



Teaching Material

(Links: see first page of Internet-Version)

- **Slides:** Trigonometric Function (power-point)
- **Applets:** For viewing: please download “Ruler and Compass CaR” from internet, free download

Next pages: Lesson Plan

Below: **Worksheet:** Trigonometric Function (worksheet to copy)

Proposal for a Lesson Plan: Introduction of Trigonometric Functions

Content	Teacher		Pupils
Circulation and oscillation - introduction	<p>Teacher shows to students some objects from every-day life: wheel, bicycle, children's swing, clock ...</p> <p>T: How are they moving? Describe their movements!</p> <p>T: Could you find some other objects which oscillate or circulate?</p> <p>T: Is there relation between these two motions: circulation and oscillation?</p> <p>Experiment: Take a gramophone and put a stick on it. Behind the gramophone place a simple pendulum. The stick circulates on the gramophone and the weight of the pendulum oscillates. Make a projection of the stick and the weight on the wall. Observe the shadows of the stick and the weight. What can you see?</p> <p>T: Yes, but only if we attended for the same amplitudes and frequencies.</p>	<p>Slide 2</p> <p>Worksheet</p> <p>Slide 3</p> <p>Slide 4</p> <p>Slide 5</p> <p>Applet 1 Worksheet</p>	<p>P: Some of them circulate and some of them oscillate.</p> <p>P: Windmill, gramophone, swing door...</p> <p>P: ... that the shadow of the stick overlaps with the shadow of the weight.</p> <p>Ps sketch the experiment.</p>

The **ScienceMath**- project: **Introduction of Trigonometric Function**

Idea: Marina Rugelj,

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<p>Graph of sin - motion</p>	<p>T: Take a point T which circulates around the unit circle. Put the center of the circle in the starting point of the coordinate system and observe the projection of the point T on y-axis. It goes up and down. Could you draw a graph of the position of projected point in dependence of time?</p>	<p>Applet 2</p>	<p>Ps try to draw a sin curve.</p>
<p>Definition of sin function</p>	<p>T: We know that ration between hypotenuse and cathetus in similar right-angled triangles is always the same:</p> $a / c = a' / c' = a'' / c''$ <p>It depends on the angle x, it is a functions of the angle x and we named this function sinus:</p> $f(x) = \frac{a}{c} = \sin x .$ <p>If hypotenuse $c = 1$ than $\sin x = a$.</p> <p>We can draw this angle x in the unit circle. We also get the right-angled triangle. The length of the hypotenuse is equal 1 ($c = 1$), therefore</p> $\sin x = \frac{a}{c} = \frac{a}{1} = a .$ <p>And a is exactly the y-coordinate of the point T on the circle.</p>	<p>Slide 6</p> <p>Slide 7</p> <p>Slide 8</p> <p>Worksheet</p>	<p>Ps draw the sin value for different angels in unit circle.</p>

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Practical task	<p>There is a windmill and point A on the propeller as you can see on the picture. The function which describes the height of the point A is equal:</p> $h(t) = 3.5 \sin \frac{2\pi}{12} t + 7.5$ <p>Questions:</p> <ol style="list-style-type: none">1. How high is rod?2. How big is radius of the propeller?3. In what time does the point come around? <p>Check the answers:</p> <ol style="list-style-type: none">1. The rod is 7,5 m high.2. The radius of the propeller is 3,5 m.3. The point need 12 seconds.	<p>Slide 12</p> <p>Worksheet Applet 4</p>	<p>Ps can work in pairs and try to answer these questions.</p>
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Next pages: **worksheet**

Worksheet: INTRODUCTION OF TRIGONOMETRIC FUNCTIONS

1. Find and put down some objects from every-day life which oscillate or circulate!
2. Is there any relation between these two motions: circulation and oscillation? Make a sketch of the experiment!

3. Draw a sin curve!



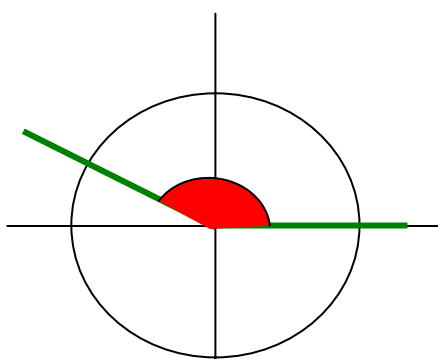
The **ScienceMath**- project: **Introduction of Trigonometric Function**

Idea: Marina Rugelj,

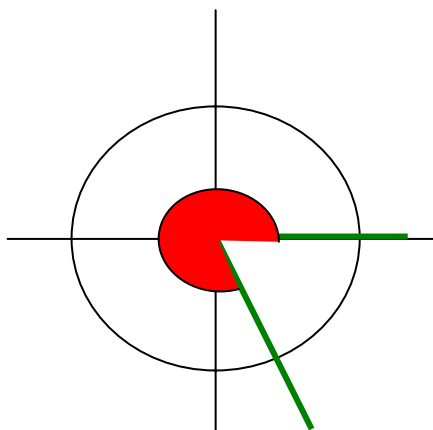
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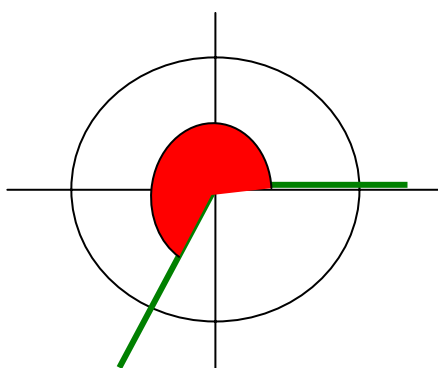
4. Draw the value of $\sin x$ for four angles x !



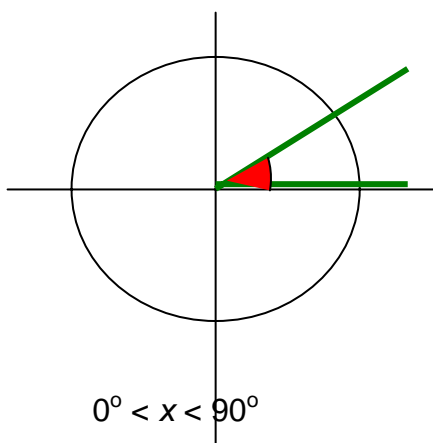
$$90^\circ < x < 180^\circ$$



$$270^\circ < x < 360^\circ$$



$$180^\circ < x < 270^\circ$$



$$0^\circ < x < 90^\circ$$

5. Draw the graphs of two functions in the same coordinate system:

$$f(x) = \sin x$$

$$f(x) = 2 \sin x$$



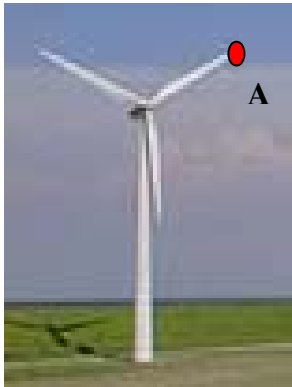
6. Draw the graphs of two functions in the same coordinate system: $f(x) = \sin x$
 $f(x) = \sin 2x$



7. Draw the graphs of two functions in the same c. system: $f(x) = \sin x$
 $f(x) = \sin x + 2$



8. There is a windmill and point A on the propeller as you can see on the picture.
The function which describes the height of the point A is equal:



$$h(t) = 3.5 \sin \frac{2\pi}{12} t + 7.5$$

- a. How high is the rod?
- b. How big is radius of the propeller?
- c. In what time does the point come around?

9. Sketch the graph!

