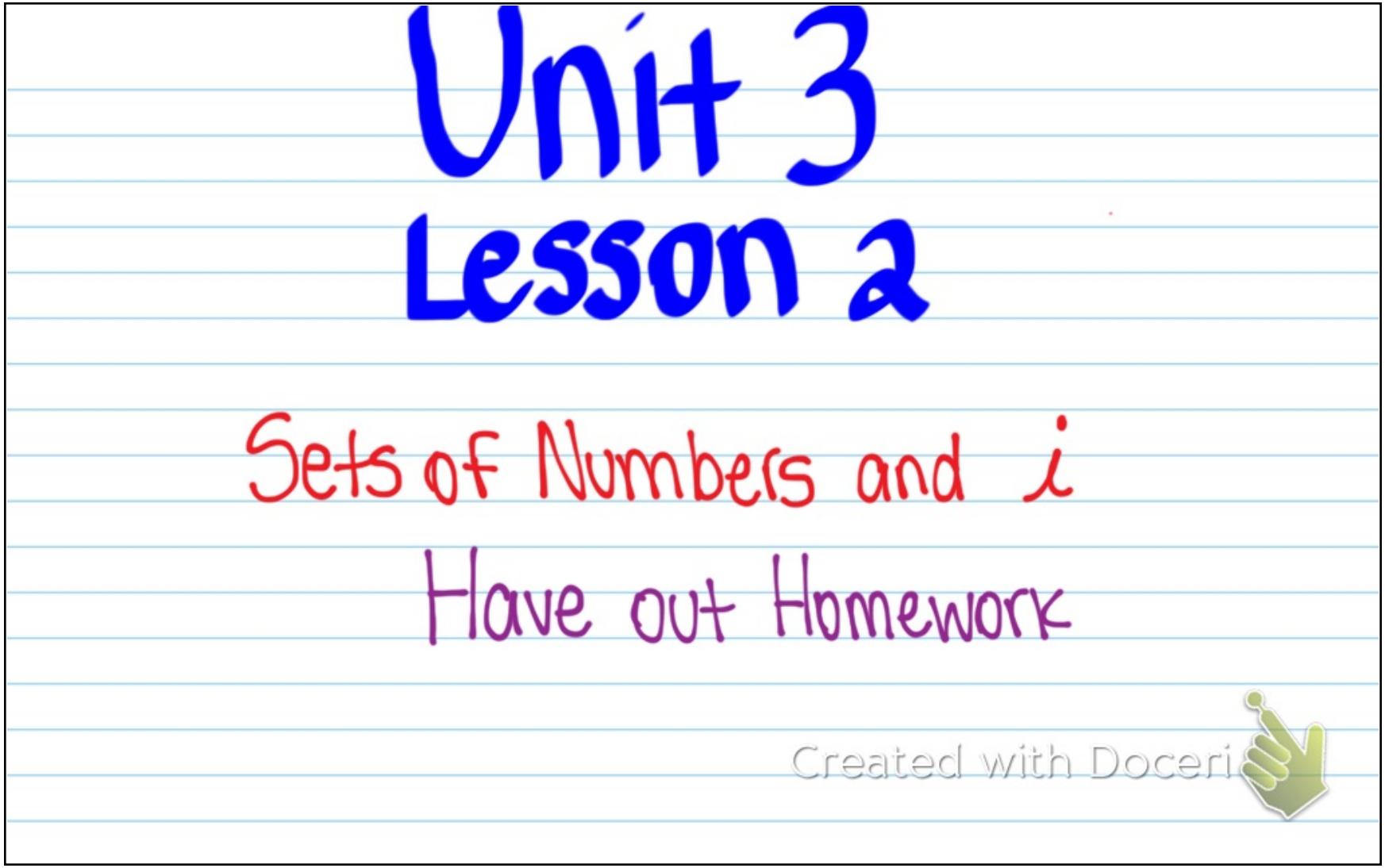
Unit 3
Lesson 2

Sets of Numbers and i

Have out Homework



Math 2 – Honors
Unit 3 – Quadratic Functions Continued
Lesson 2 → Sets of Numbers

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Date_____ **Pd**_____

In mathematics, the numbers we use can be **categorized into sets**. Our number system has two sets, the **real numbers** and the **complex numbers**. We will work with both the real numbers and the complex numbers in this course.

➢ **DEFINITIONS:**

- **REAL NUMBERS** is the set of rational numbers and irrational numbers.
- **COUNTING NUMBERS OR NATURAL NUMBERS** is the set of numbers defined by {1, 2, 3, 4, 5, ...}.
- **WHOLE NUMBERS** is the set of numbers defined by {0, 1, 2, 3, 4, 5, ...}.
- **INTEGERS** is the set of numbers defined by {..., -3, -2, -1, 0, 1, 2, 3, ...} or the set of all positive and negative whole numbers.
- **RATIONAL NUMBERS** is the set of numbers defined by $\{\frac{p}{q} \mid p \text{ and } q \text{ are integers}, q \neq 0\}$ or the set of numbers in which the decimal terminates or the decimal repeats.

Examples: These are all **rational** numbers.

