



THIRD SPACE
LEARNING

Diagnostic Questions

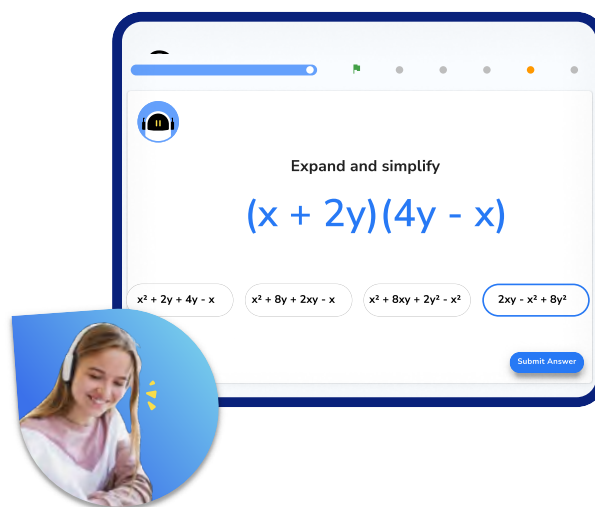
Solving Quadratic Equations | Algebra

This resource in a nutshell

Diagnostic questions are a quick and easy way of assessing your students' knowledge and understanding of a particular topic.

Students may be struggling with **solving quadratic equations** for a number of different reasons. Diagnostic questions can help to identify the particular misconception that the student has and help to determine the specific support they will need in order to improve.

They are low stakes and support students developing metacognition around how their learning is progressing and what they need to do to improve further.



At Third Space Learning, we use diagnostic questions before and after online tutoring sessions to identify gaps and track progress, an example of this is shown above.

How to use the questions in this resource

There are 20 multiple choice questions, each designed to assess each of the key skills required to master **solving quadratic equations**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **Factorising, the Number of solutions, Order of operations, Substitution, and Reading points from a graph**.

When answering these questions, students should be **encouraged to explain why they have chosen a particular answer**, and why the other three answers are incorrect. This can be done verbally in small groups, or written down on the worksheet or in their books.

This resource has been designed to be as **flexible** as possible with questions that can be easily chopped up and reordered, and come with a separate answer sheet that details all of the misconceptions highlighted in the answers.

Diagnostic Questions: Solving Quadratic Equations

1. Solve:

$$x^2 + 5x + 6 = 0$$

A) $x = 1$ $x = 5$	B) $x = 3$ $x = 2$
C) $x = -3$ $x = -2$	D) $x = -1$ $x = -5$

2. Solve:

$$x^2 + 11x + 24 = 0$$

A) $x = -3$ $x = -8$	B) $x = 4$ $x = 6$
C) $x = 3$ $x = 8$	D) $x = -4$ $x = -6$

3. Solve:

$$x^2 + 4x + 4 = 0$$

A) $x = -1$ $x = -4$	B) $x = -2$
C) $x = 2$	D) $x = -2$ $x = 2$

Diagnostic Questions: Solving Quadratic Equations

4. Solve:

$$x^2 - 6x + 8 = 0$$

A) $x = -4$ $x = -2$	B) $x = -4$ $x = 2$
C) $x = 4$ $x = -2$	D) $x = 4$ $x = 2$

5. Solve:

$$x^2 + 2x - 15 = 0$$

A) $x = -3$ $x = -5$	B) $x = -3$ $x = 5$
C) $x = 3$ $x = -5$	D) $x = 3$ $x = 5$

6. Solve:

$$2x^2 + 3x - 9 = 0$$

A) $x = -1.5$ $x = -3$	B) $x = 1.5$ $x = 3$
C) $x = -1.5$ $x = 3$	D) $x = 1.5$ $x = -3$

Diagnostic Questions: Solving Quadratic Equations

7. Solve:

$$3x^2 - 9x + 6 = 0$$

A) $x = 2$ $x = 1$	B) $x = -2$ $x = -1$
C) $x = 2$ $x = -1$	D) $x = -2$ $x = 1$

8. Solve:

$$2x^2 - 7x + 6 = 0$$

A) $x = 1$ $x = 6$	B) $x = -1$ $x = -6$
C) $x = -1.5$ $x = -2$	D) $x = 1.5$ $x = 2$

9. Which is the correct substitution into the quadratic formula for the solutions of:

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

A) $x = \frac{-2 + \sqrt{-4 + 80}}{10}$ and $x = \frac{-2 - \sqrt{-4 + 80}}{10}$	B) $x = \frac{2 + \sqrt{4 + 80}}{10}$ and $x = \frac{2 - \sqrt{4 + 80}}{10}$
C) $x = \frac{2 + \sqrt{4 - 80}}{10}$ and $x = \frac{2 - \sqrt{4 - 80}}{10}$	D) $x = \frac{-2 + \sqrt{-4 - 80}}{10}$ and $x = \frac{-2 - \sqrt{-4 - 80}}{10}$

