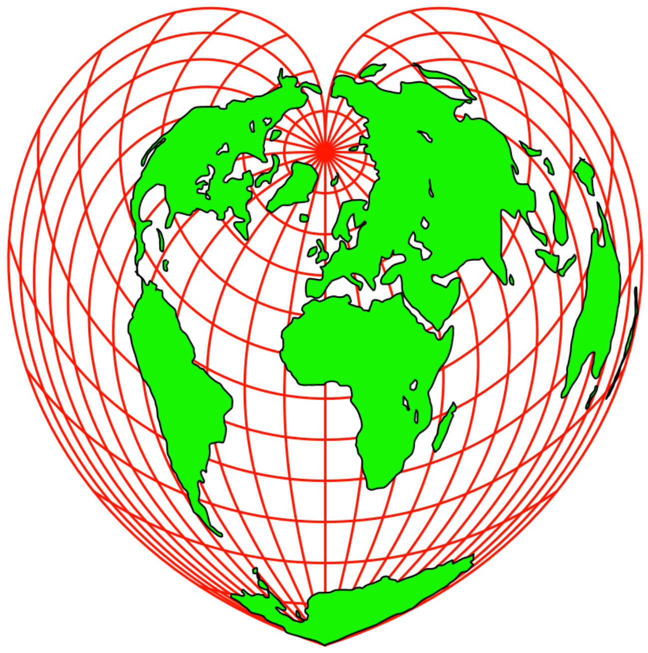
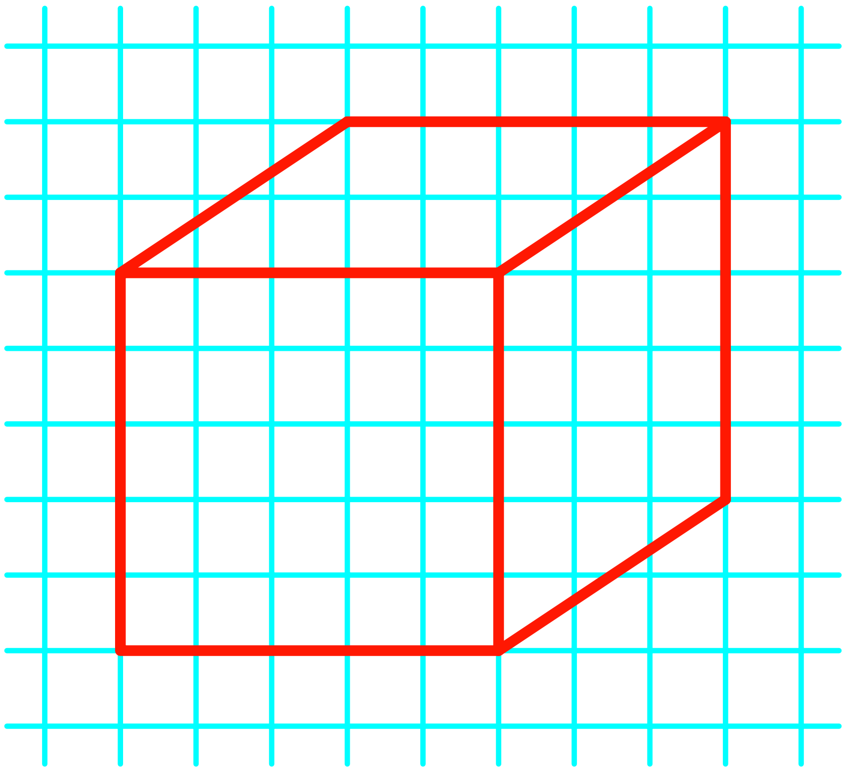
Hans Walser

Maßstab 1:1



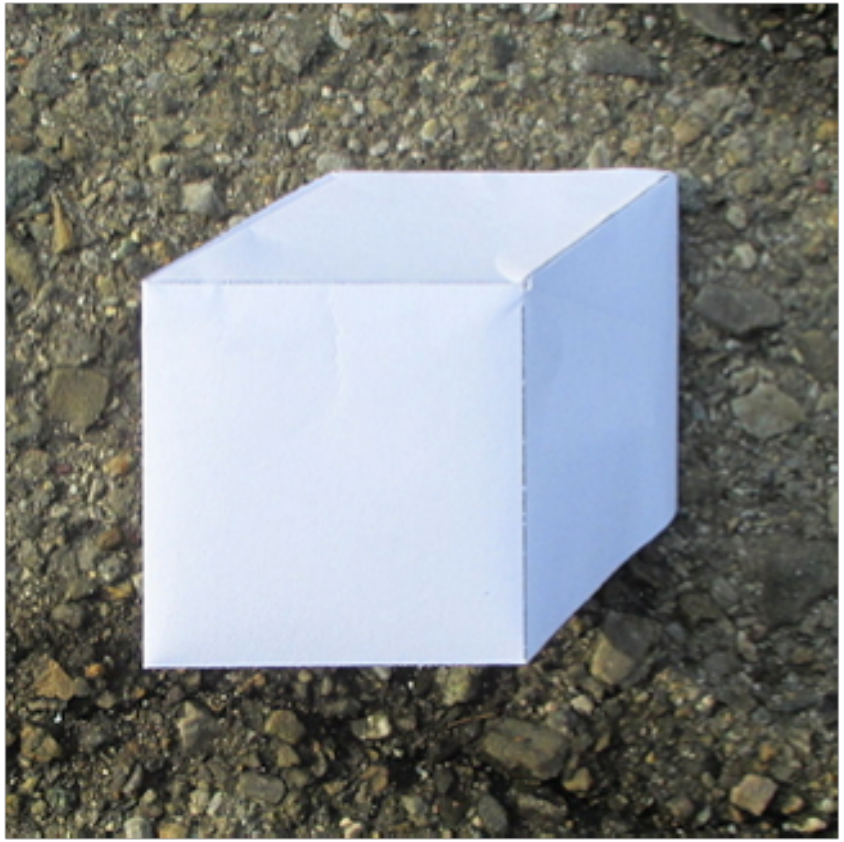
www.walser-h-m.ch/hans

Was sehen wir?



Was stellt es dar?
Was bedeutet es?

Was sehen wir?

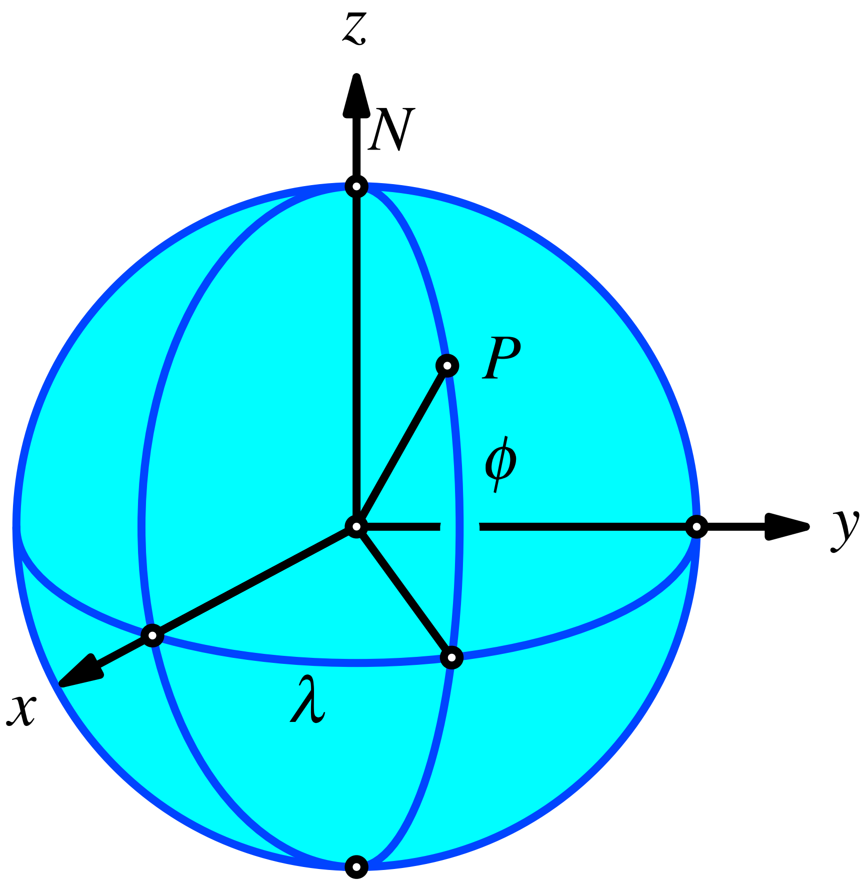


Was stellt es dar?
Was bedeutet es?

Was sehen wir?

Was stellt es dar?
Was bedeutet es?

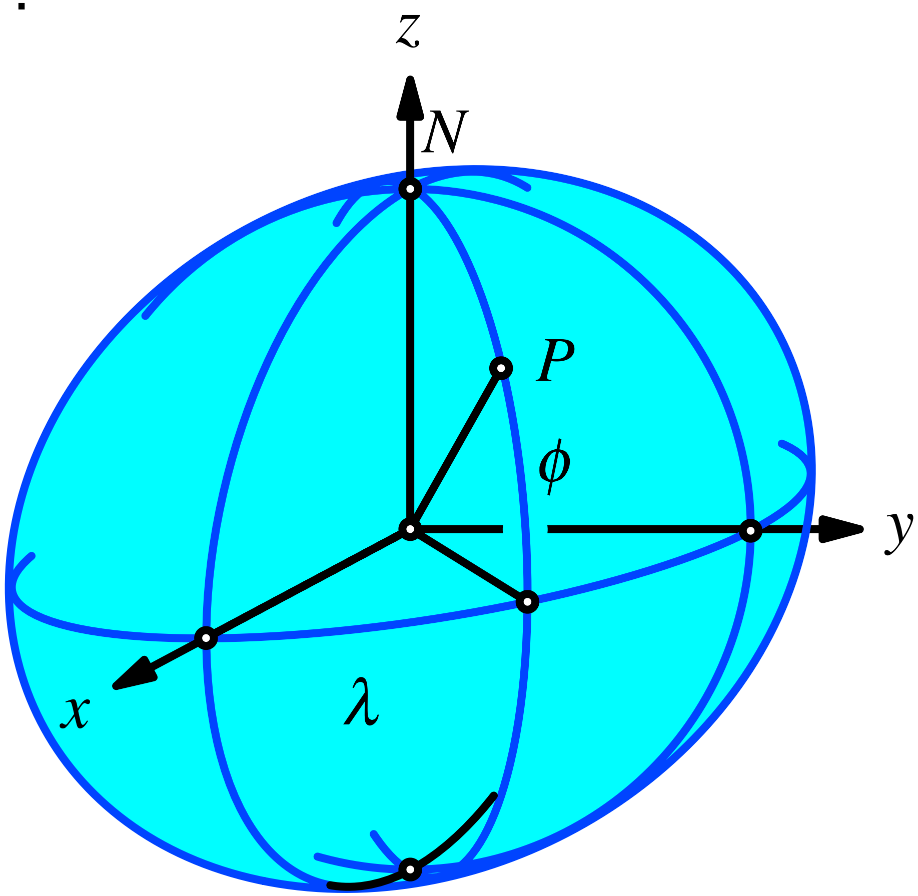
Was sehen wir?



