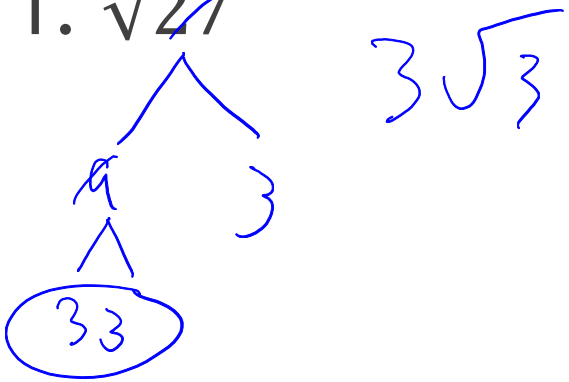
U2 D1

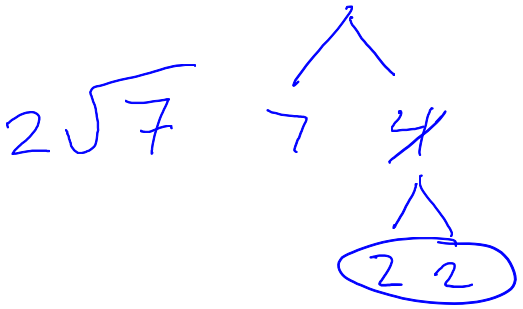
WU

1. $\sqrt{27}$



$3\sqrt{3}$

2. $\sqrt{28}$



3. $\sqrt{(x-3)^2} = \sqrt{16}$

$x - 3 = \pm 4$

$+3 \quad +3$

$x = \pm 4 + 3$

$\hookrightarrow 4 + 3 = 7$

$\hookrightarrow -4 + 3 = -1$

4. $\sqrt{(x+2)^2} = \sqrt{1}$

$x + 2 = \pm 1$

$-2 \quad -2$

$-2 + 1 = -1$

$-2 - 1 = -3$

Check your answers

1. -5
2. $4\sqrt{2}$
3. -2
4. 1
5. -1

1. $3x^2 - 5x - 4 = 0$
2. $x^2 - x + 1 = 0$
3. $2x^2 - 3x - 7 = 0$

1. {-2,10}
2. {-8, -6}
3. {-8,12}

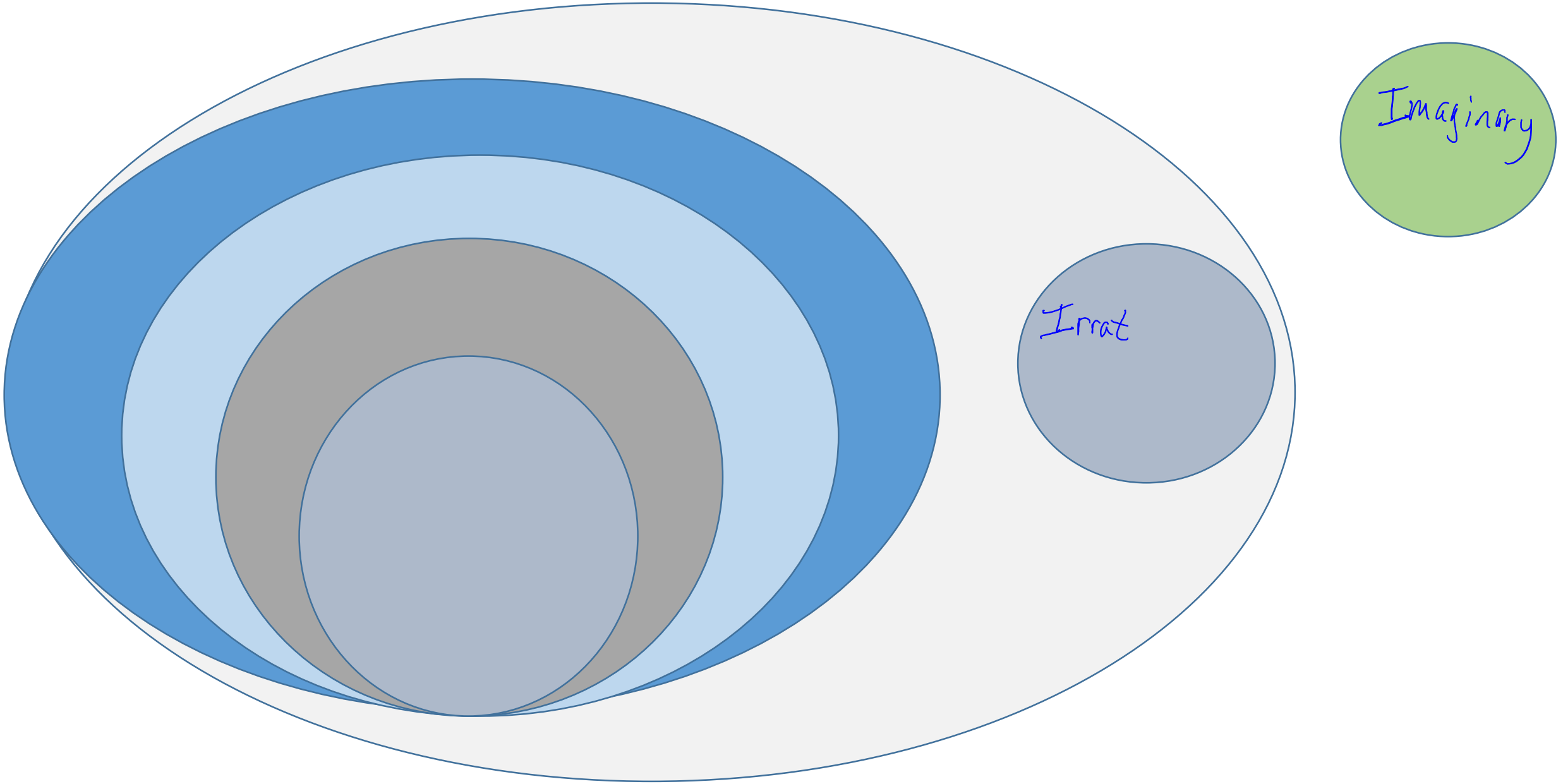
1. ± 2
2. 2
3. {0,1}

4. 3
5. $\{-2, \frac{2}{3}\}$
6. $\{\frac{1}{2}, 2\}$

1. a=5, b=4, c=-2
2. a=2, b=9, c=4
3. a=1, b=-4,c=-15
4. a=3, b=-6,c=17
5. a=1, b=-2,c=-3
6. a=1, b=4, c=14

Go over test

Number System



How would I…?

- …solve $3x^2 + 12 = 0$?

- You have probably learned “We can’t take the square root of a negative number.” This isn’t exactly true.

- $\sqrt{-4} = i * \sqrt{4} = i * 2 = 2i$

More on imaginary numbers

- $i = \sqrt{-1}$
- $i^2 = \left(\sqrt{-1}\right)^2 = -1$
- $i^3 = i^2 * i = -i$
- $i^4 = i^2 * i^2 = -1 * -1 = 1$

Quick examples

1. $\sqrt{-3}$

2. $-2\sqrt{-12}$

You Try!

3. $\sqrt{-8}$

4. $2\sqrt{-16}$

U2 D2

Warm Up

1. $\sqrt{-12}$

2. $\sqrt{-8}$

