: $x^2 + (x-7)^2 = 13^2$
$x^2 + x^2 - 14x + 49 = 169 \implies 2x^2 - 14x - 120 = 0$
$\implies x^2 - 7x - 60 = 0$.

Formula / Hints:
$\text{Base}^2 + \text{Height}^2 = \text{Hypotenuse}^2$

Question 4

Solution:
Let number of toys = x. Cost per toy = $55 - x$.
Total cost: $x(55 - x) = 750 \implies 55x - x^2 = 750$
$\implies x^2 - 55x + 750 = 0$.

Formula / Hints:
Total Cost = Quantity × Cost per item

Exercise Set 4.5 (CBSE Board Questions)

Question 1 (ii)

Solution:
Equation: $3x^2 - 4\sqrt{3}x + 4 = 0$.
$D = b^2 - 4ac = (-4\sqrt{3})^2 - 4(3)(4) = 48 - 48 = 0$.
Roots are **real and equal**.

Formula / Hints:
Discriminant $D = b^2 - 4ac$.
If $D = 0$, roots are equal.

Question 1 (iv)

Solution:
Equation: $4x^2 + 4\sqrt{3}x + 3 = 0$.
$D = b^2 - 4ac = (4\sqrt{3})^2 - 4(4)(3) = 48 - 48 = 0$.
Roots are **real and equal**.

Formula / Hints:
Discriminant condition verification.

Question 2 (ii)

Solution:
Equation: $4x^2 - 2(k+1)x + (k+1) = 0$.
Equal roots $\implies D = 0$:
$[-2(k+1)]^2 - 4(4)(k+1) = 0 \implies 4(k+1)^2 - 16(k+1) = 0$
$4(k+1)[(k+1) - 4] = 0 \implies k+1 = 0 \implies k = -1$
or $k - 3 = 0 \implies k = 3$.

Formula / Hints:
For equal roots, $b^2 - 4ac = 0$.

Question 2 (iii)

Solution:
Equation: $x^2 - 2(k+1)x + k^2 = 0$.
Equal roots $\implies D = 0$:
$[-2(k+1)]^2 - 4(1)(k^2) = 0 \implies 4(k^2 + 2k + 1) - 4k^2 = 0$
$8k + 4 = 0 \implies k = -\frac{1}{2}$.

Formula / Hints:
Expand quadratic binomial components cleanly.

Question 2 (iv)

Solution:
Equation: $k^2x^2 - 2(2k-1)x + 4 = 0$.
Equal roots $\implies D = 0$:
$[-2(2k-1)]^2 - 4(k^2)(4) = 0 \implies 4(4k^2 - 4k + 1) - 16k^2 = 0$
$-16k + 4 = 0 \implies k = \frac{1}{4}$.

Formula / Hints:
Isolate linear parameters systematically.

Question 2 (v)

Solution:
Equation: $(k+1)x^2 - 2(k-1)x + 1 = 0$.
Equal roots $\implies D = 0$:
$[-2(k-1)]^2 - 4(k+1)(1) = 0 \implies 4(k^2-2k+1) - 4k - 4 = 0$
$4k^2 - 12k = 0 \implies 4k(k-3) = 0 \implies k = 3$ (since $k \neq -1$).

Formula / Hints:
Denominator boundary condition: $k+1 \neq 0$.

Question 2 (vi)

Solution:
Equation: $x^2 + k(2x + k - 1) + 2 = 0 \implies x^2 + 2kx + (k^2 - k + 2) = 0$.
Equal roots $\implies D = 0$:
$(2k)^2 - 4(1)(k^2 - k + 2) = 0 \implies 4k^2 - 4k^2 + 4k - 8 = 0$
$4k = 8 \implies k = 2$.

Formula / Hints:
Standardize the structural form first.

Question 3 (ii)

Solution:
Equation: $kx(x-2) + 6 = 0 \implies kx^2 - 2kx + 6 = 0$.
Equal roots $\implies D = 0$:
$(-2k)^2 - 4(k)(6) = 0 \implies 4k^2 - 24k = 0$
$4k(k-6) = 0 \implies k = 6$ (since $k \neq 0$).

Formula / Hints:
Quadratic constraint requires $a \neq 0$.