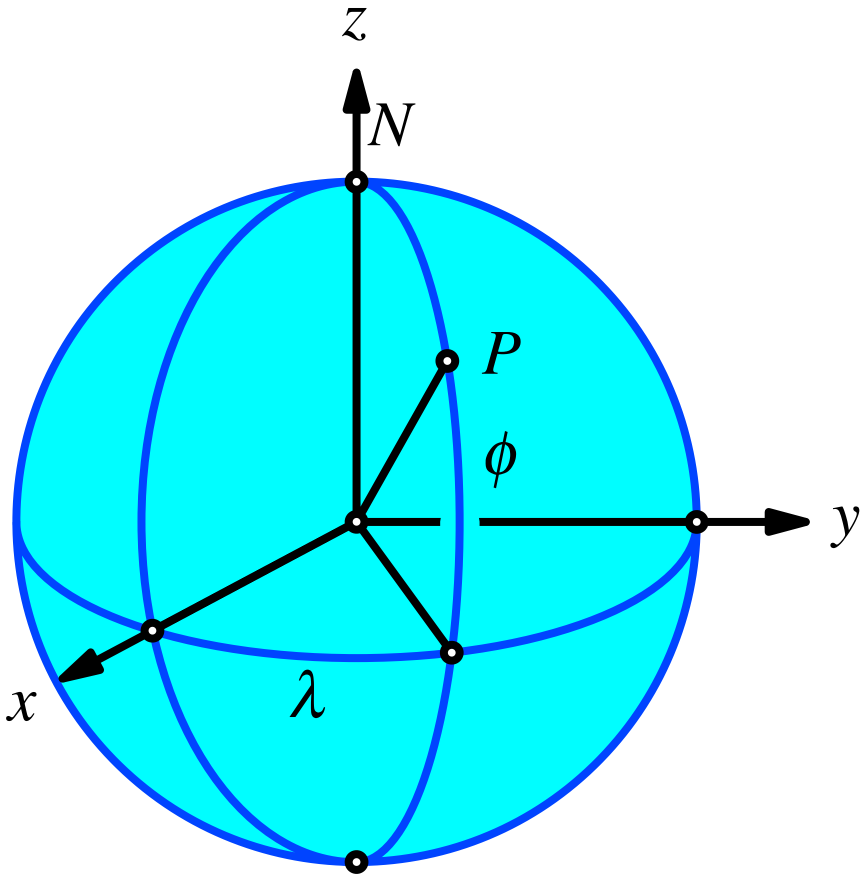
Was stellt es dar?
Was bedeutet es?

Was sehen wir?

Schrägbild

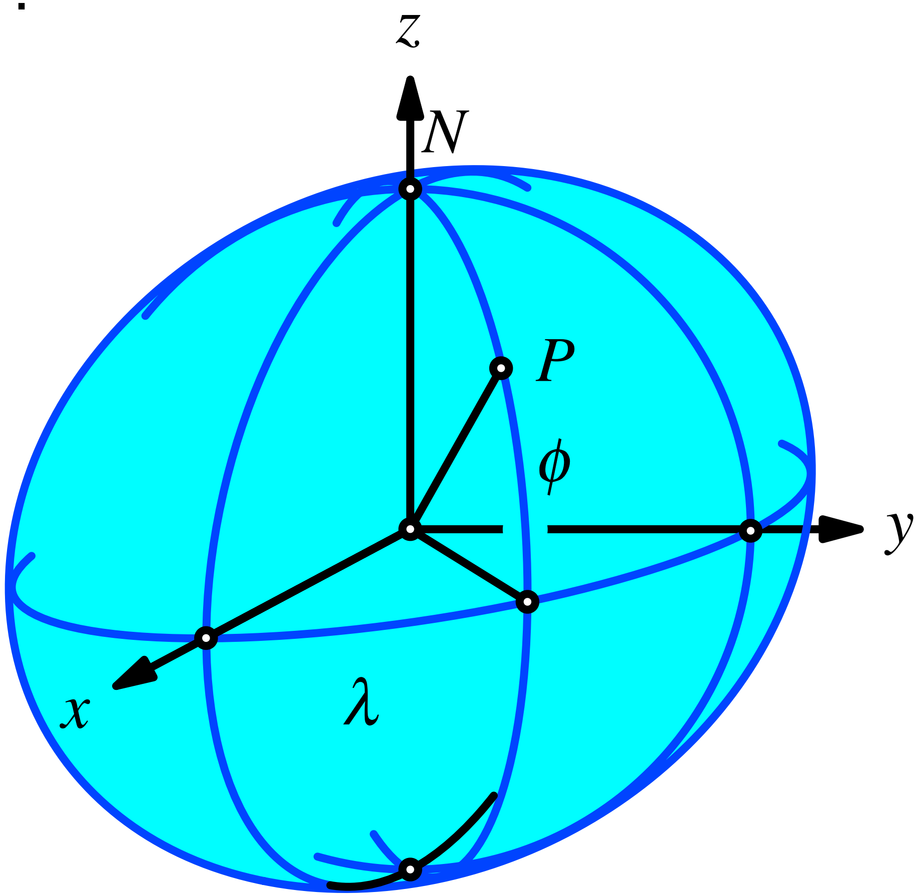


Was sehen wir?



Was sehen wir?

Schrägbild

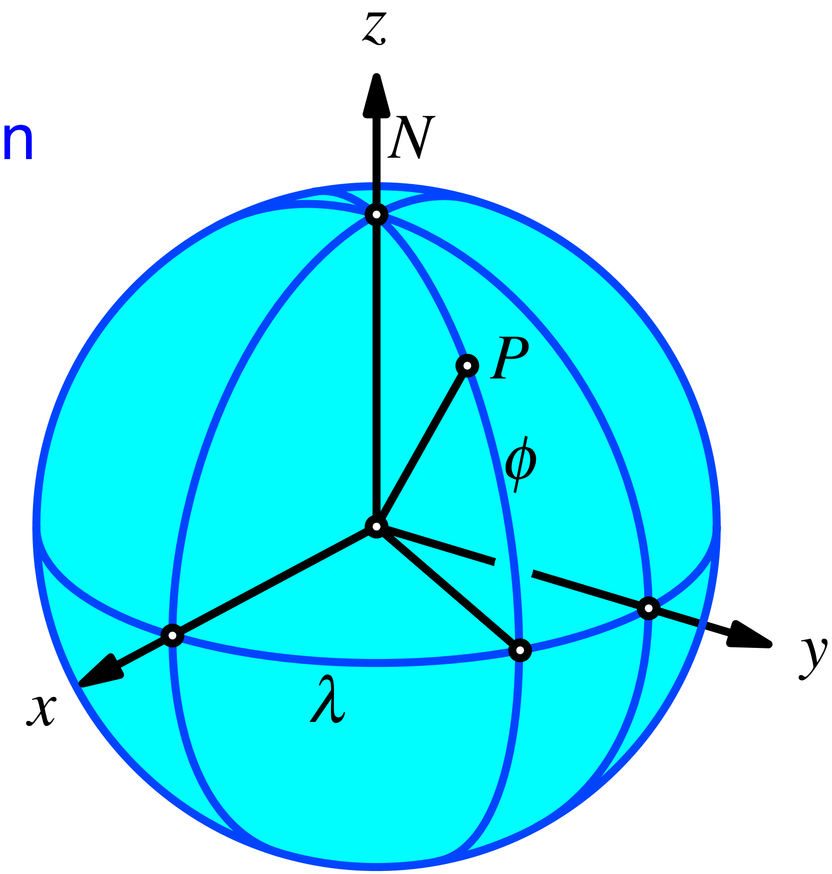


Was sehen wir?

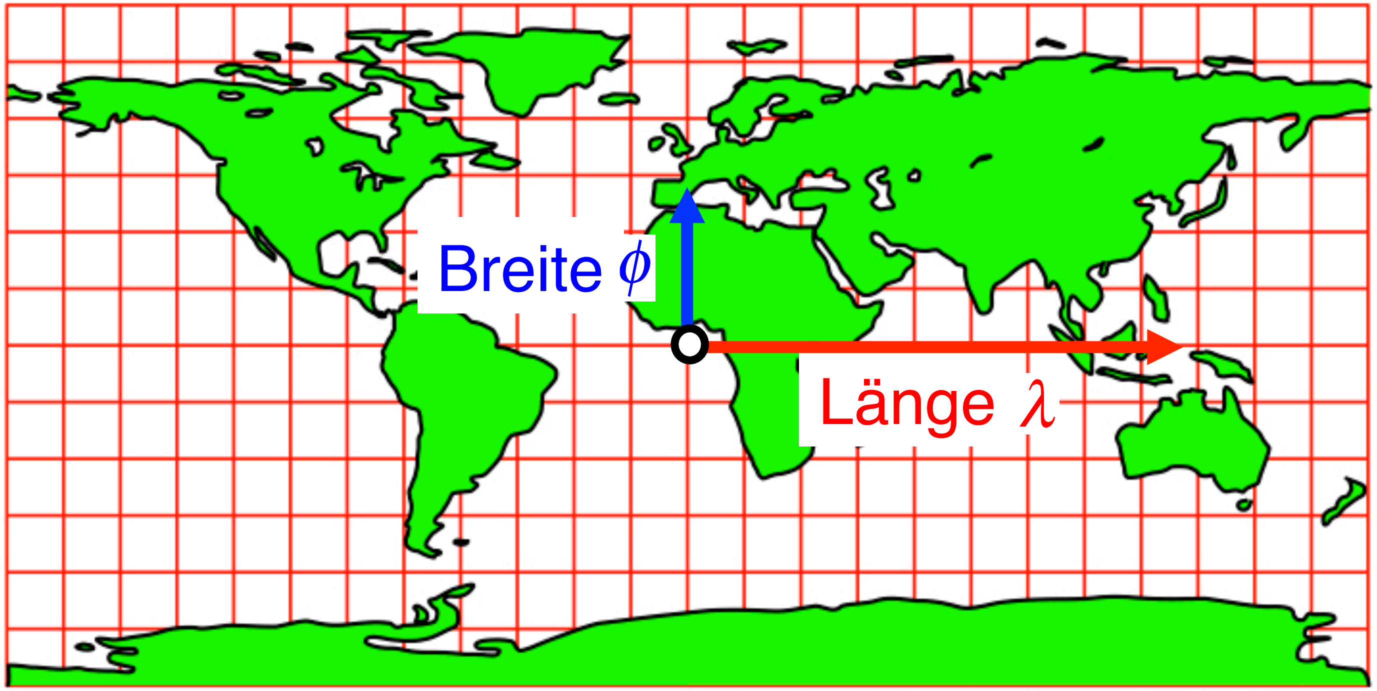
Schrägbild

Was sehen wir?

