Functions

Derivation (part 4)

Derivatives of trigonometric functions

sin'(x)

tan'(x)

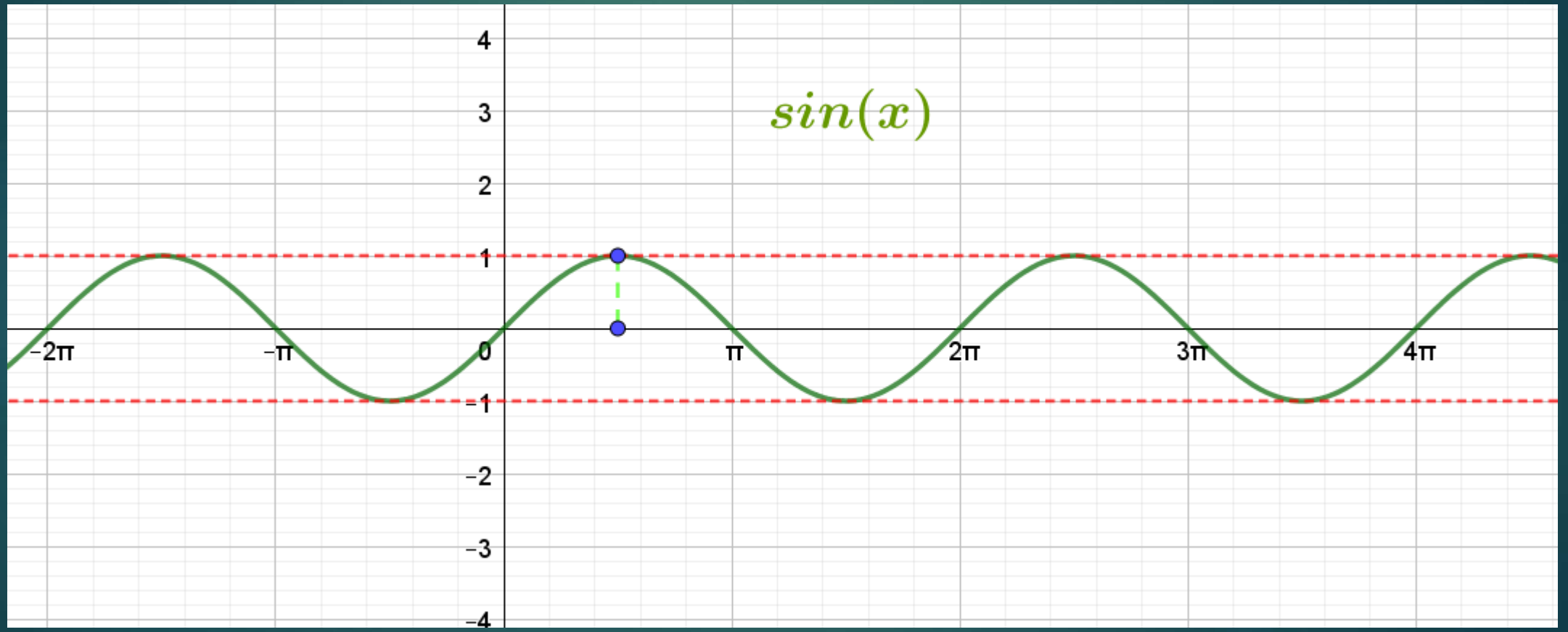
cos'(x)

cot'(x)