Diagnostic Questions: Solving Quadratic Equations

10. Solve:

$$3x^2 - 4x - 5 = 0$$

Round your answers to 3 significant figures

A) $x = -5.45$ $x = -2.55$	B) $x = 5.45$ $x = 2.55$
C) $x = -2.12$ $x = 0.786$	D) $x = 2.12$ $x = -0.786$

11. Solve:

$$5x^2 + 2x - 4 = 0$$

Round your answers to 3 significant figures

A) $x = 0.717$ $x = -1.12$	B) $x = -1.08$ $x = -2.92$
C) $x = -0.717$ $x = 1.12$	D) $x = 1.08$ $x = 2.92$

12. Solve:

$$x^2 - 2x - 48 = -13$$

A) $x = -7$ $x = 5$	B) $x = -8$ $x = 6$
C) $x = 8$ $x = -6$	D) $x = 7$ $x = -5$

Diagnostic Questions: Solving Quadratic Equations

13. Solve:

$$4x^2 - 100 = 0$$

A) $x = 5$	B) $x = -5$ $x = 5$
C) $x = 2.5$	D) $x = -2.5$ $x = 2.5$

14. Solve:

$$3x^2 = 18x$$

A) $x = 6$	B) $x = 0$ $x = -6$
C) $x = -6$	D) $x = 0$ $x = 6$

15. Solve:

$$2x^2 - 4x - 7 = 0$$

Give your answers as surds in their simplest form.

A) $x = \frac{2 + 3\sqrt{2}}{2}$ $x = \frac{2 - 3\sqrt{2}}{2}$	B) $x = \frac{-2 + 3\sqrt{2}}{2}$ $x = \frac{-2 - 3\sqrt{2}}{2}$
C) $x = \frac{4 + 6\sqrt{2}}{4}$ $x = \frac{4 - 6\sqrt{2}}{4}$	D) $x = 4 + \frac{3\sqrt{2}}{2}$ $x = 4 - \frac{3\sqrt{2}}{2}$

Diagnostic Questions: Solving Quadratic Equations

16. By first completing the square, find the solutions to the equation

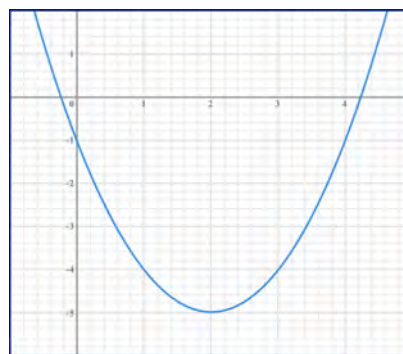
$$x^2 + 8x + 3 = 0$$

Give your answers as surds in their simplest form.

A) $(x + 4)^2 - 13 = 0$ $x = -4 \pm \sqrt{13}$	B) $(x + 4)^2 - 19 = 0$ $x = -4 \pm \sqrt{19}$
C) $(x + 4)^2 + 13 = 0$ $x = 4 \pm \sqrt{-13}$	D) $(x + 4)^2 - 3 = 0$ $x = -4 + \sqrt{3}$

17. Using the graph, estimate the solutions to:

$$x^2 - 4x - 1 = 0$$



A) $x = -1$	B) $x = -0.2$ $x = 4.2$
C) $x = 0.2$ $x = -4.2$	D) $(2, -5)$

18. Solve the equation

$$\frac{5}{x} + \frac{2x}{5} = 3$$

A) $x = 2.5$ $x = 5$	B) $x = -10$
C) $x = \frac{5}{13}$	D) $x = -2.5$ $x = -5$

Diagnostic Questions: Solving Quadratic Equations

19. Solve the equation

$$\frac{6-x}{4} + \frac{12}{4-x} = 4$$

A) $x = -2$ $x = -4$	B) $x = 2$ $x = 4$
C) $x = -\frac{46}{17}$	D) $x = -2$

20. Solve the equation

$$\frac{5}{8+x} + \frac{6-x}{9} = 2$$

A) $x = -8 \pm \sqrt{13}$	B) $x = -\frac{23}{3}$
C) $x = 3$ $x = 17$	D) $x = -3$ $x = -17$

Diagnostic Questions: Solving Quadratic Equations Answers

1. Solve:

$$x^2 + 5x + 6 = 0$$

A) $x = 1$ $x = 5$ Student has found values which sum to 6 and multiply to 5 and not solved to zero

