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# Zusammenfassung von v05

Ort ⟷ Geschwindigkeit ⟷ Beschleunigung

→ differenzieren
← integrieren

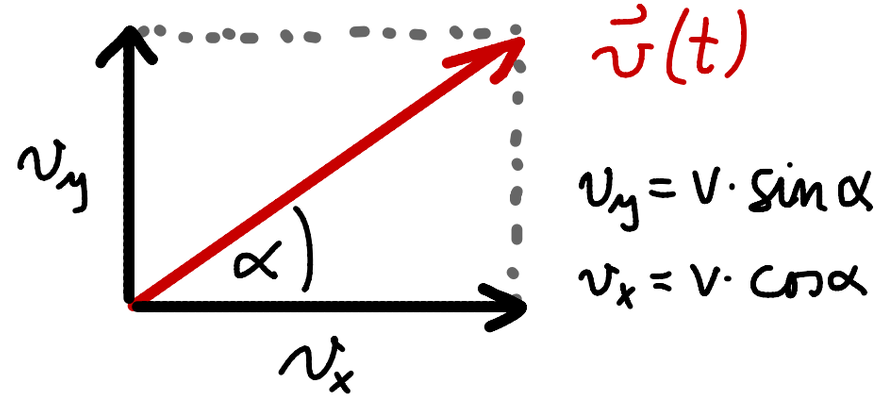
Weg-Zeit-Gesetz $s(t) = \frac{1}{2} a t^2 + v_0 t + s_0$

Integrationskonstanten
a) nicht vergessen
b) phys. interpretieren

Relativität von Orts- und Geschwindigkeitsmessungen: hängen vom KS ab

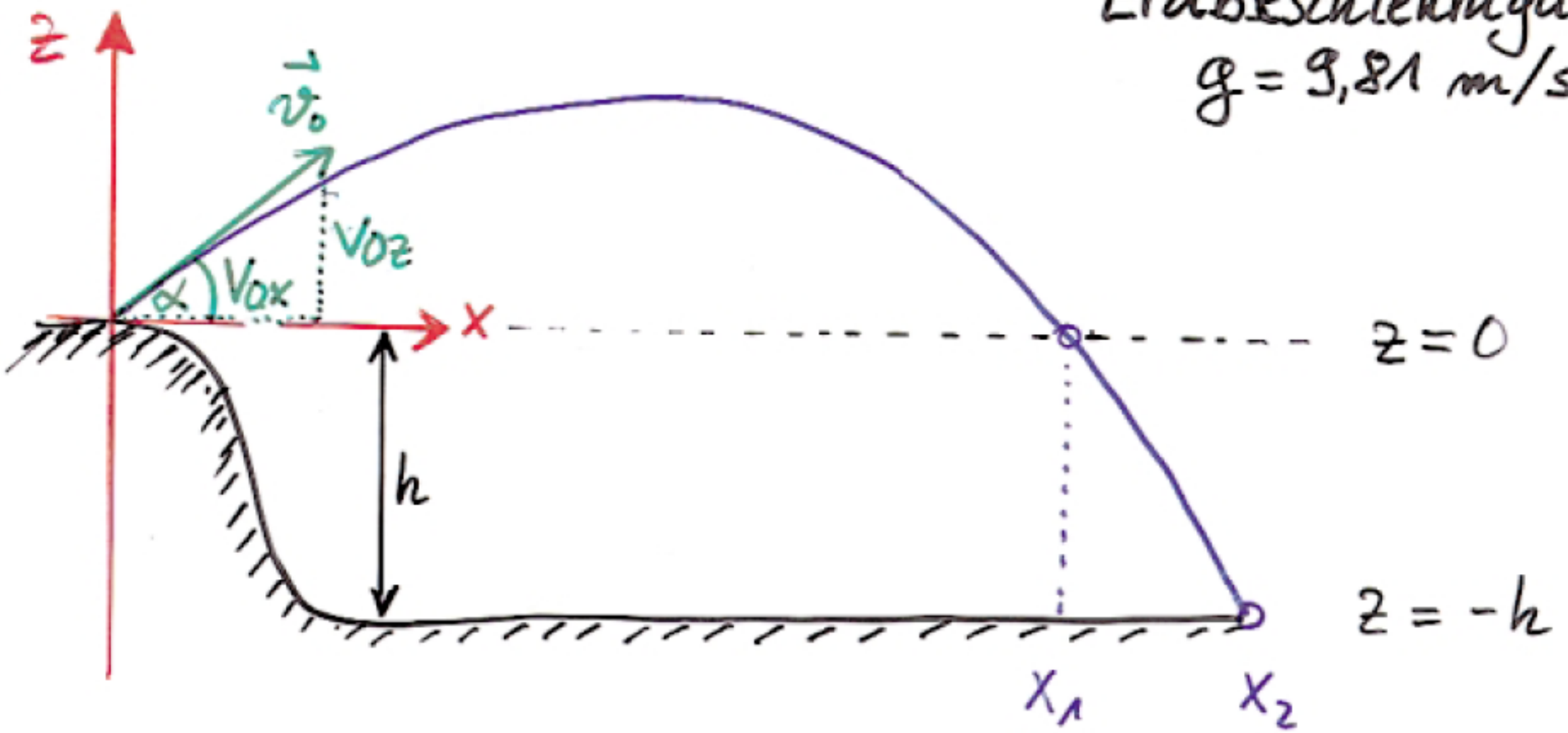
**Superpositionsprinzip!** **Vektorcharakter der phys. Grössen**