Question 3 (iii)

Solution:
Equation: $x^2 - 4kx + k = 0$.
Equal roots $\implies D = 0$:
$(-4k)^2 - 4(1)(k) = 0 \implies 16k^2 - 4k = 0$
$4k(4k-1) = 0 \implies k = \frac{1}{4}$ (since $k \neq 0$).

Formula / Hints:
Isolate the zero-factor roots.

Question 3 (v)

Solution:
Equation: $kx(x-3) + 9 = 0 \implies kx^2 - 3kx + 9 = 0$.
Equal roots $\implies D = 0$:
$(-3k)^2 - 4(k)(9) = 0 \implies 9k^2 - 36k = 0$
$9k(k-4) = 0 \implies k = 4$ (since $k \neq 0$).

Formula / Hints:
Expand distribution coefficients completely.

Question 6 (i)

Solution:
Equation: $(3k+1)x^2 + 2(k+1)x + 1 = 0$.
Equal roots $\implies D = 0$:
$[2(k+1)]^2 - 4(3k+1)(1) = 0 \implies 4(k^2+2k+1) - 12k - 4 = 0$
$4k^2 - 4k = 0 \implies 4k(k-1) = 0 \implies k = 0$ or $k = 1$.

Formula / Hints:
Substitute k back to solve roots.

Question 6 (ii)

Solution:
Equation: $x^2 + kx + 16 = 0$.
Equal roots $\implies D = 0$:
$k^2 - 4(1)(16) = 0 \implies k^2 = 64 \implies k = \pm 8$.
Roots: For $k = 8 \implies x = -4$; for $k = -8 \implies x = 4$.

Formula / Hints:
Square root extracts symmetric sign roots.

Question 6 (iii)

Solution:
Equation: $px(x-2) + 6 = 0 \implies px^2 - 2px + 6 = 0$.
Equal roots $\implies D = 0$:
$(-2p)^2 - 4(p)(6) = 0 \implies 4p^2 - 24p = 0 \implies p = 6$.
Roots: $6x^2 - 12x + 6 = 0 \implies 6(x-1)^2 = 0 \implies x = 1$.

Formula / Hints:
Factor out non-zero leading terms.

Question 8 (i)

Solution:
Equation: $(p+1)x^2 - 6(p+1)x + 3(p+9) = 0$.
Equal roots $\implies D = 0$:
$[-6(p+1)]^2 - 4(p+1)[3(p+9)] = 0 \implies 36(p+1)^2 - 12(p+1)(p+9) = 0$
$12(p+1)[3(p+1) - (p+9)] = 0 \implies 2p - 6 = 0 \implies p = 3$ $(p \neq -1)$.

Formula / Hints:
Factor common linear binomial subgroups.

Question 8 (ii)

Solution:
Equation: $(p+4)x^2 - (p+1)x + 1 = 0$.
Equal roots $\implies D = 0$:
$[-(p+1)]^2 - 4(p+4)(1) = 0 \implies p^2 + 2p + 1 - 4p - 16 = 0$
$p^2 - 2p - 15 = 0 \implies (p-5)(p+3) = 0 \implies p = 5$ or $p = -3$.

Formula / Hints:
Splitting the middle term rule.

Question 8 (iii)

Solution:
Equation: $x^2 - 2(p+1)x + p^2 = 0$.
Real roots $\implies D \geq 0$:
$[-2(p+1)]^2 - 4(1)(p^2) \geq 0 \implies 4(p^2+2p+1) - 4p^2 \geq 0$
$8p + 4 \geq 0 \implies p \geq -\frac{1}{2}$. Smallest value is $p = -\frac{1}{2}$.

Formula / Hints:
Real roots inequality condition: $D \geq 0$.

Question 9

Solution:
Equation: $x^2 + kx + 4 = 0$.
Real roots $\implies D \geq 0$:
$k^2 - 4(1)(4) \geq 0 \implies k^2 \geq 16 \implies k \geq 4$ or $k \leq -4$.
Least positive value is $k = 4$.

Formula / Hints:
Isolate limits across inequality domains.