Normalprojektion

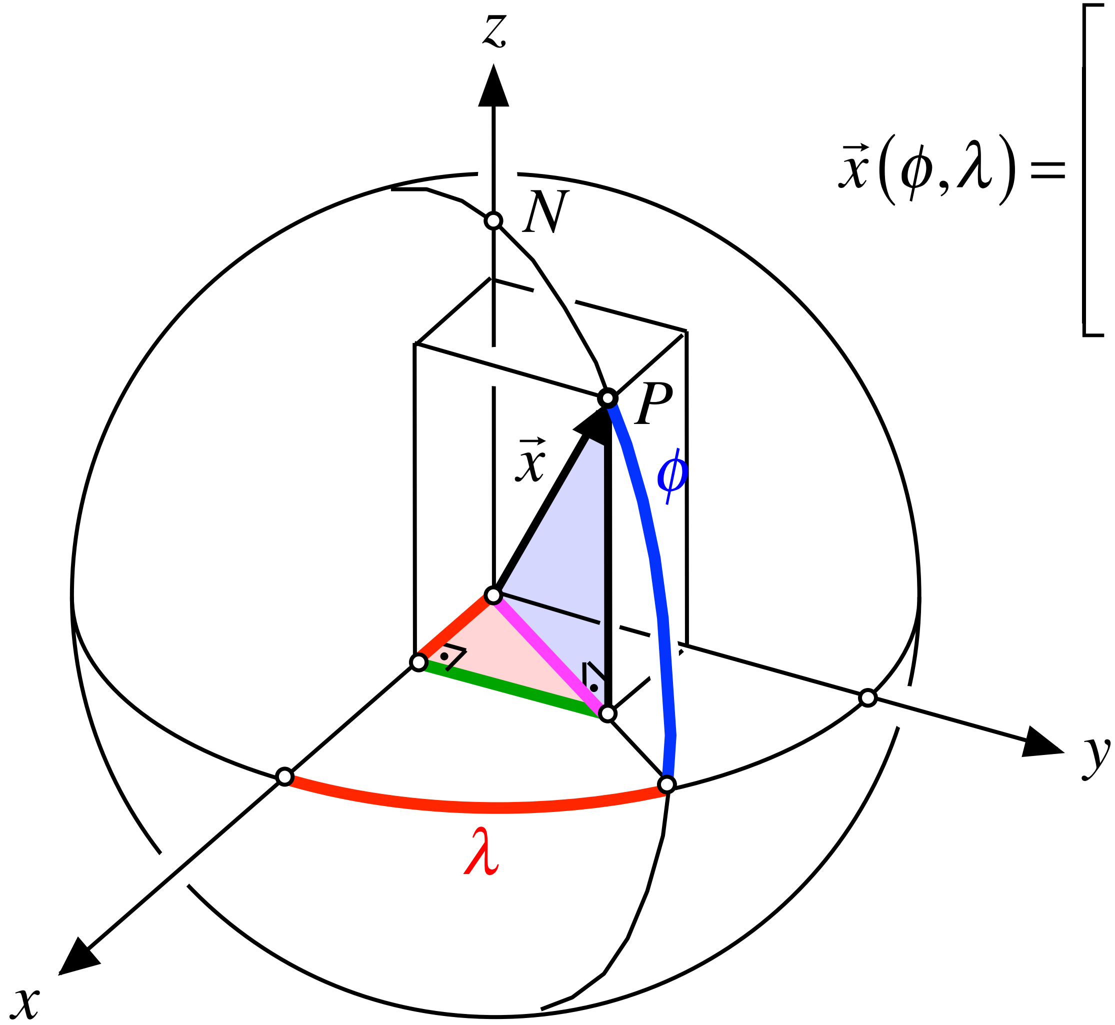


Längen oder Winkel?



(Quadratische) Plattkarte

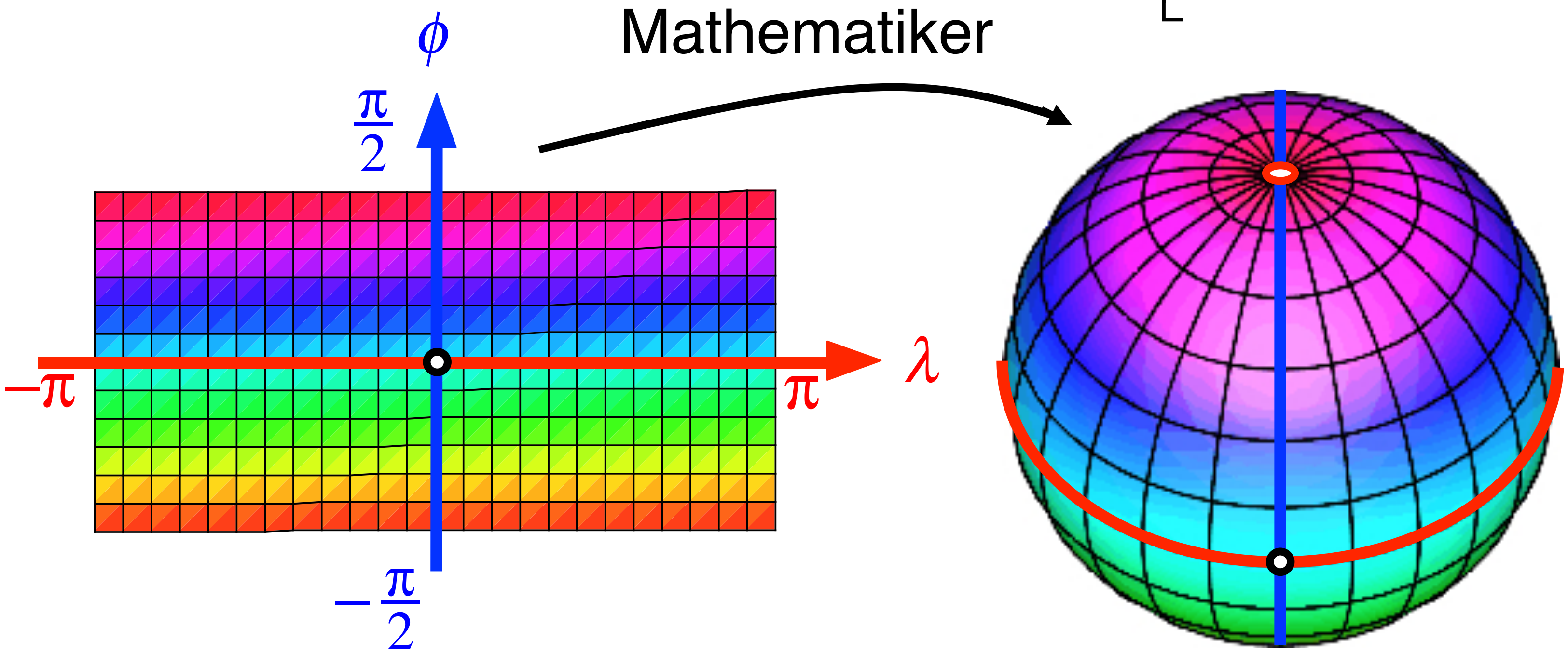
Längen oder Winkel?



$$\vec{x}(\phi,\lambda)=\begin{bmatrix}\cos(\phi)\cos(\lambda)\\ \cos(\phi)\sin(\lambda)\\ \sin(\phi)\end{bmatrix}$$

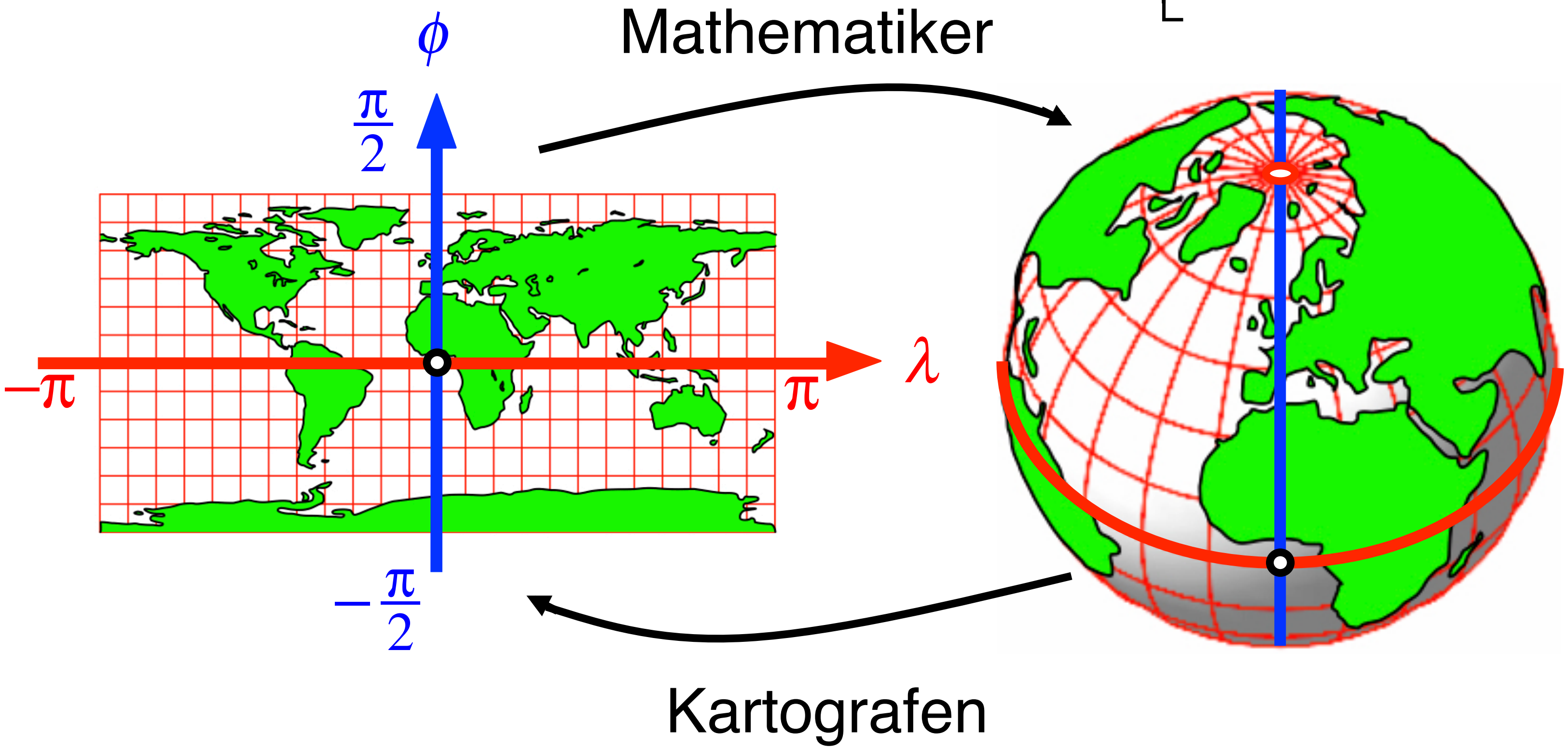
$$\phi \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right], \lambda \in [-\pi, \pi]$$