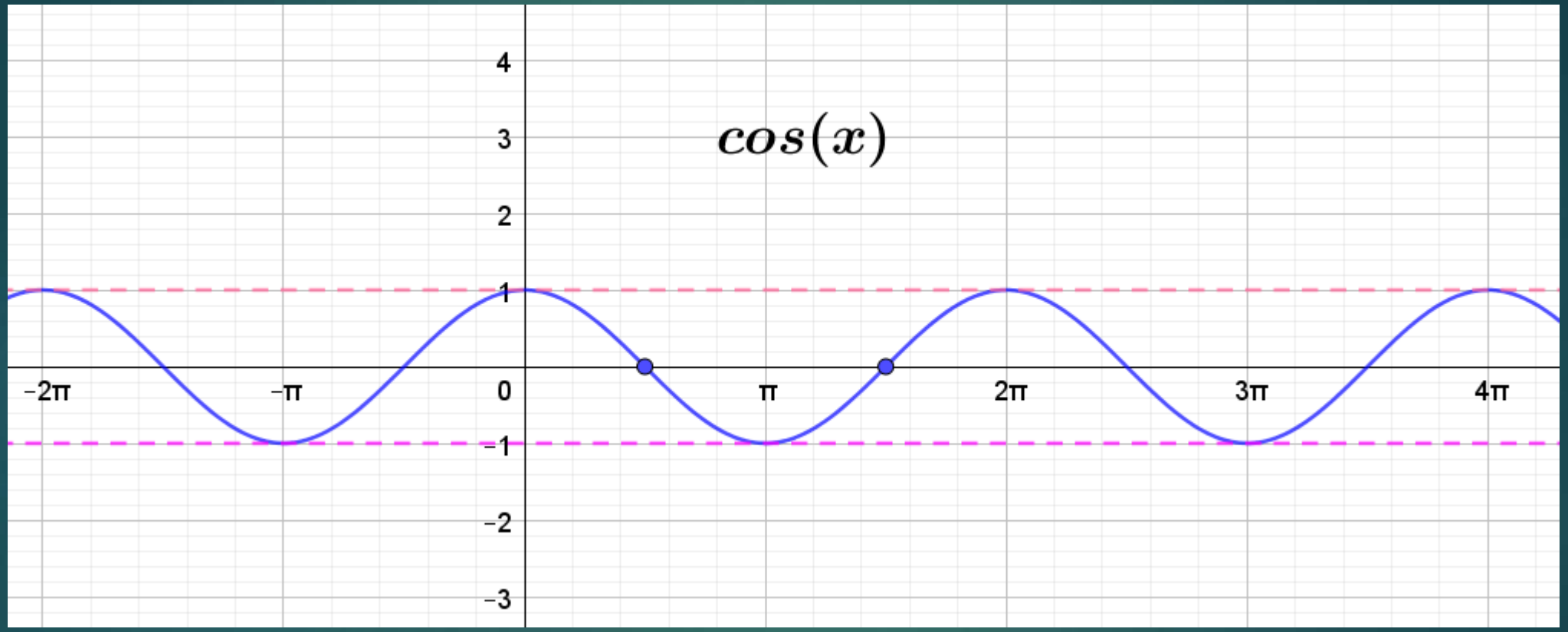
- How do you think the curve of sinx and cosx look like ?

