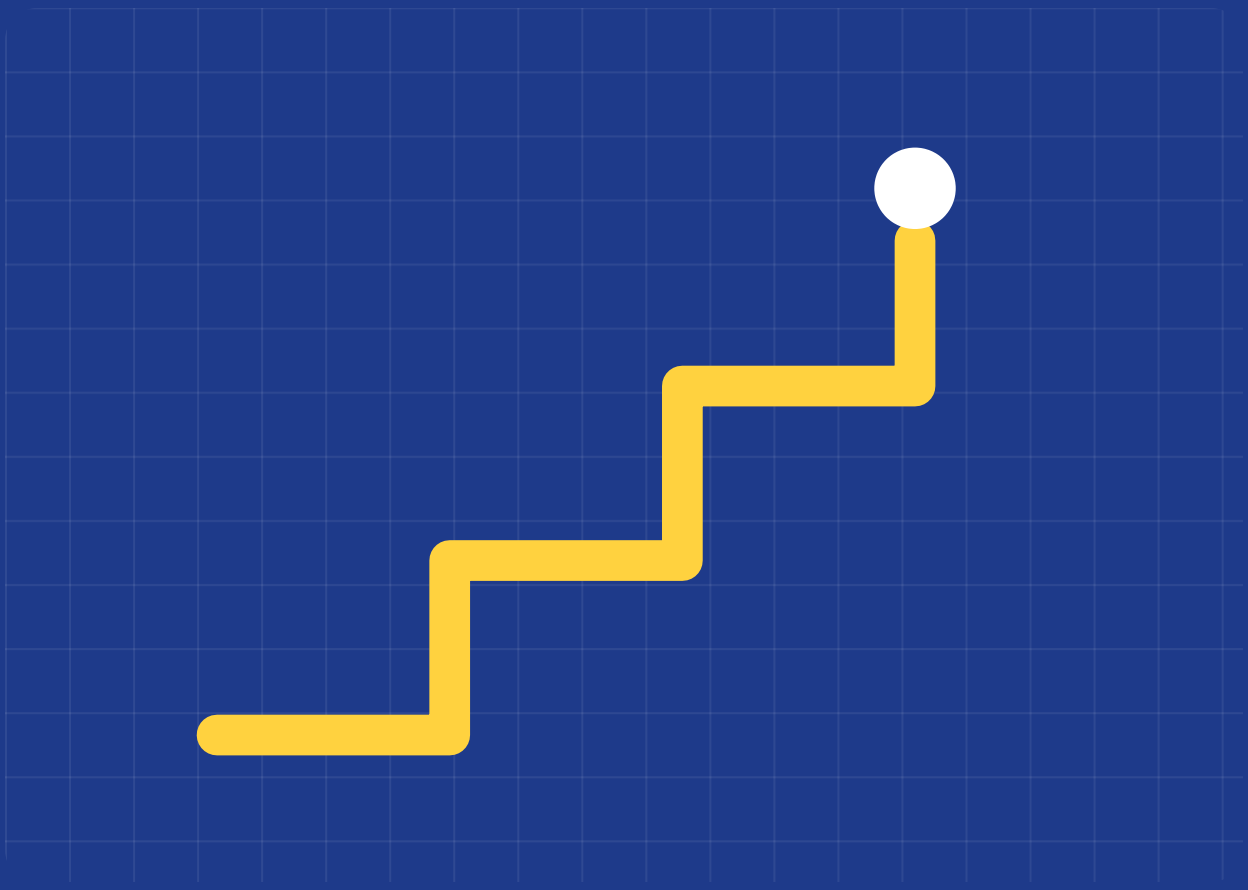
UpOnly Learning



GRADE 8

FREE SAMPLE WORKBOOK

Math Grade 8

One step at a time. · Ages 13–14 · Free sample: 1 of 10 topics

UO-MATH-8

OUR STORY

One step at a time

I'm Dr. Evan J. Hasson. I've run a specific chiropractic practice for over twelve years, and I'm a dad of three. My work is about alignment: get the structure right, and everything else works better.

At home, nothing was aligned. I was spending thousands a month on tutors, extracurriculars and programs, and when I asked about enrolling a second or third child the answer was always the same: that'll be double, that'll be triple. The charter school had a waiting list. The good public school had a waiting list. The private schools had the kind of list where it helps to know someone, or to give generously first.

