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The Imaginary number i.

finition $\sqrt{-1} = i$ and $i^2 = -1$.

Now we we don't say "no solution" when we take the square root (or any even root) of a negative. We use "i"

Example

Simplify

1. $3\sqrt{-4}$
   $3\sqrt{-1(4)}$
   $3\sqrt{-1}\cdot\sqrt{4}$
   $3i \cdot 2$
   $3 \cdot 2i$
   $\boxed{6i}$

2. $\sqrt{-45}$
   $\sqrt{(-1)(45)}$
   $\sqrt{-1}\cdot\sqrt{9\cdot 5}$
   $\boxed{3i\sqrt{5}}$

3. $(2i)^2 = 2^2 \cdot i^2 = 4\cdot(-1) = \boxed{-4}$

4. $\sqrt{-25} = \boxed{5i}$

Shortcut: When you have a quare root of a negative, you eal with it ormally but put an "i" on it after.

Simplify

5. $\sqrt{-16} - \sqrt{-49}$
   $4i - 7i$
   $\boxed{-3i}$

Note: When simplifying, you treat i like a variable, so you can CLT

Example

Simplify

6. $(-3i\sqrt{6})^2$
   $(-3i\sqrt{6})(-3i\sqrt{6})$
   $-3\cdot(-3)\, i^2 \cdot \sqrt{6}\cdot\sqrt{6}$
   $9\cdot(-1)\cdot 6$
   $\boxed{-54}$

7. $\frac{8}{3i}\cdot\frac{i}{i}$
   $\frac{8i}{3i^2}$
   $\frac{8i}{-3}$
   $\boxed{-\frac{8i}{3}}$

you rationalize the denominator in the same way you do with radicals.

Example

Simplify

8. $2\sqrt{-24}\cdot(-\sqrt{-50})$
   $2i\sqrt{4\cdot 6}\cdot(-i\sqrt{25\cdot 2})$
   $2\cdot 2i\sqrt{6}(-5i\sqrt{2})$
   $4\cdot(-5)\, i^2\sqrt{6}\cdot\sqrt{2}$
   $-20(-1)(\sqrt{12})$
   $20\sqrt{4\cdot 3}$
   $20\cdot 2\sqrt{3}$
   $\boxed{40\sqrt{3}}$

1. Reduce Rads.
2. Multiply
3. Repeat