3. $-2\sqrt{-18}$

4. $-\sqrt{-45}$

Homework 2-1

1. rational
2. natural
3. irrational
4. Integer
5. irrational
6. imaginary

7. $3\sqrt{2}$
8. $3i$
9. $\sqrt{210}$
10. $4i\sqrt{2}$
11. $6\sqrt{5}$
12. $15i\sqrt{5}$
13. $6i\sqrt{2}$
14. $-21i\sqrt{2}$
15. $-5\sqrt{3}$

Pd2/4: cross out number 8 on 2-2

Complex Numbers

- What happens if I try to combine a real and an imaginary number?
- $2 + 3i$
- Are these like terms?

- $a + bi$ is actually the standard form of a complex number.
- a is the *real* part and b is the *imaginary* part.

Examples

Simplify and write in standard form

1. $\sqrt{-12} + 4$

2. $\sqrt{-18} - 7$

3. $\sqrt{25} + 4\sqrt{-20}$

Simplifying Examples

1. $(5 + 7i) + (-2 + 6i)$
2. $(6 + 4i) + (-6 - 4i)$
3. $(3i)(-2i)$
4. $(2 + 3i)(-3 + 5i)$
5. $(3 + 7i)(2 - 3i)$
5. $(5 - 4i)^2$

Interesting!

- Something special happened in number 2!

- It summed to zero. These two complex numbers are known as *additive inverses*.

$$(6 + 4i) + (-6 - 4i) = 0$$

$$(-6 - 4i) = -(6 + 4i)$$

State the additive inverse

1. $2 + 5i$
2. $-3i$
3. $43 - 7i$

Solving Quadratics of the form ax+c=0

- $4x^2 + 100 = 0$
- $9x^2 + 54 = 0$
- $27x^2 + 12 = 0$

Looks like a difference of squares from last unit, but the terms are added instead of subtracted!

