

## MATH141 - Worksheet QUADRATIC EQUATIONS

An equation of the form

$$ax^2 + bx + c = 0, \quad a \neq 0$$

is called a **quadratic** equation.

Solution of a quadratic equation by factorising.

If  $ab = 0$  then  $a = 0$  or  $b = 0$  or  $a = b = 0$

1. Solve the following equations by first factorising the quadratic.

|                          |                          |                          |                         |
|--------------------------|--------------------------|--------------------------|-------------------------|
| (a) $x^2 - 7x + 12 = 0$  | (b) $x^2 - 10x + 16 = 0$ | (c) $x^2 + 2x - 15 = 0$  | (d) $x^2 - 4x - 21 = 0$ |
| (e) $x^2 - 5x + 6 = 0$   | (f) $x^2 + 19x + 18 = 0$ | (g) $x^2 - 17x + 72 = 0$ | (h) $x^2 + 5x = 0$      |
| (i) $x^2 + 8x + 7 = 0$   | (j) $3x^2 + 6x = 0$      | (k) $2x^2 = 32 - 12x$    | (l) $3x^2 + 7x - 6 = 0$ |
| (m) $x^2 = 10x - 21$     | (n) $x^2 - x - 56 = 0$   | (o) $3x^2 + 2x - 5 = 0$  | (p) $6x^2 = 6 - 5x$     |
| (q) $4x^2 + 19x = 5$     | (r) $6x^2 - 24 = 0$      | (s) $2x^2 = 13x - 20$    | (t) $12x^2 + 7x = 12$   |
| (u) $6x^2 + 29x - 5 = 0$ | (v) $(x - 5)^2 = 36$     | (w) $(x + 2)(x + 3) = 2$ | (x) $x^2 = 4(x + 24)$   |

Solution of a quadratic equation by completing the square.

Add to each side of the equation **the square of half the coefficient of x**.

2. Use the method of completing the square to solve the following quadratic equations. Give your answer in surd form.

|                         |                        |                        |                        |
|-------------------------|------------------------|------------------------|------------------------|
| (a) $x^2 - 2x - 4 = 0$  | (b) $x^2 + 4x - 4 = 0$ | (c) $x^2 - x - 5 = 0$  | (d) $x^2 - 6x + 2 = 0$ |
| (e) $x^2 - 5x + 1 = 0$  | (f) $x^2 + 2x - 2 = 0$ | (g) $x^2 = 6x - 4$     | (h) $x^2 + x - 1 = 0$  |
| (i) $x^2 - 6x - 5 = 0$  | (j) $x^2 + 4x = 1$     | (k) $x^2 = 2x + 5$     | (l) $x^2 + 3x - 6 = 0$ |
| (m) $x^2 - x = 3$       | (n) $x^2 - 3x = 9$     | (o) $x^2 + 6x = 7$     | (p) $x^2 + 6x = 91$    |
| (q) $x^2 - 10x = 1$     | (r) $x^2 + 2x = 6$     | (s) $x^2 + 6x + 4 = 0$ | (t) $x^2 + 8x + 9 = 0$ |
| (u) $x^2 + 10x - 6 = 0$ | (v) $x^2 = 4x + 3$     | (w) $x^2 - 12x = 28$   | (x) $x^2 + 3x = 1$     |

In order to use the method of completing the square **the coefficient of  $x^2$  must be 1**.

3. Use the method of completing the square to solve the following quadratic equations. Give your answer correct to 3 decimal places.

|                        |                        |                         |                     |
|------------------------|------------------------|-------------------------|---------------------|
| (a) $2x^2 - x - 5 = 0$ | (b) $2x^2 + x - 2 = 0$ | (c) $3x^2 - 5x - 1 = 0$ | (d) $3x^2 - 2x = 4$ |
| (e) $3x^2 = 7x + 3$    | (f) $2x^2 - 5x = 9$    | (g) $2x^2 + x = 4$      | (h) $4x^2 = 9x - 4$ |

Solution of a quadratic equation by formula.

$$\text{If } ax^2 + bx + c = 0, \text{ then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

4. Solve the following quadratic equations using the formula, giving solutions correct to decimal places:

|                         |                         |                         |                         |
|-------------------------|-------------------------|-------------------------|-------------------------|
| (a) $x^2 - 4x - 1 = 0$  | (b) $x^2 + 3x - 5 = 0$  | (c) $x^2 - 7x - 3 = 0$  | (d) $5x^2 - 2x - 4 = 0$ |
| (e) $2x^2 + 7x + 2 = 0$ | (f) $x^2 - x - 3 = 0$   | (g) $3x^2 + 9x + 5 = 0$ | (h) $x^2 + 10x + 5 = 0$ |
| (i) $7x^2 = 4x + 1$     | (j) $4x^2 - 2x - 3 = 0$ | (k) $2x^2 + 5x = 2$     | (l) $3x^2 + 7x + 1 = 0$ |

5. Solve the following quadratic equations using the formula, giving solutions in simplest surd form:

|                         |                          |                         |                          |
|-------------------------|--------------------------|-------------------------|--------------------------|
| (a) $x^2 - 6x - 1 = 0$  | (b) $x^2 + 10x + 10 = 0$ | (c) $x^2 + 2x - 5 = 0$  | (d) $x^2 - 7x + 3 = 0$   |
| (e) $4x^2 - 6x + 1 = 0$ | (f) $3x^2 + 2x - 5 = 0$  | (g) $7x^2 - 3x - 1 = 0$ | (h) $2x^2 + 5x - 12 = 0$ |
| (i) $2x^2 + 5x - 3 = 0$ | (j) $5x^2 + 8x + 2 = 0$  | (k) $6x^2 + 5x = 6$     | (l) $3x^2 = 2x + 2$      |

6. Solve the following quadratic equations by the method you consider the simplest in each case:

|                          |                          |                                   |                          |
|--------------------------|--------------------------|-----------------------------------|--------------------------|
| (a) $(x - 3)^2 = 25$     | (b) $x^2 - 13x + 36 = 0$ | (c) $2x^2 - 5x - 12 = 0$          | (d) $4x^2 - 12x + 9 = 0$ |
| (e) $x^2 = 2x + 48$      | (f) $x^2 + 6x = 72$      | (g) $x^2 - 7x + 3 = 0$            | (h) $3x^2 - x - 1 = 0$   |
| (i) $(x - 3)^2 = 9$      | (j) $2x^2 - 7x + 5 = 0$  | (k) $x^2 - 4x - 21 = 0$           | (l) $(2x - 1)^2 = 36$    |
| (m) $2x^2 - 11x + 5 = 0$ | (n) $2x^2 + 3x = 5$      | (o) $(2x + 3)^2 = (x + 4)(x + 3)$ |                          |