And underneath all of it, the same quiet threat: if you don't pay for this, your child will fall behind. Not sold with evidence. Sold with fear.

So I did my own research, and here is what I found: none of it is secret. The standards are published. The order a child should learn in is written down and freely available. It is just scattered. Nobody had done the work of pulling it together, putting it in order and handing it over. So I did.

When every step has its place, confusion has nowhere to hide.

I built this for my own kids. I'm giving it to yours.

Dr. Evan J. Hasson, DC
Founder and dad of three

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No guaranteed results, and mistakes happen. Every student learns differently. We write and review every question and answer key carefully, and we still get things wrong — an answer key can be wrong, and a question can be worded badly or have two defensible answers. Check the answer key before you hand it over, and trust your own judgment over ours. Found a problem? **Photograph the page and email it to support@uponlylearning.com** — the picture tells us more than a description, and we fix it for every family.

Safety. Some activities use household items such as scissors, coins or food. An adult should supervise and skip anything unsafe for the student.

Not professional advice. This workbook does not replace an evaluation by a qualified educator or specialist. The founder is a Doctor of Chiropractic; UpOnly Learning does not provide medical or health advice.

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INTRODUCTION

How to use this workbook

Each topic follows the same steps, so your student always knows what comes next.

① **Quick Check.** 10 questions before you teach. Read them aloud for younger students. A high score means you can move faster.

② **Learn It.** Key words, step-by-step teaching with lines you can read aloud, worked examples and the mistakes to watch for.

③ **We Do It Together.** 10 questions you do side by side. The answer and the "why" are printed right after each question, so you can talk it through.

④ **You Try.** 10 questions your student does alone.

Answers with short explanations for every question are in the **Answer Key** at the end of each topic, so students can work without peeking. Go over each wrong answer together using the explanation.

This workbook is printed in full color. To save ink, choose "Black and white" or "Grayscale" in your printer settings; every page still works in black and white.

Want online checks that score themselves and track each student's progress? Visit uponlylearning.com.

GRADE 8

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Math: Grade 8

Free Sample Workbook · Ages 13–14 · 1 of 10 topics, with a Quick Check, a lesson, We Do It Together, You Try and an answer key

Our story

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How to use this workbook

Topic 1 · Irrational numbers

Rational approximations; square roots on a number line 8.NS

Quick Check · Learn It · We Do It Together · You Try · Answer Key

TOPIC 1 · 8.NS ↑ CONTENTS

Irrational numbers

The student will tell rational from irrational numbers, convert repeating decimals into fractions, and estimate irrational numbers such as √2 and π to locate and compare them on a number line.

① Quick Check

Do this before the lesson. It shows what your student already knows. Score: ____ / 10

1. What describes an irrational number's decimal?

   A It ends after a few digits. **B** It never ends and never repeats. **C** It repeats a block of digits.

2. Write 0.555... as a fraction.

   A 5/10 **B** 5/9 **C** 55/100 **D** 5/100

3. Which number is irrational?

   A √16 **B** 0.25 **C** 1/3 **D** √2

4. Which of these is irrational?

   A √20 **B** √36 **C** √25

5. Estimate √20 to the nearest tenth.

   A 4.2 **B** 4.5 **C** 4.4

6. Write 0.999... as a fraction.

   A 10/9 **B** 9/10 **C** 1 **D** 99/100

7. Between which two tenths is √2?

   A 1.3 and 1.4 **B** 1.5 and 1.6 **C** 1.4 and 1.5

8. Use the table of perfect squares. Between which two consecutive whole numbers is √150?

n	11	12	13	14
n^2	121	144	169	196

   A 11 and 12 **B** 13 and 14 **C** 12 and 13

9. What is 0.1212... + 0.2121... as a fraction in simplest form?

   A 33/100 **B** 1/3 **C** 1/33 **D** 3/10

10. Write 5/11 as a decimal.

    A 0.5 **B** 0.0545 **C** 0.4545... **D** 0.45

② Learn It

Key words

- **rational number**: A number that can be written as a fraction of two integers, like 3/4, -5 or 0.333...
- **irrational number**: A number that cannot be written as a fraction of two integers. Its decimal goes on forever without repeating, like √2 or π.
- **terminating decimal**: A decimal that ends, like 0.25.
- **repeating decimal**: A decimal where a block of digits repeats forever, like 0.272727...
- **perfect square**: A number that is a whole number times itself, like 1, 4, 9, 16, 25.
- **square root**: A number that, multiplied by itself, gives the original number. √49 = 7 because 7 × 7 = 49.

