

LESSON #2: OPERATIONS WITH COMPLEX NUMBERS

Do Now:

a) $\sqrt{16} = 4$

b) Simplify: $\sqrt{18}$
 $\sqrt{9} \sqrt{2}$
 $3\sqrt{2}$

c) $\sqrt{-16} = ? ?$

If $\sqrt{-1} = i$ then $\sqrt{-16} =$

$\sqrt{16 \cdot \sqrt{-1}}$
 $4 \cdot i = \boxed{4i}$



Simplify:

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

2) $\sqrt{-18}$
 $\sqrt{9} \sqrt{2} \sqrt{-1}$
 $3 \cdot \sqrt{2} \cdot i$
 $\boxed{3i\sqrt{2}}$

3) $(3 - \sqrt{-9})(4 + \sqrt{-25})$
 $12 + 3\sqrt{-25} - 4\sqrt{-9} - \sqrt{225}$
 $12 + 3(5i) - 4(3i) - 15$
 $12 + 15i - 12i - 15$
 $\boxed{-3 + 3i}$

4) $2i\sqrt{-9} - i\sqrt{-36}$
 $2i(3i) - i(6i)$
 $6i^2 - 6i^2$
 $6(-1) - 6(-1)$
 $-6 + 6 = \boxed{0}$

5) $3\sqrt{-12} - 6\sqrt{-27}$
 $3\sqrt{4} \sqrt{3} \sqrt{-1} - 6\sqrt{9} \sqrt{3} \sqrt{-1}$
 $3 \cdot i \cdot 2\sqrt{3} - 6 \cdot 3 \cdot \sqrt{3} \cdot i$
 $6i\sqrt{3} - 18i\sqrt{3}$
 $\boxed{-12i\sqrt{3}}$

6) $i(i - 5i)^3$
 $i(-4i)^3$
 $i(-64i^3)$
 $i(-64 \cdot -i)$
 $i(64i) = 64i^2$
 $64(-1) = \boxed{-64}$

7) $16i^5 + 13i^{23} + (3i)^2$
 $16i + 13(-i) + 3(1)^2$
 $16i - 13i + 9$
 $3i + 9$
 $\boxed{9 + 3i}$

8) $32xi^{32} - 40xi^{10}$
 $32x(1) - 40x(-1)$
 $32x + 40x$
 $\boxed{72x}$

9) $\frac{4 + \sqrt{-16}}{2}$
 $\frac{4 \pm 4i}{2} = \boxed{2 \pm 2i}$

10) Simplify $\frac{8+\sqrt{-12}}{4}$ and leave answer in a + b and leave answer in a + bi form.

$$\frac{\sqrt{-12}}{4} = \frac{\sqrt{4} \sqrt{3} \sqrt{-1}}{4} = \frac{2i\sqrt{3}}{4} = \frac{1}{2}i\sqrt{3}$$

$$\frac{8 \pm 2i\sqrt{3}}{4} = \frac{4 \pm i\sqrt{3}}{2}$$

Practice: Simplify:

11) $\sqrt{-4} + 2\sqrt{-25}$
 $2i + 2(5i)$
 $2i + 10i$
 $12i$

12) $(1-\sqrt{-16})(2+\sqrt{-36})$
 $2 + 6i - 2(4i) - \sqrt{576}$
 $2 + 6i - 8i - 24$
 $2 - 2i - 24$
 $-22 - 2i$

13) $\sqrt{-124}$
 $\sqrt{4} \sqrt{31} \sqrt{-1}$
 $2i\sqrt{31}$

14) $2\sqrt{-18} + 3\sqrt{-32}$

~~2i~~
 $2\sqrt{9}\sqrt{-2} + 3\sqrt{16}\sqrt{-2}$
 $2i \cdot 3\sqrt{-2} + 3i \cdot 4\sqrt{-2}$
 $6i\sqrt{-2} + 12i\sqrt{-2}$
 $18i\sqrt{-2}$

15) Express $3xi^5 + 6yi^8 - 4xi^{19} - 5yi^8$ in simplest a + bi form.

$$3xi + 6y(1) - 4x(-i) - 5y(1)$$

$$3xi + 6y + 4xi - 5y$$

$$y + 7xi$$

16) Simplify $\frac{8+\sqrt{-144}}{4}$ and leave answer in a + bi form.

$$\frac{8 \pm 12i}{4} = 2 \pm 3i$$

17) $2x\sqrt{-2} + \frac{1}{2}x\sqrt{-72}$

$$2x\sqrt{-2} + \frac{1}{2}x\sqrt{36}\sqrt{-2}$$

$$2xi\sqrt{2} + \frac{1}{2}xi \cdot 6\sqrt{2}$$

$$2xi\sqrt{2} + 3xi\sqrt{2} = 5xi\sqrt{2}$$