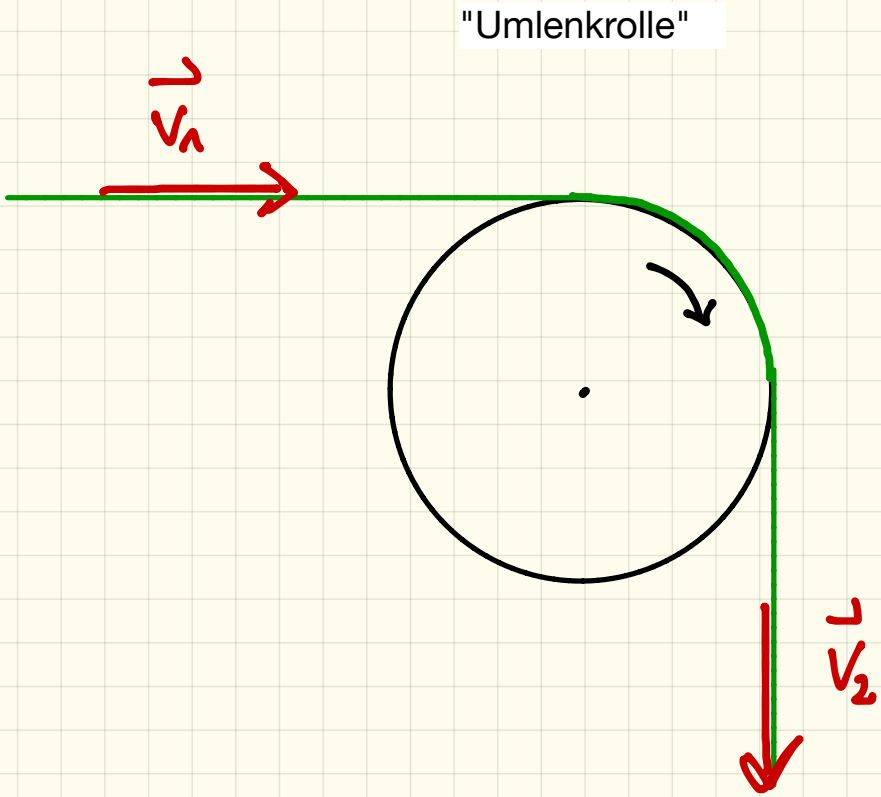
Schräger Wurf $\vec{r}(t) = \begin{pmatrix} x(t) \\ y(t) \\ z(t) \end{pmatrix}$