Let's Ask GeoGebra

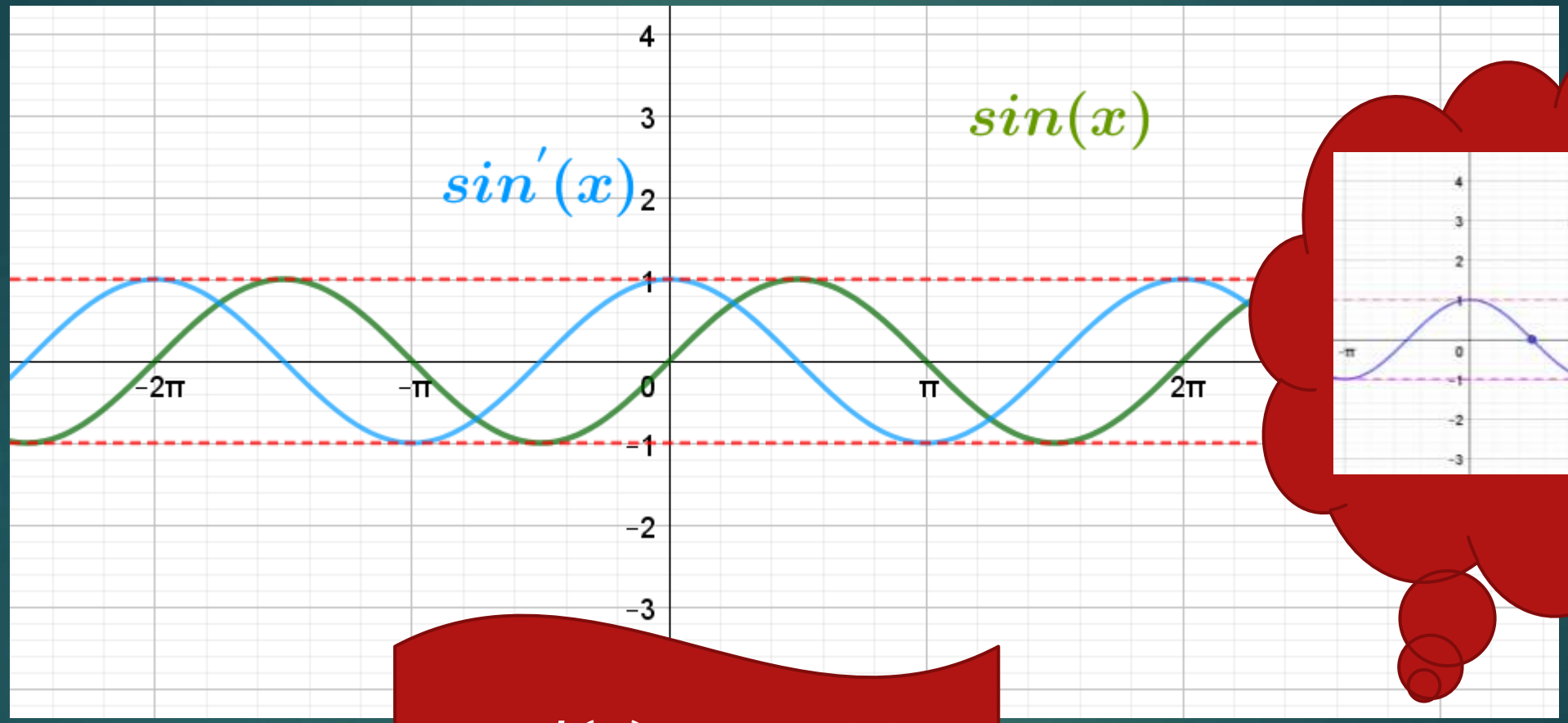
Sin(x)



Cos(x)