Question 11

Solution:
Equation: $(a^2+b^2)x^2 - 2(ac+bd)x + (c^2+d^2) = 0$ has equal roots.
$D = 0 \implies [-2(ac+bd)]^2 - 4(a^2+b^2)(c^2+d^2) = 0$
$4(a^2c^2 + 2acbd + b^2d^2) - 4(a^2c^2 + a^2d^2 + b^2c^2 + b^2d^2) = 0$
$2acbd - a^2d^2 - b^2c^2 = 0 \implies -(ad-bc)^2 = 0 \implies ad = bc \implies \frac{a}{b} = \frac{c}{d}$.

Formula / Hints:
Perfect square factorization expansion.

Question 12

Solution:
Equation: $(1+m^2)x^2 + 2mcx + (c^2-a^2) = 0$ has equal roots.
$D = 0 \implies (2mc)^2 - 4(1+m^2)(c^2-a^2) = 0$
$4m^2c^2 - 4(c^2 - a^2 + m^2c^2 - m^2a^2) = 0$
$-4c^2 + 4a^2 + 4m^2a^2 = 0 \implies c^2 = a^2(1+m^2)$.

Formula / Hints:
Distribute coefficients and clear common groups.

Exercise Set 4.6 (CBSE Board Questions)

Question 1

Solution:
Let consecutive odd positive integers be x and $(x+2)$.
$x^2 + (x+2)^2 = 394 \implies 2x^2 + 4x + 4 = 394 \implies 2x^2 + 4x - 390 = 0$
$x^2 + 2x - 195 = 0 \implies (x+15)(x-13) = 0 \implies x = 13$.
The numbers are 13 and 15.

Formula / Hints:
$(x+2)^2 = x^2 + 4x + 4$.

Question 3

Solution:
Let numbers be x and $(x-3)$.
Product: $x(x-3) = 504 \implies x^2 - 3x - 504 = 0$
$(x-24)(x+21) = 0 \implies x = 24$ or $x = -21$.
Pairs are $(24, 21)$ or $(-21, -24)$.

Formula / Hints:
Quadratic root extraction can yield symmetric negative pairs.

Question 4

Solution:
Given $a + b = 15 \implies b = 15 - a$. Reciprocals sum: $\frac{1}{a} + \frac{1}{b} = \frac{3}{10}$.
$\frac{a+b}{ab} = \frac{3}{10} \implies \frac{15}{a(15-a)} = \frac{3}{10} \implies \frac{5}{15a-a^2} = \frac{1}{10}$
$15a - a^2 = 50 \implies a^2 - 15a + 50 = 0 \implies (a-10)(a-5) = 0$.
Numbers are 5 and 10.

Formula / Hints:
Substitute linear definitions straight into rational terms.

Question 5

Solution:
Let numbers be x and $(9-x)$.
$\frac{1}{x} + \frac{1}{9-x} = \frac{1}{2} \implies \frac{9}{9x-x^2} = \frac{1}{2}$
$18 = 9x - x^2 \implies x^2 - 9x + 18 = 0 \implies (x-6)(x-3) = 0$.
Numbers are 3 and 6.

Formula / Hints:
Cross multiply to clear denominators.

Question 6

Solution:
Let integers be $x, (x+1), (x+2)$.
$x^2 + (x+1)(x+2) = 46 \implies x^2 + x^2 + 3x + 2 = 46$
$2x^2 + 3x - 44 = 0 \implies (2x+11)(x-4) = 0 \implies x = 4$.
The integers are 4, 5, and 6.

Formula / Hints:
Consecutive integers update step by $+1$.

Question 8

Solution:
Identical problem template to Question 1.
Equation forms: $x^2 + 2x - 195 = 0 \implies x = 13$.
The numbers are 13 and 15.

Formula / Hints:
Duplicate board tracking variant.

Question 11

Solution:
Let the number be x. Given $x + \sqrt{x} = \frac{6}{25}$.
Let $\sqrt{x} = y \implies y^2 + y - \frac{6}{25} = 0 \implies 25y^2 + 25y - 6 = 0$
$(5y - 1)(5y + 6) = 0 \implies y = \frac{1}{5} \implies x = y^2 = \frac{1}{25}$.

Formula / Hints:
Variable transformation shortcut method: $\sqrt{x} = y$.

