

## 8th lesson

<https://www2.karlin.mff.cuni.cz/~kuncova/en/teachIM.php>  
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### Exercises

1. Solve for  $x \in \mathbb{R}$ .

Algorithm for  $\sin u$ ,  $\cos u$  (and  $\tan u$ ,  $\cot u$ ):

- Are there conditions?
- Find all the solutions  $u$  on the interval  $[0, 2\pi)$ . Use the unit circle or value table and make sure, You have all the solutions.
- Add the constant  $+k2\pi$  (or  $+k\pi$  for  $\tan$  or  $\cot$ ).
- Express  $u$ .

(a)  $\sin x = \frac{1}{2}$

(g)  $\cos(2x) = -\frac{\sqrt{3}}{2}$

(b)  $\cos x = \frac{1}{2}$

(h)  $\frac{1}{\sin(\frac{x}{3}-\pi)} = \sqrt{2}$

(c)  $\tan x = \sqrt{3}$

(i)  $\cot(3x) = 0$

(d)  $3 \sin x - 2 = 5 \sin x - 1$

(j)  $\frac{1}{\cos^2 x} = 4$

(e)  $2 \sin x - 1 = 0$

(k)  $\tan \frac{x}{2} = -3$

(f)  $2 \cos x = \sqrt{2}$

(l)  $2 \cos(4x) + 1 = 0$

2. Solve for  $x \in [0, 2\pi)$

Algorithm:

- Check the conditions.
- Our aim is to have 0 on the right side and a product of functions (or quadratic equation) on the left side.
- Move functions to the left side, factor out everything You can.
- Do not divide by functions (if possible).
- Apply formulae.
- Solve for the product or substitute for the quadratic equation.
- Make a conclusion.

(a)  $\sin^2 x \cos x = 4 \cos x$

(f)  $\tan^2 x - 2 = 3 \tan x$

(b)  $3 \sin^3 x = \sin^2 x$

(g)  $2 \sin^2 x + \cos x = 1$

(c)  $\cos(2x) = 3 \cos x - 2$

(h)  $2 \sin^2 x - 1 = 0$

(d)  $\sin(2x) = \sqrt{3} \cos x$

(i)  $\tan(x - \frac{\pi}{2}) = 1$

(e)  $\cos^2 x - 2 \cos x = 3$

(j)  $2 \cos^2 x + \cos x - 1 = 0$

(k)  $\tan x \sin^2 x = 3 \tan x$   
 (l)  $2 \cos^2 x + 3 \sin x = 0$

(m)  $\cos 2x + 3 \sin x - 2 = 0$

3. Solve for  $x \in [0, 2\pi)$

Algorithm:

- What about the conditions?
- Modify the inequation as in the previous exercise.
- Do not divide by a function. If You do, consider different cases (it can change the inequation mark)
- Solve for an equation.
- Make a table value / solve with graph / solve with unit circle.
- Make a conclusion.

(a)  $2 \sin x \leq 1$

(f)  $\sin(2x) > \cos x$

(b)  $\tan x \geq 3$

(g)  $-6|\sin x| \leq -3$

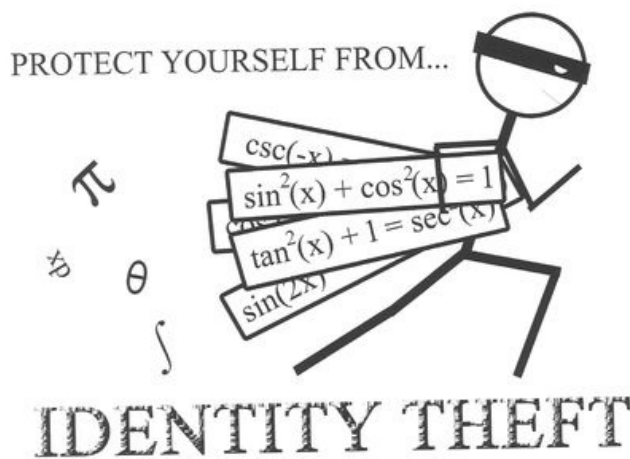
(c)  $\tan x \geq -\sqrt{3}$

(h)  $3 \cot^2 x + 3 \cot x - \sqrt{3} \cot x < \sqrt{2}$

(d)  $\sin x \geq \frac{1}{2}$

(i)  $(2 \cos x - 1)(2 \cos x + 1) < 0$

(e)  $\sin x > \cos x$



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Caption 1: [http://www.geek-jokes.com/identity-theft/?post\\_in\\_lightbox=1](http://www.geek-jokes.com/identity-theft/?post_in_lightbox=1)