

## 0.1 The genesis of circle

Andrej Rehak

[www.principiauniversi.com](http://www.principiauniversi.com)

### Abstract

Geometric demonstration of free fall and rotation reveals space-time nature of the genesis of circle. We show that the operations with radius are equivalent to operations with velocity. Consequently, conventional spatial unit for radius (m), becomes equivalent to dynamic space-time unit for speed (m/s). We prove that the velocity is a physical equivalence of geometric idea of radius.

### The genesis of circle

Each unit of time, speed of the body in a free fall increases by the amount of acceleration measured in that time, while it is known that the distance traveled corresponds to area of the triangle whose legs are values at coordinates of velocity and time.

Our thought experiment begins with  $v, t$  diagram where in time  $1t$ , acceleration  $1a$ , reaches velocity  $1v$ . Accordingly, in one time unit, velocity (m/s) equals length (m). Let us say that length is the distance from scope of the circle to its center, i.e. radius.

According to Galileo's formula for distance traveled at a constant acceleration (0.1.1), in one time unit  $t$  of described surrounding, the traveled path  $s$  is equal to half the amount of acceleration  $a$ ;

$$s = \frac{at^2}{2} \quad 0.1.1$$

To describe the cycle, the speed of scope points of the mentioned circle, compared to time coordinate points at which it spins, is  $2\pi$ . Distance traveled by velocity value, which in a free fall draws its radius from its center, is for the same ratio smaller than its surface (Figure 0.1a).

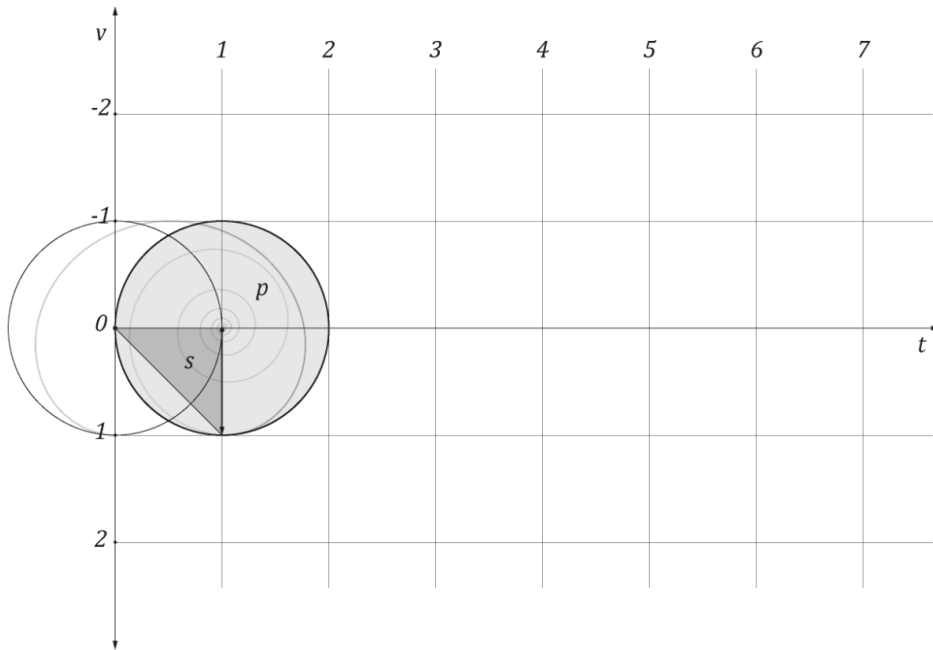


Figure 0.1a

$$a = v = r \Rightarrow \frac{o}{t} = \frac{p}{s} = 2\pi \quad 0.1.2$$

In a free fall, such system does not describe a circle, i.e. it is not a pendulum.

If circle of radius  $r$  rolls in a free fall, at time coordinate  $t$ , of described  $v, t$  diagram, in a way that each point of its scope, in contact with the ground is stationary relative to the surface, its rotation cycle charts  $2\pi$  units of time (Figure 0.1b).

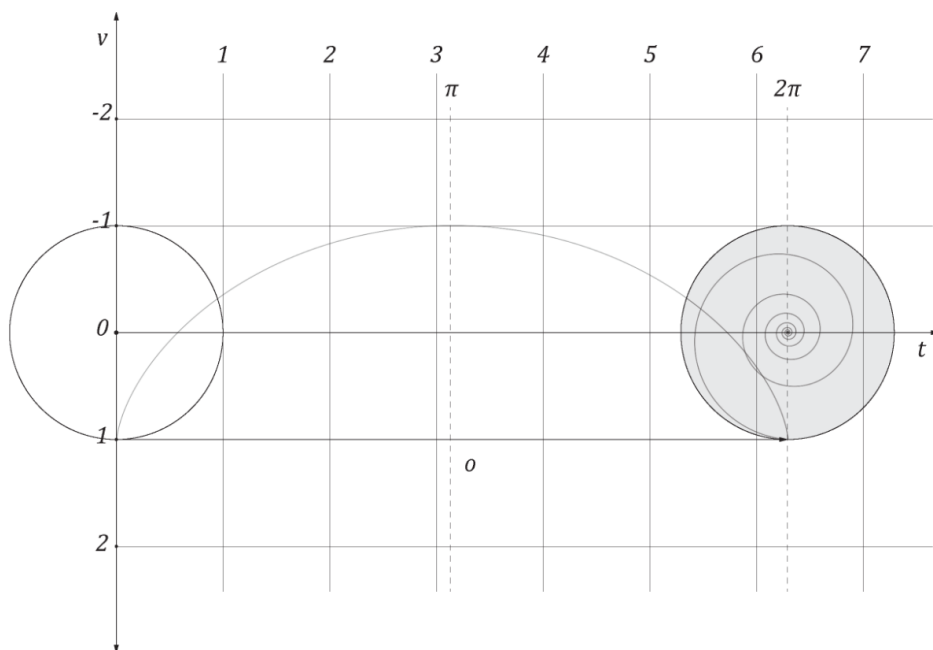


Figure 0.1b

For the scenario described above, we can say that the cycle of the circle, i.e. the time  $t$ , equivalents to its circumference  $o$ ;

$$t = o \tag{0.1.3}$$

To reach speed  $v$ , in time  $2\pi$  of free fall  $a$ , in shown  $v, t$  diagram, acceleration within the system is reduced to the amount  $1/2\pi$  (Figure 0.1c, 0.1.4);