Question 14

Solution:
Let larger number be x. Smaller number square $= 8x$.
$x^2 - 8x = 180 \implies x^2 - 8x - 180 = 0 \implies (x - 18)(x + 10) = 0 \implies x = 18$.
Smaller square $= 8(18) = 144 \implies$ Smaller number $= \pm 12$.
Numbers are $(18, 12)$ or $(18, -12)$.

Formula / Hints:
Reject negative dimensions if constraints require natural targets.

Question 16

Solution:
Let denominator $= x$. Numerator $= x - 3$. Fraction $= \frac{x-3}{x}$.
Add 2: New fraction $= \frac{x-1}{x+2}$.
$\frac{x-3}{x} + \frac{x-1}{x+2} = \frac{29}{20} \implies \frac{(x-3)(x+2)+x(x-1)}{x^2+2x} = \frac{29}{20}$
$\frac{2x^2-2x-6}{x^2+2x} = \frac{29}{20} \implies 40x^2 - 40x - 120 = 29x^2 + 58x$
$11x^2 - 98x - 120 = 0 \implies (11x + 12)(x - 10) = 0 \implies x = 10$.
Original fraction $= \frac{10-3}{10} = \frac{7}{10}$.

Formula / Hints:
Cross multiplication mechanics tracking framework.

Question 20

Solution:
Let tens digit $= x$. Units digit $= x - 5$.
Product: $x(x - 5) = 36 \implies x^2 - 5x - 36 = 0 \implies (x - 9)(x + 4) = 0 \implies x = 9$.
Units digit $= 9 - 5 = 4$. Number $= 94$.

Formula / Hints:
Digits must be single positive whole integers.

Question 21

Solution:
Let greater integer $= x$. Twice smaller $= x + 5 \implies$ Smaller $= \frac{x+5}{2}$.
$x^2 - \left(\frac{x+5}{2}\right)^2 = 400 \implies x^2 - \frac{x^2+10x+25}{4} = 400$
$4x^2 - x^2 - 10x - 25 = 1600 \implies 3x^2 - 10x - 1625 = 0$
$(3x+65)(x-25) = 0 \implies x = 25$. Smaller $= \frac{25+5}{2} = 15$.

Formula / Hints:
Scale full linear row blocks to drop fractions.

Question 22

Solution:
Let digits be x and $y \implies xy = 12$. Original number $= 10x + y$.
Add 36: $(10x+y)+36 = 10y+x \implies 9y-9x = 36 \implies y - x = 4 \implies y = x + 4$.
$x(x+4) = 12 \implies x^2+x-12 = 0 \implies (x+6)(x-2) = 0 \implies x = 2$.
$y = 2 + 4 = 6$. Number $= 26$.

Formula / Hints:
Interchanged lines reverse digit coefficients.

Question 23

Solution:
Let original number $= 10x + y$. Given $10x + y = 7(x + y) \implies 3x = 6y \implies x = 2y$.
Also: $10x + y = 5xy + 2$. Substitute $x = 2y$:
$10(2y) + y = 5(2y)y + 2 \implies 21y = 10y^2 + 2 \implies 10y^2 - 21y + 2 = 0$
$(10y - 1)(y - 2) = 0 \implies y = 2 \implies x = 2(2) = 4$. Number $= 42$.

Formula / Hints:
Simultaneous coefficient substitution system loops.

Exercise Set 4.7 (CBSE Board Questions)

Question 1

Solution:
Let original speed = x km/hr. Distance = 90 km.
$\frac{90}{x} - \frac{90}{x+15} = \frac{30}{60} = \frac{1}{2} \implies 90\left(\frac{15}{x^2+15x}\right) = \frac{1}{2}$
$2700 = x^2 + 15x \implies x^2 + 15x - 2700 = 0 \implies (x+60)(x-45) = 0 \implies x = 45.$
Original speed = 45 km/hr.

Formula / Hints:
Convert time differences into hours consistently.

Question 2

Solution:
Let speed = x km/hr. Distance = 360 km.
$\frac{360}{x} - \frac{360}{x+5} = 1 \implies 360\left(\frac{5}{x^2+5x}\right) = 1 \implies x^2 + 5x - 1800 = 0$
$(x+45)(x-40) = 0 \implies x = 40$ km/hr.

