

Warmup:

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

$$i^2 = -1$$

$$\sqrt{-10}$$

$$4\sqrt{-7}$$

$$2\sqrt{-8}$$

$$i\sqrt{10}$$

$$4i\sqrt{7}$$

$$2i\sqrt{8}$$

$$4\sqrt{2}$$

$$22$$

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

$$4i\sqrt{2}$$

$$\sqrt{-100} = 10i$$

Algebra 2

HW #1 Simplifying Imaginary Numbers

Name: keyIn 1 – 24, express each number in terms of i , and simplify.

1. $\sqrt{-36}$

$$\sqrt{-1} \cdot \sqrt{36}$$

$$\boxed{6i}$$

2. $\sqrt{-100}$

$$\sqrt{-1} \cdot \sqrt{100}$$

$$\boxed{10i}$$

3. $-\sqrt{-81}$

$$-1 \cdot \sqrt{-1} \cdot \sqrt{81}$$

$$\boxed{-9i}$$

4. $2\sqrt{-49}$

$$2 \cdot \sqrt{-1} \cdot \sqrt{49}$$

$$2 \cdot 7i$$

$$\boxed{14i}$$

$$2i \sqrt{49}$$

$$\begin{matrix} \nearrow & \searrow \\ \boxed{7} & \boxed{7} \end{matrix}$$

$$2 \cdot 7 \cdot i$$

5. $\frac{1}{8}\sqrt{-64}$

$$\frac{1}{8} \cdot \sqrt{-1} \cdot \sqrt{64}$$

$$\frac{1}{8} \cdot 8i = \boxed{i}$$

6. $-\frac{2}{3}\sqrt{-9}$

$$-\frac{2}{3} \cdot \sqrt{-1} \cdot \sqrt{9}$$

$$-\frac{2}{3} \cdot 3i = \boxed{-2i}$$

7. $\frac{3}{4}\sqrt{-144}$

$$\frac{3}{4} \cdot \sqrt{-1} \cdot \sqrt{144}$$

$$\frac{3}{4} \cdot 12i = \boxed{9i}$$

8. $\frac{1}{3}\sqrt{-25}$

$$\frac{1}{3} \cdot \sqrt{-1} \cdot \sqrt{25}$$

$$\frac{1}{3} \cdot 5i = \boxed{\frac{5i}{3}}$$

$$\frac{9i}{4}$$

$$\frac{5}{3}i$$

9. $\sqrt{-\frac{1}{4}}$

$$\sqrt{-1} \cdot \sqrt{\frac{1}{4}}$$

$$= \boxed{\frac{1}{2}i}$$

$$\frac{i}{2}$$

10. $\sqrt{-\frac{16}{25}}$

$$\sqrt{-1} \cdot \sqrt{\frac{16}{25}}$$

$$\boxed{\frac{4}{5}i}$$

$$\frac{4i}{5}$$

11. $4\sqrt{-\frac{49}{64}}$