$\frac{1}{2} = 0.5$ *terminated decimal*

$\frac{-2}{3} = -0.6666\ldots$ *repeating decimal*

$\frac{2}{7} = 0.285714285\ldots$ *repeating decimal*

$\frac{9}{4} = 2.25$ *terminated decimal*

$5 = 5.0$ *terminated decimal*

$-\frac{12}{3} = 4.0$ *terminated decimal*

$\sqrt{4} = 2.0$ *terminated decimal*

IRRATIONAL NUMBERS is the set of numbers in which the decimal does not terminate and does not repeat.

Examples: These are all **irrational** numbers.

$\sqrt{2} = 1.414213562\ldots$ *does not terminate nor repeats*

$\pi = 3.141592654\ldots$ *does not terminate nor repeats*

$\frac{\sqrt{3}}{5} = 0.3464101615\ldots$ *does not terminate nor repeats*

5

COMPLEX NUMBERS

Real Numbers

Rational $\frac{5}{3}$ 0.63 $0.0\overline{12}$

- **Integers** $\{\ldots, -2, -1, 0, 1, 2, \ldots\}$
  - **Whole** $\{0, 1, 2, 3, \ldots\}$
    - **Natural** $\{1, 2, 3, \ldots\}$

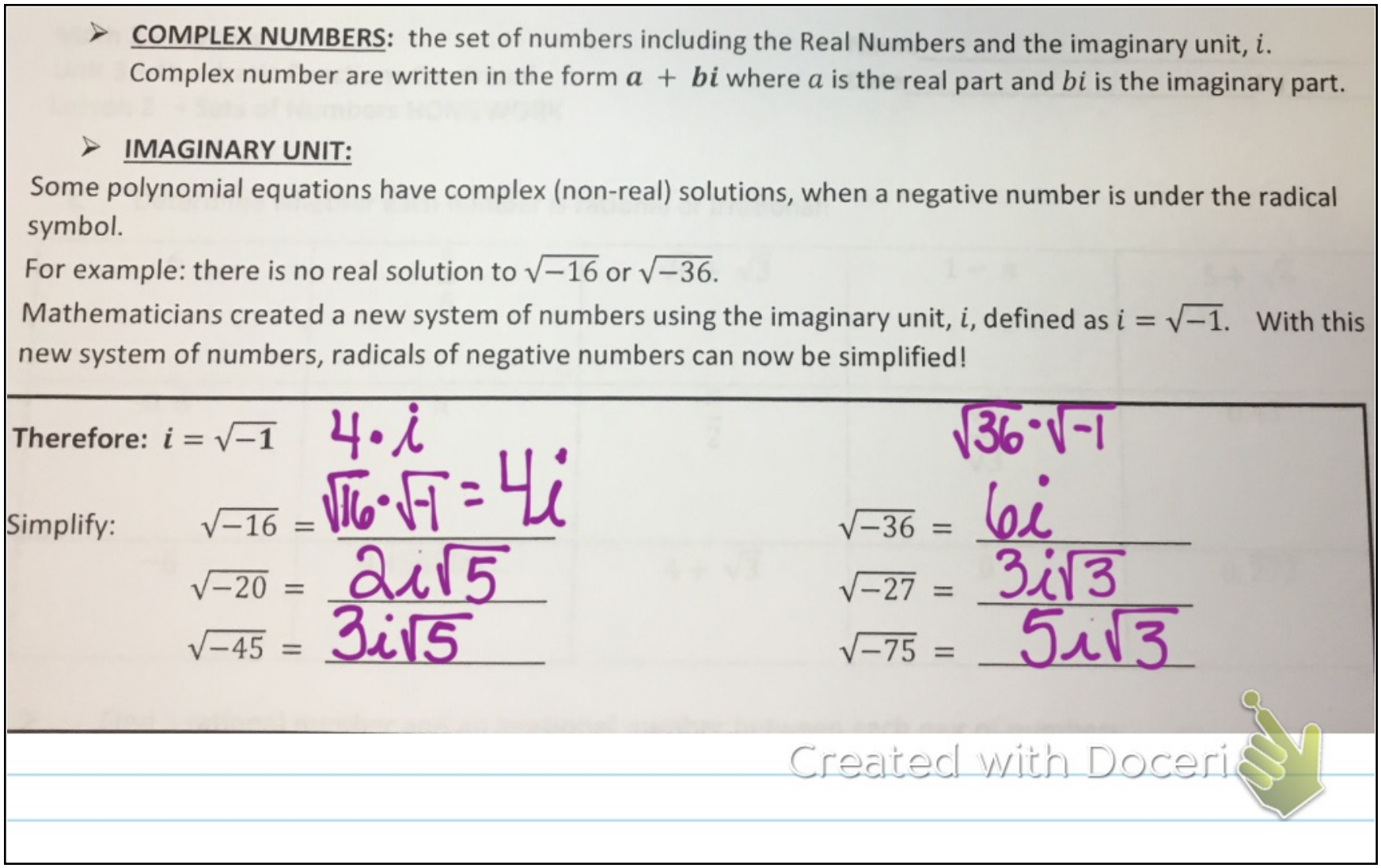
Irrational $\sqrt{3}$ π $0.10010001\ldots$

Imaginary Unit

$i = \sqrt{-1}$

$4 + 3i$ $4-3i$

$5 - 7i$ $5+7i$



➢ **COMPLEX NUMBERS:** the set of numbers including the Real Numbers and the imaginary unit, i. Complex number are written in the form $a + bi$ where a is the real part and bi is the imaginary part.