$$\vec{x}(\phi,\lambda) = \begin{bmatrix} \cos(\phi)\cos(\lambda) \\ \cos(\phi)\sin(\lambda) \\ \sin(\phi) \end{bmatrix}$$



$$\phi \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right], \lambda \in [-\pi, \pi]$$

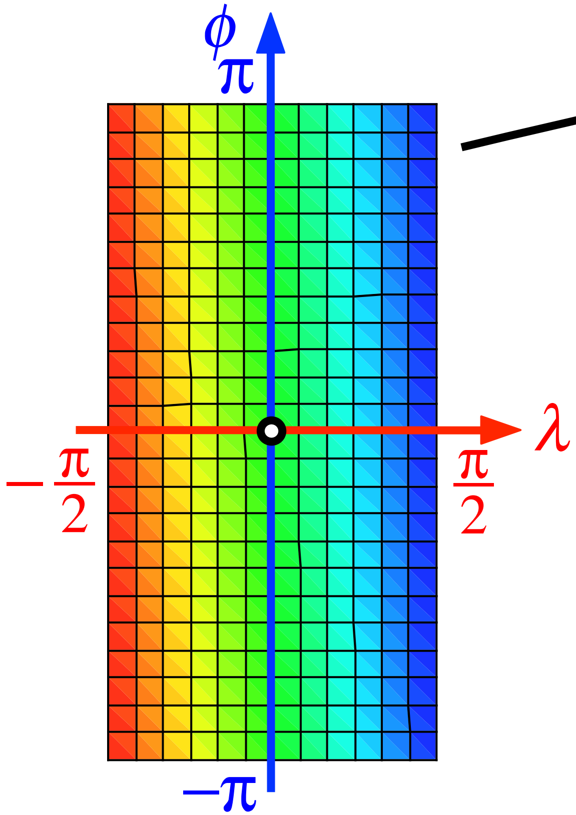
$$\vec{x}(\phi, \lambda) = \begin{bmatrix} \cos(\phi)\cos(\lambda) \\ \cos(\phi)\sin(\lambda) \\ \sin(\phi) \end{bmatrix}$$



Idee eines Schülers:
Plattkarte Hochformat

$\phi \in [-\pi, \pi], \lambda \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

$$\vec{x}(\phi,\lambda) = \begin{bmatrix} \cos(\phi)\cos(\lambda) \\ \cos(\phi)\sin(\lambda) \\ \sin(\phi) \end{bmatrix}$$

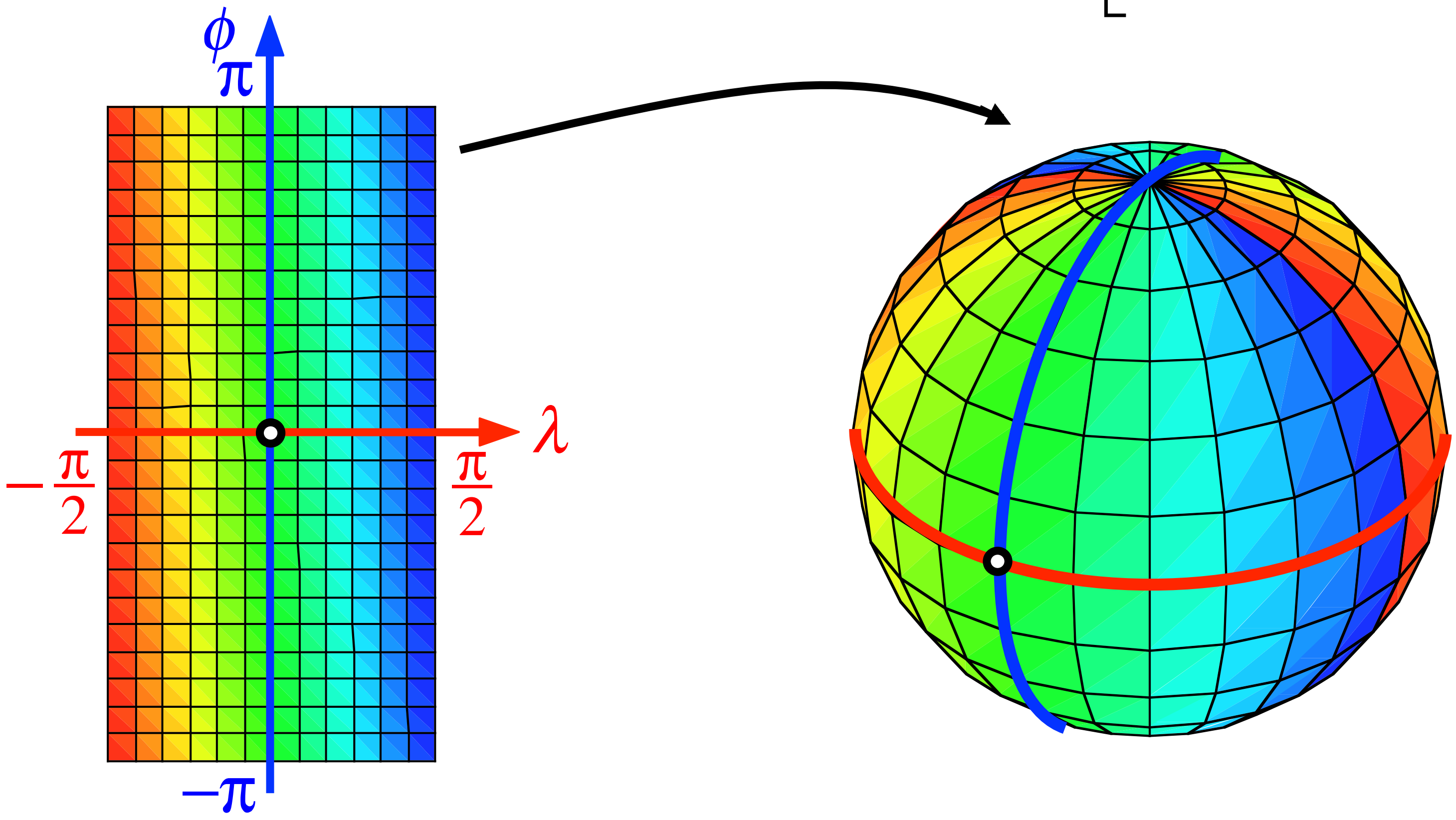


?

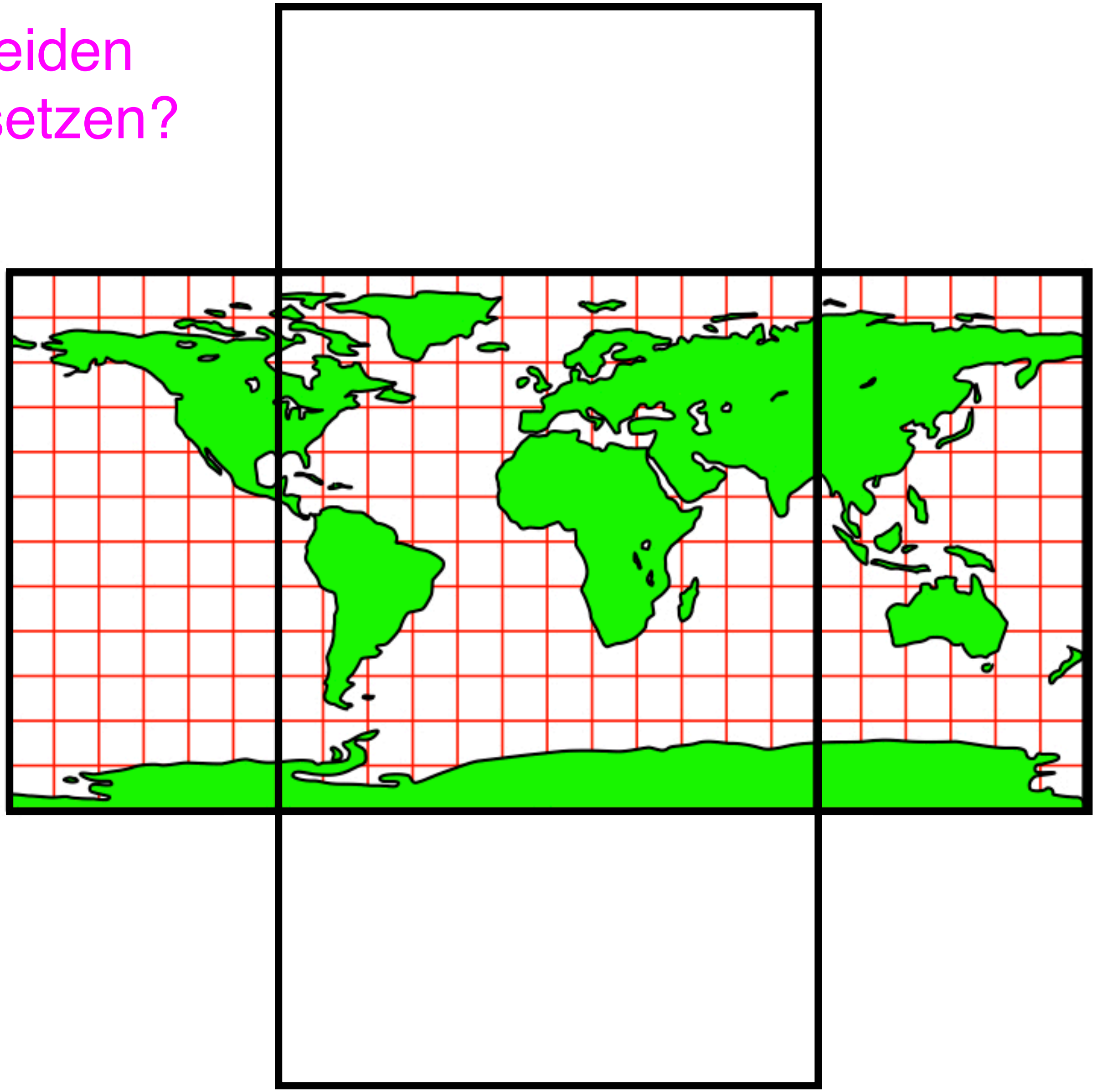
Idee eines Schülers:
Plattkarte Hochformat