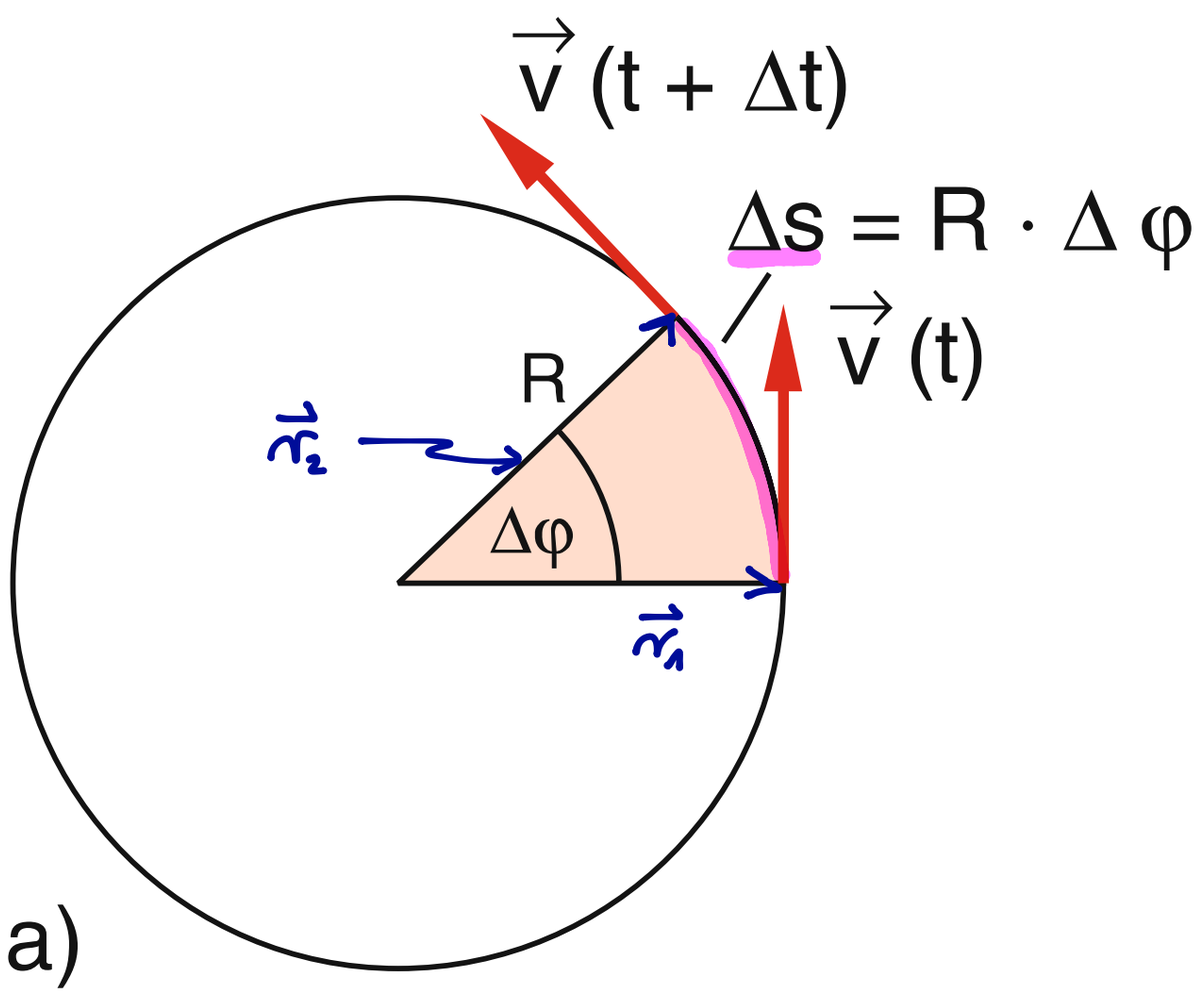



$\vec{v}(t)$, $\vec{a}(t)$ komp. weise nach gegeb. Situation; Vorzeichen konsistent!