$$4 \cdot \sqrt{-1} \cdot \sqrt{\frac{49}{64}}$$

$$4 \cdot \frac{7}{8}i = \boxed{\frac{7}{2}i}$$

$$\frac{7i}{2}$$

12. $\frac{3}{5}\sqrt{-\frac{100}{9}}$

$$\frac{3}{5} \cdot \sqrt{-1} \cdot \sqrt{\frac{100}{9}}$$

$$\frac{3}{5} \cdot \frac{10}{3}i = \boxed{2i}$$

13. $\sqrt{-3}$

$\sqrt{-1} \cdot \sqrt{3}$

$\sqrt{3} i$

$i\sqrt{3}$

14. $\sqrt{-29}$

$\sqrt{-1} \cdot \sqrt{29}$

$\sqrt{29} i$

$i\sqrt{29}$

15. $3\sqrt{-11}$

$3 \cdot \sqrt{-1} \cdot \sqrt{11}$

$3\sqrt{11} \cdot i$
 $3i\sqrt{11}$

16. $-\sqrt{-10}$

$-1 \cdot \sqrt{-1} \cdot \sqrt{10}$

$-i\sqrt{10}$

17. $\sqrt{-20}$

$\sqrt{-1} \cdot \sqrt{20}$

$2\sqrt{5} \cdot i$

$2i\sqrt{5}$

18. $-\sqrt{-28}$

$-1\sqrt{-1} \cdot \sqrt{28}$

$-2\sqrt{7} \cdot i$

$-2i\sqrt{7}$

19. $2\sqrt{-75}$

$2 \cdot \sqrt{-1} \cdot \sqrt{75}$

$2 \cdot 5\sqrt{3} \cdot i$

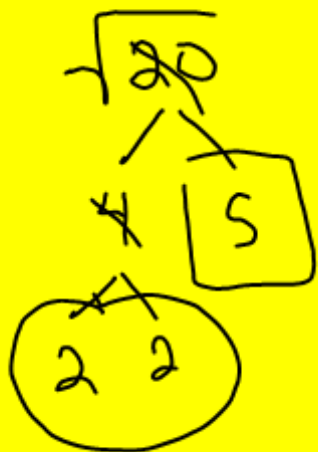
$10i\sqrt{3}$

20. $5\sqrt{-8}$

$5 \cdot \sqrt{-1} \cdot \sqrt{8}$

$5 \cdot 2\sqrt{2} \cdot i$

$10i\sqrt{2}$



21. $\frac{2}{3}\sqrt{-72}$	22. $-\frac{1}{2}\sqrt{-300}$	23. $-\sqrt{-\frac{1}{3}}$	24. $4\sqrt{-\frac{1}{8}}$
$\frac{2}{3} \cdot \sqrt{-1} \cdot \sqrt{72}$	$-\frac{1}{2} \cdot \sqrt{-1} \cdot \sqrt{300}$	$-1 \cdot \sqrt{-1} \cdot \sqrt{\frac{1}{3}}$	$4 \cdot \sqrt{-1} \cdot \sqrt{\frac{1}{8}}$
$\frac{2}{3} \cdot 6\sqrt{2} \cdot i$	$-\frac{1}{2} \cdot 10\sqrt{3} \cdot i$	$-\sqrt{\frac{1}{3}} \cdot i$	$4 \cdot i \cdot \frac{1}{2\sqrt{2}}$
$4i\sqrt{2}$	$-5i\sqrt{3}$	$-i\sqrt{\frac{1}{3}}$	$\frac{2i}{\sqrt{2}}$

$4i\sqrt{\frac{1}{8}}$

$$\sqrt{\frac{1}{3}} = \frac{\sqrt{1}}{\sqrt{3}} = \frac{1}{\sqrt{3}} = \frac{-2 \cdot 1}{\sqrt{3}}$$

