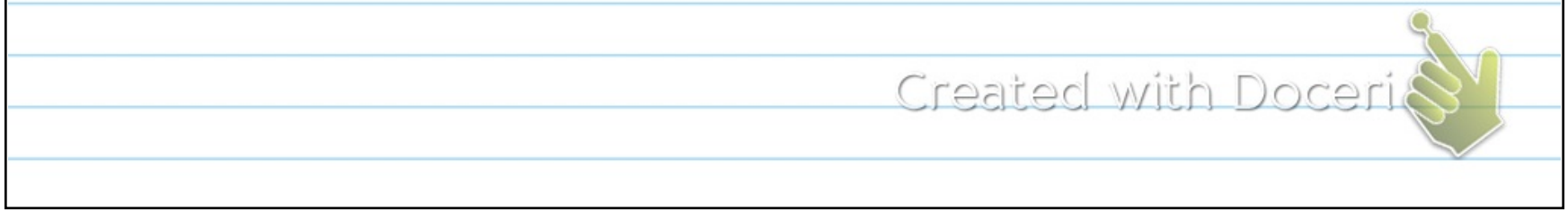
Unit 3
Lesson 4

Discriminant and Quadratic Formula



Name_____

Unit 3 – Quadratic Functions Continued

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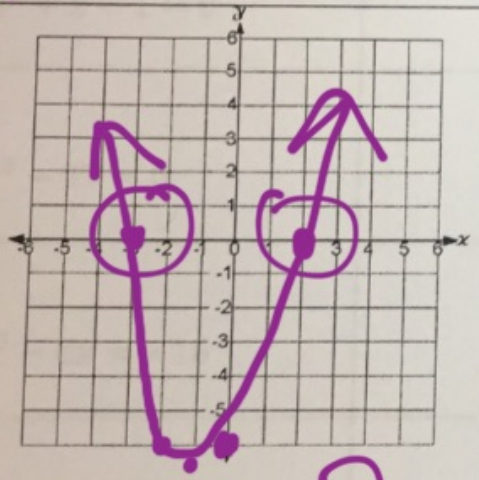
Lesson 4 → Discriminant & Quadratic Formula

- Solve the following equations by factoring.
- Graph the equation.