Erdbeschleunigung
$g = 9{,}81\ m/s^2$




"Umlenkrolle"
$\vec{v}_1$
$\vec{v}_2$



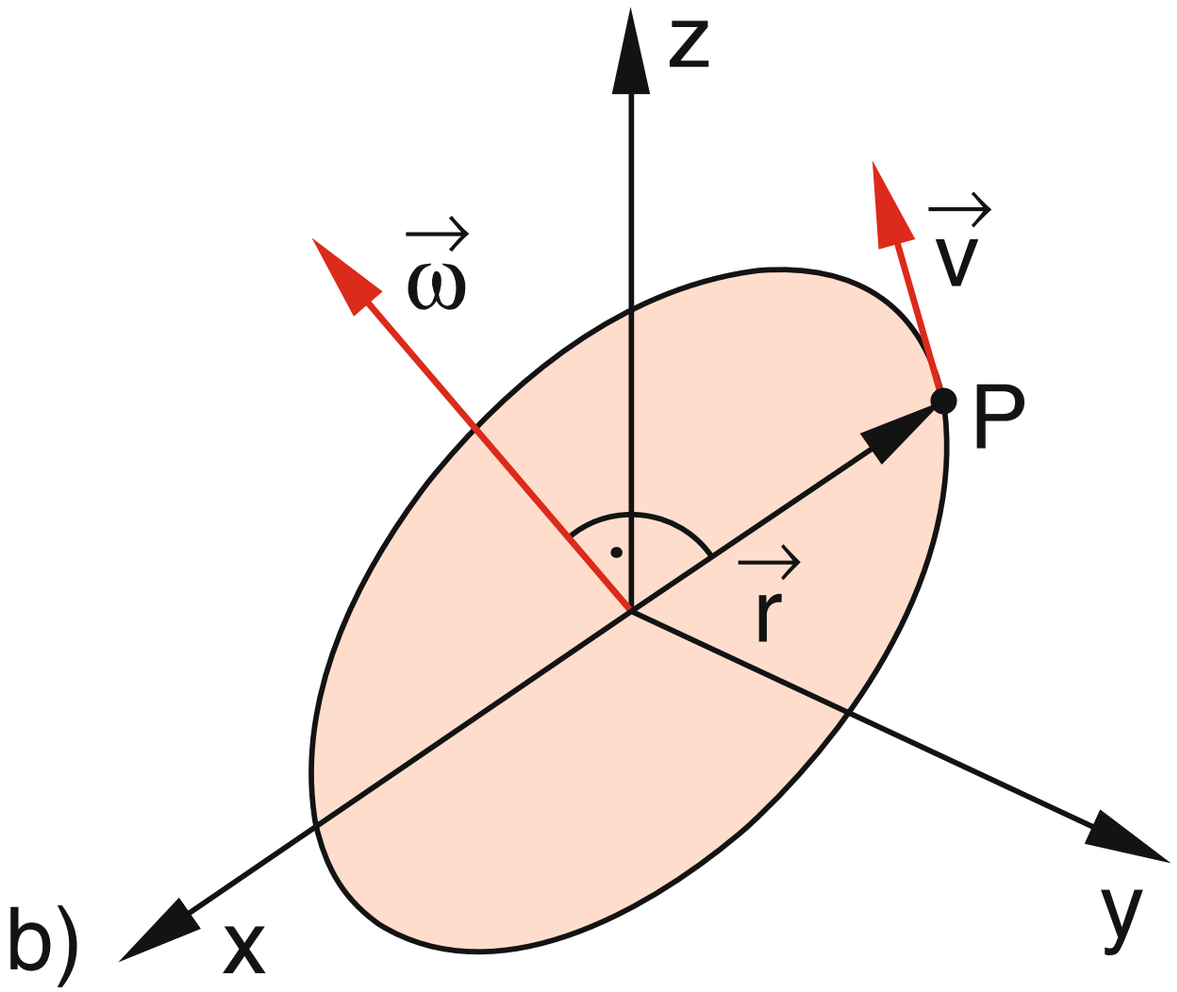




**Abb. 2.10.