➢ **IMAGINARY UNIT:**

Some polynomial equations have complex (non-real) solutions, when a negative number is under the radical symbol.

For example: there is no real solution to $\sqrt{-16}$ or $\sqrt{-36}$.

Mathematicians created a new system of numbers using the imaginary unit, i, defined as $i = \sqrt{-1}$. With this new system of numbers, radicals of negative numbers can now be simplified!

Therefore: $i = \sqrt{-1}$

Simplify:

$\sqrt{-16} =$ $4 \cdot i$ $\sqrt{16} \cdot \sqrt{-1} = 4i$

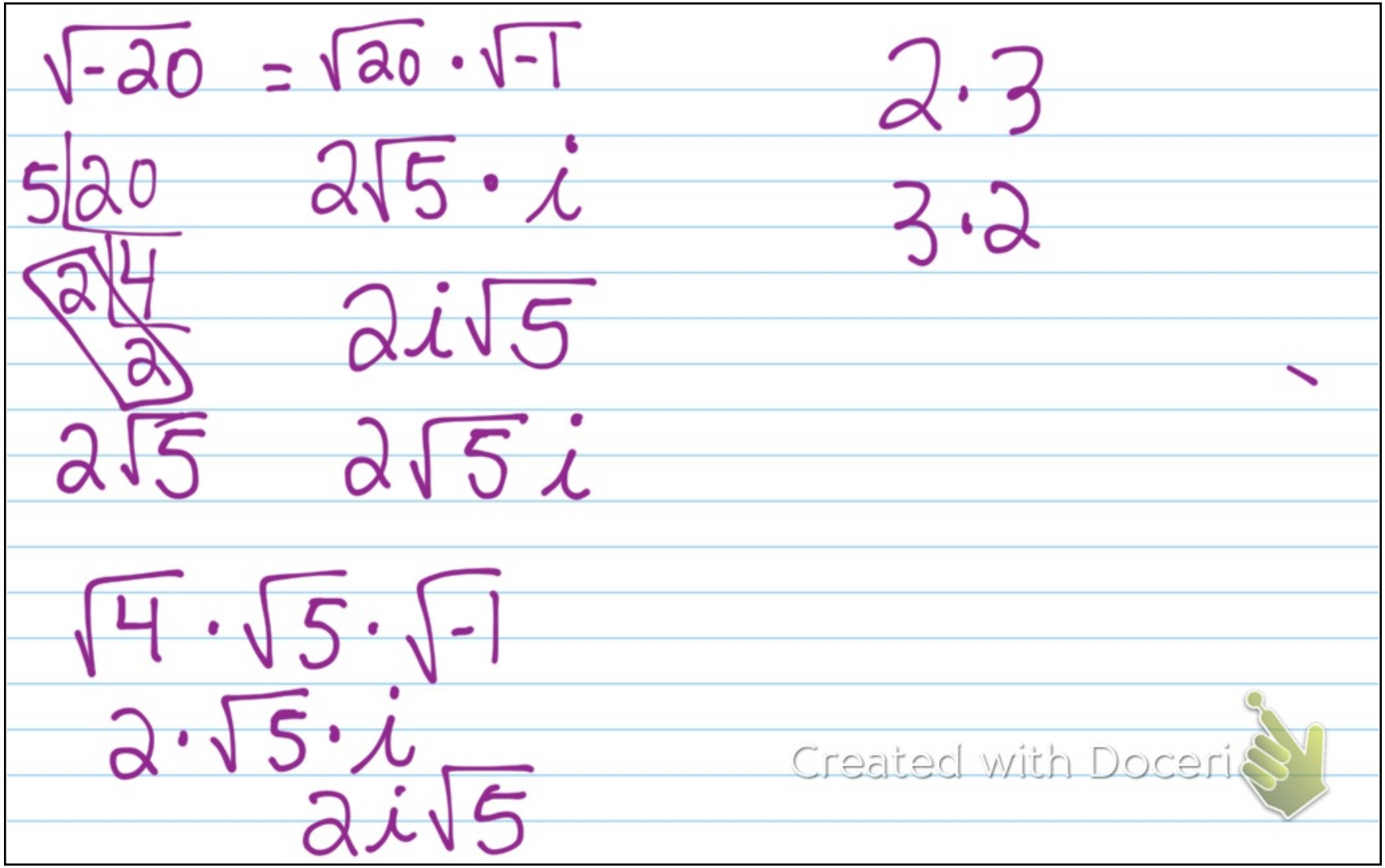
$\sqrt{-20} =$ $2i\sqrt{5}$

$\sqrt{-45} =$ $3i\sqrt{5}$

$\sqrt{-36} =$ $\sqrt{36} \cdot \sqrt{-1}$ $6i$

$\sqrt{-27} =$ $3i\sqrt{3}$

$\sqrt{-75} =$ $5i\sqrt{3}$


√-20 = √20 · √-1
5|20
2|4
2
2√5
2√5 · i