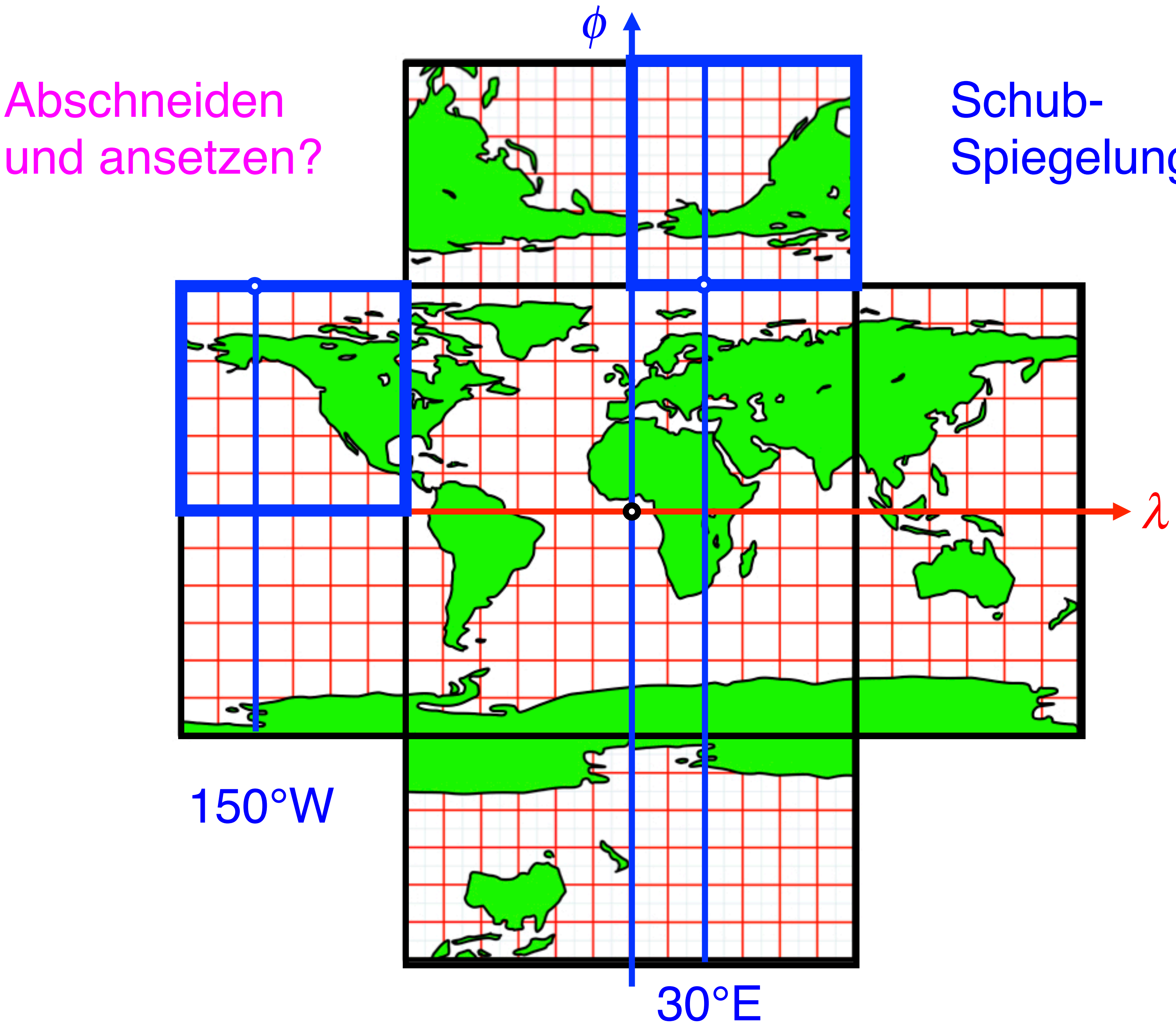
$$\phi \in [-\pi, \pi], \lambda \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$$

$$\vec{x}(\phi, \lambda) = \begin{bmatrix} \cos(\phi)\cos(\lambda) \\ \cos(\phi)\sin(\lambda) \\ \sin(\phi) \end{bmatrix}$$



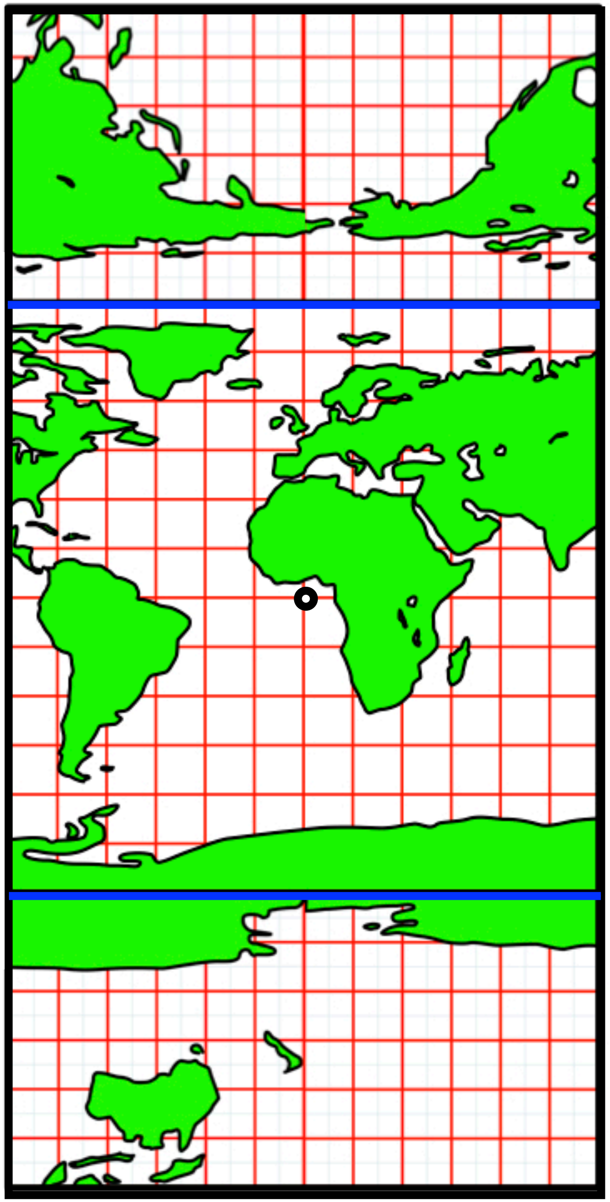
Abschneiden
und ansetzen?



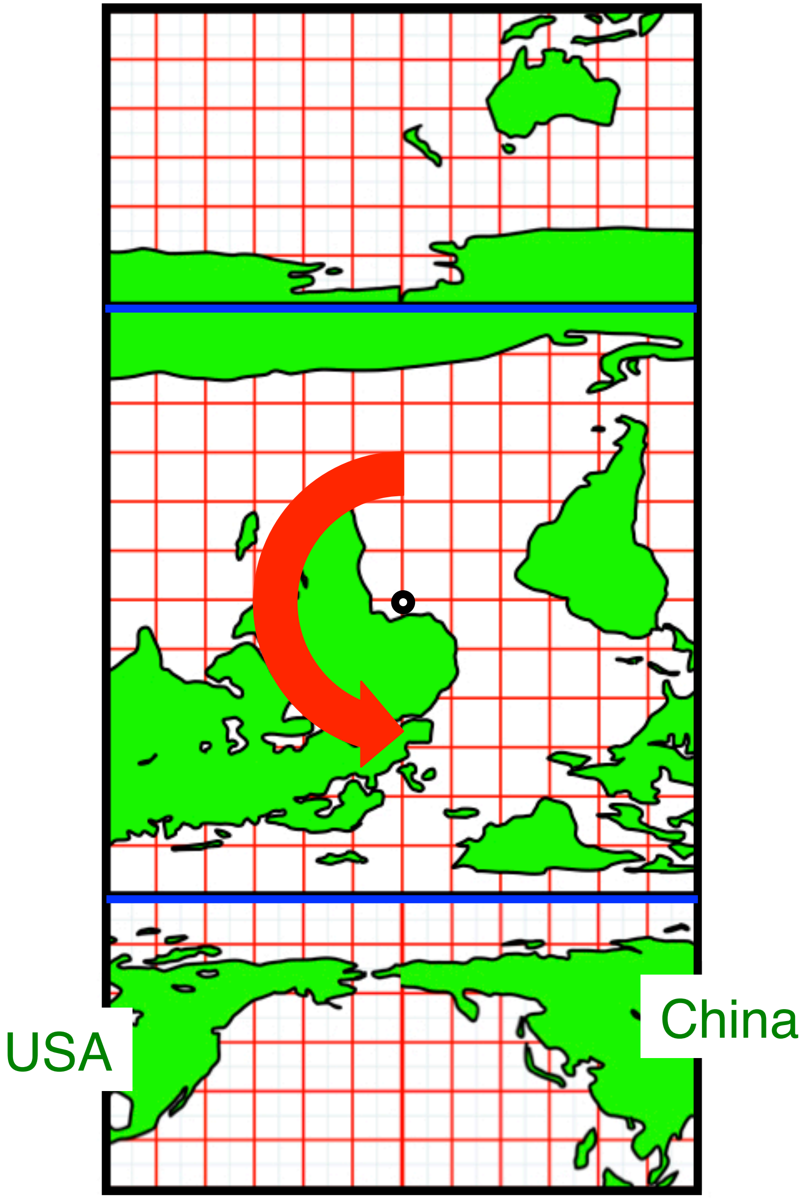


Abschneiden
und ansetzen?
ϕ
Schub-
Spiegelung
λ
150°W
30°E

Die Welt im
Hochformat



Die Welt im
Hochformat



Immer der Nase nach

... so geh hübsch sittsam und lauf nicht vom Wege ab!