** (**a**) Gleichförmige Kreisbewegung. (**b**) Zur Definition der Winkelgeschwindigkeit

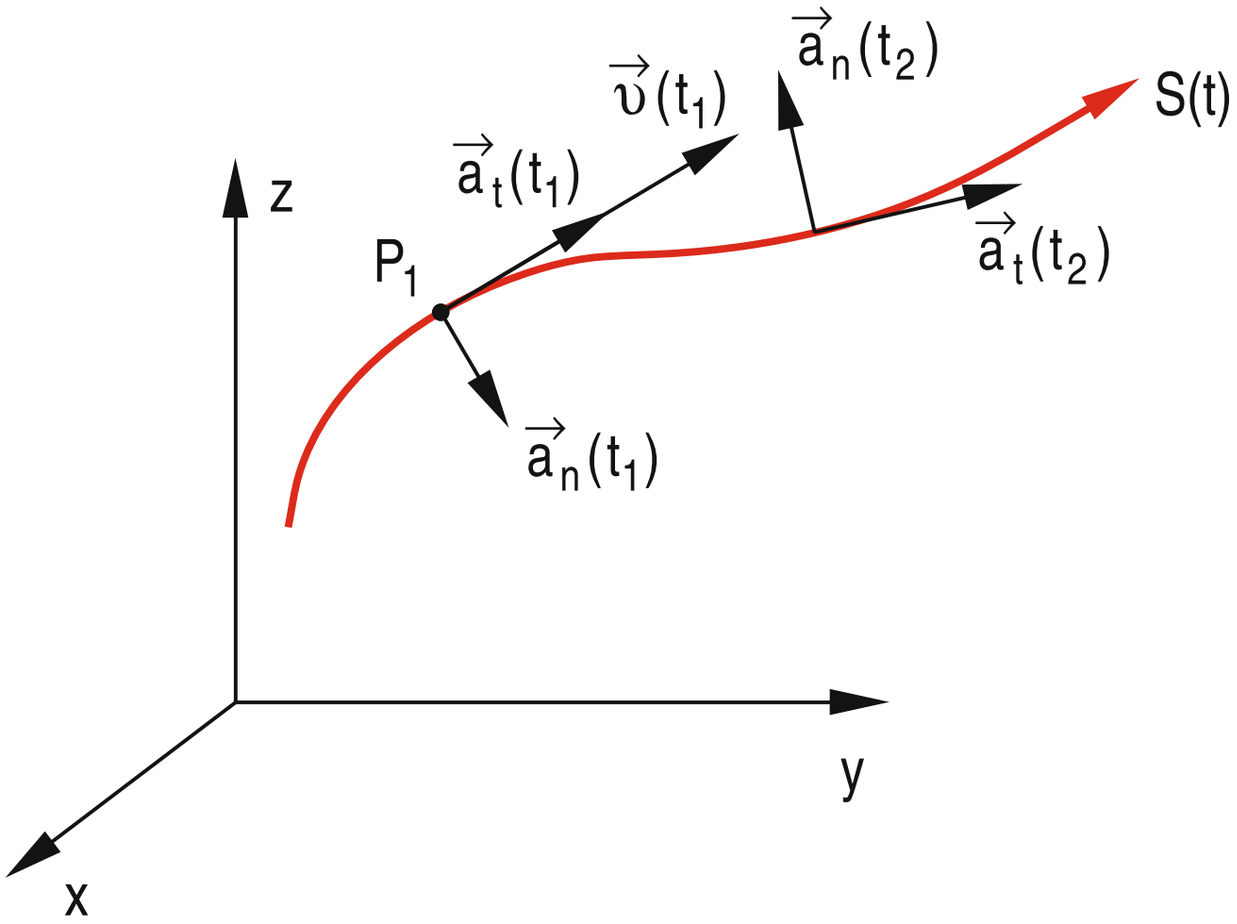
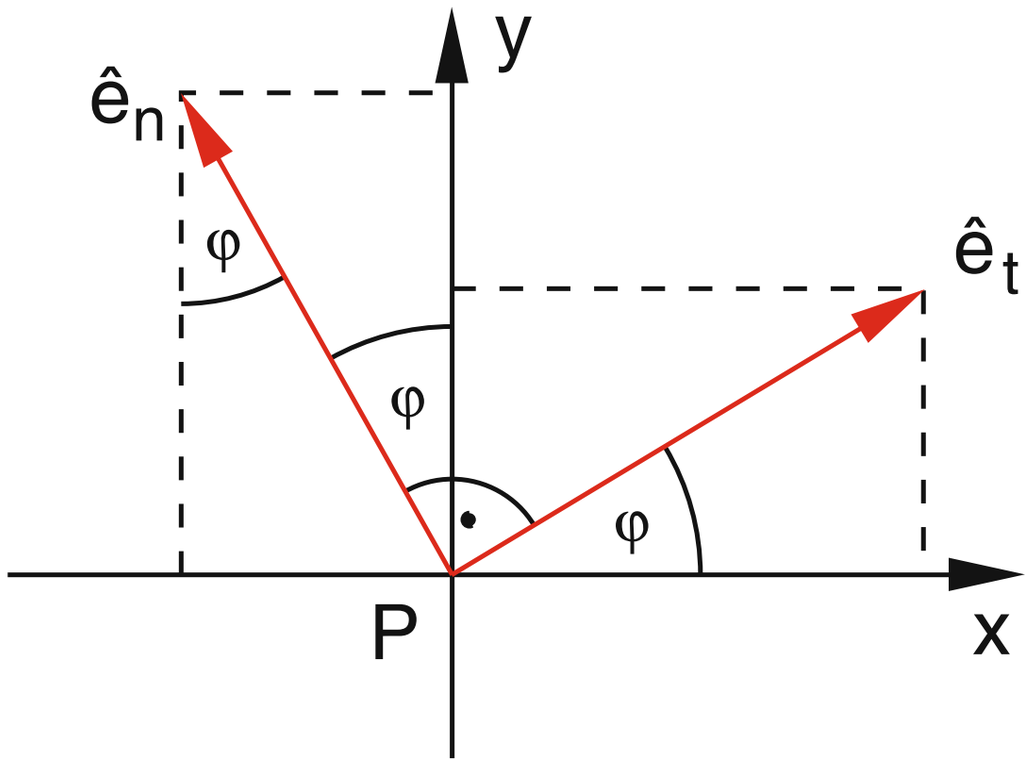



