



THIRD SPACE
LEARNING

Diagnostic Questions

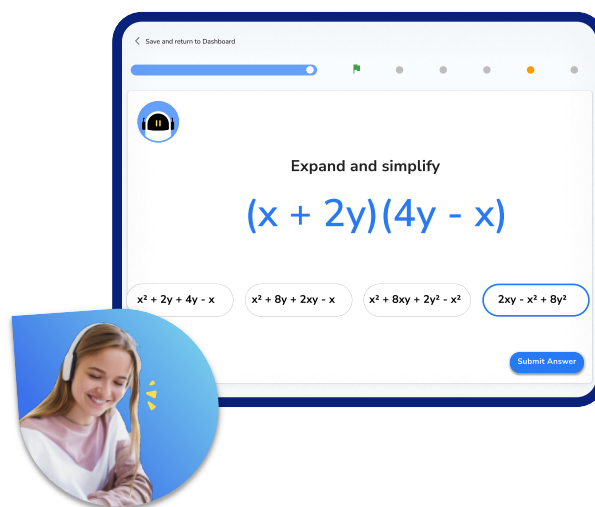
Trial & improvement | Algebra

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 **Trial and Improvement** 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 10 multiple choice questions, each designed to assess each of the key skills required to master **trial and improvement**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions; including: **Incorrect rounding**, **Laws of indices**, **Confusing area and perimeter**, and **Rearranging equations**.

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: Trial & improvement

1. Use trial and improvement to find the positive solution (correct to two significant figures) to:

$$x^2 - 8 = 0$$

A) 2.8	B) $2\sqrt{2}$
C) 64	D) 2.83

2. The equation $x^2 + x = 34$ has a solution between 5 and 6. Use trial and improvement to find this solution correct to two decimal places.

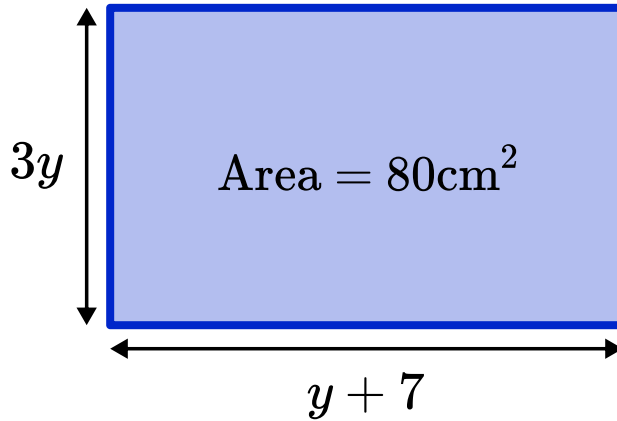
A) 5.4	B) 5.36
C) 5.35	D) -6.35

3. The equation $x^3 - x = 450$ has only one solution. Use trial and improvement to find this solution correct to two decimal places.

A) 7.66	B) 7.62
C) 21.72	D) 7.71

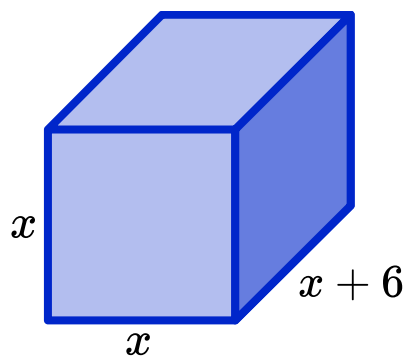
Diagnostic Questions: Trial & improvement

4. Use a trial and improvement method to find the value of y (correct to two decimal places) that solves the geometric problem pictured:



A) 8.25 cm	B) 2.74 cm
C) -9.74 cm	D) 42.82 cm

5. The cuboid pictured has volume 1320cm^3 . Use a trial and improvement method to determine the value of x , correct to two decimal places.



