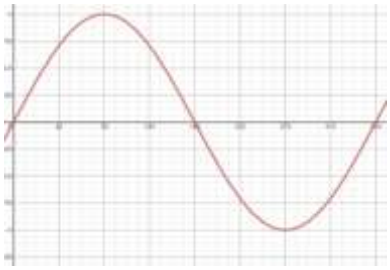
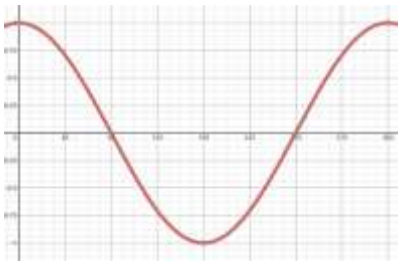
Trigonometrical equations

The trig graphs show us that due to symmetry, sin, cos and tan take similar values in all four quadrants (although some are negative). Sine is positive in the 1st and 2nd, cos is positive in the 1st and 4th and tan is positive in the 1st and 3rd. A CAST diagram can help us work out which other angles could be solutions to trigonometrical equations.

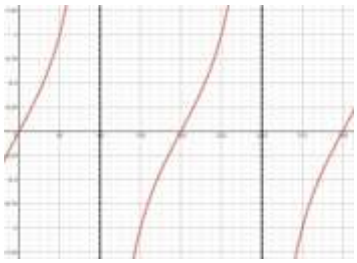
$y = \sin x$



$y = \cos x$



$y = \tan x$

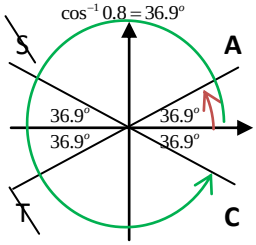


e.g.1

$\cos\theta = 0.8$

$\theta = 36.9 or 360 - 36.9$

$= 36.9 or 323.1$



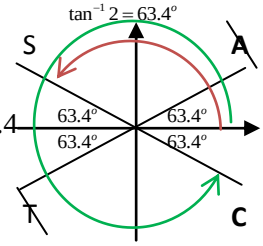
Step 1 – draw CAST diagram with two diagonal lines
Step 2 – is ratio positive or negative? Cross off those quadrants not required - in this case we want cos to be positive so choose A (all) and C (cos) by crossing off S and T
Step 3 – find inverse trig of ratio (ignore negative signs)
Step 4 – working clockwise from positive x axis, draw arcs representing two required angles within range –
Step 5 – calculate size of angles using angle laws.

e.g.2

$\tan\theta = -2$

$\theta = 180 - 63.4 or 360 - 63.4$

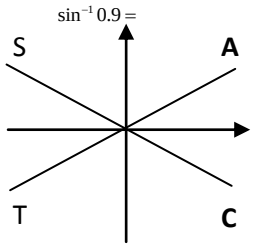
$= 116.6 or 296.6$



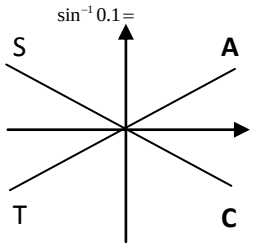
Step 1 – draw CAST diagram with two diagonal lines
Step 2 – is ratio positive or negative? Cross off those quadrants not required. In this case we don't want tan to be positive so cross out A (all) and T (tan)
Step 3 – find inverse trig of ratio (ignore negative signs)
Step 4 – working clockwise from positive x axis, draw arcs representing two required angles within range.
Step 5 – calculate size of angles using angle laws.