**Abb. 2.11.** Tangential- und Normalbeschleunigung



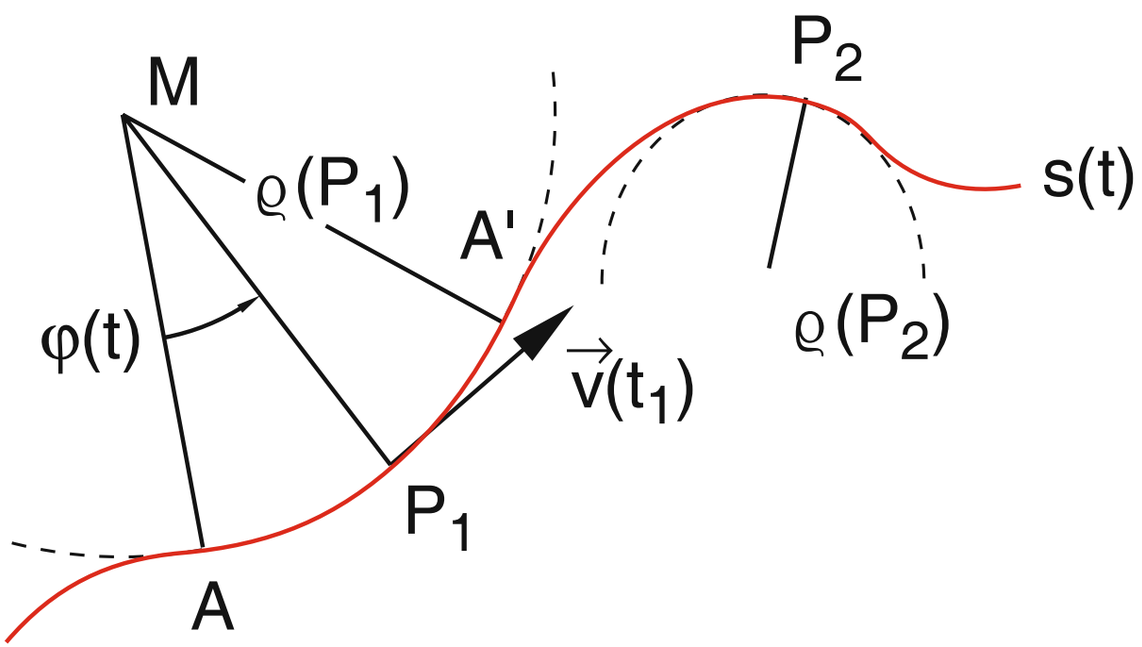
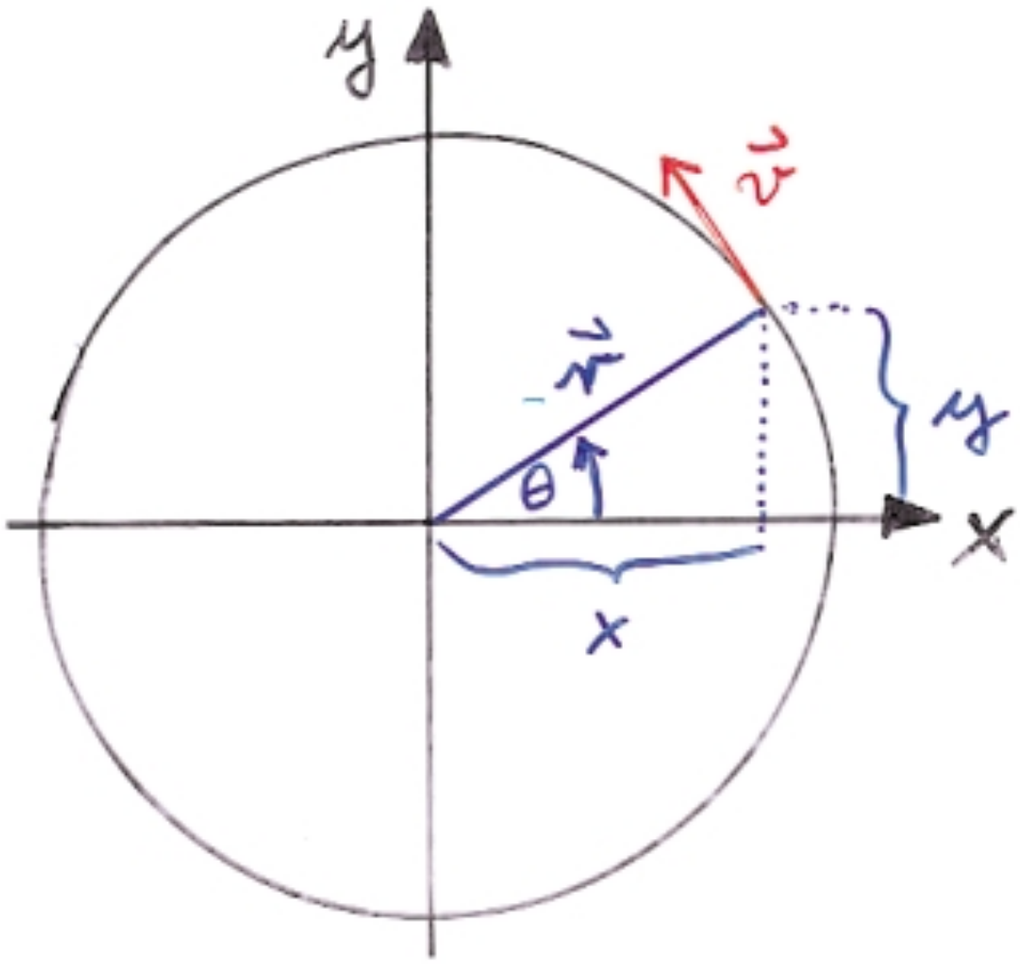