Keine Seitenkrümmung

Geodätische Linie $\ddot{x}^m + \Gamma^m_{kl}\dot{x}^k\dot{x}^l = 0$

Durchgehendes Plastikband

Großkreis (Orthodrome)

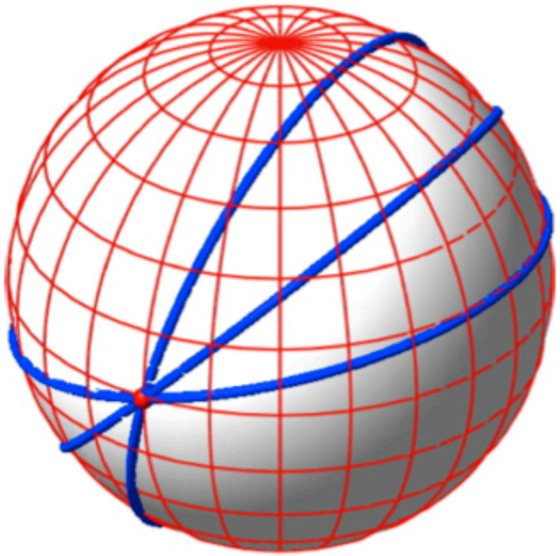
Immer der Nase nach

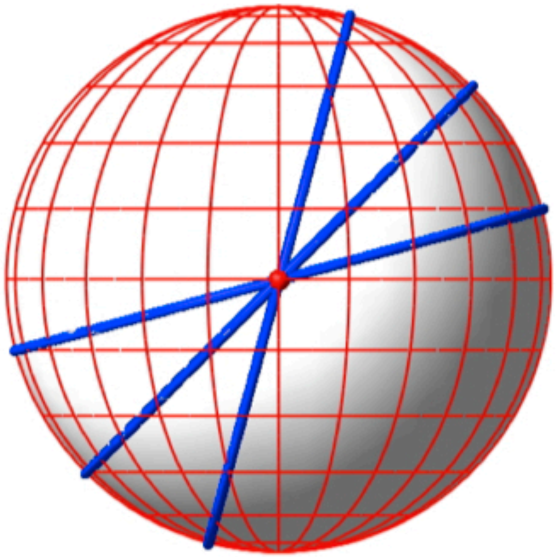
La línia recta és creació de l'home; la línia corba, de Déu.

ANTONI GAUDÍ

Immer der Nase nach

Großkreise statt Geraden

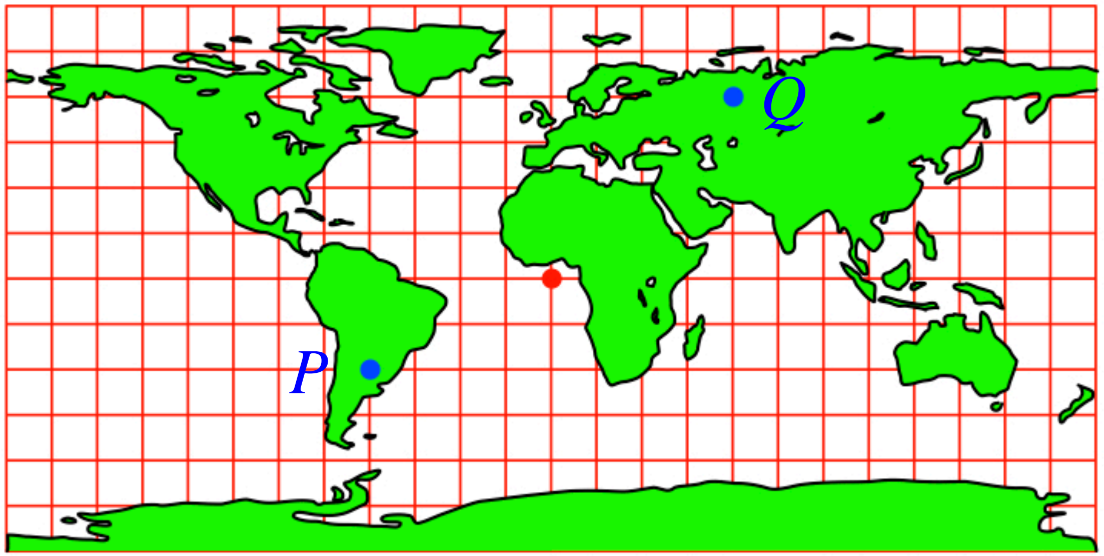


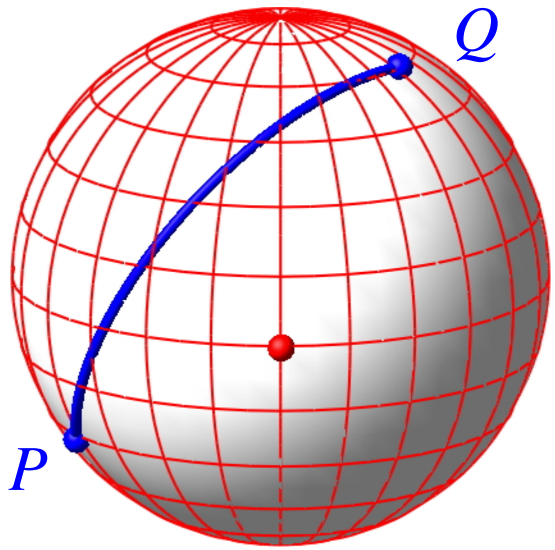


Blick von der Seite

Immer der Nase nach

Großkreisbogen von P nach Q?

