

WA8MNALE2

Linear and non-linear equations and inequalities

Core + Challenge

Solving Equations of the Form $x^2 = k$

I can solve $x^2 = k$, explain why there are two solutions when $k > 0$, and give exact or rounded answers.

Name: _____ Date: _____ Score: _____ / 58

Key idea

$x^2 = k$ asks: which numbers square to give k ? Since $5^2 = 25$ **and** $(-5)^2 = 25$, $x^2 = 25$ has **two** solutions: $x = \pm 5$ ($x = 5$ or $x = -5$).

$k > 0$: two solutions, $x = \pm\sqrt{k}$. **$k = 0$:** one solution, $x = 0$. **$k < 0$:** no solution, because no number squared is negative.

Make x^2 the subject first: $3x^2 + 2 = 50 \rightarrow 3x^2 = 48 \rightarrow x^2 = 16 \rightarrow x = \pm 4$. **Exact:** $x = \pm\sqrt{20}$. **Rounded:** $x \approx \pm 4.47$ (2 d.p.).

Graph link: the solutions of $x^2 = k$ are the x -values where the parabola $y = x^2$ meets the horizontal line $y = k$. In a context like a length, reject the negative.

A

Fluency *practise the skill*

/ 16 marks

Solve each equation. Give all solutions. 1 mark each.

1. $x^2 = 49$ _____

9. $x^2 + 7 = 16$ _____

2. $x^2 = 81$ _____

10. $x^2 - 10 = 111$ _____

3. $x^2 = 144$ _____

11. $x^2 \div 4 = 9$ _____

4. $x^2 = 0$ _____

12. $x^2 = 20$ (exact) _____

5. $x^2 = -16$ _____

13. $x^2 = 20$ (1 d.p.) _____

6. $x^2 = \frac{9}{25}$ _____

14. $x^2 = 7$ (2 d.p.) _____

7. $x^2 = 0.36$ _____

15. $5x^2 = 0$ _____

8. $2x^2 = 50$ _____

16. $x^2 + 9 = 0$ _____

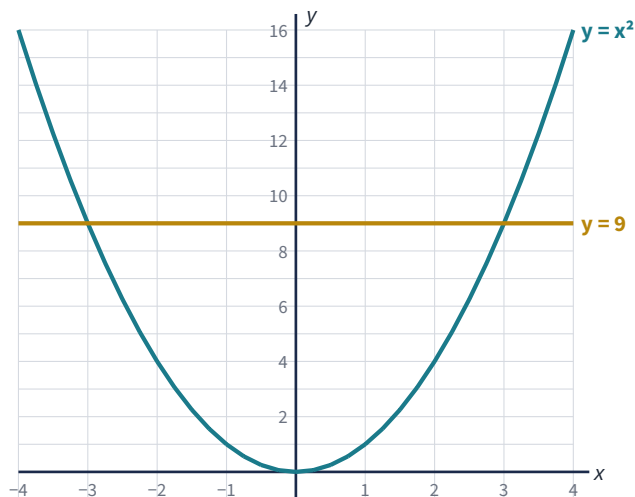
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B

Core *apply the skill to problems*

/ 22 marks

- 1 The graph shows $y = x^2$ and the line $y = 9$. Use it to solve $x^2 = 9$. Explain why there are two solutions. [2 marks]



Answer: _____

- 2 Solve $3x^2 = 75$. [2 marks]

Answer: _____

- 3 Solve $x^2 - 13 = 36$, and check both solutions by substitution. [2 marks]

Answer: _____

- 4 A square tile has an area of 400 cm^2 . Write an equation, find its side length and explain why one solution is rejected. [2 marks]

Answer: _____

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- 5 A square lawn has an area of 60 m^2 . Find its side length, correct to 1 decimal place. [2 marks]

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Answer: _____

- 6 Solve $x^2 = 50$, giving (a) exact answers, (b) answers rounded to 2 decimal places. [2 marks]

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Answer: _____

- 7 Solve $2x^2 + 7 = 1$, or explain why there is no solution. [2 marks]

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Answer: _____

- 8 Solve $x^2 \div 5 - 4 = 16$. [2 marks]

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Answer: _____

- 9 A round pizza tray has an area of 1000 cm^2 . Use $A = \pi r^2$ to find its radius, correct to 1 decimal place. [3 marks]

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Answer: _____

- 10 A stone is dropped from a lookout 80 m above the water. The distance it has fallen after t seconds is $d = 5t^2$ metres. How long does it take to reach the water? [3 marks]

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Answer: _____

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C Reasoning *explain, justify and check*

/ 9 marks

- 1 Explain why $x^2 = 36$ has two solutions but $x^2 = -36$ has none. [2 marks]

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- 2 Ben solved $x^2 + 16 = 25$ like this: $x + 4 = 5$, so $x = 1$. Show that his answer is wrong, explain his error and solve the equation correctly. [3 marks]

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- 3 True or false: ' $x^2 = k$ always has two solutions.' Justify with examples. [2 marks]

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- 4 Use the graph of $y = x^2$ to explain how many times a horizontal line $y = k$ meets the parabola when $k > 0$, $k = 0$ and $k < 0$ (see the graph in Core Q1). [2 marks]

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D Challenge *multi-step and problem-solving*

/ 11 marks

- 1 Solve $(x - 3)^2 = 25$. [3 marks]

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Answer: _____

- 2 A cube has a total surface area of 150 cm^2 . Find its volume. [3 marks]

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Answer: _____

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- 3 For which values of k does $2x^2 + k = 18$ have (a) two solutions, (b) exactly one solution, (c) no solution? [3 marks]

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Answer: _____

- 4 The two solutions of $x^2 = k$ differ by 14. Find k . [2 marks]

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Answer: _____

How did I go?

Fluency ____ / 16 Core ____ / 22 Reasoning ____ / 9 Challenge ____ / 11 **Total ____ / 58**

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