Warm-up

1. Have the student list the perfect squares from 1 × 1 to 12 × 12 (1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144).
2. Ask: What number times itself is 2? Have them guess and check on paper: 1 × 1 = 1 is too small, 2 × 2 = 4 is too big. So it is between 1 and 2.
3. Let them try 1.4 × 1.4 = 1.96 and 1.5 × 1.5 = 2.25. It is between 1.4 and 1.5.

n	1	2	3	4	5	6
n^2	1	4	9	16	25	36
n	**7**	**8**	**9**	**10**	**11**	**12**
n^2	49	64	81	100	121	144

> *Some numbers are so stubborn that you can never write them exactly as a fraction or a decimal that stops or repeats. Today we meet them and learn to pin them down.*

Teach

1. Review: every fraction becomes a decimal that either ends (1/4 = 0.25) or repeats (1/3 = 0.333...). These are rational numbers.
2. Show converting a repeating decimal to a fraction. Let x = 0.777... Then 10x = 7.777... Subtract: 10x - x = 7.777... - 0.777..., so 9x = 7 and x = 7/9.
3. For two repeating digits, multiply by 100: x = 0.363636..., 100x = 36.3636..., so 99x = 36 and x = 36/99 = 4/11.
4. Introduce irrational numbers: decimals that never end and never repeat. Examples: √2 = 1.41421356..., π = 3.14159265... The square root of any whole number that is not a perfect square is irrational.
5. Estimate √50: 49 < 50 < 64, so 7 < √50 < 8. Since 50 is very close to 49, √50 is just a little more than 7. Try 7.1 × 7.1 = 50.41, too big, so √50 is between 7.0 and 7.1, about 7.07.

6. Locate on a number line: draw from 0 to 4 and mark √2 a bit less than 1.5, π a bit more than 3, and √10 a bit more than π (3.16 versus 3.14).
7. Show that we use approximations to compare and estimate expressions, like π^2 is about 3.14 × 3.14, which is about 9.86, a bit less than 10.



> *Every number has a spot on the number line, even the ones whose decimals never end. Squeezing them between perfect squares tells us exactly where to look.*

Guided practice

1. Have the student sort these into rational and irrational: 0.5, √16, √7, 2/3, π, 0.121212..., -9, √20.
2. Convert 0.555... into a fraction together using the 10x method. (5/9)
3. Estimate √20 to the nearest tenth together: 16 < 20 < 25, so between 4 and 5. Try 4.4 × 4.4 = 19.36 and 4.5 × 4.5 = 20.25, so it is between 4.4 and 4.5. Check the halfway point: 4.45 × 4.45 = 19.8025, less than 20, so √20 rounds to 4.5.
4. Have the student place √20, 4.4 and 4 2/3 on a number line in order.
5. Work through the two worked examples together.



> *Guess, square it, adjust. That three-step loop gets you closer and closer to any square root.*

Worked examples

Write 0.232323... as a fraction.
Let x = 0.232323... Two digits repeat, so multiply by 100: 100x = 23.2323... Subtract: 99x = 23, so x = 23/99.

Order from least to greatest: √10, π, 3.2.



√10 is between 3 and 4. 3.1 × 3.1 = 9.61 and 3.2 × 3.2 = 10.24, so √10 is between 3.1 and 3.2. Try 3.16 × 3.16 = 9.9856, just under 10, so √10 is a little more than 3.16. π is about 3.14, which is smaller. Order: π, √10, 3.2.

Watch for these mistakes

Mistake: Every square root is irrational, so √36 is irrational.
Fix: √36 = 6 exactly, because 6 × 6 = 36. Only square roots of numbers that are not perfect squares are irrational. Have the student check the perfect squares list first.

Mistake: π is exactly 3.14, or exactly 22/7.
Fix: Both are approximations. π's decimal goes on forever without repeating (3.14159265...), so it cannot equal any fraction. 3.14 and 22/7 are handy estimates for calculating.

③ We Do It Together: 10 questions

> *Do these side by side. Read each question together, let your student answer, then read the answer and the "why" right below it and talk it through.*

1. Is π rational or irrational?

A rational, because it equals 3.14 **B** rational **C** rational, because it equals 22/7 **D** irrational

> **Answer: D** irrational
> **Why:** Its decimal goes on forever without repeating; 22/7 and 3.14 are only approximations.