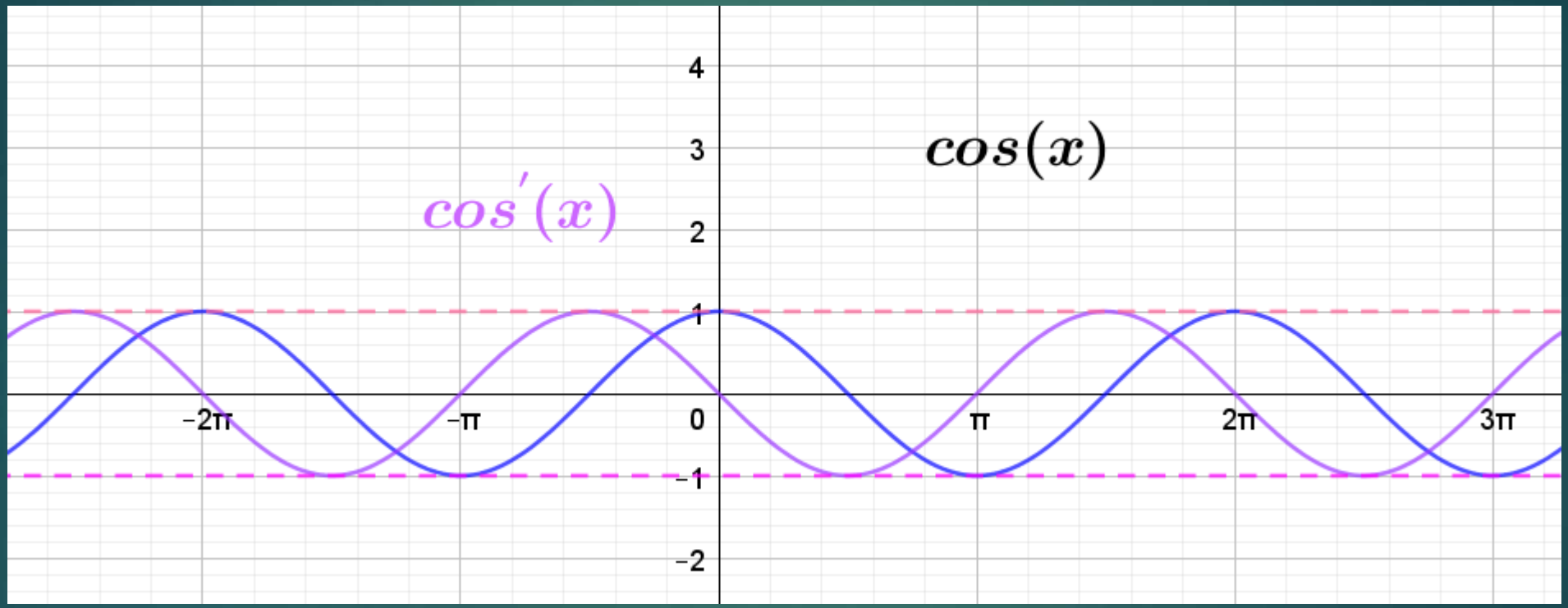


Derivative of sin(x)