U2 D3

Warm Up – Solve!

1. $4x^2 + 100 = 0$

2. $9x^2 + 54 = 0$

3. $27x^2 + 12 = 0$

Steps to solve:

1. Isolate x^2 by subtracting "c", then dividing both sides by "a". ("a" is the number in front of x^2.)

2. Square root both side to remove the exponent ($\pm\sqrt{\ }$ on the right)

3. Reduce!

Warm Up – Simplify

1. $(2 + i)(4 + 2i)$
2. $3i - 2 + (6i - 9) - (2i + 4)$

Homework 2-2

1. $4i$
2. $-15i$
3. $-5-9i$
4. $32-8i$
5. $-2-3i$
6. $-7-6i$
7. $-38+69i$
8. $-98+114i$

ESPN and equations

- Sports science - archery

Tracking Ellison's Shot

Instead of shooting at a target (because that math is for a 4th level math course), Ellison wants to know how long he can keep an arrow in the air if he shot it as far as he could in the same way he shoots at a target.

Tracking Ellison's Shot

$$y = -9.81x^2 + 67.056x + 1.524$$

Gravity pulls down on the arrow at 9.81 m/s Since it pulls down, we use a negative.

The arrow is released at over 150 mph! (~67.056 m/s)

Ellison's shoots his bow from just below his chin, about 5 feet off the ground (1.524 m)

Tracking Ellison's Shot

$$y = -9.81t^2 + 67.056t + 1.524$$

To find out when the arrow hits the ground, we need to factor and find when y=0 since y is the height.

Can we factor this equation?

Sometimes factoring is hard.

- There once was a negative boy, who was all mixed up, so he went to a radical party, but because he was square, he lost out on four awesome chicks, so he cried his way home and when the night was all over, it was 2 AM.

Standard Form of a Quadratic and Quadratic Formula

- $ax^2 + bx + c = 0$

- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

- If you don't like the story there are lots of songs (Beyondce, One Directions, ect) to help you remember

Practice 1

$x^2 + 3x - 4 = 0$

a= b= c=

x=

Practice 2

$5m^2 + 7m - 2 = 0$

a= b= c=

x=

Practice 3

$4x^2 - 8x + 13 = 0$

a= b= c=

x=

Practice 4

$2x^2 + 8x + 8 = 0$

a= b= c=

x=

Tracking Ellison's Shot

$$y = -9.81t^2 + 67.056t + 1.524$$

Now can we solve this?
Yes! We can solve any quadratic with this formula!

Conclusions?

- What did you notice about the number under the radical in the last three problems and our answers?
- The number under the radical is called the *discriminant*.
- If d>0 you will have two real roots.
- If d<0 you will have two imaginary roots.
- If d=0 you will have one root. (A *double root*.)

How many solutions and what type?

$$\mathrm{d} = b^2 - 4ac$$

- Calculate the discriminant to determine how many and what type of solution each quadratic has.

