

# Chapter 5: Quadratic Functions & Complex Numbers

## Imaginary Numbers

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

$$\sqrt{-25} = \sqrt{25} \sqrt{-1} = 5i$$

Examples:

$$\begin{aligned} &\sqrt{-32} + \sqrt{-50} \\ &\sqrt{16}\sqrt{2}\sqrt{-1} + \sqrt{25}\sqrt{2}\sqrt{-1} \\ &4i\sqrt{2} + 5i\sqrt{2} \\ &9i\sqrt{2} \end{aligned}$$

$$3\sqrt{-27} - 4\sqrt{-75}$$

9·3·-1                      25·3·-1

$$9i\sqrt{3} - 20i\sqrt{3}$$

$$\boxed{-11i\sqrt{3}}$$

$$\sqrt{-121} + \sqrt{80} - \sqrt{20} + \sqrt{-36}$$

16·5                      4·5

$$11i + 4\sqrt{5} - 2\sqrt{5} + 6i$$

$$\boxed{17i + 2\sqrt{5}}$$

## Powers of $i$

$$i^0 = 1$$

$$i^1 = i$$

$$i^2 = (\sqrt{-1})^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

$$i^5 = i^3 \cdot i^2 = -i \cdot -1 = i$$

$$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$$

$$i^7 = i^6 \cdot i = -1 \cdot i = -i$$

$$i^8 = i^4 \cdot i^4 = 1 \cdot 1 = 1$$

$$i^9 = i^3 \cdot i^6 = -i \cdot -1 = i$$

$$i^{10} = i^5 \cdot i^5 = i \cdot i = i^2 = -1$$

$$i^{87} = -i$$

$$87 \div 4 = 21.75$$
$$\frac{3}{4}$$

$i, -1, -i, 1$

$$i^{102} = -1$$

$$102 \div 4 = 25.5$$
$$\frac{2}{4}$$