Formula / Hints:
Time Equation: $T_{\text{slow}} - T_{\text{fast}} = \Delta T$

Question 3

Solution:
Let speed = x km/hr. Distance = 480 km.
$\frac{480}{x-8} - \frac{480}{x} = 3 \implies 480\left(\frac{8}{x^2-8x}\right) = 3 \implies 160 \times 8 = x^2 - 8x$
$x^2 - 8x - 1280 = 0 \implies (x-40)(x+32) = 0 \implies x = 40$ km/hr.

Formula / Hints:
Speed reduction increases total travel time.

Question 4

Solution:
Let passenger speed = x km/hr. Express speed = $(x+11)$ km/hr.
$\frac{132}{x} - \frac{132}{x+11} = 1 \implies 132\left(\frac{11}{x^2+11x}\right) = 1 \implies x^2 + 11x - 1452 = 0$
$(x+44)(x-33) = 0 \implies x = 33.$
Passenger speed = 33 km/hr, Express speed = 44 km/hr.

Formula / Hints:
Isolate standard factorization pairs.

Question 5

Solution:
Speed boat = 18 km/hr. Let stream speed = x km/hr.
$\frac{24}{18-x} - \frac{24}{18+x} = 1 \implies 24\left(\frac{2x}{324-x^2}\right) = 1 \implies 48x = 324 - x^2$
$x^2 + 48x - 324 = 0 \implies (x+54)(x-6) = 0 \implies x = 6$ km/hr.

Formula / Hints:
Upstream uses $(v - x)$; downstream uses $(v + x)$.

Question 6

Solution:
Speed boat = 9 km/hr. Let stream speed = x km/hr. Total time = 3h 45m = $\frac{15}{4}$ hours.
$\frac{15}{9-x} + \frac{15}{9+x} = \frac{15}{4} \implies 15\left(\frac{18}{81-x^2}\right) = \frac{15}{4} \implies \frac{18}{81-x^2} = \frac{1}{4}$
$72 = 81 - x^2 \implies x^2 = 9 \implies x = 3$ km/hr.

Formula / Hints:
Total journey times sum up downstream and upstream blocks.

Question 7

Solution:
Let speed = x km/hr. Distance = 360 km. Time diff = 48 mins = $\frac{4}{5}$ hours.
$\frac{360}{x} - \frac{360}{x+5} = \frac{4}{5} \implies 360\left(\frac{5}{x^2+5x}\right) = \frac{4}{5} \implies 90 \times 5 \times 5 = x^2 + 5x$
$x^2 + 5x - 2250 = 0 \implies (x+50)(x-45) = 0 \implies x = 45$ km/hr.

Formula / Hints:
Scale fraction equations down by common terms first.

Question 8

Solution:
Let usual speed = x km/hr. Time diff = 40 mins = $\frac{2}{3}$ hours. Distance = 1600 km.
$\frac{1600}{x} - \frac{1600}{x+400} = \frac{2}{3} \implies 1600\left(\frac{400}{x^2+400x}\right) = \frac{2}{3}$
$800 \times 400 \times 3 = x^2 + 400x \implies x^2 + 400x - 960000 = 0$
$(x+1200)(x-800) = 0 \implies x = 800$ km/hr.

Formula / Hints:
Large value trinomial factorization grouping paths.

Question 9

Solution:
Let first speed = x km/hr. Total time = 3 hours.
$\frac{63}{x} + \frac{72}{x+6} = 3 \implies \frac{21}{x} + \frac{24}{x+6} = 1 \implies \frac{21(x+6)+24x}{x^2+6x} = 1$
$45x + 126 = x^2 + 6x \implies x^2 - 39x - 126 = 0 \implies (x-42)(x+3) = 0 \implies x = 42$ km/hr.

Formula / Hints:
Add the sequential leg components to track full hours.

Question 10

Solution:
Let usual speed = x km/hr. Time diff = 50 mins = $\frac{5}{6}$ hours. Distance = 1250 km.
$\frac{1250}{x} - \frac{1250}{x+250} = \frac{5}{6} \implies 1250\left(\frac{250}{x^2+250x}\right) = \frac{5}{6}$
$250 \times 250 \times 6 = x^2 + 250x \implies x^2 + 250x - 375000 = 0$
$(x + 750)(x - 500) = 0 \implies x = 500$ km/hr.

