The **ScienceMath-**project: **Function x^(3/2) and x^(1/2): practical Examples**
Idea: Tine Golež,
St. Stanislav Institution for Education,
Diocesan Classical Gymnasium Ljubljana, Slovenia

Education and Culture
Lifelong learning programme
COMENIUS

Teaching Material

Equipment needed

Pendulum with rods of

- 20 cm
- 40 cm
- 60 cm
- 80 cm.

The rods are made of brass.

Procedure

Experiment: We insert the shortest rod and measure the oscillation period, than 40 cm etc. (please, see **Youtube: sciencemathproject pendulum**)

Results:

length [m]	oscillation period
0,20	0,96
0,40	2,63
0,60	4,81
0,80	7,40

Plot the graph: We use Excel to plot the graph. The four points are (actually 5, we added (0; 0) point also) presented. **See attached Excel file, Sheet 1.**

Fit a function: Then we try to plot a line through the points. The straight line is calculated to pass through (0; 0) and (0,80; 7,40). Hence: y = 9,25x. See Sheet 2. Obviously it doesn't fit to measured values.

Next we try by x^2. We again fit the coordinate (0,80; 7,40) on parabola; therefore $y = 11{,}56x^2$. Again – that is not the appropriate modeled function, no doubt. **See Sheet 3.**

So we try by $y = ax^{3/2}$. In this case, a = 10,34. This function is the right one. We showed the use of $y = ax^{3/2}$ function. **See Sheet 4 and Sheet 5.**

The **ScienceMath-**project: **Function x^(3/2) and x^(1/2): practical Examples**
Idea: Tine Golež,
St. Stanislav Institution for Education,
Diocesan Classical Gymnasium Ljubljana, Slovenia

Physics Background

The equation for oscillation period of torsion pendulum made of a rod is:

$$t_0 = 2\pi\sqrt{\frac{\frac{1}{12}ml^2}{D}}$$

where *l* is the length of the rod, *m* mass of the rod and *D* the constant of torsion spring. As the mass is proportional to the length (mass = density*length*cross section area), the oscillation period is thus proportional to (length)$^{3/2}$.

Question to the students:

What should be the oscillation period of 50 cm rod?

Carrying out the experiment (After the student's prediction).

Additional Experiment (SQRT(x)):

Now a 60 cm brass rod is replaced by 60 cm aluminum rod, then iron rod latter replaced by wood rod. Here the only changing parameter is mass of the rod while the length of all rods is 60 cm. According to the equation:

$$t_0 = 2\pi\sqrt{\frac{\frac{1}{12}ml^2}{D}}$$

the dependence should be y = ax$^{1/2}$. The procedure can be very similar to just shown one – using Excel and fitting a curve through the measured values. Certainly we must also measure mass of each rod!

This project has been funded with support from the European Commission. This publication reflects the views only of the author(s), and the Commission cannot be held responsible for any use which may be made of the information contained therein.