B) $x = 3$ $x = 2$ Student has used the values in brackets without solving to zero

C) $x = -3$ $x = -2$ Correct answer

D) $x = -1$ $x = -5$ Student has found values which sum to 6 and multiply to 5 and then solved to zero

2. Solve:

$$x^2 + 11x + 24 = 0$$

A) $x = -3$ $x = -8$ Correct answer

B) $x = 4$ $x = 6$ Student has just found values which multiply to 24 and not solved to zero

C) $x = 3$ $x = 8$ Student has not solved to zero

D) $x = -4$ $x = -6$ Student has just found values which multiply to 24 and then solved to zero

3. Solve:

$$x^2 + 4x + 4 = 0$$

A) $x = -1$ $x = -4$ Student has factorised incorrectly

B) $x = -2$ Correct answer

C) $x = 2$ Student has not solved correctly to zero

D) $x = -2$ $x = 2$ Student has factorised incorrectly

Diagnostic Questions: Solving Quadratic Equations Answers

4. Solve:

$$x^2 - 6x + 8 = 0$$

A) $x = -4$ $x = -2$ Student has not solved correctly to zero

B) $x = -4$ $x = 2$ Student has an incorrect sign

C) $x = 4$ $x = -2$ Student has an incorrect sign

D) $x = 4$ $x = 2$ Correct answer

5. Solve:

$$x^2 + 2x - 15 = 0$$

A) $x = -3$ $x = -5$ Student has factorised incorrectly

B) $x = -3$ $x = 5$ Student has an incorrect sign

C) $x = 3$ $x = -5$ Correct answer

D) $x = 3$ $x = 5$ Student has an incorrect sign

6. Solve:

$$2x^2 + 3x - 9 = 0$$

A) $x = -1.5$ $x = -3$ Student has an incorrect sign

B) $x = 1.5$ $x = 3$ Student has an incorrect sign

C) $x = -1.5$ $x = 3$ Student has factorised incorrectly

D) $x = 1.5$ $x = -3$ Correct answer

Diagnostic Questions: Solving Quadratic Equations Answers

7. Solve:

$$3x^2 - 9x + 6 = 0$$

A) $x = 2$ $x = 1$ Correct answer

B) $x = -2$ $x = -1$ Student has factorised incorrectly

C) $x = 2$ $x = -1$ Student has an incorrect sign

D) $x = -2$ $x = 1$ Student has an incorrect sign

8. Solve:

$$2x^2 - 7x + 6 = 0$$

A) $x = 1$ $x = 6$ Student has ignored the coefficient of x^2 when factorising

B) $x = -1$ $x = -6$ Student has ignored the coefficient of x^2 when factorising and solved incorrectly

C) $x = -1.5$ $x = -2$ Student has factorised incorrectly

D) $x = 1.5$ $x = 2$ Correct answer

9. Which is the correct substitution into the quadratic formula for the solutions of:

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

A) $x = \frac{-2 + \sqrt{-4 + 80}}{10}$ and $x = \frac{-2 - \sqrt{-4 + 80}}{10}$ Student has made mistakes with signs when substituting the “b” value

B) $x = \frac{2 + \sqrt{4 + 80}}{10}$ and $x = \frac{2 - \sqrt{4 + 80}}{10}$ Correct answer

C) $x = \frac{2 + \sqrt{4 - 80}}{10}$ and $x = \frac{2 - \sqrt{4 - 80}}{10}$ Student has made a mistake with signs when substituting the “c” value

D) $x = \frac{-2 + \sqrt{-4 - 80}}{10}$ and $x = \frac{-2 - \sqrt{-4 - 80}}{10}$ Student has made mistakes with signs when substituting the “c” and “b” values

Diagnostic Questions: Solving Quadratic Equations Answers

10. Solve:

$$3x^2 - 4x - 5 = 0$$

Round your answers to 3 significant figures

A) $x = -5.45$ $x = -2.55$ Student has used incorrect formula $b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

B) $x = 5.45$ $x = 2.55$ Student has used incorrect formula $-b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

C) $x = -2.12$ $x = 0.786$ Student has not used “ $-b$ ”

D) $x = 2.12$ $x = -0.786$ Correct answer

11. Solve:

$$5x^2 + 2x - 4 = 0$$

Round your answers to 3 significant figures

A) $x = 0.717$ $x = -1.12$ Correct answer

B) $x = -1.08$ $x = -2.92$ Student has used incorrect formula $-b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

C) $x = -0.717$ $x = 1.12$ Student has not used “ $-b$ ”

D) $x = 1.08$ $x = 2.92$ Student has used incorrect formula $b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