AM

1. $x^2 + x - 6 = 0$

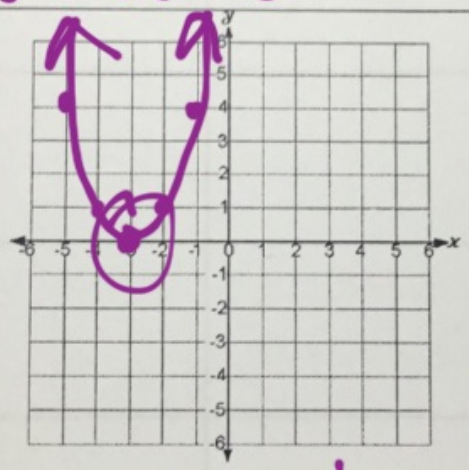
$(x+3)(x-2)=0$



Number of Solutions: 2

2. $x^2 + 6x + 9 = 0$

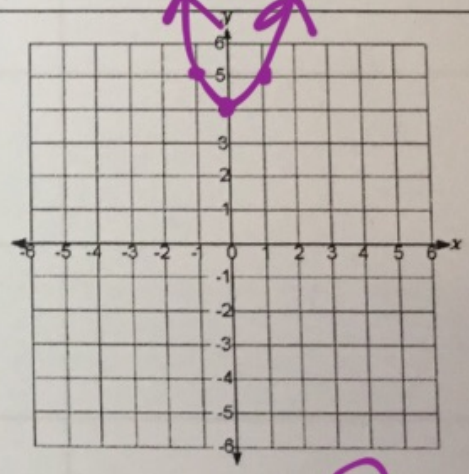
$(x+3)(x+3)=0$



Number of Solutions: 1

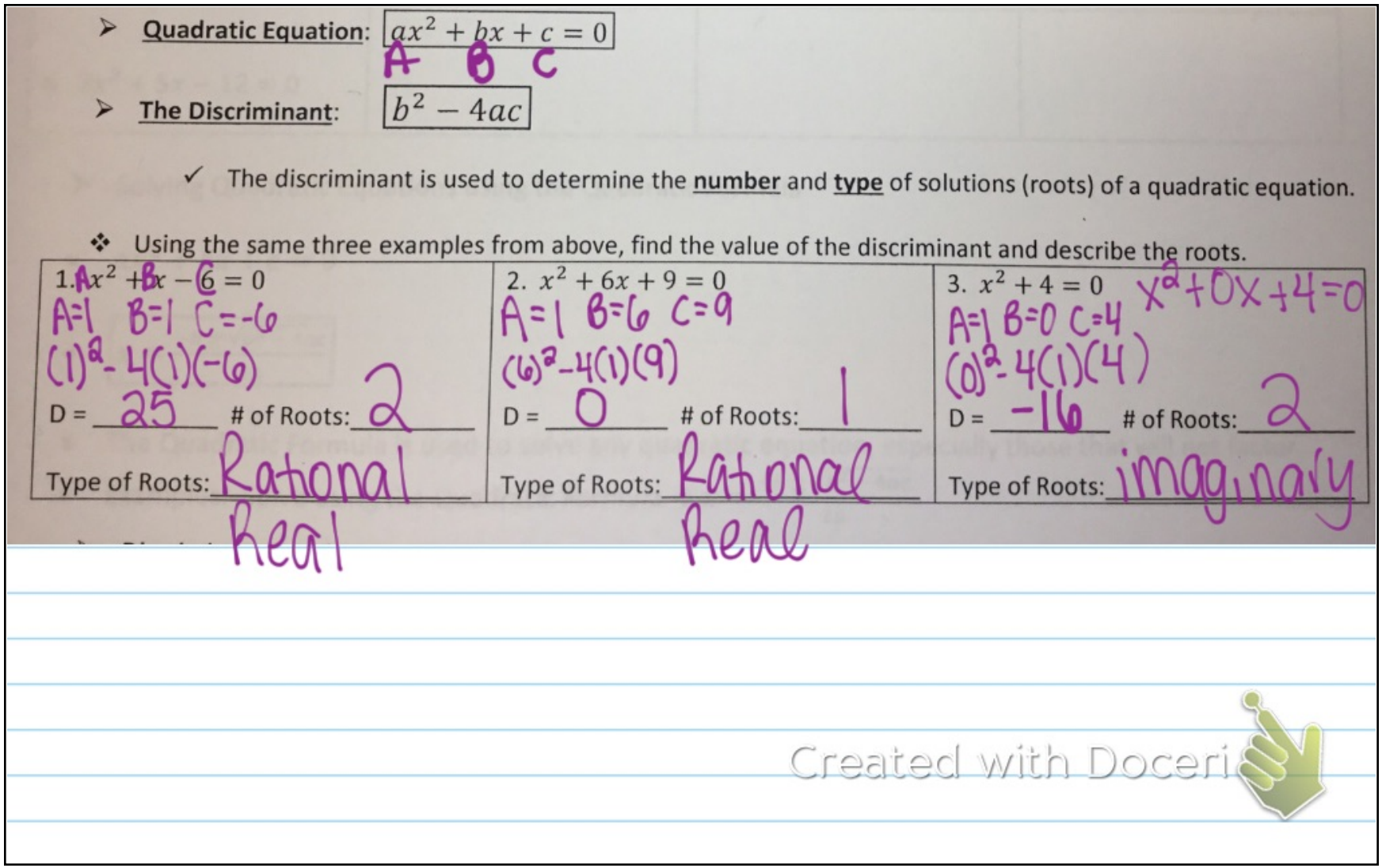
3. $x^2 + 4 = 0$

$x^2 = -4$



Number of Solutions: 0

(no) Real Solutions



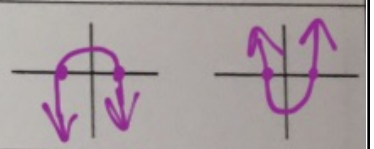
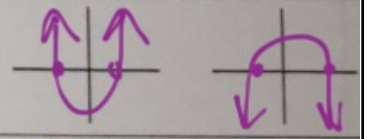
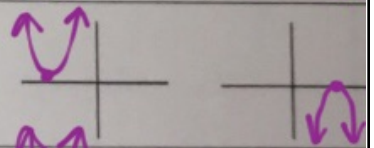
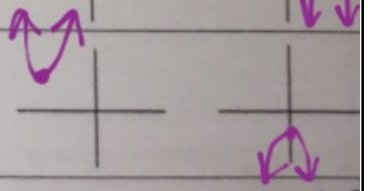
- **Quadratic Equation**: $ax^2 + bx + c = 0$ A B C
- **The Discriminant**: $b^2 - 4ac$

✓ The discriminant is used to determine the **number** and **type** of solutions (roots) of a quadratic equation.