$\frac{-2i}{\sqrt{3}}$

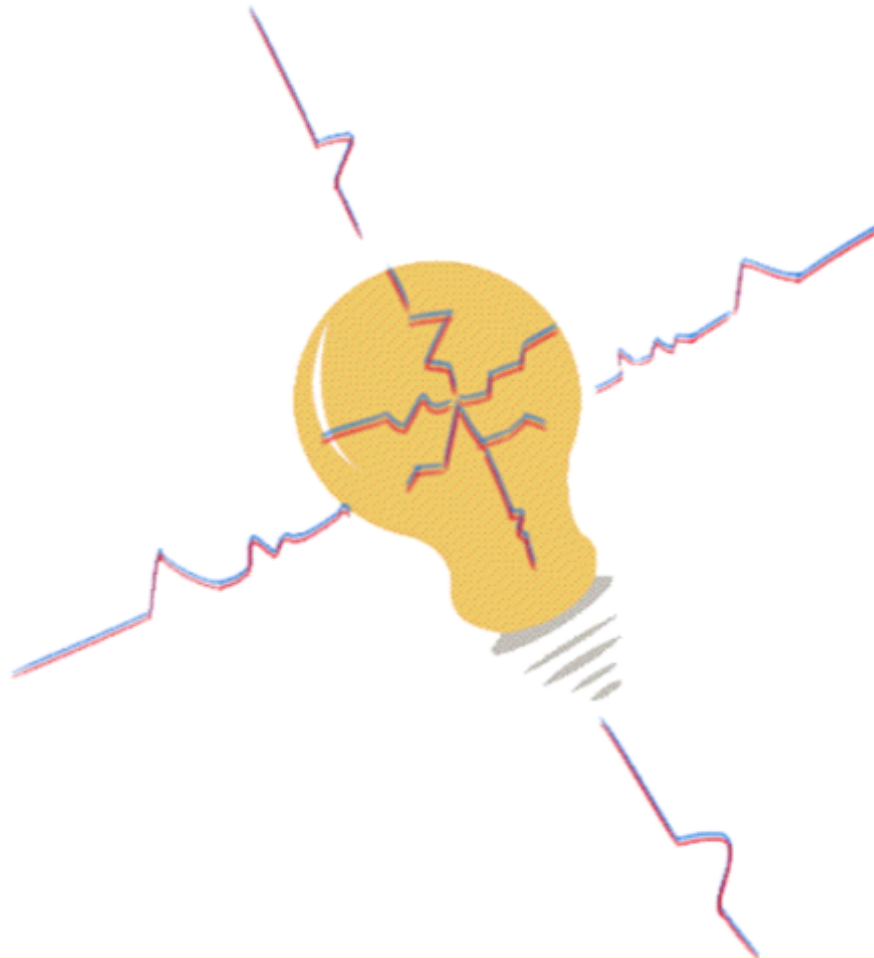
$$\sqrt{8} = 2\sqrt{2}$$

$\begin{matrix} \sqrt{8} \\ \swarrow \quad \searrow \\ 4 \quad 2 \\ \swarrow \quad \searrow \\ 2 \quad 2 \end{matrix}$

$$4i\sqrt{\frac{1}{8}} = \frac{4i \cdot 1}{\sqrt{8}}$$

$$\frac{4i}{2\sqrt{2}} = \frac{2i}{\sqrt{2}}$$

**Imaginary numbers are used in the real world.
Engineers use them to describe electrical currents.**



Powers of i

$$i^{-3} = \sqrt{-1}$$

$$i^{-2} = -1$$

$$i^{-1} = -i$$

$$i^0 = \underline{1}$$

$$i^1 = \sqrt{-1}$$

$$i^2 = -1$$

$$i^3 = \underline{-i}$$

$$i^4 = 1$$

$$i^2 \times i^2$$

$$-1 \times -1 = +1$$

$$i^5 = \sqrt{-1}$$

$$\sqrt{-1} \cdot \sqrt{-1} = -1$$

$$i^6 = -1$$

$$i^1 \times i^2$$

$$i \times -1 = -i$$

$$i^7 = -i$$

$$i^8 = \underline{1}$$

$$i^{41} = i \quad \checkmark$$

$i^0 = 1$	$i^1 = i$	$i^2 = -1$	$i^3 = -i$
$i^4 = 1$	$i^5 = i$	$i^6 = -1$	$i^7 = -i$
$i^8 = 1$	$i^9 = i$	$i^{10} = -1$	$i^{11} = -i$