2. Is 1/4 = 0.25 rational?

A No, it is too short **B** Yes, the decimal ends **C** No, only repeating decimals are rational

> **Answer: B** Yes, the decimal ends
> **Why:** A fraction of integers is rational, and its decimal ends or repeats.

3. Use the table of perfect squares. Between which two consecutive whole numbers is √50?

n	6	7	8	9
n^2	36	49	64	81

A 6 and 7 **B** 7 and 8 **C** 8 and 9

> **Answer: B** 7 and 8
> **Why:** 49 < 50 < 64, and √49 = 7, √64 = 8.

4. Between which two consecutive whole numbers is √10?

A 3 and 4 **B** 2 and 3 **C** 4 and 5

> **Answer: A** 3 and 4
> **Why:** 9 < 10 < 16, so 3 < √10 < 4.

5. Which is greater, π or 22/7?

A Cannot tell **B** 22/7 **C** π **D** They are equal

> **Answer: B** 22/7
> **Why:** 22/7 = 3.1428..., which is slightly more than π = 3.1415.... So 22/7 is greater.

6. Which number is rational?

A $\sqrt{2}$ **B** $\sqrt{3}$ **C** $\sqrt{0.25}$

> **Answer: C** $\sqrt{0.25}$
> **Why:** $\sqrt{0.25} = 0.5 = 1/2$.

7. Which number is between 3 and 4?

A $\sqrt{20}$ **B** $\sqrt{5}$ **C** $\sqrt{17}$ **D** $\sqrt{10}$

> **Answer: D** $\sqrt{10}$
> **Why:** $9 < 10 < 16$. $\sqrt{5}$ is below 3 and $\sqrt{17}$ and $\sqrt{20}$ are above 4.

8. Which lists π, $\sqrt{10}$ and 3.2 from least to greatest?

A π, 3.2, $\sqrt{10}$ **B** 3.2, $\sqrt{10}$, π **C** π, $\sqrt{10}$, 3.2 **D** $\sqrt{10}$, π, 3.2

> **Answer: C** π, $\sqrt{10}$, 3.2
> **Why:** $\pi \approx 3.1416$, $\sqrt{10} \approx 3.1623$ and 3.2 is greatest.

9. What is $\sqrt{2} \times \sqrt{2}$?

A 1.41 **B** 2 **C** 4 **D** 1.96

> **Answer: B** 2
> **Why:** $\sqrt{2}$ is the number whose square is 2, so $\sqrt{2} \times \sqrt{2} = 2$ exactly. The 1.96 comes from the rounded value 1.4.

10. Which lists 2.6, $\sqrt{7}$ and 8/3 from least to greatest?

A $\sqrt{7}$, 2.6, 8/3 **B** 8/3, $\sqrt{7}$, 2.6 **C** 2.6, $\sqrt{7}$, 8/3

> **Answer: C** 2.6, $\sqrt{7}$, 8/3
> **Why:** $\sqrt{7} \approx 2.646$ and $8/3 \approx 2.667$.

④ You Try: 10 questions

Now your student works alone. Check answers in the Answer Key at the end of this topic. Score: ____ / 10

1. Which is the best estimate of π for quick calculations?

A 3.14 **B** 3.04 **C** 3.41 **D** 3.0

2. Between which two consecutive whole numbers is √2?

A 2 and 3 **B** 0 and 1 **C** 1 and 2 **D** 1 and 4

3. The number line shows where √2 is. What is √2 rounded to the nearest tenth?



A 2.0 **B** 1.5 **C** 1.4 **D** 1.2

4. Write 0.121212... as a fraction in simplest form.

A 4/33 **B** 1/33 **C** 12/100 **D** 1/8

5. Which whole number is π^2 closest to?

A 3 **B** 11 **C** 10 **D** 6

6. Write 0.888... as a fraction.

A 8/99 **B** 8/9 **C** 8/10 **D** 88/100

7. A number that can be written as a fraction of two integers (denominator not 0) is called what?

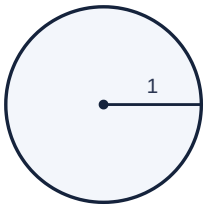
A irrational **B** rational **C** a whole number **D** a perfect square

8. A student writes 0.777... = 7/10. What is the mistake?

A It should be 77/100. **B** It should be 7/99. **C** 7/10 = 0.7 ends; the repeating decimal is 7/9.