Formula / Hints:
Split giant constants via known shared components.

Question 11

Solution:
Let usual speed = x km/hr. Time diff = 30 mins = $\frac{1}{2}$ hours. Distance = 1500 km.
$\frac{1500}{x} - \frac{1500}{x+100} = \frac{1}{2} \implies 1500\left(\frac{100}{x^2+100x}\right) = \frac{1}{2}$
$300000 = x^2 + 100x \implies x^2 + 100x - 300000 = 0$
$(x + 600)(x - 500) = 0 \implies x = 500$ km/hr.

Formula / Hints:
Factor pairs mapping check logic step.

Question 12

Solution:
Let speed = x km/hr. Time taken = $\frac{x}{2}$ hours. Distance = 2592 km.
Speed × Time = Distance $\implies x \times \frac{x}{2} = 2592 \implies x^2 = 5184 \implies x = 72$ km/hr.
Time taken = $\frac{72}{2} = 36$ hours.

Formula / Hints:
Distance = Speed × Time

Question 14

Solution:
Let upward speed = x km/h. Downward speed = $(x+10)$ km/h. Distance = 150 km.
Time diff = $2\frac{1}{2} = \frac{5}{2}$ hours.
$\frac{150}{x} - \frac{150}{x+10} = \frac{5}{2} \implies 150\left(\frac{10}{x^2+10x}\right) = \frac{5}{2} \implies 30 \times 10 \times 2 = x^2 + 10x$
$x^2 + 10x - 600 = 0 \implies (x+30)(x-20) = 0 \implies x = 20$ km/h.
Upward speed = 20 km/h, Downward speed = 30 km/h.

Formula / Hints:
Upward travel takes longer because speeds are lower.

Exercise Set 4.8 (CBSE Board Questions)

Question 6

Solution:
Let sister's age = x years. Girl's age = $2x$ years.
Four years hence: $(2x+4)(x+4) = 160 \implies 2x^2+12x+16 = 160$
$2x^2 + 12x - 144 = 0 \implies x^2 + 6x - 72 = 0 \implies (x+12)(x-6) = 0 \implies x = 6$.
Sister's age = 6 years, Girl's age = 12 years.

Formula / Hints:
Update ages before multiplying product components.

Exercise Set 4.10 (CBSE Board Questions)

Question 3

Solution:
Let sides of squares be x and y. Sum of areas: $x^2 + y^2 = 640$.
Difference of perimeters: $4x - 4y = 64 \implies x - y = 16 \implies x = y + 16$.
$(y + 16)^2 + y^2 = 640 \implies y^2 + 32y + 256 + y^2 = 640$
$2y^2 + 32y - 384 = 0 \implies y^2 + 16y - 192 = 0 \implies (y + 24)(y - 8) = 0 \implies y = 8$.
Sides are 8 m and 24 m.

Formula / Hints:
Area $= s^2$, Perimeter $= 4s$.

Question 4

Solution:
Let sides of squares be x and y. $x^2 + y^2 = 52$.
Difference of perimeters: $4x - 4y = 8 \implies x - y = 2 \implies x = y + 2$.
$(y + 2)^2 + y^2 = 52 \implies y^2 + 4y + 4 + y^2 = 52 \implies 2y^2 + 4y - 48 = 0$
$y^2 + 2y - 24 = 0 \implies (y + 6)(y - 4) = 0 \implies y = 4$.
Sides are 4 cm and 6 cm.

Formula / Hints:
Substitute linear side differences to extract targets.

Question 5

Solution:
Let breadth $= x$ m. Length $= 2x + 1$ m. Area $= 528$ m^2.
$x(2x + 1) = 528 \implies 2x^2 + x - 528 = 0$
$2x^2 + 33x - 32x - 528 = 0 \implies x(2x + 33) - 16(2x + 33) = 0 \implies x = 16$.
Breadth $= 16$ m, Length $= 2(16) + 1 = 33$ m.

