Exercises – Quadratics ; Factor Method, Completing the Square

Solve by Inspection:

1. $x(x-2) = 0$

2. $(x-1)(x+2) = 0$

3. $(2x-5)(x+1) = 0$

Solve using the "Factor method":

4. $x^2 - 11x = 0$

5. $9x - 4x^2 = 0$

6. $5x^2 = 3x$

7. $x^2 - 9 = 0$

8. $4x^2 - 25 = 0$

9. $x^2 - x - 12 = 0$

10. $x^2 + 3x - 28 = 0$

11. $x^2 - 16x + 28 = 0$

12. $x^2 = 7x - 6$

13. $6x^2 + 11x + 4 = 0$

14. $8x^2 + 6 = 16x$

Solve by "Completing the square":

15. $x^2 + 8x = 9$

16. $x^2 - 10x + 24 = 0$

17. $x^2 + 6x + 1 = 0$

18. $2x^2 + 6x = 3$

Answers: (1) $x = 0, 2$ (2) $x = 1, -2$ (3) $x = 2.5, -1$ (4) $x = 0, 11$ (5) $x = 0, 2.25$ (6) $x = 0, 0.6$

(7) $x = 3, -3$ (8) $x = 2.5, -2.5$ (9) $x = 4, -3$ (10) $x = 4, -7$ (11) $x = 14, 2$ (12) $x = 1, 6$

(13) $x = -\frac{1}{2}, -\frac{4}{3}$ (14) $x = \frac{1}{2}, \frac{3}{2}$ (15) $x = -9, 1$ (16) $x = 6, 4$ (17) $x = -3 \pm 2\sqrt{2}$ (18) $x = \frac{-3 \pm \sqrt{15}}{2}$

Quadratic Formula – Exercises

<u>Solving quadratics using the formula:-</u>

The 2 possible solutions to: $ax^2 + bx + c = 0$ are . . . . $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

To find them:

Step 1: write down the values of the co-efficients a, b and c to start your working.

Step 2: Find the *discriminant*, $\Delta = b^2 - 4ac$ as a separate calculation.

Step 3: The solutions are . . . . $x_1 = \dfrac{-b + \sqrt{\Delta}}{2a}$ and $x_2 = \dfrac{-b - \sqrt{\Delta}}{2a}$

<u>EXERCISE</u> – Solve using the quadratic formula:

(1) $3x^2 - 7x - 2 = 0$

(2) $x^2 + 6x = 3$

(3) $6x^2 - 10 = \dfrac{x}{2}$

(4) $n(2n + 9) = -3$

(5) $8x^2 = 5 - 6x$

(6) $2x^2 - 4x - 1 = 0$

<u>Answers:</u>

(1) $x = \dfrac{7 \pm \sqrt{73}}{6}$ (2) $x = -3 \pm 2\sqrt{3}$ (3) $x = \dfrac{4}{3}$ or $-\dfrac{5}{4}$ (4) $n = \dfrac{-9 \pm \sqrt{57}}{4}$

(5) $x = \dfrac{1}{2}$ or $-\dfrac{5}{4}$ (6) $x = \dfrac{2 \pm \sqrt{6}}{2}$

QUADRATIC EQUATIONS

Q1. Solve the following quadratic equations:
    (a) $x^2 + 5x + 6 = 0$ (b) $x^2 - 2x - 24 = 0$ (c) $x^2 - 8x + 16 = 0$
    (d) $x^2 + x - 12 = 0$ (e) $x^2 + x - 56 = 0$ (f) $x^2 - 5x - 24 = 0$

Q2. Solve:
    (a) $6x^2 - 8x - 8 = 0$ (b) $8x^2 - 10x - 3 = 0$
    (c) $20x^2 + 19x + 3 = 0$ (d) $6x^2 - 10x - 24 = 0$
    (e) $12x^2 + 31x + 7 = 0$ (f) $9x^2 - 70x - 16 = 0$

Q3. Solve:
    (a) $x^2 - 25 = 0$ (b) $x^2 + 6x = 27$ (c) $10x^2 = x + 2$ (d) $x^2 - x = 0$
    (e) $5x - x^2 = 0$ (f) $9x = x^2$ (g) $x^2 = 1$ (h) $9x^2 - 4 = 0$

Q4. Solve the following by completing the square:
    (a) $x^2 + 4x - 3 = 0$ (b) $x^2 - 6x + 1 = 0$ (c) $x^2 + 2x - 5 = 0$
    (d) $x^2 - 3x - 2 = 0$ (e) $x^2 - 7x + 2 = 0$ (f) $x^2 + 9x - 8 = 0$

