

# The Weekly Rigor

No. 279

“A mathematician is a machine for turning coffee into theorems.”

October 26, 2019

## 12 Problems Solving Composite Trigonometric Equations (Type III)

(Part 1)

Type III Equations: Involving tangent or cotangent.

### PROBLEMS

Solve for  $x$  over the interval  $[0, 2\pi)$ . Show (write out) the use of reference angles and the reference triangles to determine the solution(s), except in cases where  $x$  is a quadrant angle ( $0, \frac{\pi}{2}, \pi,$  and  $\frac{3\pi}{2}$ ).

1.  $3 \tan(2x) - \sqrt{3} = 0$

2.  $\sqrt{3} \cot\left(\frac{1}{2}x\right) + 1 = 0$

3.  $\tan\left(\frac{2}{3}x\right) + 1 = 0$

4.  $\tan^2\left(\frac{x}{3}\right) - 3 = 0$

5.  $\tan(4x) - 1 = 0$

6.  $\tan(3x) = 0$

$$7. \cot\left(\frac{3}{2}x\right) - 1 = 0$$

$$8. \tan^2(2x) - 1 = 0$$

$$9. \cot\left(\frac{1}{2}x\right) = 0$$

$$10. \cot^2(2x) - 3 = 0$$

$$11. \cot\left(\frac{1}{4}x\right) - \sqrt{3} = 0$$

$$12. \cot(2x) - 1 = 0$$

### ANSWERS

1. $\frac{\pi}{12}, \frac{7\pi}{12}, \frac{13\pi}{12}, \frac{19\pi}{12}$	2. $\frac{4\pi}{3}$
3. $\frac{9\pi}{8}$	4. $\pi$
5. $\frac{\pi}{16}, \frac{5\pi}{16}, \frac{9\pi}{16}, \frac{13\pi}{16}, \frac{17\pi}{16}, \frac{21\pi}{16}, \frac{25\pi}{16}, \frac{29\pi}{16}$	6. $0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, \frac{5\pi}{3}$
7. $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$	8. $\frac{\pi}{8}, \frac{3\pi}{8}, \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8}, \frac{11\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}$
9. $\pi$	10. $\frac{\pi}{3}, \frac{5\pi}{3}$
11. $\frac{2\pi}{3}$	12. $\frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{8}, \frac{13\pi}{8}$

“Only he who never plays, never loses.”