COMPEX NUMBERS

Agenda:

Objective: Evaluate powers of *i*

(1 presentations for Extra Credit?)

1) DO NOW- what is i? what is i^2?
2) Simplify Radicals (#1, 2, 3)
3) Exploration of Powers of "i" (#4, 5)
4) Summarize Rule - Evaluating Powers of i
5) Exit Ticket

HW: "HW Worksheet #1"

DO NOW

The number $\sqrt{-1}$ is defined by the letter i

By assigning $\sqrt{-1} = i$ we are able to continue solving equations we were not previously able to do.

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

Then what is: $i^2 =$

When working with a negative number under a radical sign, ***deal with" i" first.***
Therefore:

$$\sqrt{-4} = \sqrt{-1} \bullet \sqrt{4} = i \bullet \sqrt{4} = i \bullet 2 = 2i$$

and

$$\sqrt{-8} = \sqrt{-1} \bullet \sqrt{8} = i \bullet 2\sqrt{2} = 2i\sqrt{2}$$

1. Write the following in simplified radical form and for these four problems, show the steps—do not do all work in your head yet!

a. $\sqrt{-9}$ = _____ b. $\sqrt{-20}$ = _____ c. $3\sqrt{-16}$ = _____ d. $5\sqrt{-18}$ = _____

2. Try this: $\sqrt{-4} \cdot \sqrt{-9}$ = _____

(If you did this correctly, the answer is -6.)
If you did not get -6 as your answer, copy the board work.

3. Try to simplify the following problems. (Show your work.)

a. $\sqrt{-25} \cdot \sqrt{-16}$ = _____ b. $\sqrt{-6} \cdot \sqrt{-2}$ = _____ c. $\sqrt{-36} \cdot \sqrt{4}$ = _____

- Correct your work if you missed any of these. You will need the examples later.

4. An exploration of powers of *i*. (Remember i is defined by $i = \sqrt{-1}$.)
Directions: Calculate the powers of *i*. Try to discover a pattern.

$i^1 = i$ $i^2 = -1$ $i^3 =$ _____ $i^4 =$ _____

$i^5 =$ _____ $i^6 =$ _____ $i^7 =$ _____ $i^8 =$ _____

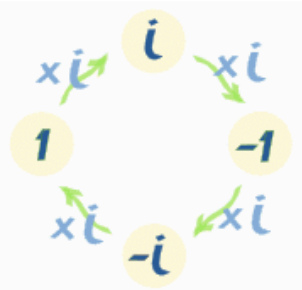
$i^9 =$ _____ $i^{10} =$ _____ $i^{11} =$ _____ $i^{12} =$ _____

$i^{13} =$ _____ $i^{14} =$ _____ $i^{15} =$ _____ $i^{16} =$ _____

5. What kind of **pattern** appears to be unfolding? Can you write a **rule** that will help you simplify any power of *i*?

Interesting Property

The Unit Imaginary Number, i, has an interesting property. It "cycles" through 4 different values each time you multiply:



- i × i = **-1**,
- then **-1** × i = -i,
- then -i × i = **1**,
- then **1** × i = **i** (back to i again!)

Simplifying i^n

Step 1. Divide n by 4 and find the remainder r.
Step 2. Replace the exponent (power) on i by the remainder, $i^n = i^r$.
Step 3. Use the results $i^0 = 1$, $i^1 = i$, $i^2 = -1$, and $i^3 = -i$ to simplify if necessary.

Solve the following problems and simplify the answers.

1. **Choose:**

Simplify: i^{35}

- ○ 1
- ○ i
- ○ $-i$

Explanation

6. Check out the accuracy and usefulness of the rule and try to simplify the following:

$i^{18} =$ _____ $i^{21} =$ _____ $i^{40} =$ _____ $i^{55} =$ _____

Name_____

Score:_____/4

Block_____

Exit Ticket

Simplify the following. Use the simplest power of i.
Show all work to receive partial credit.

1) $\sqrt{-49}$ =	2) i^{62}= (Circle the correct answer below) a) i b)-1 c) $-i$ d) 1

Name_____

Score:_____/4

Block_____

Exit Ticket

Simplify the following. Use the simplest power of i.
Show all work to receive partial credit.

1) $\sqrt{-81}$ =	2) i^{27} = (Circle the correct answer below) a) i b)-1 c) $-i$ d) 1

518 Complex Numbers

HW Worksheet #1 Name_____

Block_____

1. $\sqrt{-100}$ =

2. $\sqrt{-40}$ =

3. $\sqrt{-36}$

4. $-\sqrt{64}$

5. $\sqrt{-50}$

6. $\sqrt{-4} \cdot \sqrt{-49}$ =

7. $\sqrt{-3} \cdot \sqrt{-8}$ =

8. $\sqrt{-3} \cdot \sqrt{8}$

9. $3 \cdot \sqrt{-32}$ =

10. i^{51} =

11. i^{80} =

12. i^{14} =

13. i^{16} =

14. i^{401}

15. i^{0} =

16. i^{7} =

17. i^{3}

18. i^{62} =

19. $i^{2} \cdot i^{3}$

20. $i^{5} \cdot i^{7}$ =

518 Complex Numbers

HW Worksheet #1 Name_____

Block_____

1. $\sqrt{-100}$ =

$10i$

2. $\sqrt{-40}$ =

$\sqrt{-4 \cdot 10}$

$= 2i\sqrt{10}$

3. $\sqrt{-36}$

$6i$

4. $-\sqrt{64}$

-8

5. $\sqrt{-50}$

$\sqrt{-25 \cdot 2}$

$= 5i\sqrt{2}$

6. $\sqrt{-4} \cdot \sqrt{-49}$ =

$4i \cdot 7i$

$= 28i^2$

$= -28$

7. $\sqrt{-3} \cdot \sqrt{-8}$ =

$i\sqrt{3} \cdot \sqrt{-4 \cdot 2}$

$= i\sqrt{3} \cdot 2i\sqrt{2}$

$= 2i^2\sqrt{6} = -2\sqrt{6}$

8. $\sqrt{-3} \cdot \sqrt{8}$

$i\sqrt{3} \cdot \sqrt{4 \cdot 2}$

$i\sqrt{3} \cdot 2\sqrt{2}$

$= 2i\sqrt{6}$

9. $3 \cdot \sqrt{-32}$ =

$3 \cdot \sqrt{-16 \cdot 2}$

$= 3 \cdot 4i\sqrt{2}$

$= 12i\sqrt{2}$

10. i^{51} =

$4\overline{)51}$ r 3

4

11

8

3

$= i^3$

$= -i$

11. i^{80} =

$4\overline{)80}$ r 0

$= i^0$

$= 1$

12. i^{14} =

$4\overline{)14}$ r 2

$= i^2$

$= -1$

13. i^{16} =

$4\overline{)16}$ r 0

$= i^0 = 1$

14. i^{401}

$4\overline{)401}$ r 1

$= i^1 = i$

15. i^0 =

$= 1$

16. i^7 =

$4\overline{)7}$ r 3

$= i^3 = -i$

17. i^3

$-i$

18. i^{62} =

$4\overline{)62}$ r 2

$= i^2 = -1$

19. $i^2 \cdot i^3 = i^5$

$-1 \cdot -i$

i

20. $i^5 \cdot i^7$ =

$= i^{12}$

$= i^0 = 1$