Solve these in the range $0 \le \theta \le 360$

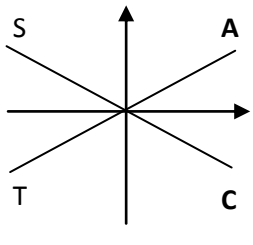
1. $\sin\theta = 0.9$



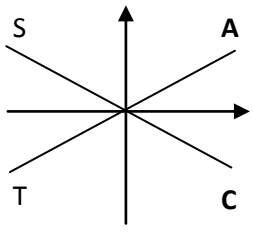
2. $\sin\theta = -0.1$



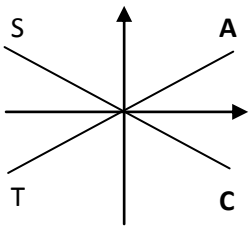
3. $\cos\theta = 0.3$



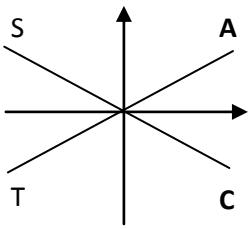
4. $\cos\theta = -0.25$



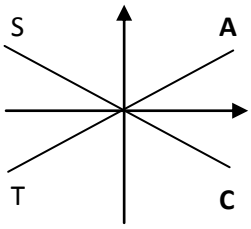
5. $\tan\theta = 0.5$



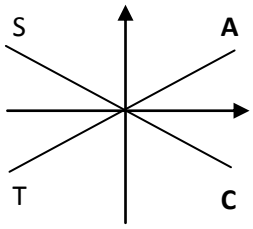
6. $\tan\theta = -2.5$



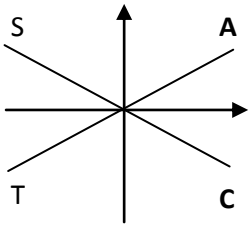
7. $\sin\theta = -\frac{1}{2}$



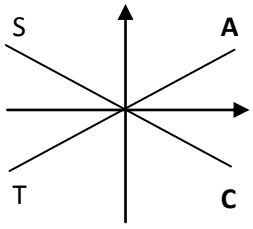
8. $\cos\theta = \frac{1}{\sqrt{2}}$



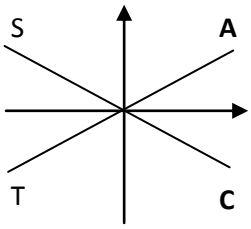
9. $\tan\theta = \sqrt{3}$



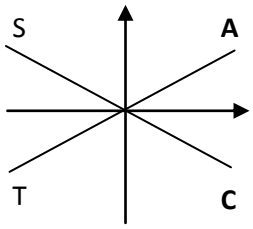
10. $\sin\theta = -\frac{\sqrt{3}}{2}$



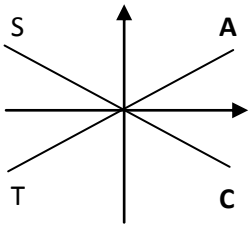
11. $3\sin\theta = 2$



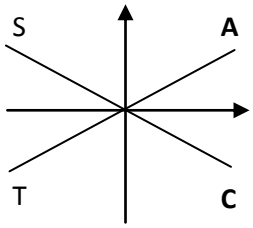
12. $4\cos\theta = 2$



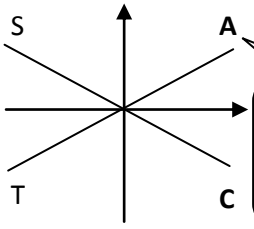
13. $6\sin\theta = 2 + 4\sin\theta$



14. $3\tan\theta = 2 + 5\tan\theta$

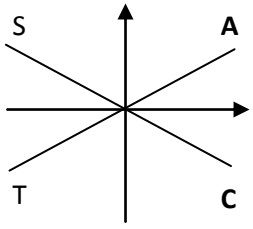


15. $\tan^2\theta = 5$



You will need all 4 quadrants as when you square root you will get both + and -

16. $\sin^2\theta = .625$



17. $2\sin^2\theta + 3\sin\theta + 1 = 0$

18. $6\cos^2\theta - \cos\theta - 1 = 0$

4 solutions possibly

19. $3\tan^2\theta + 4\tan\theta - 4 = 0$

20. $3\sin^2\theta + 3 = 13\sin\theta$

Sin cannot be bigger than 1 or smaller than -1 so you will have to ignore some solutions here