**Abb. 2.13.** Lokaler Krümmungsradius einer beliebigen krummlinigen Bahnkurve

# “Harmonische” Bewegungen, Kreisbewegung




Kreisbeweg. um Koord.urspr.

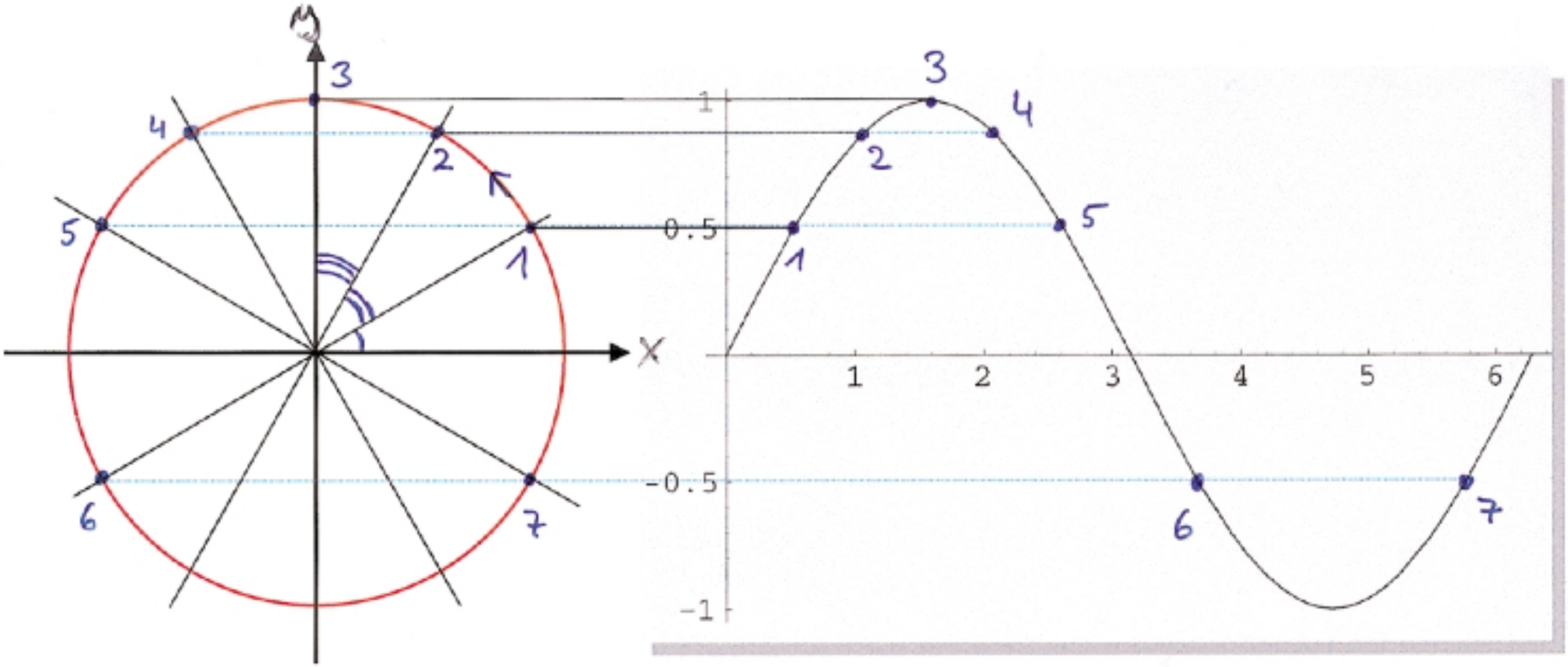
$|\vec{v}| = \text{konst.}$

o.B.d.A. $\vec{r}(t) = \begin{pmatrix} x(t) \\ y(t) \end{pmatrix}$

$r = |\vec{r}| = \sqrt{x^2+y^2}$

$x = r \cdot \cos\theta$, $y = r \cdot \sin\theta$

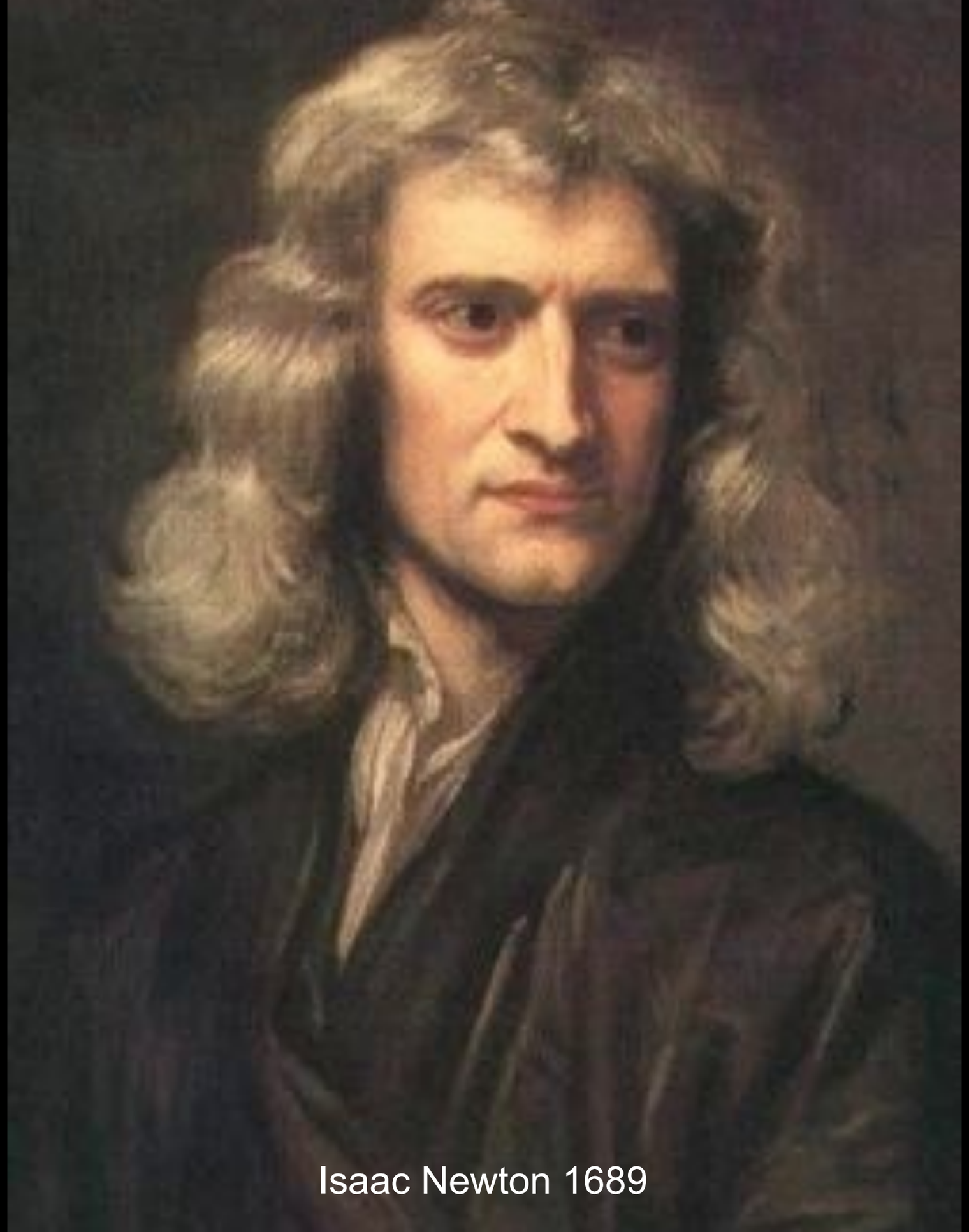
# Projektion einer gleichmäßigen Kreisbewegung: „harmonische Schwingung"




$\theta(t) = \omega t$

$y(t) = r \cdot \sin \omega t$

[hier $r=1$]



Isaac Newton 1689




# MEMOIRS OF Sr. ISAAC NEWTONS Life.

Wm. Stukeley 1752.