❖ Using the same three examples from above, find the value of the discriminant and describe the roots.

1. $Ax^2 + Bx - C = 0$	2. $x^2 + 6x + 9 = 0$	3. $x^2 + 4 = 0$ $x^2+0x+4=0$
A=1 B=1 C=-6	A=1 B=6 C=9	A=1 B=0 C=4
$(1)^2 - 4(1)(-6)$	$(6)^2 - 4(1)(9)$	$(0)^2 - 4(1)(4)$
D = 25 # of Roots: 2	D = 0 # of Roots: 1	D = -16 # of Roots: 2
Type of Roots: Rational Real	Type of Roots: Rational Real	Type of Roots: imaginary

➢ Discriminant Conclusions:

Value of the Discriminant: $b^2 - 4ac$	Number and Type of Roots	What does the graph look like?
$b^2 - 4ac$ is **POSITIVE** and a **PERFECT SQUARE** $\boxed{b^2 - 4ac > 0}$	2 real rational	Intersects the x – axis twice 
$b^2 - 4ac$ is **POSITIVE** and **NOT** a **PERFECT SQUARE** $\boxed{b^2 - 4ac > 0}$	2 real irrational	Intersects the x – axis twice 
$\boxed{b^2 - 4ac = 0}$	1 real rational	Intersects the x – axis once 
$b^2 - 4ac$ is **NEGATIVE** $\boxed{b^2 - 4ac < 0}$	2 imaginary	Never Intersects the x – axis 

Equation	Discriminant	Number and Type of Roots	Rational or Irrational
1. $8x^2 + 2x - 1 = 0$	$(2)^2-4(8)(-1)$ $4-(-32) = 36$	2 real rational	rational b/c 36 is perfect square
2. $x^2 + x + 1 = 0$	$(1)^2-4(1)(1)$ $1-4=-3$	2 imaginary	imaginary
$x^2+0x-27=0$ 3. $x^2 - 27 = 0$	$(0)^2-4(1)(-27)$ 108	2 real irrational	irrational
$x^2-8x+16$ 4. $x^2 - 8x = -16$	$(-8)^2-4(1)(16)$ $64-64=0$	1 real rational	rational
x^2+4x-1 5. $x^2 + 4x + 9 = 10$	$(4)^2-4(1)(-1)$ $16+4=20$	2 real irrational	2 real irrational
6. $3x^2 + 5x - 12 = 0$	$(5)^2-4(3)(-12)$ $25-(12)(-12)$ $25-(-144)=169$	2 real rational	rational