2i√5
2√5 i
√4 · √5 · √-1
2 · √5 · i
2i√5
2 · 3
3 · 2
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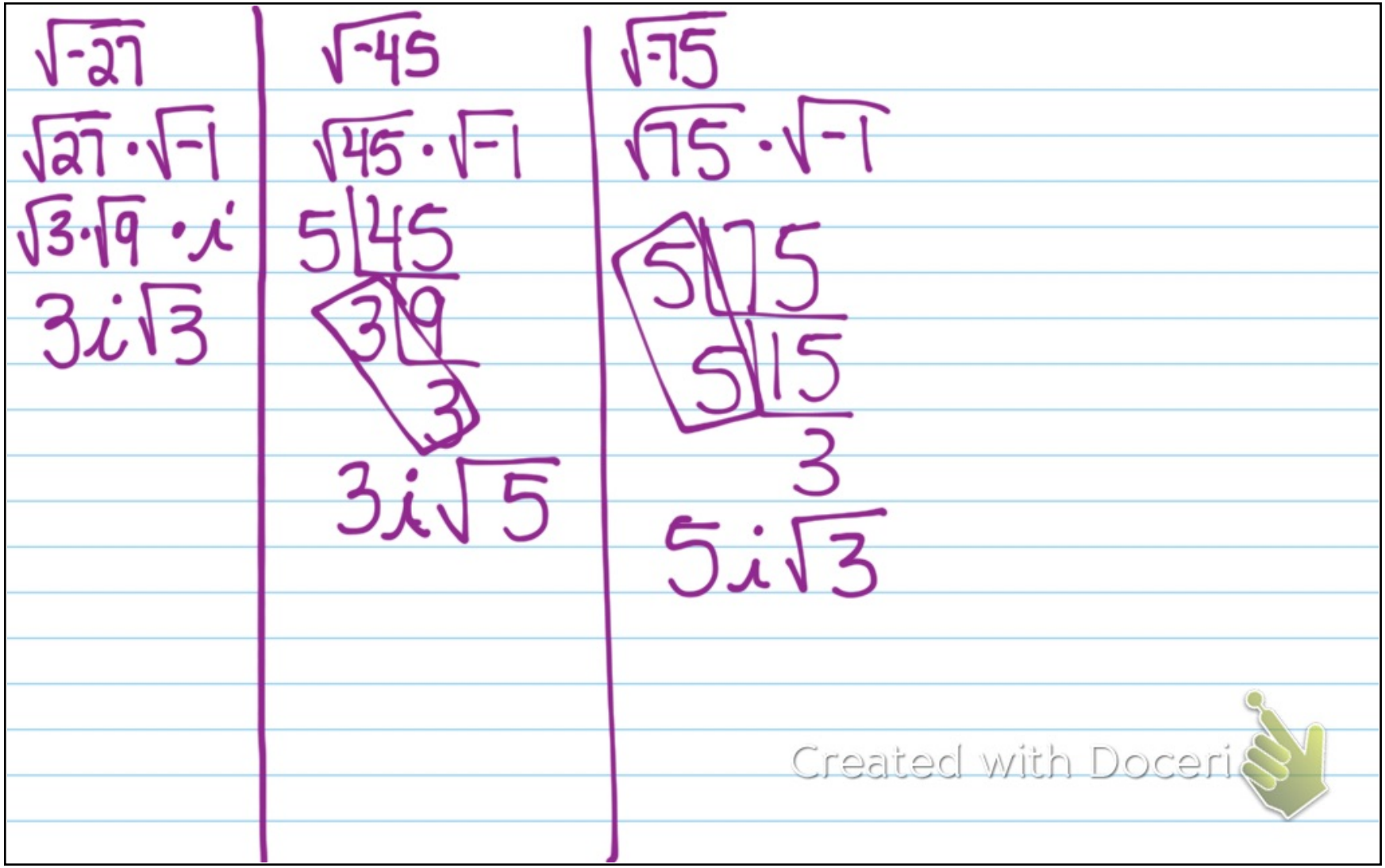
√-27
√27 · √-1
√3 · √9 · i
3i√3
√-45
√45 · √-1
5|45
3|9
3
3i√5
√-75
√75 · √-1
5|75
5|15
3
5i√3
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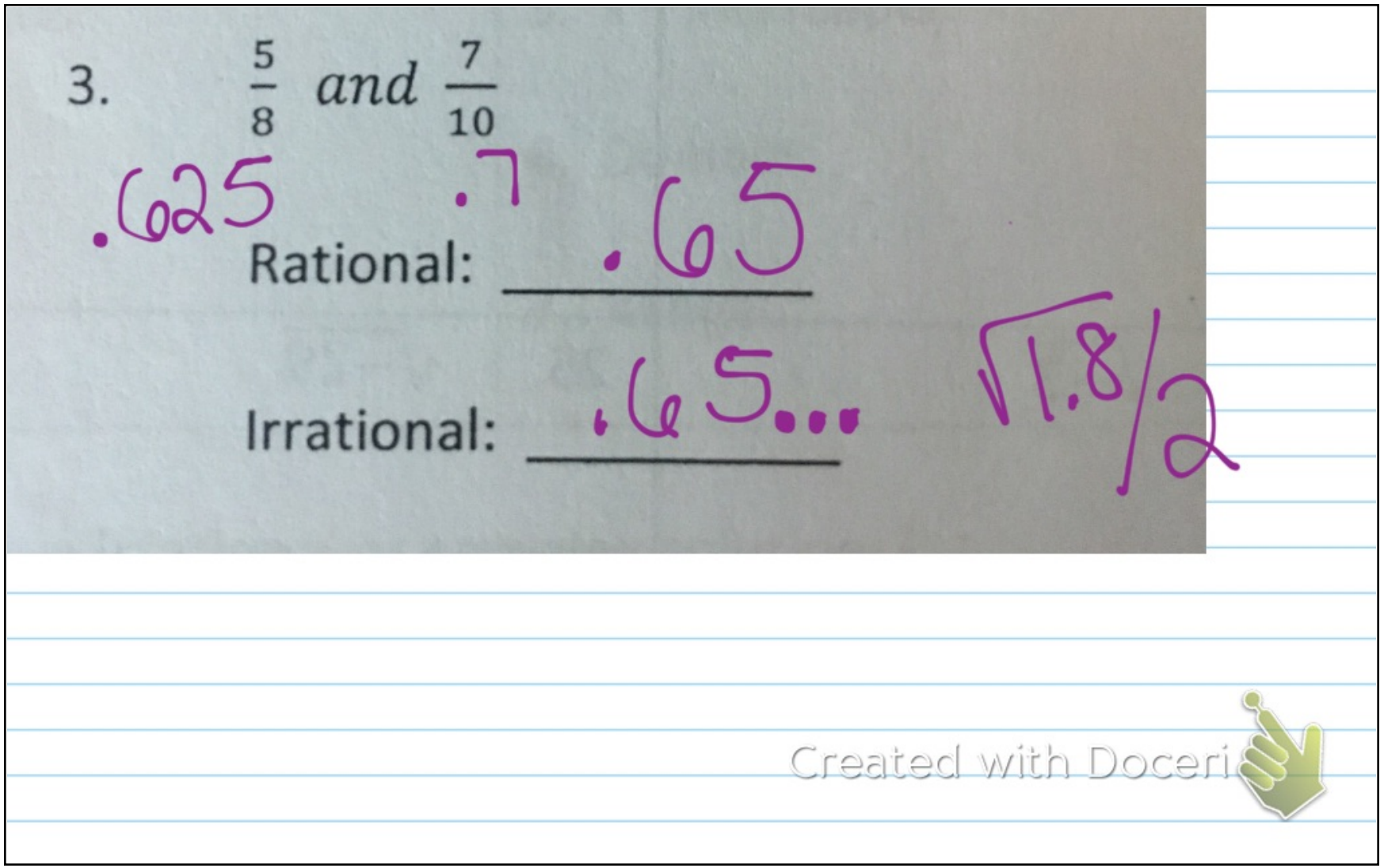
Always, Sometimes or Never True:

A
S
S
A
N
S
A
S
A
S
S

1. The sum of a rational number and an irrational number is irrational.
2. The circumference of a circle is irrational. $C = 2\pi r$ $r = \frac{C}{2\pi}$ $\frac{2\pi r}{\pi} = 2r$
3. The diagonal of a square is irrational.
4. The sum of two rational numbers is rational.
5. The product of a rational number and an irrational number is irrational. $\pi \cdot 0 = 0$
6. The sum of two irrational numbers is irrational.
7. The product of two rational numbers is irrational.
8. The product of two irrational numbers is irrational.
9. An expression containing both 6 and π is irrational.
10. Between two rational numbers there is an irrational number.
11. Between two irrational numbers there is an irrational number.
12. The circumference of a circle is irrational.
13. A real number is a complex number.
14. A complex number can also a real number.
15. A complex number can be only imaginary.

Page 6-7 Odd HW


3. $\frac{5}{8}$ and $\frac{7}{10}$
.625
.7
Rational: .65
Irrational: .65...
√1.8/2
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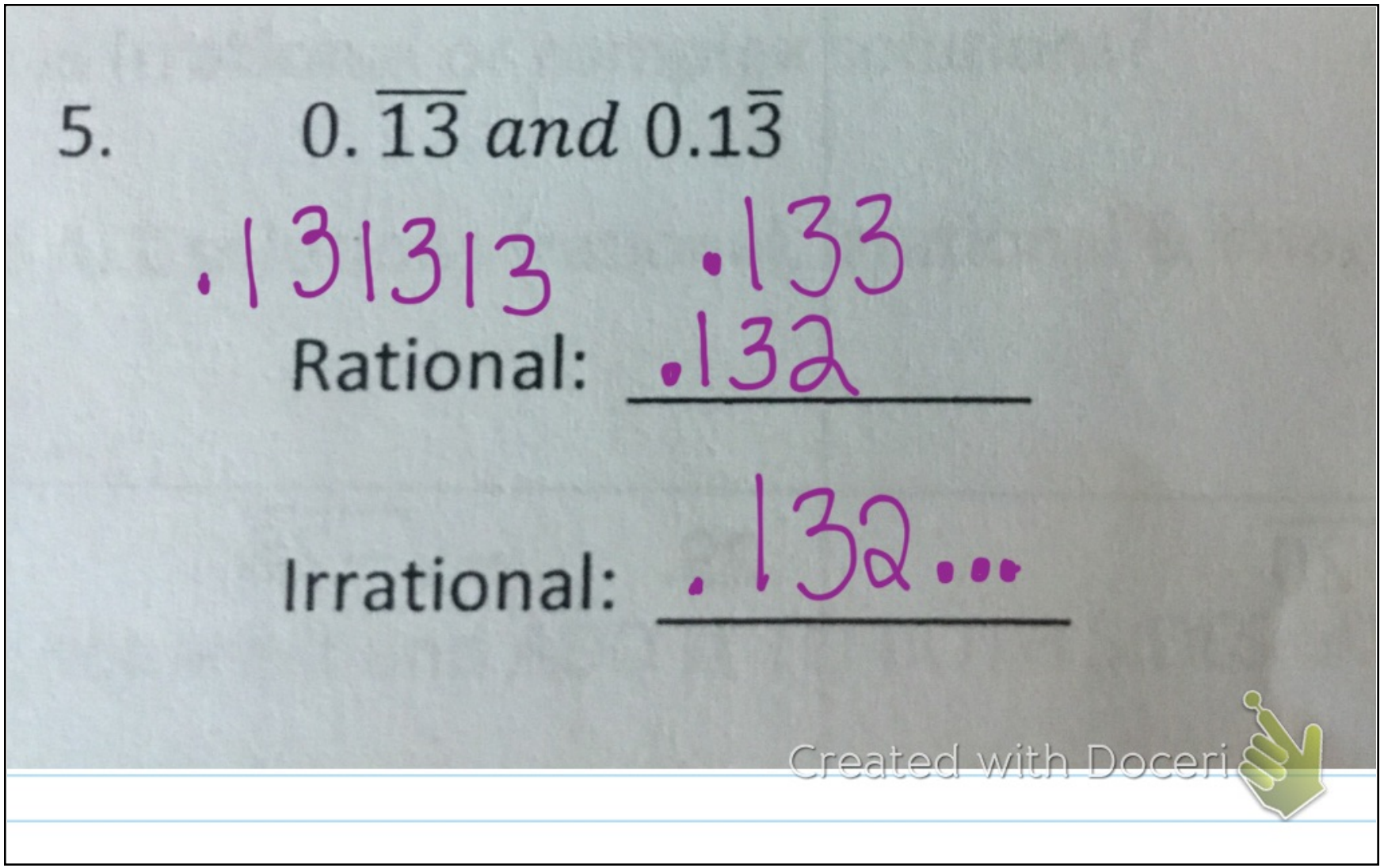
5. $0.\overline{13}$ *and* $0.1\overline{3}$
.131313
.133
Rational: .132
Irrational: .132...