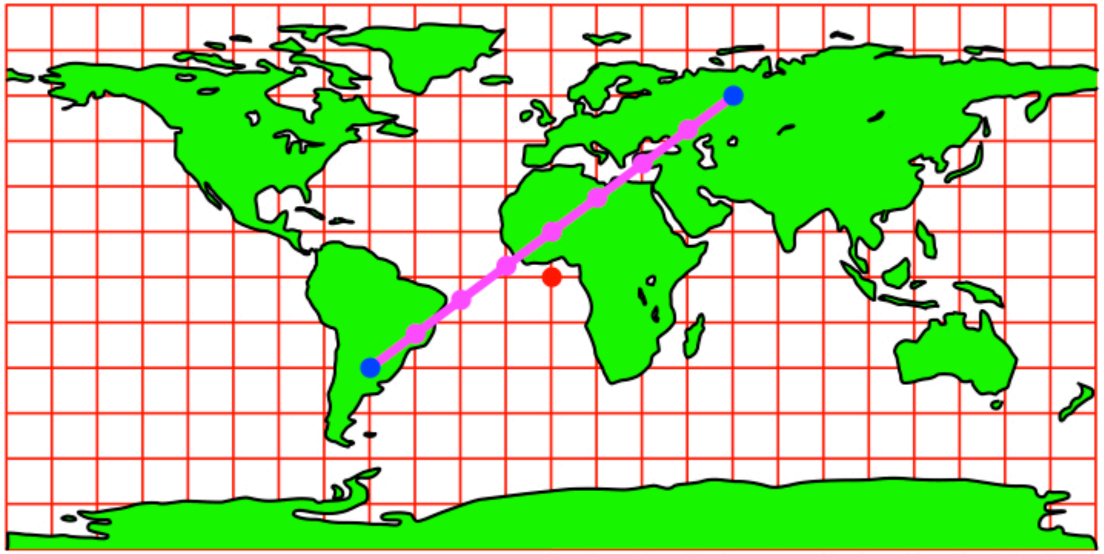


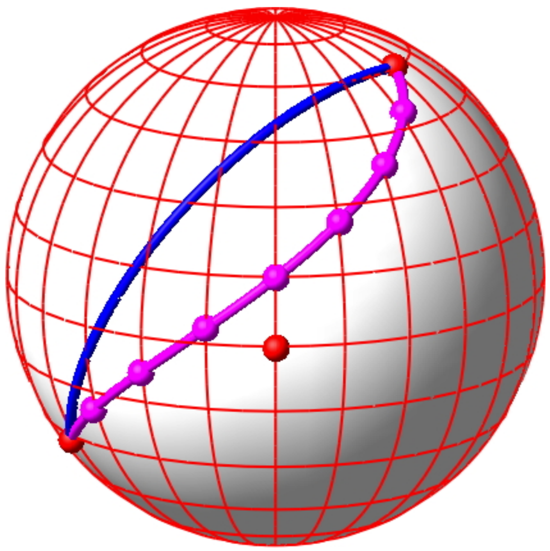


Immer der Nase nach

Großkreisbogen von P nach Q

Eine falsche Idee

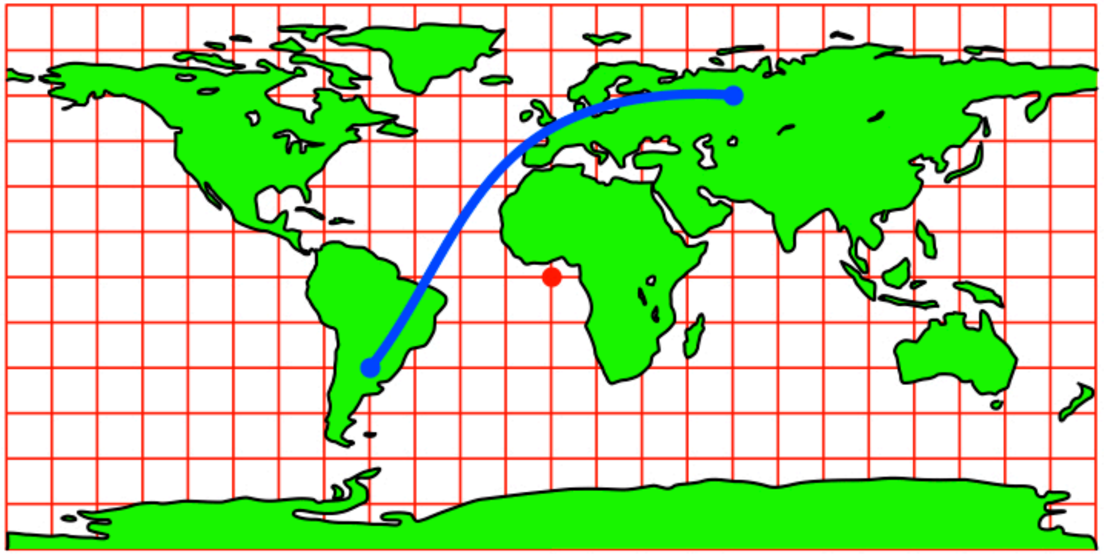


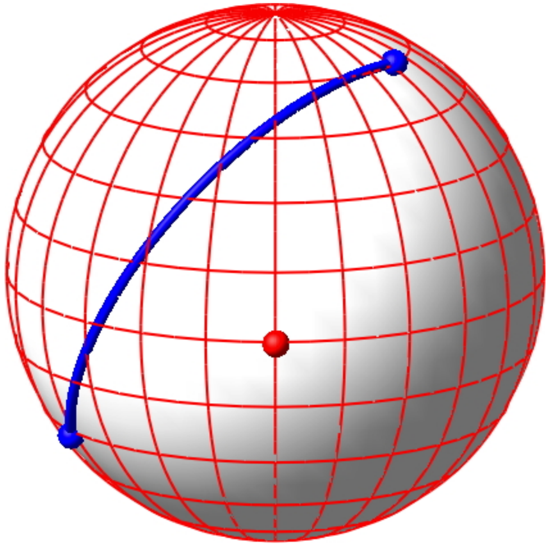


Immer der Nase nach

Großkreisbogen von P nach Q

Die richtige Kurve

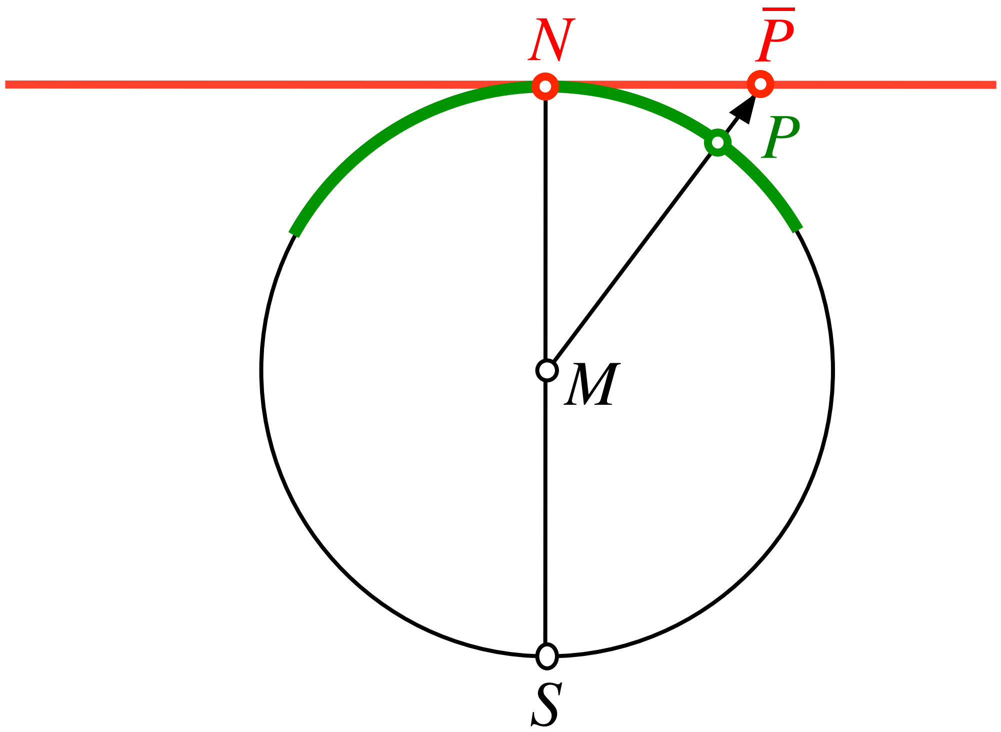


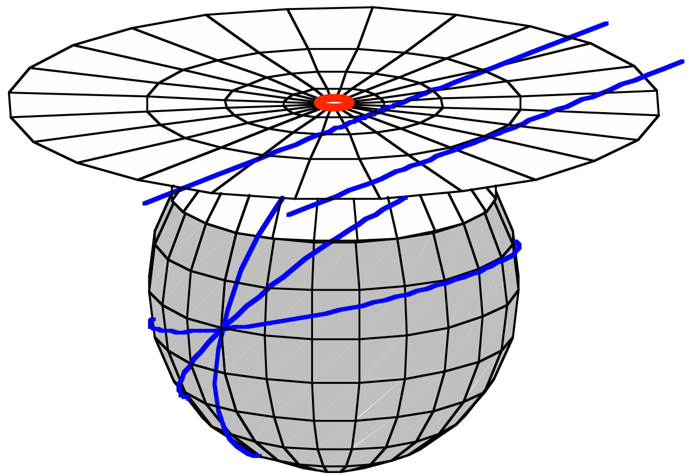


Großkreis als Gerade auf der Karte?

Großkreis als Gerade auf der Karte?

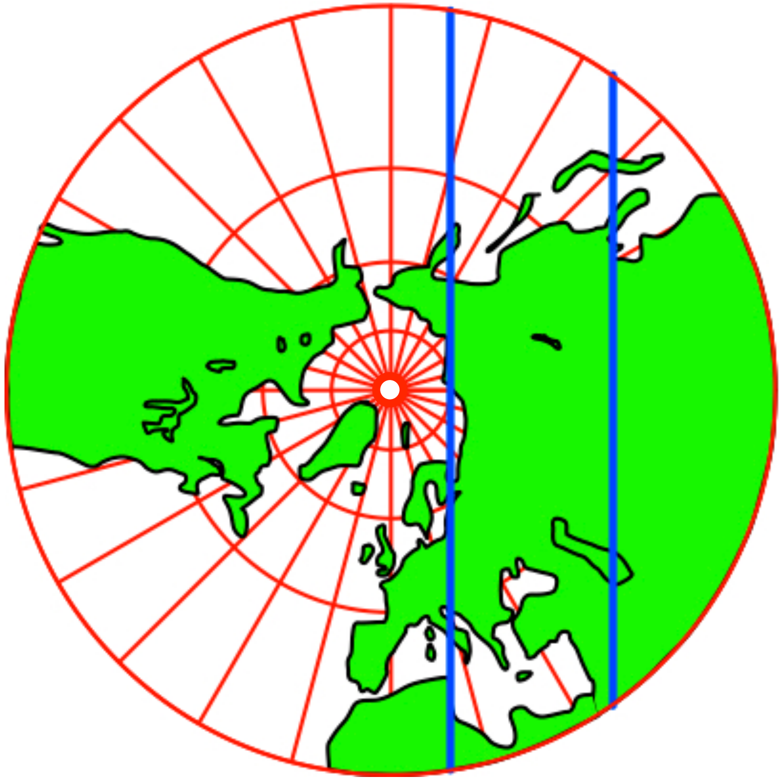
Gnomonische Projektion
Zentralprojektion von Kugelmitte aus

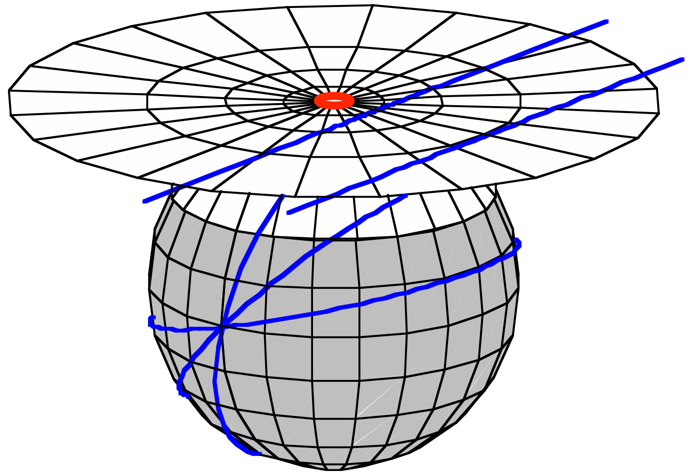




Großkreis als Gerade auf der Karte?

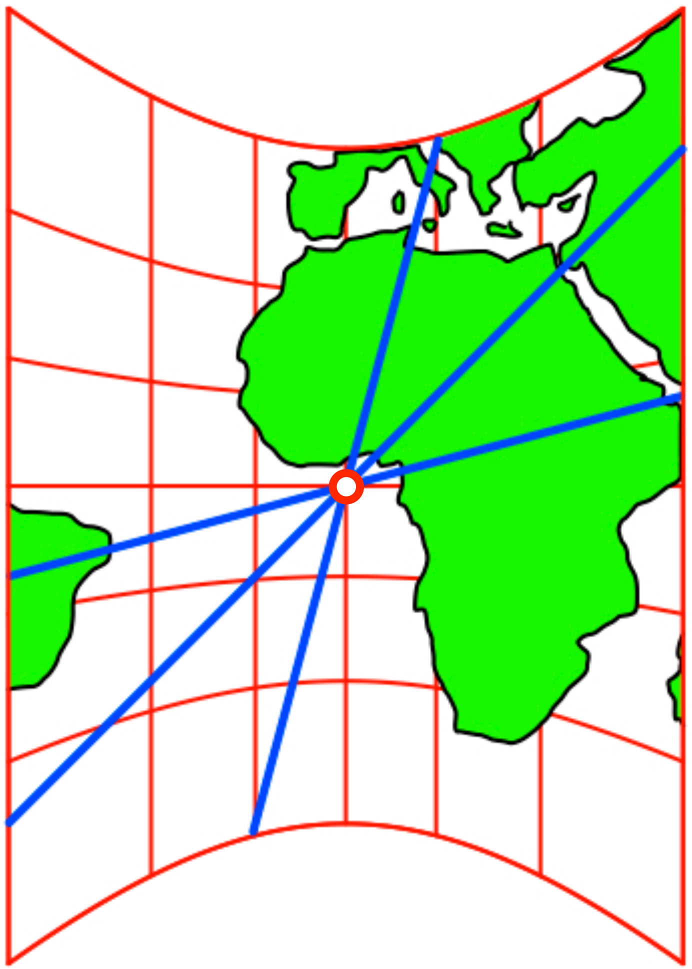
Gnomonische Projektion

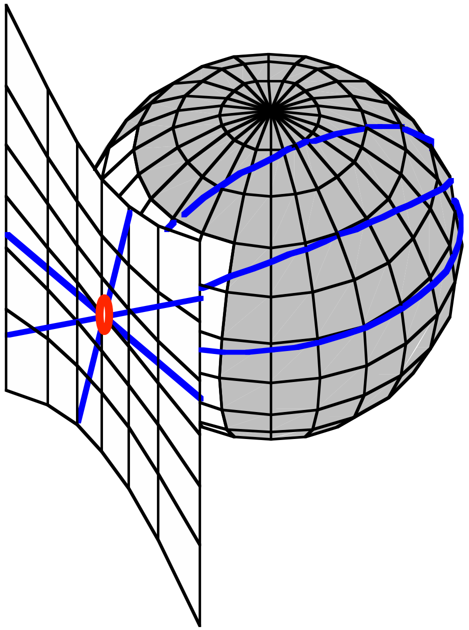




Großkreis als Gerade auf der Karte?