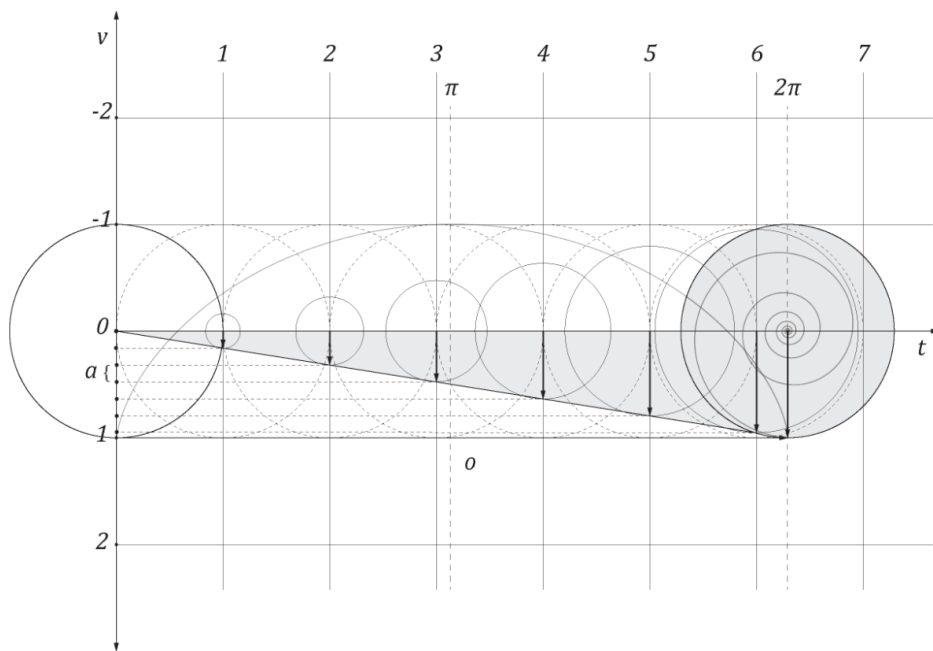


Figure 0.1c

$$a_{\pi} = \frac{1}{2\pi} \tag{0.1.4}$$

Calculated by Galileo's formula, in described system of acceleration, the distance traveled equals the area of a right triangle whose legs are values of velocity and time. Its surface area is equal to the area of the reference circle and amounts  $\pi$  (Figure 0.1d).

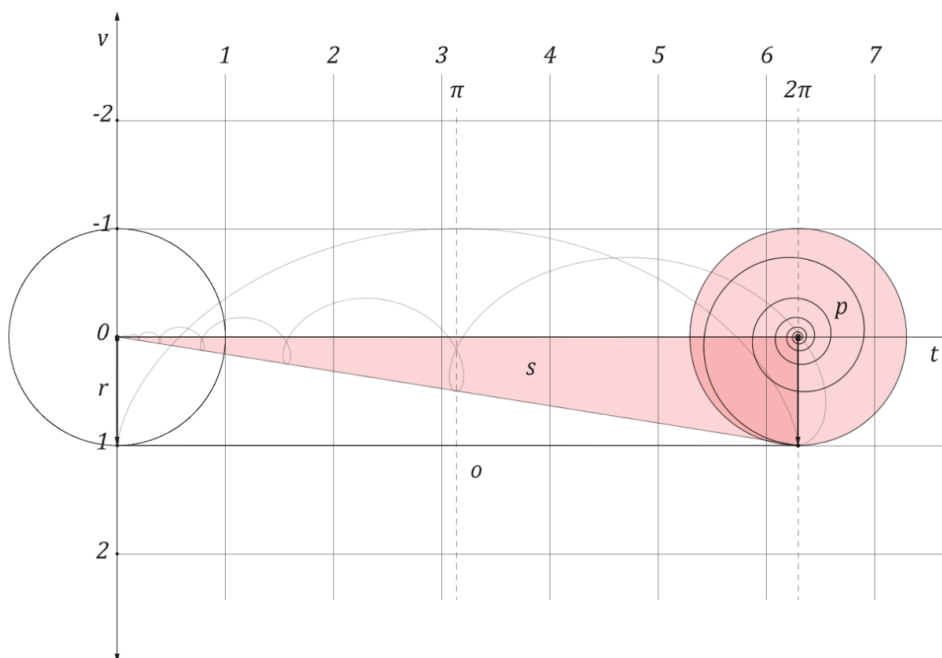


Figure 0.1d

In described system, expanding radius and velocity cover the same path.

Thus we write;

$$s = p \tag{0.1.5}$$

From which it follows;

$$v = r \tag{0.1.6}$$

We conclude that the velocity is a physical interpretation of geometrical idea of radius<sup>1</sup>.

All operations with radius are equivalent to operations with speed. This applies to all symmetrical cases of any scalar value of velocity (radius), for which applies that the ratio between the radius and the circle's circumference is  $2\pi$ .

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<sup>1</sup> <http://www.principiauniversi.com/blogs/12-0-dot-1-the-genesis-of-circle>