➢ Solving Quadratic Equations using the Quadratic Formula

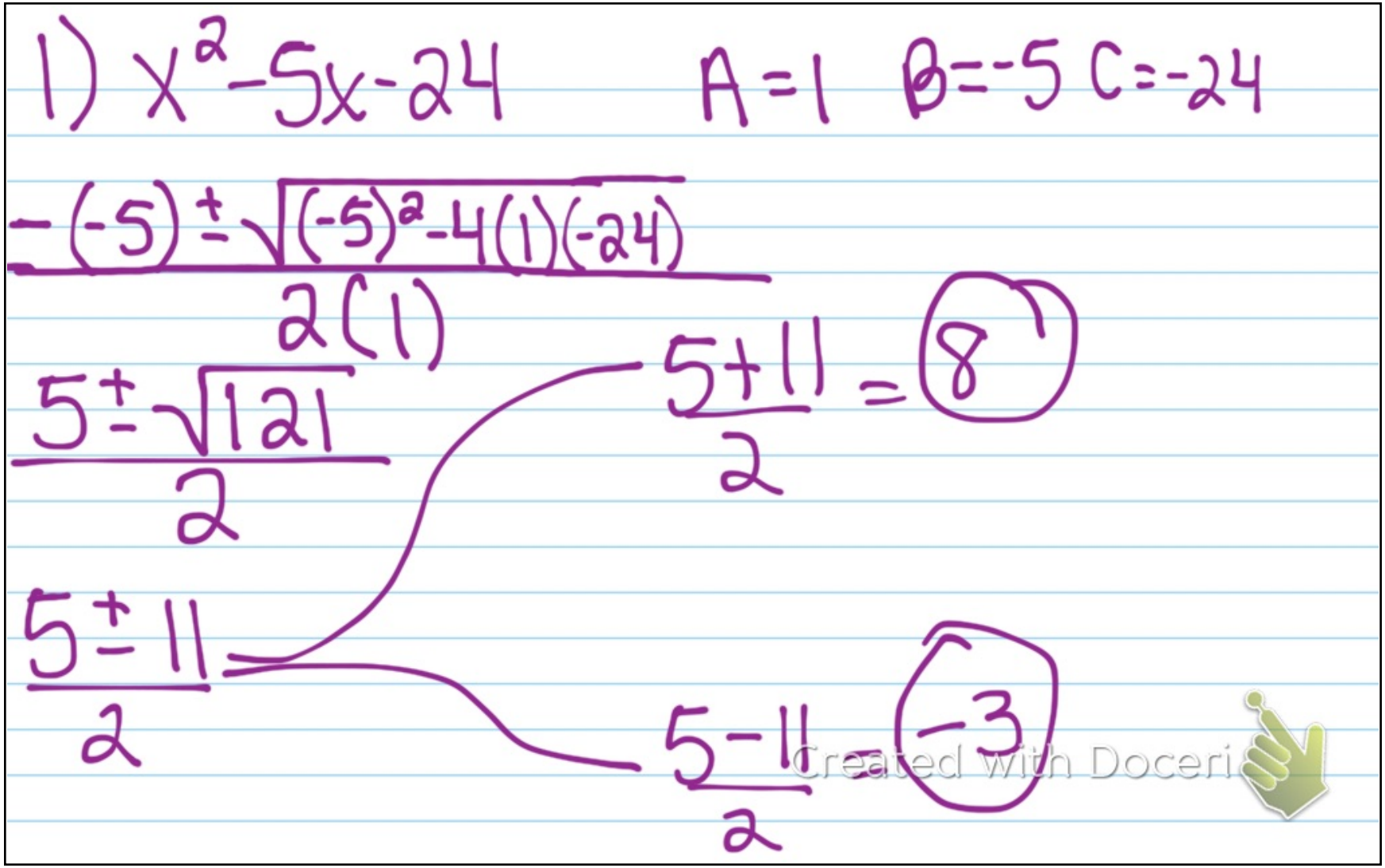
- $ax^2 + bx + c = 0$
- $\boxed{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$
- The Quadratic Formula is used to solve any quadratic equation, especially those that will not factor.
- Examples: Solve using the Quadratic Formula → $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1. $x^2 - 5x - 24 = 0$

