I. TRUE or FALSE. Write **TRUE** if the statement is correct, and write **FALSE** otherwise.

1. The set of imaginary numbers is closed under addition and multiplication.
2. For all $a \in \mathbb{R}, m, n \in \mathbb{N}$, $\sqrt[n]{\sqrt[m]{n}} = \sqrt[mn]{a}$
3. For all $a \in \mathbb{R}, m, n \in \mathbb{N}, a^{\frac{m}{n}} = \sqrt[n]{a^m}$

II. Simplify the following.

1. Rational Exponents and Radicals
   (a) $(-64)^{-\frac{2}{3}}$
   (b) $\left[\dfrac{25a^{\frac{4}{3}}b^{\frac{1}{2}}}{4a^{\frac{1}{3}}b^{\frac{2}{3}}}\right]^{-\frac{3}{2}}$
   (c) $\left[\dfrac{8^{\frac{2}{3}} - 4x^{-2}}{x^{-1} - x^0}\right]^{\frac{1}{2}}$
   (d) $b^{-\frac{2}{3}}\left(b^{-\frac{1}{3}} - b^{\frac{2}{3}}\right)$
   (e) $\left(a^{\frac{1}{4}} - a^{\frac{1}{2}}\right)\left(a^{-\frac{1}{4}} - a^{-\frac{1}{2}}\right)$
   (f) $\dfrac{a^2 - 2a^{-1} - a^{-\frac{1}{2}}}{a^{\frac{1}{2}}}$
   (g) $\dfrac{(x+1)^{\frac{1}{2}} - \frac{1}{2}x(x+1)^{-\frac{1}{2}}}{\left[(x+1)^{\frac{1}{2}}\right]^2}$

2. Radicals
   (a) $\sqrt[6]{(400)(324)}$
   (b) $\sqrt[3]{4x^2y^2}\sqrt[3]{6x^2z^2}\sqrt[3]{45x^2y^2z}$
   (c) $\dfrac{270u^2vw^3}{\sqrt[4]{288u^5v^6w^2}}$
   (d) $\sqrt{\frac{1}{5}} - 3\sqrt{\frac{1}{125}} + \sqrt{20}$
   (e) $\sqrt[4]{36} - \sqrt{54} + \sqrt{96}$
   (f) $\dfrac{5\sqrt{3} - 4\sqrt{5}}{2\sqrt{5} + 3\sqrt{3}}$
   (g) $\dfrac{9}{\sqrt[4]{9}} + \dfrac{\sqrt{6} - \sqrt{2}}{\sqrt{6} + \sqrt{2}}$
   (h) $\dfrac{1}{\sqrt[3]{4} - 2}$

III. Do the following.

1. Express in standard form.
   (a) $\left(4 - 2\sqrt{-45}\right) - \left(3 + \sqrt{63}\right)$
   (b) $\sqrt{-12}\sqrt{-16}\sqrt{-27}$
   (c) $\dfrac{2-3i}{1+5i}$
   (d) $(i-1)^2 - (-i-1)^2 + i^4$
   (e) $i + i^2 + i^3 + \cdots + i^{2010}$
   (f) $\left(\left(\left((i^1)^2\right)^3\right)^{\cdots}\right)^{2010}$
2. If $z = a + bi$, we define the *modulo* of z by $|z| = \sqrt{z \cdot \bar{z}}$. Find:
   (a) $|4+3i|$
   (b) $|2-i|$
   (c) $|i^2|$

Examples from CAT by Castillo, et. al, CAT by Leithold
Also, courtesy of manjologs

compiled by mpona2010