A) 33.46 cm	B) 35.75 cm
C) 9.29 cm	D) 10.97 cm

Diagnostic Questions: Trial & improvement

6. Given that $x_1 = -2$ and $x_{n+1} = \frac{1}{3x_n^2} + 1$ find the value of x_2 :

A) $\frac{11}{12}$	B) $\frac{13}{12}$
C) $\frac{37}{36}$	D) $\frac{1}{13}$

7. Find the value of x to three decimal places when $x_1 = 5$ and $x_{n+1} = \sqrt{x_n + 3}$:

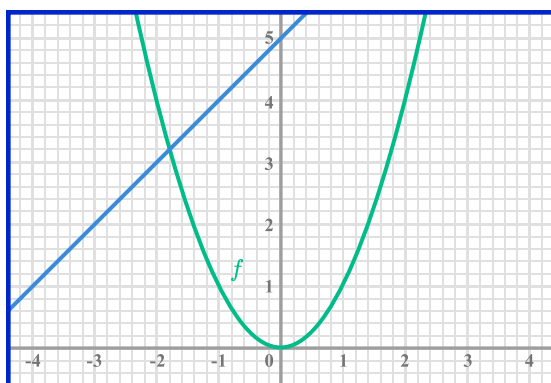
A) 2.828	B) 2.327
C) 2.303	D) 2.414

8. The equation $x^4 = x^2 + 4542$ has a solution between 8 and 9. Use a trial and improvement method to find this solution correct to two decimal places:

A) 8.72	B) 8.23
C) 8.24	D) 8.18

Diagnostic Questions: Trial & improvement

9. By considering the graph below, and using a trial and improvement method, find the x value (correct to three significant figures) for the solution to $y = x^2$ and $y = x + 5$, given that $x < 0$.



A) -2.79	B) -1.79
C) 3.21	D) -1.75

10. A continued fraction is a number representation based on iteration. By setting a $a_n = 1$ for $n = 0, 1, 2, 3, 4$ find an approximation to the number ϕ :

$$a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\ddots + \frac{1}{a_n}}}}$$

A) 1.6	B) 0.615
C) 1.615	D) 2.6

Diagnostic Questions: Trial & improvement Answers

1. Use trial and improvement to find the positive solution (correct to two significant figures) to:

$$x^2 - 8 = 0$$

A) 2.8 Correct answer

B) $2\sqrt{2}$ Student gave answer as simplified surd

C) 64 Student does not understand the solution process

D) 2.83 Student gave answer correct to two decimal places

2. The equation $x^2 + x = 34$ has a solution between 5 and 6. Use trial and improvement to find this solution correct to two decimal places.

A) 5.4 Student rounded to two significant figures

B) 5.36 Student rounded required solution incorrectly

C) 5.35 Correct answer

D) -6.35 Student did not find required solution

3. The equation $x^3 - x = 450$ has only one solution. Use trial and improvement to find this solution correct to two decimal places.

A) 7.66 Student found the cube root of 450

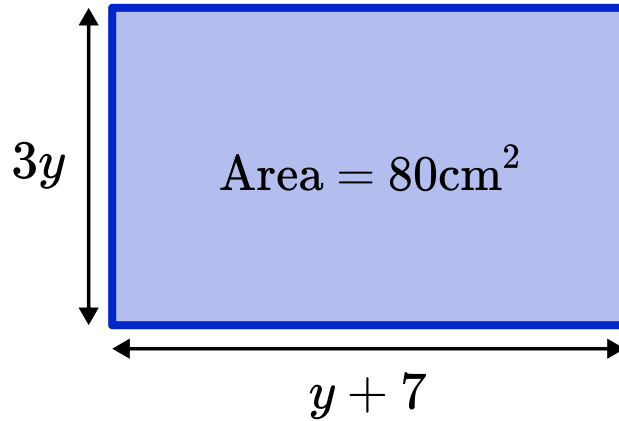
B) 7.62 Student solved $x^3 + x = 450$

C) 21.72 Student solved $x^2 - x = 450$

D) 7.71 Correct answer

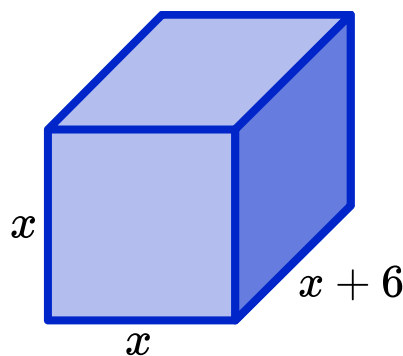
Diagnostic Questions: Trial & improvement Answers

