☆ an error in each section ☆

solving trig equations

with algebra

- isolate a trig function on one side
  (like $\sin(\square) = \square$ or $\cos(\square) = \square$ or $\tan(\square) = \square$)
  - by using algebra
  - by using trig identities
- use the inverse trig function to solve for the angle
  → remember, there are multiple solutions! consult the unit circle, there are usually 3 there. when you include additional rotations, there are ∞ more.
- finish solving with algebra

with graphing

graph each side of the equation, look for intersections

restricted domain

maybe we only want solutions between 0 and 2π.
then there would be a few solutions.
(usually 2 solutions, but 4 if there was a 2θ, 6 if there was a 3θ, etc.)

writing all solutions to a trig equation

when you use your inverse trig function to get an angle,
your calculator will only give you one angle, but there are ∞.
find all of them!

for inverse sine: $\# \pm 2\pi n$ or $\# - \pi \pm 2\pi n$
for inverse cosine: $\# \pm 2\pi n$ or $-\# \pm 2\pi n$
for inverse tangent: $\# \pm \pi n$

} n is any whole number

remember that this happens <u>when</u> you do the inverse trig function!
any additional algebra steps happen to <u>all</u> of the solutions!

example of solving a trig equation with algebra

Solve: $\cos(3\theta)\cdot\tan(3\theta)=\frac{\sqrt{3}}{2}$

$\cos(3\theta)\cdot\tan(3\theta)=\frac{\sqrt{3}}{2}$ ↓ trig identity

$\cos(3\theta)\cdot\frac{\sin(3\theta)}{\cos(3\theta)}=\frac{\sqrt{3}}{2}$ ↓ multiply fractions

$\frac{\cos(3\theta)\cdot\sin(3\theta)}{\cos(3\theta)}=\frac{\sqrt{3}}{2}$ ↓ Cancel $\cos(3\theta)$

$\sin(3\theta)=\frac{\sqrt{3}}{2}$ ↓ inverse trig function

$\square=\sin^{-1}(\square)$

make sure you list all the angles!
find 2 on the unit circle, then add in additional rotations.

divide both sides by 3 ↓

$\frac{3\theta}{3}=\frac{\frac{\pi}{3}\pm 2\pi n}{3}$ or $3\theta=\pi-\frac{\pi}{3}\pm 2\pi n$

$\frac{3\theta}{3}=\frac{\frac{2\pi}{3}\pm 2\pi n}{3}$ ↓

$\theta=\frac{\pi}{9}\pm\frac{2\pi}{3}n$ or $\theta=\frac{2\pi}{9}\pm\frac{2\pi}{3}n$

what if you need all the solutions between 0 and 2π?
this one has 6 solutions!

$\frac{\pi}{9},\ \frac{\pi}{9}+\frac{2\pi}{3},\ \frac{\pi}{9}+\frac{2\pi}{3}+\frac{2\pi}{3}=$ $\frac{\pi}{9},\ \frac{7\pi}{9},\ \frac{13\pi}{9},$

$\frac{2\pi}{9},\ \frac{2\pi}{9}+\frac{2\pi}{3},\ \frac{2\pi}{9}+\frac{2\pi}{3}+\frac{2\pi}{3}=$ $\frac{2\pi}{9},\ \frac{8\pi}{9},\ \frac{14\pi}{9}$