$5x^2 + 6x - 1 = 0$

$2x^2 - 3x + 2 = 0$

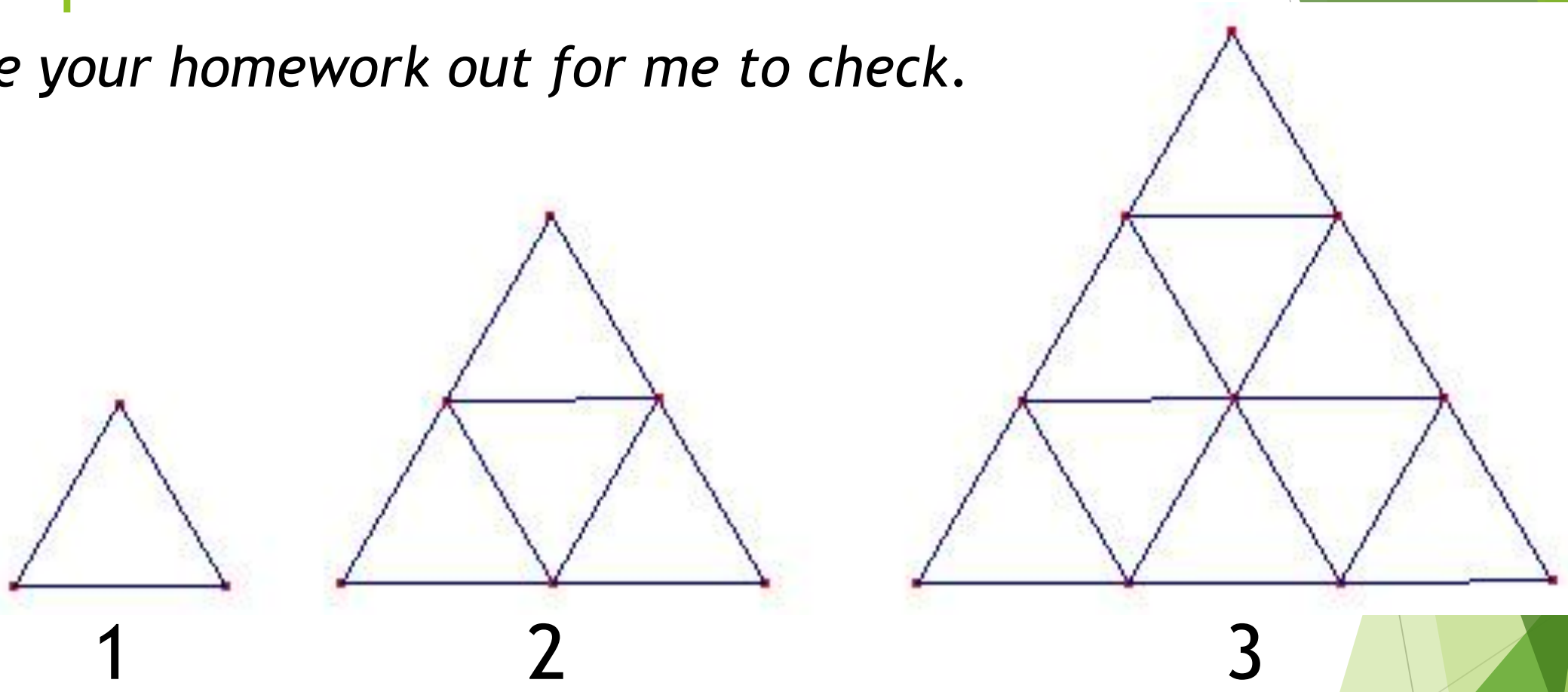
$x^2 - 4x + 4 = 0$

$3x^2 - 2x + 14 = 0$

U2 D4

Warm Up

Have your homework out for me to check.



How many triangles in pattern 5? 15?

Bonus: What would the perimeter of the 5th triangle be?

Homework 2-3 Honors

1. -4, 5/4

2. 8, 3

3. $\frac{3\pm\sqrt{21}}{2}$

4. $\frac{-5\pm\sqrt{5}}{2}$

5. $-1\pm\frac{\sqrt{5}}{2}$

6. $7\pm\sqrt{3}$

7. $5\pm2i$

8. $3\pm i$

9. -19; 2 imaginary roots

10. 288; 2 real, irrational roots

11. 81; 2 real, rational roots

12. -136; 2 imaginary roots

Homework 2-3

1. $\frac{7 \pm \sqrt{73}}{4}$
2. 8, 3
3. $\frac{3 \pm \sqrt{21}}{2}$
4. $\frac{-5 \pm \sqrt{5}}{2}$
5. $-1 \pm \frac{\sqrt{5}}{2}$
6. $7 \pm \sqrt{3}$
7. $5 \pm 2i$
8. $3 \pm i$
9. -19; 2 imaginary roots
10. 288; 2 real, irrational roots
11. 81; 2 real, rational roots
12. -136; 2 imaginary roots

Review!

- Let's play a game!
- Grab a marker board and a team of 3 or 4 people.

- First group to hold up the correct answers gets 2 points.
- The next 4 groups with a correct answer get 1 point.
- You MUST show your work, and the marker board must switch members every round.

- All members of every group with over 8 points at the end gets a piece of candy.

Round 1

- Solve using the quadratic formula:
- $x^2 - 5x - 14 = 0$

Round 2

- Solve using the quadratic formula:
- $2x^2 + 2x + 12 = 0$

Round 3

- Solve using the quadratic formula:
- $2x^2 + 8x + 7 = 4$

Round 4

- State the discriminant and number of roots. Describe the roots.
- $x^2 + 9x + 4 = 0$

Round 5

- State the discriminant and number of roots. Describe the roots.
- $2x^2 + 8x + 8 = 0$

Round 6

- State the discriminant and number of roots. Describe the roots.
- $2x^2 + 3x - 20 = 0$