Formula / Hints:
Area of Rectangle $=$ Length $\times$ Breadth

Exercise Set 4.11 (CBSE Board Questions)

Question 4

Solution:
Let faster pipe fill in x mins. Slower pipe fills in $(x+5)$ mins.
Together they fill in $11\frac{1}{9} = \frac{100}{9}$ mins.
$\frac{1}{x} + \frac{1}{x+5} = \frac{9}{100} \implies \frac{2x+5}{x^2+5x} = \frac{9}{100} \implies 200x + 500 = 9x^2 + 45x$
$9x^2 - 155x - 500 = 0 \implies (x-20)(9x+25) = 0 \implies x = 20.$
Faster pipe takes 20 mins, Slower pipe takes 25 mins.

Formula / Hints:
Work rate inversion: $\frac{1}{t_1} + \frac{1}{t_2} = \frac{1}{T}$

Question 5

Solution:
Let larger diameter pipe take x hours. Smaller takes $(x+10)$ hours.
Given: $\frac{4}{x} + \frac{9}{x+10} = \frac{1}{2} \implies \frac{4(x+10)+9x}{x^2+10x} = \frac{1}{2} \implies \frac{13x+40}{x^2+10x} = \frac{1}{2}$
$26x + 80 = x^2 + 10x \implies x^2 - 16x - 80 = 0 \implies (x-20)(x+4) = 0 \implies p = 20.$
Larger pipe takes 20 hours, Slower takes 30 hours.

Formula / Hints:
Sum up fraction shares completed inside partial hours.

Question 6

Solution:
Let smaller tap fill in x hours. Larger fills in $(x-2)$ hours.
Together they fill in $1\frac{7}{8} = \frac{15}{8}$ hours.
$\frac{1}{x} + \frac{1}{x-2} = \frac{8}{15} \implies \frac{2x-2}{x^2-2x} = \frac{8}{15} \implies 30x - 30 = 8x^2 - 16x$
$8x^2 - 46x + 30 = 0 \implies 4x^2 - 23x + 15 = 0 \implies (4x-3)(x-5) = 0 \implies x = 5.$
Smaller tap takes 5 hours, Larger takes 3 hours.

Formula / Hints:
Drop common multipliers from core trinomial systems.

Question 3

Solution:
Let original price = x. Total budget = 360. Reduced price = $x - 2$.
$\frac{360}{x-2} - \frac{360}{x} = 2 \implies 360\left(\frac{2}{x^2-2x}\right) = 2 \implies x^2 - 2x - 360 = 0$
$(x-20)(x+18) = 0 \implies x = 20$. Original price is 20.

Formula / Hints:
Quantity = $\frac{\text{Total Budget}}{\text{Price per item}}$

Question 5

Solution:
Let Math marks = x. English marks = $30 - x$.
$(x+2)(30-x-3) = 210 \implies (x+2)(27-x) = 210$
$27x - x^2 + 54 - 2x = 210 \implies x^2 - 25x + 156 = 0 \implies (x-12)(x-13) = 0$.
If Math = 12 $\implies$ English = 18; if Math = 13 $\implies$ English = 17.

Formula / Hints:
Two distinct valid combinations exist for matching marks.

Question 6

Solution:
Let Math marks = x. Science marks = $32 - x$.
$(x+4)(32-x-2) = 253 \implies (x+4)(30-x) = 253$
$30x - x^2 + 120 - 4x = 253 \implies x^2 - 26x + 133 = 0 \implies (x-19)(x-7) = 0$.
If Math = 19 $\implies$ Science = 13; if Math = 7 $\implies$ Science = 25.

Formula / Hints:
Track product modifications exactly as stated.

Question 8

Solution:
Circular park diameter = 13 m. Let distance from gate A = x m, from gate B = y m.
By properties of circle geometry, angle in a semicircle $= 90^\circ \implies x^2 + y^2 = 13^2 = 169$.
Difference of distances: $x - y = 7 \implies x = y + 7$.
$(y+7)^2 + y^2 = 169 \implies y^2 + 14y + 49 + y^2 = 169 \implies 2y^2 + 14y - 120 = 0$
$y^2 + 7y - 60 = 0 \implies (y+12)(y-5) = 0 \implies y = 5$ m.
$x = 5 + 7 = 12$ m.
Yes, it is possible; distances are 5 m and 12 m.

Formula / Hints:
Diametrically opposite gates form a right-angled triangle on any boundary point.