$(x-8)(x+3)=0$

$8 \quad -3$

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


1) $x^2-5x-24$ A=1 B=-5 C=-24
$\frac{-(-5)\pm\sqrt{(-5)^2-4(1)(-24)}}{2(1)}$
$\frac{5\pm\sqrt{121}}{2}$
$\frac{5\pm11}{2}$
$\frac{5+11}{2}=8$
$\frac{5-11}{2}=-3$
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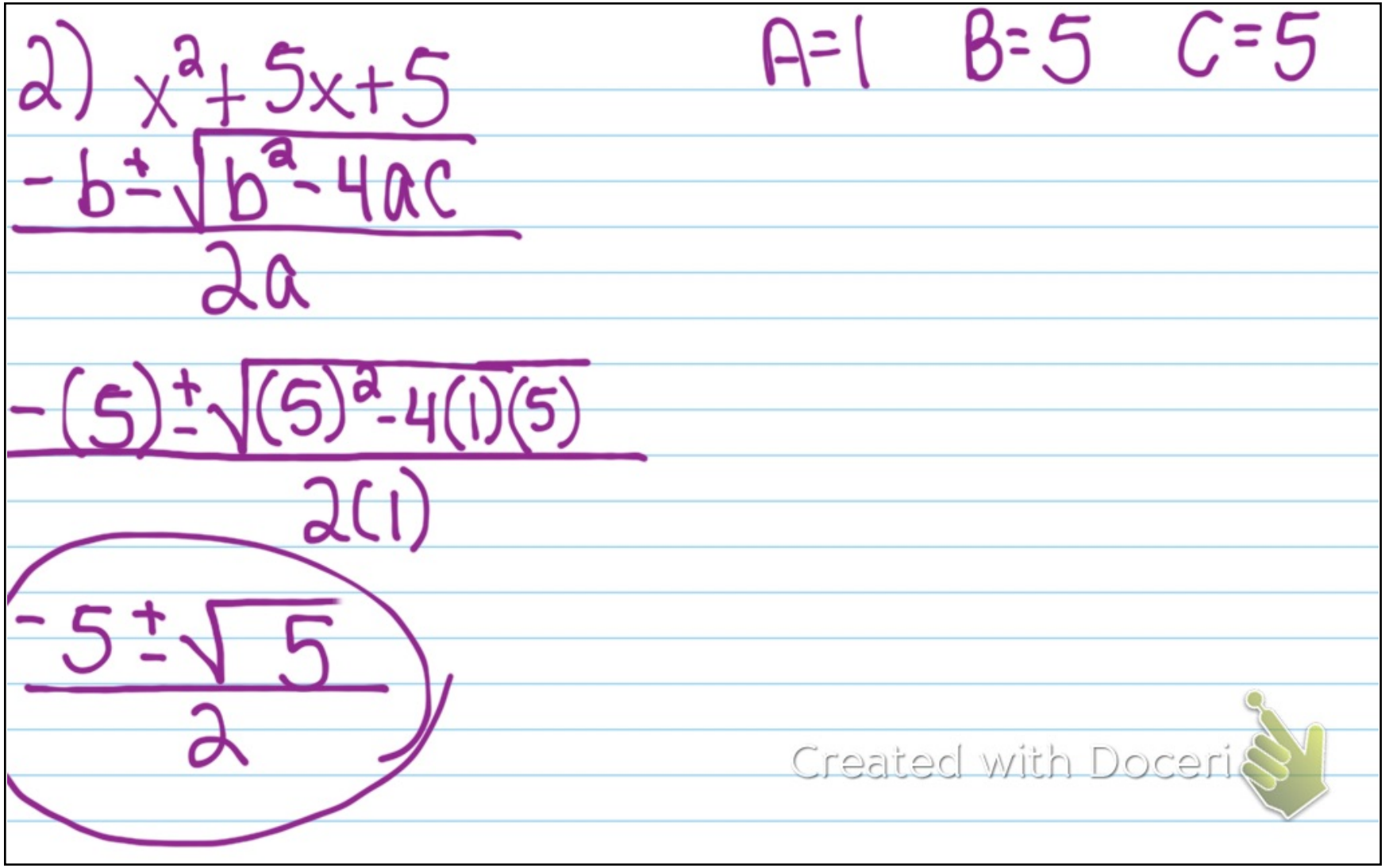
2) x^2+5x+5
A=1 B=5 C=5
$\frac{-b\pm\sqrt{b^2-4ac}}{2a}$
$\frac{-(5)\pm\sqrt{(5)^2-4(1)(5)}}{2(1)}$
$\frac{-5\pm\sqrt{5}}{2}$
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3. $4x^2 + 8x - 1 = 0$