D Nothing; both are 0.7.

9. This circle has a radius of 1. Is its circumference, 2π, rational?



A Yes, it is about 6.28 **B** Yes, it is exactly 6.28 **C** No, it is irrational

10. Is π^2 greater than 10 or less than 10?

A exactly 10 **B** less, about 9.87 **C** greater, about 10.4

Irrational numbers: Answers and explanations

① Quick Check

1. What describes an irrational number's decimal?

   B It never ends and never repeats.

   Terminating and repeating decimals are rational.

2. Write 0.555... as a fraction.

   B 5/9

   Let x = 0.555.... Then 9x = 5, so x = 5/9.

3. Which number is irrational?

   D √2

   √2 is a decimal that never ends and never repeats. √16 = 4 and 1/3 repeats.

4. Which of these is irrational?

   A √20

   25 and 36 are perfect squares, so √25 = 5 and √36 = 6 are rational. 20 is not a perfect square, so √20 is irrational.

5. Estimate √20 to the nearest tenth.

   B 4.5

   4.4 × 4.4 = 19.36 and 4.5 × 4.5 = 20.25, so √20 is between 4.4 and 4.5. Halfway is 4.45, and 4.45 × 4.45 = 19.8025, which is less than 20. So √20 is more than 4.45 and rounds to 4.5. (√20 is about 4.47.)

6. Write 0.999... as a fraction.

   C 1

   Let x = 0.999.... Then 10x = 9.999..., so 10x - x = 9, 9x = 9 and x = 1. So 0.999... is exactly 1.

7. Between which two tenths is √2?

   C 1.4 and 1.5

   $1.4^2 = 1.96$ and $1.5^2 = 2.25$, and 2 lies between.

8. Use the table of perfect squares. Between which two consecutive whole numbers is √150?

   C 12 and 13

   144 < 150 < 169.

9. What is 0.1212... + 0.2121... as a fraction in simplest form?

   B 1/3

   12/99 + 21/99 = 33/99 = 1/3.

10. Write 5/11 as a decimal.

    C 0.4545...

    5 ÷ 11 repeats the block 45. 0.45 ends, so it is not equal.

④ You Try

1. Which is the best estimate of π for quick calculations?

   A 3.14

   π ≈ 3.14159..., so 3.14 is a handy approximation.

2. Between which two consecutive whole numbers is √2?

   C 1 and 2

   $1 < 2 < 4$, so $1 < \sqrt{2} < 2$.

3. The number line shows where √2 is. What is √2 rounded to the nearest tenth?

   C 1.4

   $1.4 \times 1.4 = 1.96$, which is close to 2. √2 = 1.41421....

4. Write 0.121212... as a fraction in simplest form.

   A 4/33

   $100x - x = 12$, so $x = 12/99 = 4/33$.

5. Which whole number is π^2 closest to?

   C 10

   3.14×3.14 is about 9.86, and the nearest whole number is 10.

6. Write 0.888... as a fraction.

   B 8/9

   $9x = 8$, so $x = 8/9$.

7. A number that can be written as a fraction of two integers (denominator not 0) is called what?

   B rational

   That is the definition of a rational number.

8. A student writes 0.777... = 7/10. What is the mistake?

   C 7/10 = 0.7 ends; the repeating decimal is 7/9.

   Let x = 0.777...: $10x - x = 7$, so $x = 7/9$.

9. This circle has a radius of 1. Is its circumference, 2π, rational?

   C No, it is irrational

   Twice an irrational number is still irrational; 6.28 is only an approximation.

10. Is π^2 greater than 10 or less than 10?

    B less, about 9.87

    π is less than 3.15, and $3.15 \times 3.15 = 9.9225$, so π^2 is less than 10. It is about 9.87.

THE FULL WORKBOOK

Keep going with the full Math workbook

You just tried one topic. The full Grade 8 workbook has every topic below, each with a Quick Check, a lesson, We Do It Together, up to 90 You Try questions, Show What You Know and a full answer key.

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3. Slope and linear equations 8.EE.B
4. Systems of equations 8.EE.C
5. Variables on both sides 8.EE.C.7
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One step at a time.

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