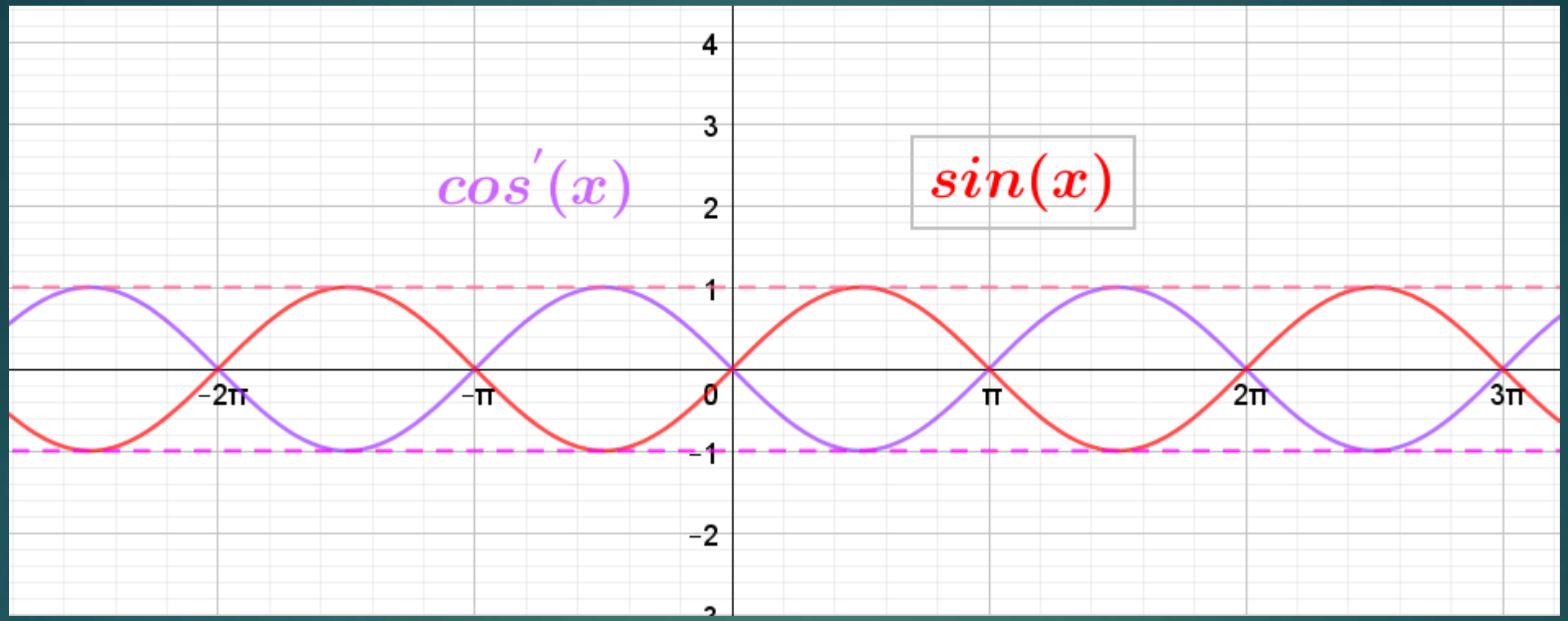


$$sin'(x) = cos(x)$$

Derivative of cos(x)



Derivative of cos(x)



$$cos'(x) = -\sin(x)$$

Derivative of tan(x)

$$\tan x = \frac{\sin(x)}{\cos(x)}$$

$$\left(\frac{U}{V}\right)' = \frac{U'V - V'U}{V^2}$$

$$U = \sin(x)$$
$$U' = \cos(x)$$

$$V = \cos(x)$$
$$V' = -\sin(x)$$

$$tan'(x) = \frac{\cos(x).\cos(x) - (-\sin(x)).\sin(x)}{cos^2(x)}$$

$$tan'(x) = \frac{cos^2(x) + sin^2(x)}{cos^2(x)}$$

Rule

$$tan'(x) = \frac{1}{cos^2(x)}$$

Derivative of cot(x)

$$\cot x = \frac{\cos(x)}{\sin(x)}$$

$$\cot'(x) = \frac{-\sin(x).\sin(x) - \cos(x).\cos(x)}{\sin^2(x)} = \frac{-\sin^2(x) - \cos^2(x)}{\sin^2(x)}$$

$$\cot'(x) = \frac{-[\cos^2(x) + \sin^2(x)]}{\sin^2(x)}$$

Rule

$$\cot'(x) = \frac{-1}{\sin^2(x)}$$

General Rules

Derivative of

sin(ax)	cos(ax)	tan(ax)	cot(ax)
is acos(ax)	is – asin(ax)	is $\frac{a}{cos^2(ax)}$	is $\frac{-a}{sin^2(ax)}$

Application 1
find the derivative of :

- $f(x) = cos^3 x$
- $h(x) = cos^2(x).\cos(5x)$

Pause the video
Try to solve this application

Solution

Pause the video
Check your answers

- $f'(x) = \left(cos^3 x\right)' = 3cos^2(x).(-sinx)$
- $h'(x) = \left(cos^2(x).\cos(5x)\right)'$

$$= 2cos(x)\left(-sin(x)\right).cos(5x) + cos^2(x).(-5sin(5x))$$

Application 2 : find the derivative of :

- $f(x) = sin^2(2x).\cos(3x)$
- $g(x) = cos^2(3x).sin^2(2x)$
- $h(x) = \sin(x).\sin(5x)$
- $t(x) = sin^2(3x).\sin(5x)$

Pause the video to solve this application carefully

Application 2 : Solution

- $f'(x) = 2sin(2x).\big(2cos(2x)\big).\cos(3x) + sin^2(x).(-3sin(3x))$
- $g'(x) = 2cos(3x).(-3sin(3x)).sin^2(2x) + cos^2(3x).2.sin(2x).(2cos(2x))$
- $h'(x) = \cos(x).\sin(5x) + sin(x).5cos(5x)$
- $t'(x) = 2sin(3x).3cos(3x)sin(5x) + sin^2\,(3x).5cos(5x)$

Pause the video
Check your answers