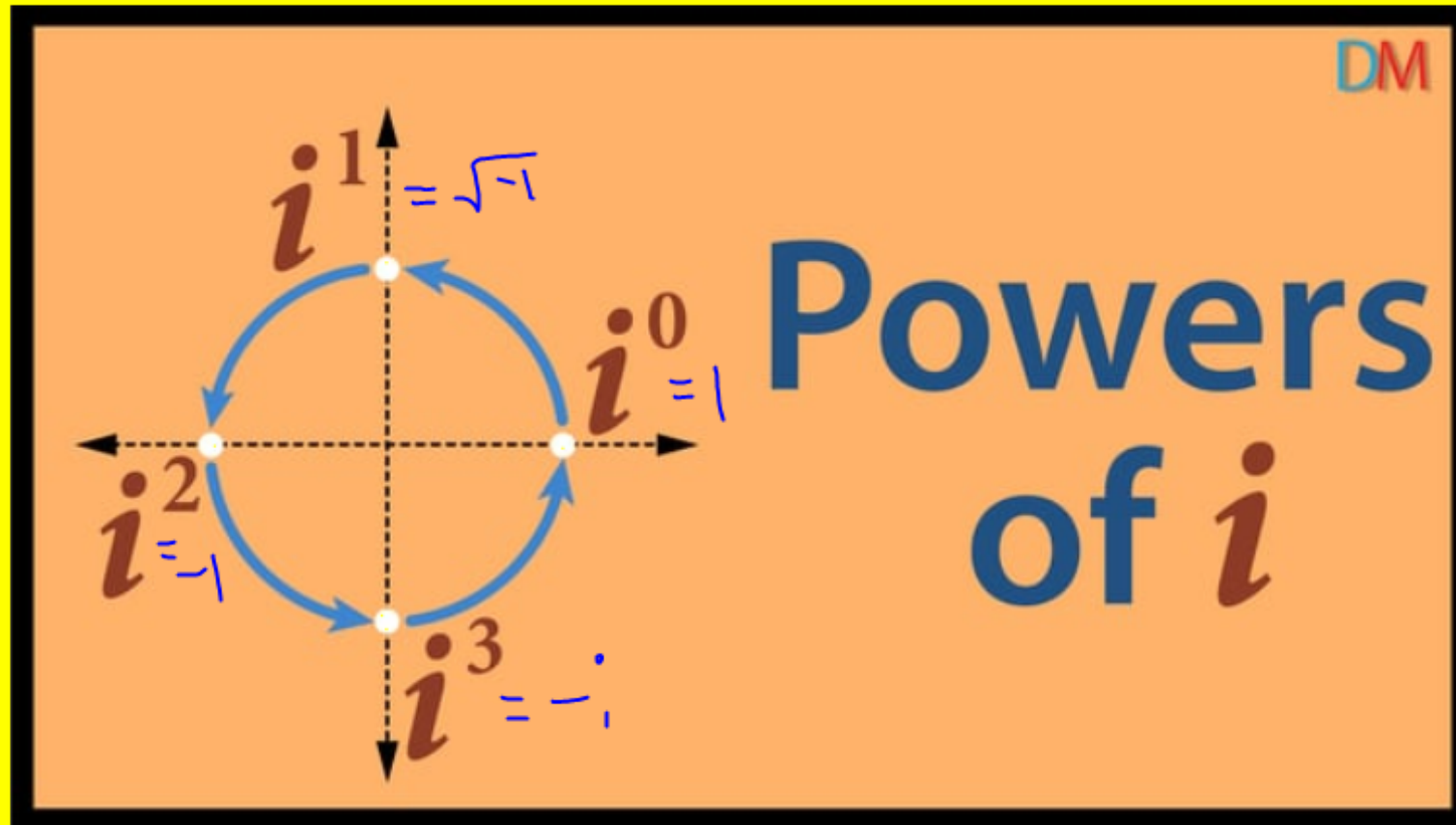
$$i^{12} = 1$$

$$i^{13} = i \text{ or } \sqrt{-1}$$

$$i^{14} = -1$$

$$i^{15} = -i$$

How do we simplify powers of i ?



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

Powers

$$i^2 = -1$$

of

$$i^4 = 1$$

i

$$i^3 = -i$$



How do we simplify powers of i ?

Always divide the exponent by 4

- If it divides evenly, a remainder of 0, then the answer is 1.
- If you get a remainder of 1, then the answer is i .
- If you get a remainder of 2, then the answer is -1 .
- If you get a remainder of 3, then the answer is $-i$.

$$i^{456} = i^0 = \textcircled{1} \quad \frac{456}{4} = 114 \text{ R } 0$$

Examples:

$$i^{10} =$$

$$i^2 = \textcircled{-1}$$

$$\frac{10}{4} = 2.\underbrace{5}_{\text{remainder of 2}}$$

R	Decimal
0	0
1	.25
2	.5
3	.75

$$i^{20} = i^0 = \textcircled{1}$$

$$\frac{20}{4} = 5.0$$

No remainder

$$i^{37} = i^1$$

$$= \sqrt{-1}$$

~~277:~~

$$\frac{37}{4} = 9.25$$

R1

$$i^{-3} = \sqrt{-1}$$

$$\frac{-3}{4} = -.75$$

Negatives

	R	D	
	0	0	1
★	1	-.25	-i
	2	-.5	$\sqrt{-1}$
★	3	<u>-.75</u>	$\sqrt{-1}$

$$i^{-9} = -i$$

$$\frac{-9}{4} = -2.25$$

$$i^{-22} = -1$$

$$\frac{-22}{4} = -5.5$$

Simplify the following powers of i.

1) $i^{66} = i^2 = -1$

2) $i^{92} = i^0 = 1$

3) $i^{125} = i^1 = \sqrt{-1}$ or i

4) $i^{23} = i^3 = -i$

5) $i^{43} = i^3 = -i$

6) $i^{802} = i^2 = -1$

7) $i^{624} = i^0 = 1$

8) $i^{349} = i^1 = i$ or $\sqrt{-1}$

HW #2 Simplify Powers of i