12. Solve:

$$x^2 - 2x - 48 = -13$$

A) $x = -7$ $x = 5$ Student has incorrect signs

B) $x = -8$ $x = 6$ Student has ignored the “ -13 ” and has used incorrect signs

C) $x = 8$ $x = -6$ Student has ignored the “ -13 ”

D) $x = 7$ $x = -5$ Correct answer

Diagnostic Questions: Solving Quadratic Equations Answers

13. Solve:

$$4x^2 - 100 = 0$$

A) $x = 5$ Student has forgotten the negative answer

B) $x = -5$ $x = 5$ Correct answer

C) $x = 2.5$ Student performed inverse operations in the wrong order and forgot the negative answer

D) $x = -2.5$ $x = 2.5$ Student performed inverse operations in the wrong order

14. Solve:

$$3x^2 = 18x$$

A) $x = 6$ Student cancelled out the x and lost the 0 solution

B) $x = 0$ $x = -6$ Student has an incorrect sign

C) $x = -6$ Student has an incorrect sign and lost the 0 solution

D) $x = 0$ $x = 6$ Correct answer

15. Solve:

$$2x^2 - 4x - 7 = 0$$

Give your answers as surds in their simplest form.

A) $x = \frac{2+3\sqrt{2}}{2}$ $x = \frac{2-3\sqrt{2}}{2}$ Correct answer

B) $x = \frac{-2+3\sqrt{2}}{2}$ $x = \frac{-2-3\sqrt{2}}{2}$ Student has not used “ $-b$ ”

C) $x = \frac{4+6\sqrt{2}}{4}$ $x = \frac{4-6\sqrt{2}}{4}$ Student did not simplify their fractions

D) $x = 4 + \frac{3\sqrt{2}}{2}$ $x = 4 - \frac{3\sqrt{2}}{2}$ Student has used incorrect formula $-b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

Diagnostic Questions: Solving Quadratic Equations Answers

16. By first completing the square, find the solutions to the equation:

$$x^2 + 8x + 3 = 0$$

Give your answers as surds in their simplest form.

A) $(x + 4)^2 - 13 = 0$, $x = -4 \pm \sqrt{13}$ **Correct answer**

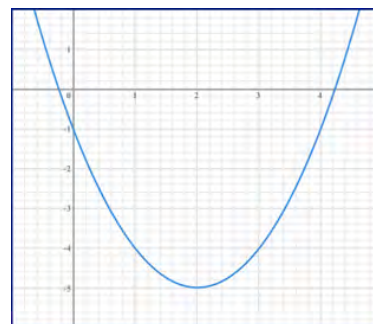
B) $(x + 4)^2 - 19 = 0$, $x = -4 \pm \sqrt{19}$ Student collected the constant terms “-16” and “3” incorrectly

C) $(x + 4)^2 + 13 = 0$, $x = 4 \pm \sqrt{-13}$ Student collected the constant terms “-16” and “3” incorrectly

D) $(x + 4)^2 - 3 = 0$, $x = -4 + \sqrt{3}$ Student completed the square incorrectly

17. Using the graph, estimate the solutions to:

$$x^2 - 4x - 1 = 0$$



A) $x = -1$ Student used the y -intercept value

B) $x = -0.2$ $x = 4.2$ **Correct answer**

C) $x = 0.2$ $x = -4.2$ Student has inverted the signs of the roots

D) $(2, -5)$ Student has written the turning point

18. Expand and simplify

$$\frac{5}{x} + \frac{2x}{5} = 3$$

A) $x = 2.5$ $x = 5$ **Correct answer**

B) $x = -10$ Student added the denominators

C) $x = \frac{5}{13}$ Student forgot to change the numerators before adding

D) $x = -2.5$ $x = -5$ Student has incorrect signs

Diagnostic Questions: Solving Quadratic Equations Answers

19. Solve the equation

$$\frac{6 - x}{4} + \frac{12}{4 - x} = 4$$

A) $x = -2$ $x = -4$ Correct answer

B) $x = 2$ $x = 4$ Student has incorrect signs

C) $x = \frac{46}{15}$ Student forgot to change the numerators before adding

D) $x = 2$ Student added the denominators

20. Solve the equation

$$\frac{5}{8 + x} + \frac{6 - x}{9} = 2$$

A) $x = -8 \pm \sqrt{13}$ Student collected the “ x ” coefficients incorrectly

B) $x = -\frac{23}{3}$ Student added the denominators

C) $x = 3$ $x = 17$ Student has incorrect signs

D) $x = -3$ $x = -17$ Correct answer

Where to go next?

For more diagnostic questions, and GCSE maths revision resources and worksheets to support students in fixing any misconceptions take a look at the free Third Space Learning [GCSE maths revision](#) pages.

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