4. Use a trial and improvement method to find the value of y (correct to two decimal places) that solves the geometric problem pictured:



- A) 8.25 *cm* Student confused area and perimeter
 B) 2.74 *cm* Correct answer
 C) -9.74 *cm* Student did not consider the context
 D) 42.82 *cm* Student squared the area before initiating their method

5. The cuboid pictured has volume 1320cm^3 . Use a trial and improvement method to determine the value of x , correct to two decimal places.



- A) 33.46 *cm* Student set up problem incorrectly, solving $x(x + 6) = 1320$
 B) 35.75 *cm* Student set up problem incorrectly, solving $x^2 + x + 6 = 1320$
 C) 9.29 *cm* Correct answer
 D) 10.97 *cm* Student approximated the cube root of 1320

Diagnostic Questions: Trial & improvement Answers

6. Given that $x_1 = -2$ and $x_{n+1} = \frac{1}{3x_n^2} + 1$ find the value of x_2 :

- A) $\frac{11}{12}$ Student did not deal with negative sign correctly
- B) $\frac{13}{12}$ Correct answer
- C) $\frac{37}{36}$ Student found product in denominator before squaring
- D) $\frac{1}{13}$ Student added one to the denominator, rather than adding a whole one

7. Find the value of x to three decimal places when $x_1 = 5$ and $x_{n+1} = \sqrt{x_n + 3}$:

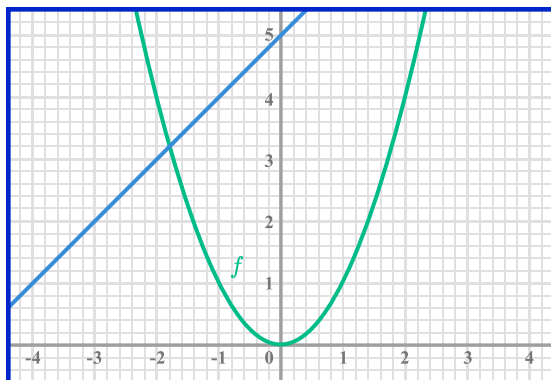
- A) 2.828 Student found x_2
- B) 2.327 Student found x_4
- C) 2.303 Correct answer
- D) 2.414 Student found x_3

8. The equation $x^4 = x^2 + 4542$ has a solution between 8 and 9. Use a trial and improvement method to find this solution correct to two decimal places:

- A) 8.72 Student square rooted each term in an effort to simplify, before applying trial and improvement
- B) 8.23 Student truncated rather than rounded
- C) 8.24 Correct solution
- D) 8.18 Student rearranged incorrectly, solving $x^4 + x^2 = 4542$

Diagnostic Questions: Trial & improvement Answers

9. By considering the graph below, and using a trial and improvement method, find the x value (correct to three significant figures) for the solution to $y = x^2$ and $y = x + 5$, given that $x < 0$.



- A) -2.79 Student rearranged to form one equation incorrectly
B) -1.79 Correct answer
 C) 3.21 Student gave the y value (not x value)
 D) -1.75 Student attempted to approximate using only the graph
-
10. A continued fraction is a number representation based on iteration. By setting a $a_n = 1$ for $n = 0, 1, 2, 3, 4$ find an approximation to the number ϕ :

$$a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\ddots + \frac{1}{a_n}}}}$$

- A) 1.6 Correct answer**
 B) 0.615 Student structured the calculation incorrectly
 C) 1.615 Student iterated beyond the required step
 D) 2.6 Student made an error using their calculator

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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