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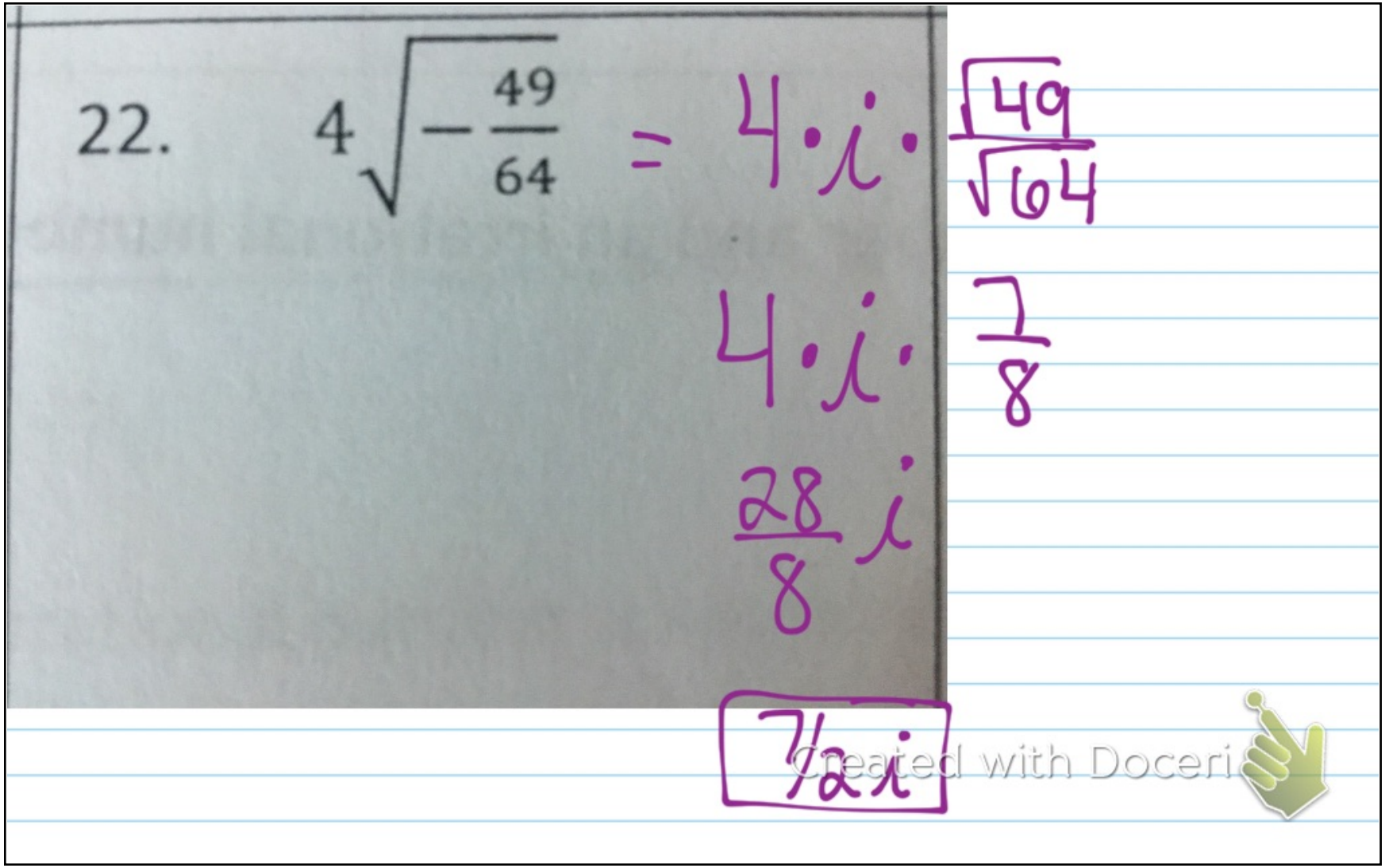
22.
$4\sqrt{-\frac{49}{64}}$
$= 4 \cdot i \cdot \frac{\sqrt{49}}{\sqrt{64}}$
$4 \cdot i \cdot \frac{7}{8}$
$\frac{28}{8} i$
$7\frac{1}{2} i$
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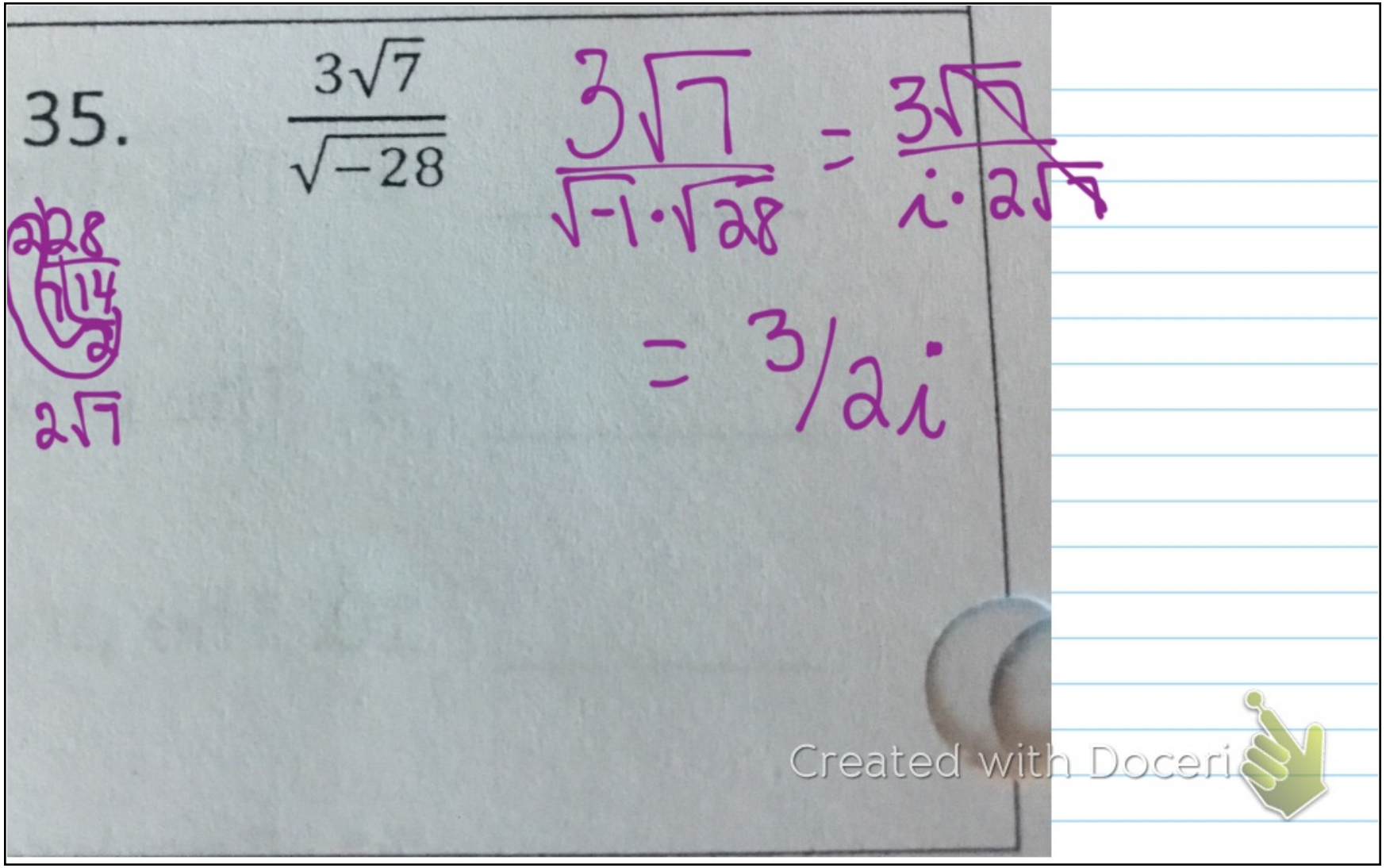
35.
$\frac{3\sqrt{7}}{\sqrt{-28}}$
$\frac{3\sqrt{7}}{\sqrt{-1}\cdot\sqrt{28}} = \frac{3\sqrt{7}}{i\cdot 2\sqrt{7}}$
$= 3/2i$
28
14
2
$2\sqrt{7}$
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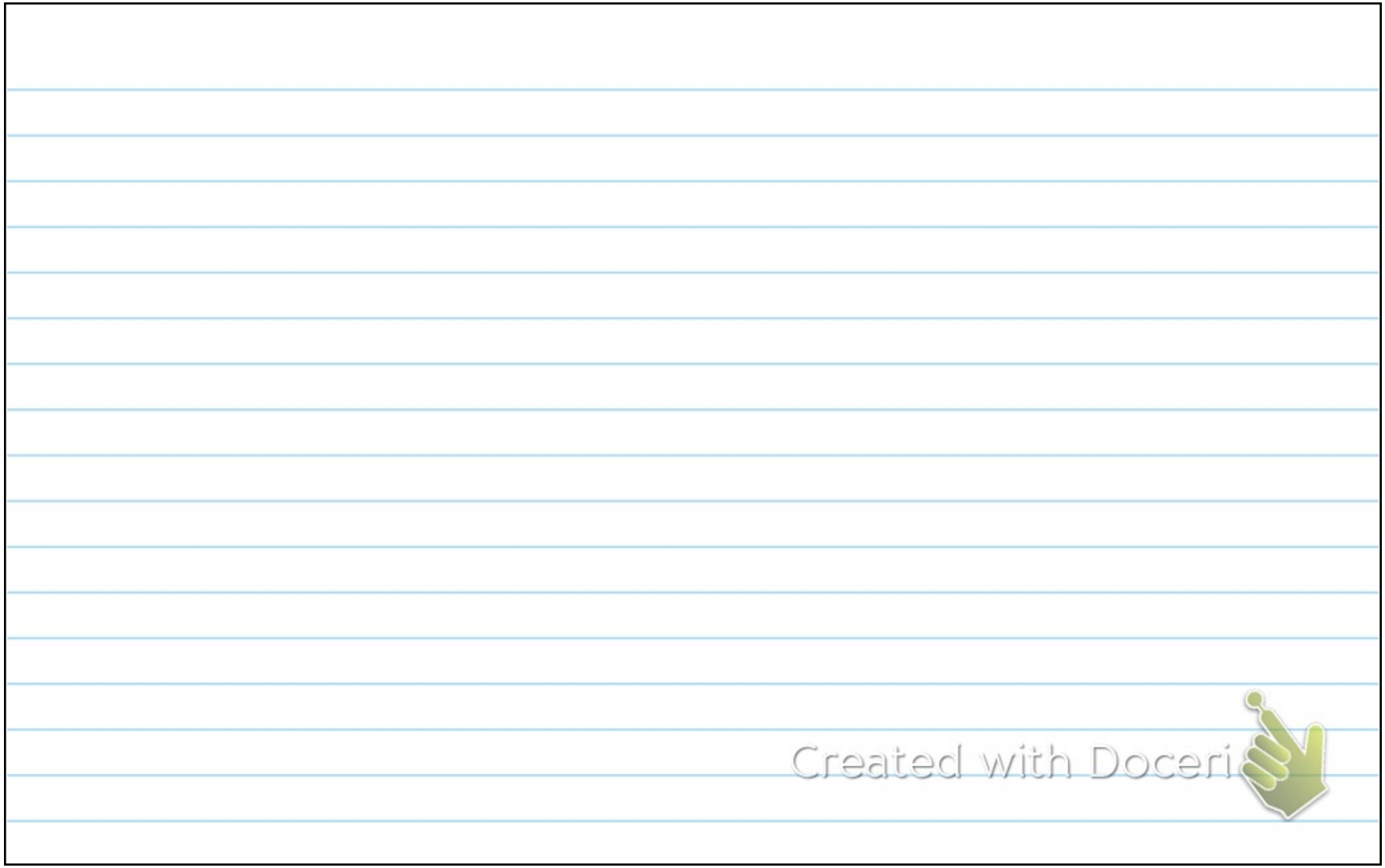
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