Round 7

- Reduce. Answer must be in standard form.
- $-2 + 4i - 3 - 7i$

Round 8

- Reduce. Answer must be in standard form.
- $(4 - 5i)(4 + i)$

Round 9

- Simplify
- $-\sqrt{212}$

Round 10

- Simplify
- $\sqrt{-1872}$

Kahoot

- https://play.kahoot.it/#/k/8103e910-111a-4d4c-b647-162bc9f72417

U2 D6

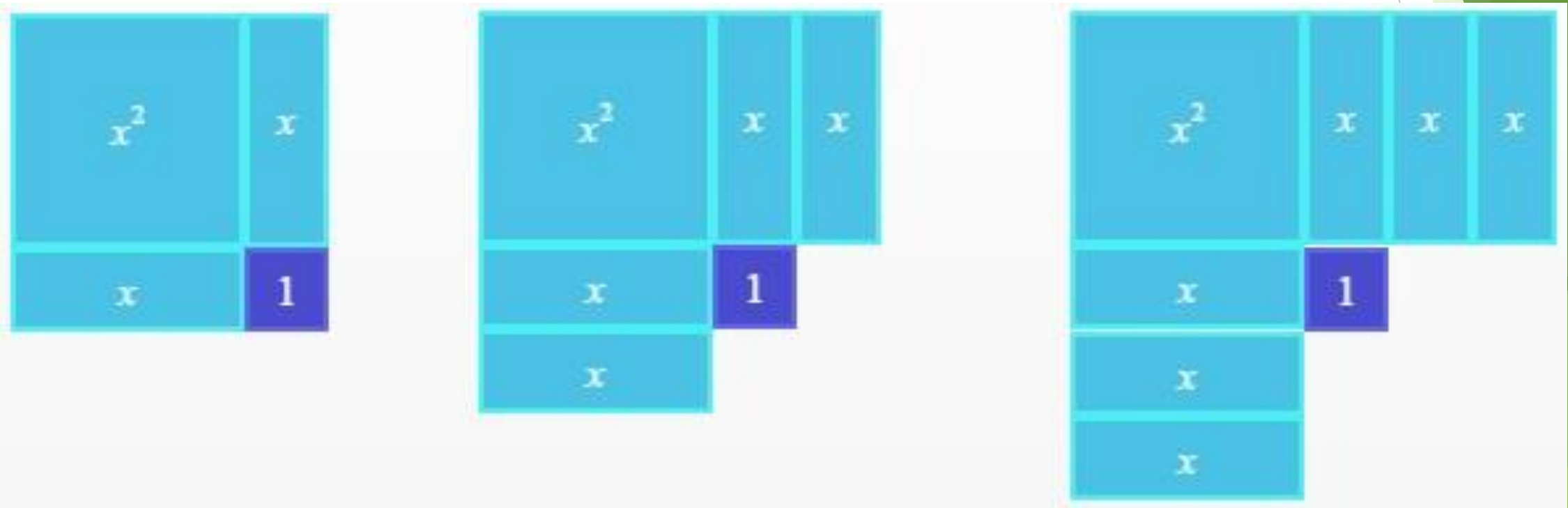
Quiz

Post-Quiz

Ignore this → LINK

How many 1's are needed to make a square in each pattern?

How does this relate to the number of x's? (not x^2s)



The Pattern

- We needed half of the x's, squared to "complete the square."
- This is actually a method of factoring and is also useful in later maths.

Perfect Square Trinomial

$$a^2 + 2ab + b^2$$

Factors to: $(a + b)(a + b)$ or $(a + b)^2$

- Examples
  - $9x^2 + 12x + 4$
  - $49x^2 - 14x + 1$
  - $x^2 + 10x + 25$
  - $144x^2 - 240x + 100$

- To complete the square: $x^2 - 8x + 5 = 0$

1. Calculate $(\frac{b}{2})^2$ (Just like the pattern!)
2. Add and subtract that number. (Group the subtracted with the c term.)
3. Make a squared binomial with x and $\frac{b}{2}$
4. Solve for x by $\pm$ square rooting both sides.

Examples

$x^2 - 8x + 36 = 0$

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

$x^2 + 6x + 34 = 0$

$x^2 + 12x + 4$

$3x^2 - 12x - 7 = 0$

$4x^2 + 8x - 9 = 0$

You try!

U2 D7

Re-Quiz

U2 D8

Warm Up

Homework 2-5

1. $\{-17, 3\}$
2. $-7 \pm \sqrt{87}$
3. $1 \pm i\sqrt{5}$
4. $-1 \pm i\sqrt{19}$
5. $\{-1, 3\}$
6. $\{-4, 2\}$

More practice completing the square

- Around the room

U2 D9

Warm Up

Homework 2-6

Review Day!

Homework: Review page

U2 D10

Test