The complex number system assumes that there WILL be negatives inside of the radical. Because of this – absolute value signs are NOT necessary when solving the problem!

g) $\sqrt{-25x^2y^4}$

h) $\sqrt{-60xy^3}$

i) $\sqrt{-27x^{10}y^7}$

2.3 Operations in the Number Systems

Rational Vs. Rational	
Add	Multiply
$5 + 4 = 9$ $\frac{1}{2} - \frac{3}{4} = -\frac{1}{4}$ Rational	$6 \cdot 2 = 12$ $\frac{1}{3} \cdot \frac{4}{5} = \frac{4}{15}$ Rational

Rational Vs. Irrational	
Add	Multiply
$2 + \pi = 5.1415...$ Irrational	$3 \cdot \pi = 9.42477...$ Irrational

Irrational Vs. Irrational	
Add	Multiply
$-\sqrt{6} + \sqrt{6} = 0$ Rational $\pi + 2\pi = 9.42477...$ Irrational	$\pi \cdot \frac{1}{\pi} = 1$ Rational $\sqrt{2} \cdot \sqrt{6} = \sqrt{12}$ Irrational

Irrational vs. irrational can be either rational or irrational.

* You can always type it into your calculator and check.

* You can always type these in your calculator to see if it would be rational or irrational

1) Determine whether each sum or product will be rational or irrational.

a. $\sqrt{12} + 6$

Irrational + Rational

$\boxed{\text{Irrational}}$

b. $9 - \frac{2}{3}$

$\frac{27}{3} - \frac{2}{3} = \frac{21}{3}$ $\boxed{\text{Rational}}$

c. $-\sqrt{5} * \sqrt{20}$

$-\sqrt{5*20} = -\sqrt{100} = -10$

$\boxed{\text{Rational}}$

d. $2\pi * \pi$

$2\pi^2$ $\boxed{\text{Irrational}}$

Operations with Complex Numbers

What is a complex number? __Number with a real part & imaginary part__

In order to add or subtract complex numbers, we need to __combine like terms__.

2) Simplify.

a) $(-3 - 9i) + (11 - \overset{7i}{\cancel{7i}})$

$\underset{\textstyle -3}{\bigcirc} - 9i \underset{\textstyle +11}{\bigcirc} - 7i$

$\boxed{8 - 16i}$

b) $(-1 - 3i) - (3 - 6i)$

$\bigcirc{-1} - 3i \bigcirc{-3} + 6i$

$\boxed{-4 + 3i}$

c) $(6 - 11i) - (11 - 6i)$

$\underset{6}{} \bigcirc{-11i} - 11 + \bigcirc{6i}$

$\boxed{-5 - 5i}$

We can multiply complex numbers through distribution, but there is something special that happens when we do this. Recall that we learned that $i = \sqrt{-1}$. What happens when we want to find i^2?

$\boxed{\begin{array}{l} i = \sqrt{-1} \\ i^2 = -1 \end{array}}$

3) Multiply. $i^2 = -1$

a) $(-7 + 2i)(-7 - 4i)$

$49 + 28i + 14i - 8i^2$

$-8(-1)$

$\bigcirc{49} + 28i + 14i \bigcirc{+8} = \boxed{57 + 42i}$

* i^2 changes the sign of the coefficient

b) $(6 + 8i)(-6 - 2i)$

$\bigcirc{-36} - 12i - 48i - 16i^2$

$\bigcirc{+16}$

$= \boxed{-20 - 60i}$

c) $(4 - 2i)^2$

$= (4 - 2i)(4 - 2i)$

$= \bigcirc{16} - 8i - 8i + 4i^2$

$\bigcirc{-4}$

$= \boxed{12 - 16i}$

d) $(-1 + 6i)(-5 + 4i)$

$\bigcirc{5} - 4i - 30i + 24i^2$

$\bigcirc{-24}$

$\boxed{-19 - 34i}$

g) $5(2 - 3i) + 4(2i)$

$10 - 15i + 8i$

$\boxed{10 - 7i}$

h) $(3 + 9i) - 5(2 - i)$

$3 + 9i - 10 + 5i$

$\boxed{-7 + 14i}$