4. $4x^2 = -11x + 20$

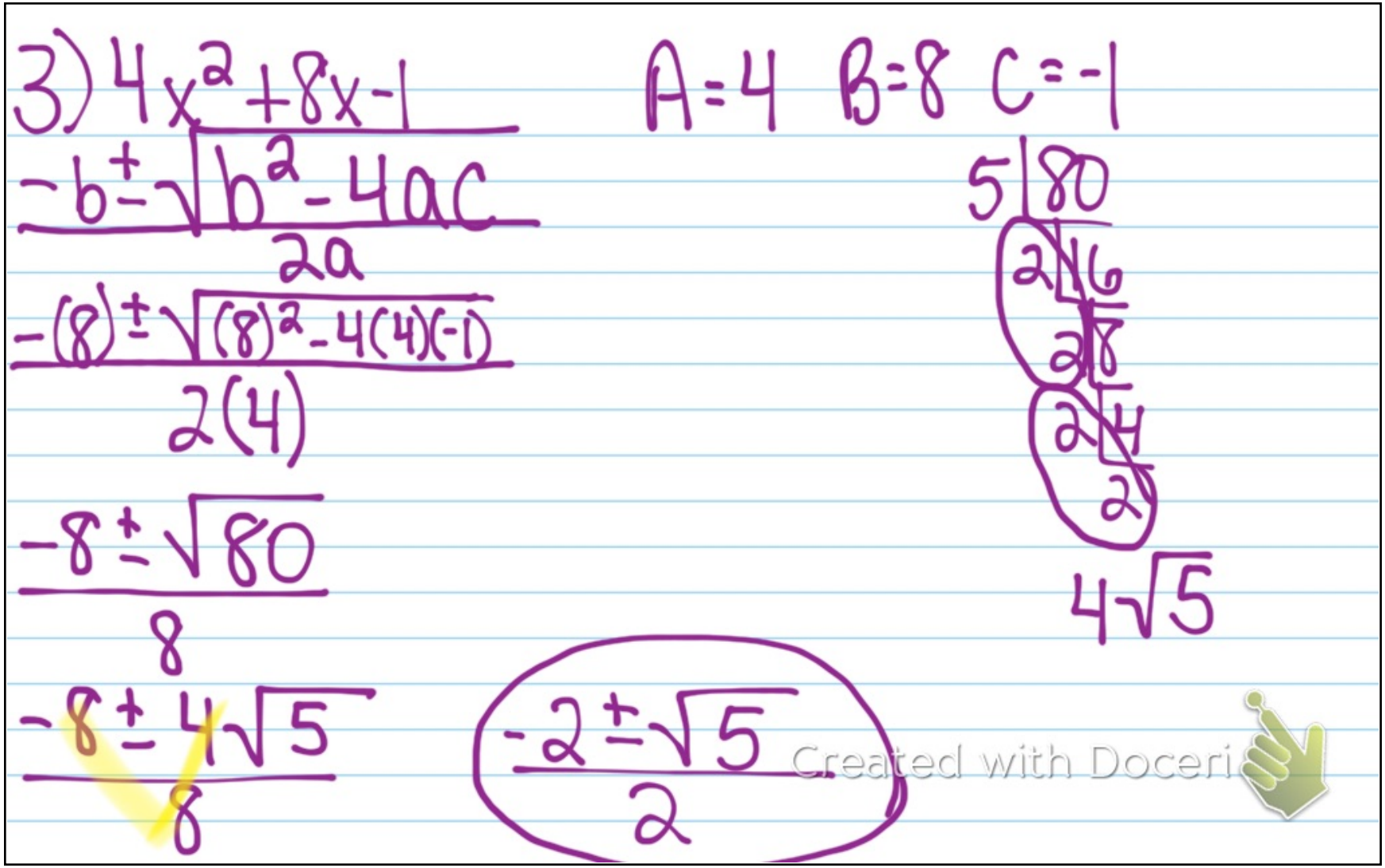
$4x^2+11x-20$

$x^2+11x-80$

$(x+\frac{16}{4})(x-5)$

$(x+4)(4x-5)$

-4 $\quad 5/4$


3) $4x^2+8x-1$
$A=4$ $B=8$ $C=-1$
$\frac{-b\pm\sqrt{b^2-4ac}}{2a}$
$\frac{-(8)\pm\sqrt{(8)^2-4(4)(-1)}}{2(4)}$
$\frac{-8\pm\sqrt{80}}{8}$
$\frac{-8\pm4\sqrt{5}}{8}$
$\frac{-2\pm\sqrt{5}}{2}$
5 | 80
2 | 16
2 | 8
2 | 4
2
$4\sqrt{5}$
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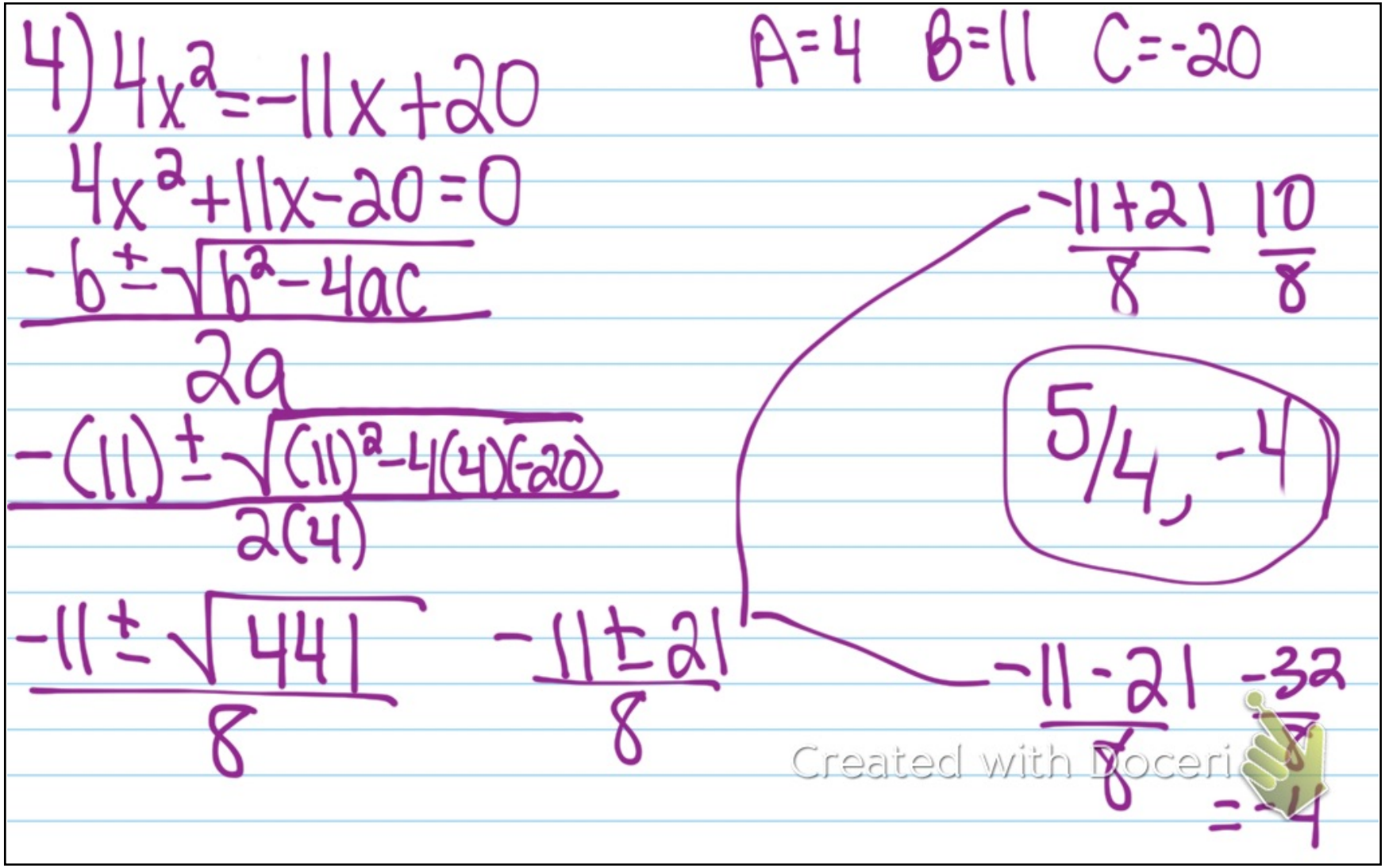
4) $4x^2 = -11x + 20$
$4x^2 + 11x - 20 = 0$
$A = 4 \quad B = 11 \quad C = -20$
$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
$\frac{-(11) \pm \sqrt{(11)^2 - 4(4)(-20)}}{2(4)}$
$\frac{-11 \pm \sqrt{441}}{8}$
$\frac{-11 \pm 21}{8}$
$\frac{-11 + 21}{8} \quad \frac{10}{8}$
$\frac{-11 - 21}{8} \quad \frac{-32}{8} = -4$
$5/4, -4$
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5. $x^2 + 25 = 10x$