In magnis, voluisse sat est. of his family; & some being an account, chiefly of the junior part of his life.

# PHILOSOPHIÆ
## NATURALIS
# PRINCIPIA
## MATHEMATICA.

Autore *J S. NEWTON, Trin. Coll. Cantab. Soc.* Matheſeos Profeſſore *Lucaſiano*, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
*Julii* 5. 1686.

*LONDINI*,

Juſſu *Societatis Regiæ* ac Typis *Joſephi Streater*. Proſtat apud plures Bibliopolas. *Anno* MDCLXXXVII.



# AXIOMATA SIVE LEGES MOTUS

### Lex. I.

*Corpus omne perſeverare in ſtatu ſuo quieſcendi vel movendi uniformiter in directum, niſi quatenus a viribus impreſſis cogitur ſtatum illum mutare.*

PRojectilia perſeverant in motibus ſuis niſi quatenus a reſiſtentia aeris retardantur & vi gravitatis impelluntur deorſum. Trochus, cujus partes cohærendo perpetuo retrahunt ſeſe a motibus rectilineis, non ceſſat rotari niſi quatenus ab aere retardatur. Majora autem Planetarum & Cometarum corpora motus ſuos & progreſſivos & circulares in ſpatiis minus reſiſtentibus factos conſervant diutius.

### Lex. II.

*Mutationem motus proportionalem eſſe vi motrici impreſſæ, & fieri ſecundum lineam rectam qua vis illa imprimitur.*

Si vis aliqua motum quemvis generet, dupla duplum, tripla triplum generabit, ſive ſimul & ſemel, ſive gradatim & ſucceſſive impreſſa fuerit. Et hic motus quoniam in eandem ſemper plagam cum vi generatrice determinatur, ſi corpus antea movebatur, motui ejus vel conſpiranti additur, vel contrario ſubducitur, vel obliquo oblique adjicitur, & cum eo ſecundum utriuſq; determinationem componitur. Lex. III.


Titelblatt des „Atlas novus coelestis" (1742) von J.G. Doppelmaier, mit einigen berühmten Astronomen.

# OPTICKS:
## OR, A TREATISE OF THE REFLEXIONS, REFRACTIONS, INFLEXIONS and COLOURS OF LIGHT.
ALSO
## Two TREATISES OF THE SPECIES and MAGNITUDE OF Curvilinear Figures.

LONDON,
Printed for SAM. SMITH, and BENJ. WALFORD, Printers to the Royal Society, at the *Prince's Arms* in St. *Paul's* Church-yard. MDCCIV.

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ther: & a few more whom he know.

after dinner, the weather being warm, we went into the garden, & drank thea under the shade of some appletrees; only he, & my self. amidst other discourse, he told me, he was just in the same situation, as when formerly, the notion of gravitation came into his mind. why sh? that apple always descend perpendicularly to the ground, thought he to himself; occasiond by the fall of an apple, as he sat in a contemplativ mood. why sh? it not go sideways, or upwards? but constantly to the earths center? assuredly, the reason is, that the earth draws it. there must be a drawing power in matter. & the sum of the drawing power in the matter of the earth must be in the earths center, not in any side of the earth. therefore dos this apple fall perpendicularly or towards the center. if matter thus draws matter; it must be in proportion of its quantity. therefore the apple draws the earth, as well as the earth draws the apple.

& thus by degrees, he began t
properly of gravitation to the mo
earth, & of the heavenly bodys: t
distances, their magnitudes, their p
volutions: to find out, that this propo



## Newtons Apfel im Original

Vor seinem Tod im Jahr 1727 schilderte Isaac Newton seine Lebenserfahrungen dem Historiker William Stukeley, der sie 25 Jahre später als Biografie "Memoires of Sir Isaac Newton's Life" veröffentlichte. Das Werk beschreibt die Geschichte von Newtons Eingebung zur Ursache der Schwerkraft wie folgt:

*Why should that apple always decend perpendicularly to the ground, thought he to himself, occation'd by the fall of an apple (...). Why should it not go sideways, or upwards, but constantly to the earths center? Assuredly, the reason is, that the earth draws ist. There must be a drawing power in matter. (...) If matter thus draws matter; it must be in proportion of its quantity. Therefore the apple draws the earth, as well as the earth draws the apple. (...) he began to apply this property of gravitation to the motion of the earth, and of the heavenly bodies; to consider their distances, their magnitudes, their periodical rotations (...).*