



**I. Write TRUE if the statement is always true, otherwise write FALSE.**

1. The graphs of  $y = 2^x$  and  $y = 3^x$  will not intersect.
2. The law of sines and cosines hold for any triangle.
3. The sequence whose defining function is  $f(x) = \log_3 2^x$  is an arithmetic sequence.
4. If  $go < gi$ , then  $o < i$ .
5. For real number  $x$ ,  $\text{Arccsc}(\csc x) = x$ .
6.  $\cos 3 > \cos 2 > \cos 1$
7. For any nonzero real numbers  $x$  and  $y$  with  $x \neq -y$ , then  $\frac{1}{x^{-1} + y^{-1}} = x + y$
8. The conjugate of a real number is itself.
9. If  $a$  is a real number, then  $a$  has a multiplicative inverse.
10. The union of the set of natural numbers and their additive inverses is the set of integers.

**II. Do as indicated.**

1. How many triangles are determined by  $\alpha = 34^\circ$ ,  $\beta = 59^\circ$  and  $\gamma = 77^\circ$ ?
2. Solve for all possible complex values of  $z$  in rectangular form.
  - a.  $2z - i = 5i(3 - z)$
  - b.  $16 + 2z^4 = 16\sqrt{3}i$
3. Find the vertex and intercepts of  $a(x) = x^2 - 2x - 3$  and draw its graph.
4. Given the quadratic equation  $b(x) = -x^2 + 1$ , find:
  - a. the sum and product of the roots of  $b(x)$ .
  - b. the number of distinct real zeros of  $b(x)$ .
5. Find the point(s) of intersection of the graphs of  $a(x)$  and  $b(x)$  algebraically. (*i.e. without using their graphs*)

### III. Solve only for $x$ .

- $\cos^2 y + \sin^2 2x = 1$   
 $\cos y + \sin 2x = 1$   $x \in [0, 2\pi]$
- $\left| \frac{3x+2}{x+1} \right| < 3$
- $\cos^2 x \sin 3x - \cos x \sin 3x - 2 \sin 3x = 0$ , for  $0 < x < 2\pi$
- $2(\sqrt{x+3})^3 + x + 3 - 2\sqrt{x+3} = 1$
- $e^{2x} + 3e^x + 2 > 0$

### IV. Problem Solving.

- A closed rectangular box (having top and bottom) has length 2 cm greater than its width and height 1 cm greater than its width. The number of square centimeters in its total area is 32 greater than the number of cubic centimeters in its volume. Find its dimensions.
- Sitting by the window to practice scales one day, Katrina spotted a balloon 92ft. above the ground having an angle of elevation of  $15^\circ$ . At that moment Hayden was lounging on the tree nearby, and he noticed an angle of elevation of the same balloon is  $45^\circ$ . If from Katrina's window, Hayden has an angle of depression of  $30^\circ$ , and the balloon is in direct line between Hayden and Katrina, how high is Katrina's floor from the ground and how far is Hayden from Katrina's apartment?
- If  $\cos x = \frac{12}{13}$  and  $0 < x < \frac{\pi}{2}$ , evaluate  $\cos 2x$ ,  $\sin \frac{x}{2}$ , and  $\tan \frac{x}{2}$ .

END OF EXAM