$x^2 - 10x + 25$

$(x-5)^2 = 0$

$x = 5$

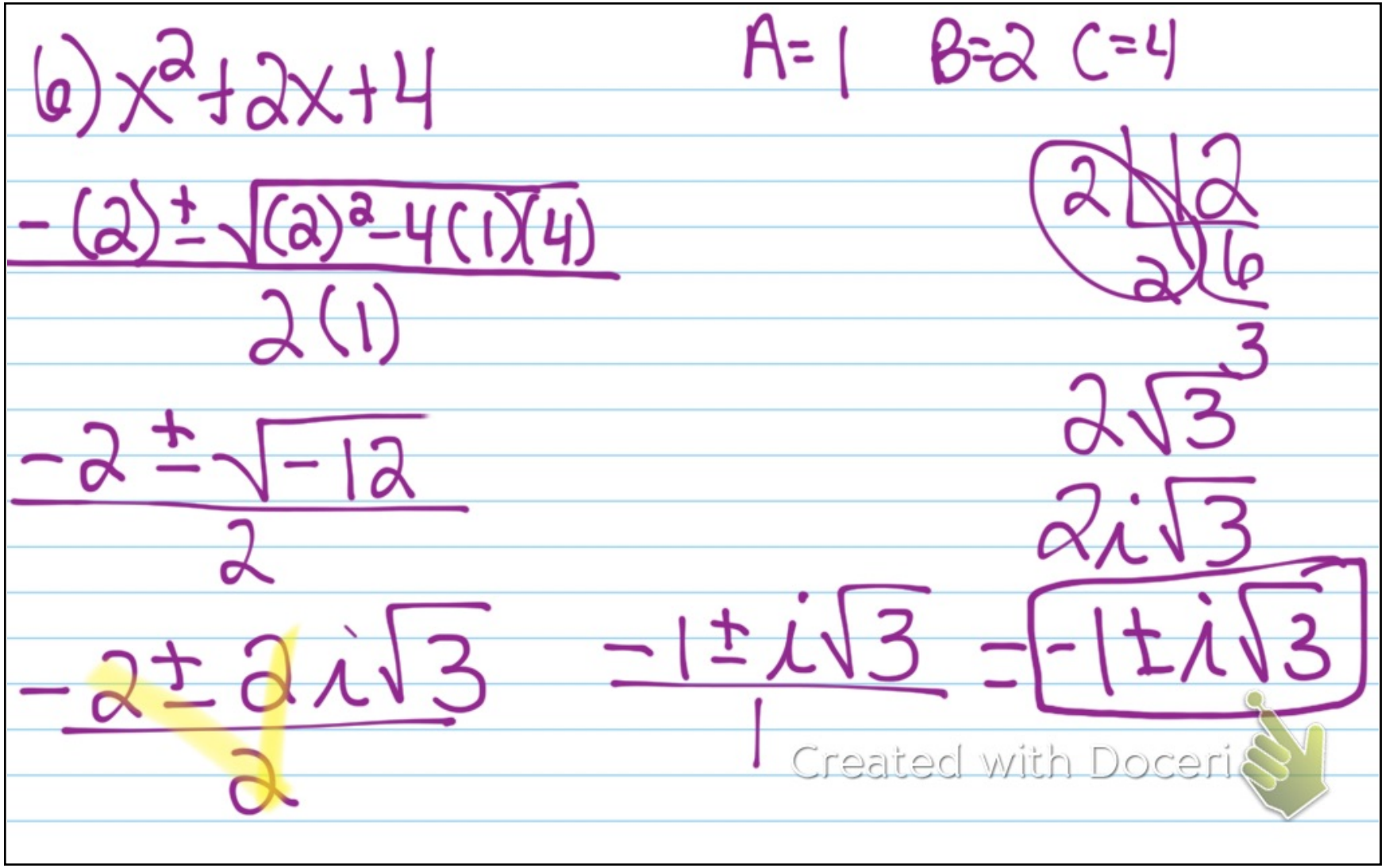
6. $x^2 + 2x + 4 = 0$

5) $x^2+25=10x$ $A=1$ $B=-10$ $C=25$

$x^2-10x+25=0$

$$\frac{-(-10)\pm\sqrt{(-10)^2-4(1)(25)}}{2(1)}$$

$$\frac{10\pm\sqrt{0}}{2} \quad \frac{10\pm0}{2} \quad \frac{10}{2}=5$$


b) x^2+2x+4
A=1 B=2 C=4
$\frac{-(2)\pm\sqrt{(2)^2-4(1)(4)}}{2(1)}$
$\frac{-2\pm\sqrt{-12}}{2}$
$\frac{-2\pm 2i\sqrt{3}}{2}$
$\frac{-1\pm i\sqrt{3}}{1}$
$-1\pm i\sqrt{3}$
2 | 12
2 | 6
3
$2\sqrt{3}$
$2i\sqrt{3}$
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Page 15-16 Odd HW