Q5. Solve the following by completing the square:
    (a) $2x^2 - 5x + 2 = 0$ (b) $4x^2 + 10x + 3 = 0$
    (c) $6x^2 - 5x - 2 = 0$ (d) $5x^2 - 3x - 4 = 0$
    (e) $3x^2 - 3x - 1 = 0$ (f) $3x^2 - 8x + 3 = 0$

Q6. Use the quadratic formula to solve these:
    (a) $3x^2 - 9x + 2 = 0$ (b) $2x^2 + 2x - 1 = 0$
    (c) $4x^2 + 7x + 3 = 0$ (d) $2x^2 + 11x - 5 = 0$
    (e) $3x^2 + 9x + 5 = 0$ (f) $5x^2 - 3x - 4 = 0$

Q7. Solve:
    (a) $3x + 5 = -\dfrac{2}{x}$ (b) $x = \dfrac{3}{5x + 8}$ (c) $x^2 + 4x = -\dfrac{4}{3}$
    (d) $x = \dfrac{1}{2x} + \dfrac{1}{4}$ (e) $x - 1 = -\dfrac{1}{4x}$ (f) $4x = 7 - \dfrac{3}{2x}$

Q8. (a) Two consecutive even numbers have a product of 288. What are the numbers?

    (b) The sum of a negative number and its square equals 156. What is the number?

    (c) The base of a triangle is 6 cm longer than its height. If the area of the triangle is 140 cm², what is the length of the base?

    (d) At present Mark's age is x^2 years and Peter's age is x years. When Mark is 10x years, Peter will be 3x years. What are their present ages?

    (e) The sum of three consecutive numbers is squared and the result is 441. What are the numbers?

Quadratic equations — *Answers*

Q1. (a) $x = -2, -3$ (b) $x = -4, 6$ (c) $x = 4$ (d) $x = -4, 3$
    (e) $x = -8, 7$ (f) $x = -3, 8$

Q2. (a) $x = -\dfrac{2}{3}, 2$ (b) $x = -\dfrac{1}{4}, 1\dfrac{1}{2}$ (c) $x = -\dfrac{3}{4}, -\dfrac{1}{5}$ (d) $x = -1\dfrac{1}{3}, 3$

    (e) $x = -2\dfrac{1}{3}, -\dfrac{1}{4}$ (f) $x = 8, -\dfrac{2}{9}$

Q3. (a) $x = -5, 5$ (b) $x = -9, 3$ (c) $x = -\dfrac{2}{5}, \dfrac{1}{2}$ (d) $x = 0, 1$

    (e) $x = 0, 5$ (f) $x = 0, 9$ (g) $x = -1, 1$ (h) $x = -\dfrac{2}{3}, \dfrac{2}{3}$

Q4. (a) $x = -2 \pm \sqrt{7}$ (b) $x = 3 \pm \sqrt{8}$ (c) $x = -1 \pm \sqrt{6}$ (d) $x = \dfrac{3 \pm \sqrt{17}}{2}$

    (e) $x = \dfrac{7 \pm \sqrt{41}}{2}$ (f) $x = \dfrac{-9 \pm \sqrt{113}}{2}$

Q5. (a) $x = \dfrac{1}{2}, 2$ (b) $x = \dfrac{-5 \pm \sqrt{13}}{4}$ (c) $x = \dfrac{5 \pm \sqrt{73}}{12}$ (d) $x = \dfrac{3 \pm \sqrt{89}}{10}$

    (e) $x = \dfrac{3 \pm \sqrt{21}}{6}$ (f) $x = \dfrac{4 \pm \sqrt{7}}{3}$

Q6. (a) $x = \dfrac{9 \pm \sqrt{57}}{6}$ (b) $x = \dfrac{-1 \pm \sqrt{3}}{2}$ (c) $x = -1, -\dfrac{3}{4}$ (d) $x = \dfrac{-11 \pm \sqrt{161}}{4}$

    (e) $x = \dfrac{-9 \pm \sqrt{21}}{6}$ (f) $x = \dfrac{3 \pm \sqrt{89}}{10}$

Q7. (a) $x = -1, -\dfrac{2}{3}$ (b) $x = \dfrac{-4 \pm \sqrt{31}}{5}$ (c) $x = \dfrac{-6 \pm 2\sqrt{6}}{3}$ (d) $x = \dfrac{1 \pm \sqrt{33}}{8}$

    (e) $x = \dfrac{1}{2}$ (f) $x = \dfrac{1}{4}, 1\dfrac{1}{2}$

Q8. (a) $16, 18$ (b) -13 (c) $20\,\text{cm}$ (d) $64, 8$ (e) $6, 7, 8$ or $-8, -7, -6$