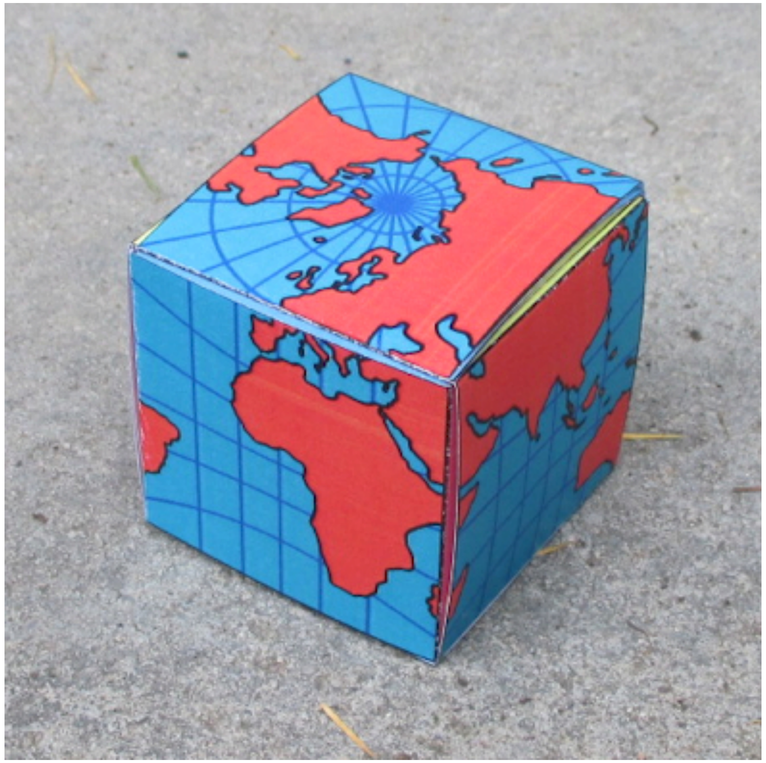
Gnomonische Projektion





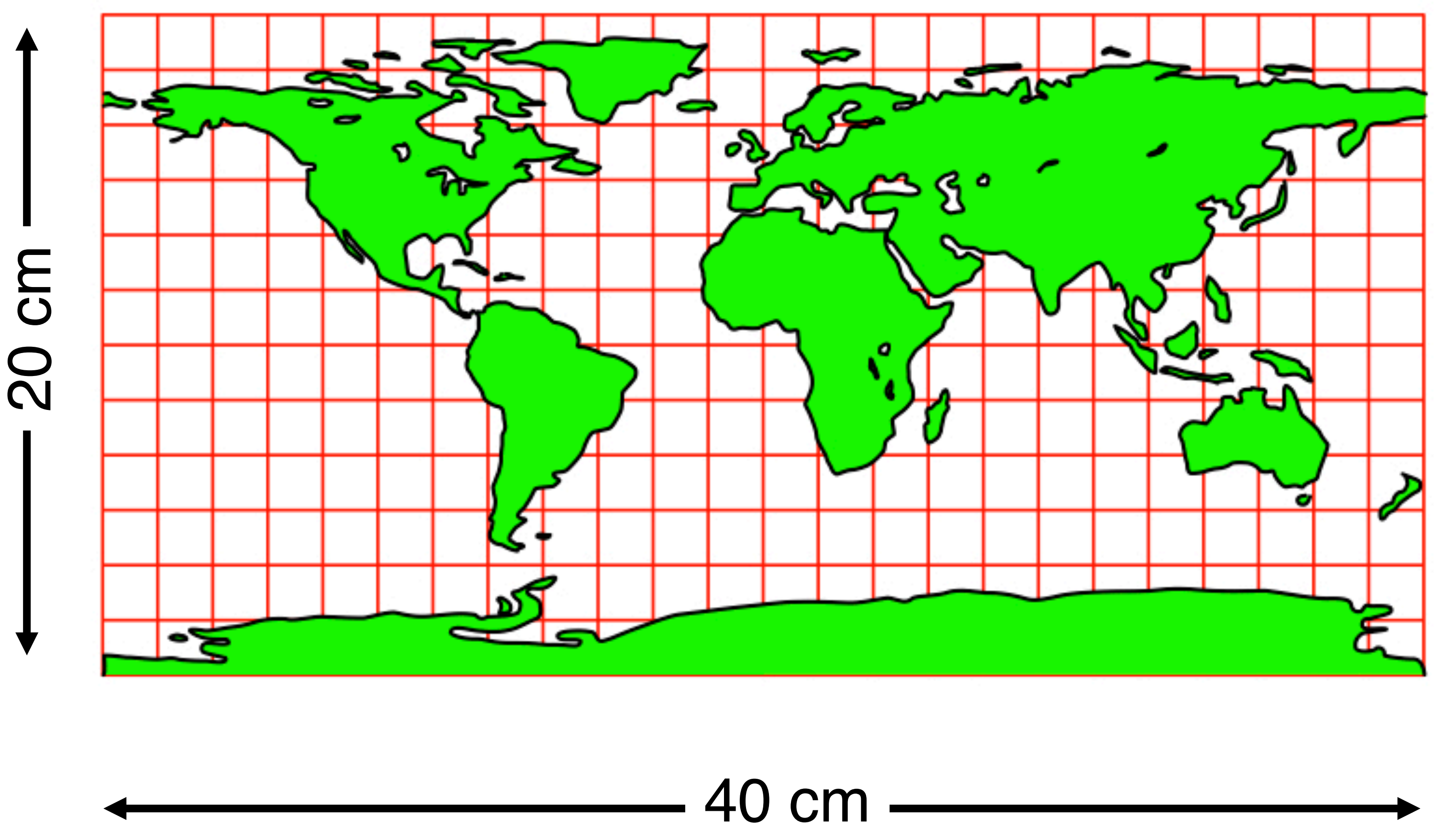
Großkreis als Gerade auf der Karte?

Gnomonische Projektion

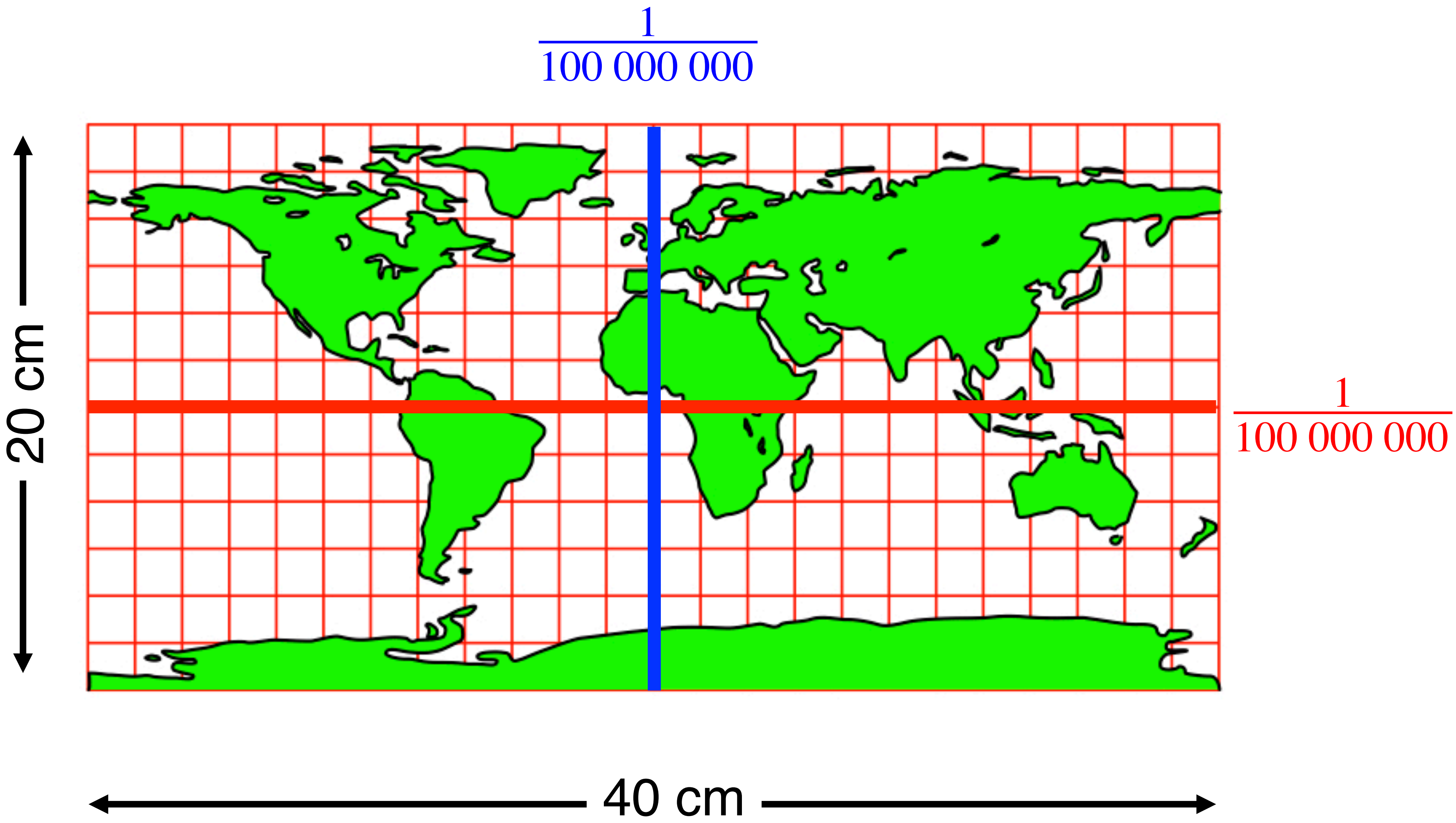


Handout Würfelwelt

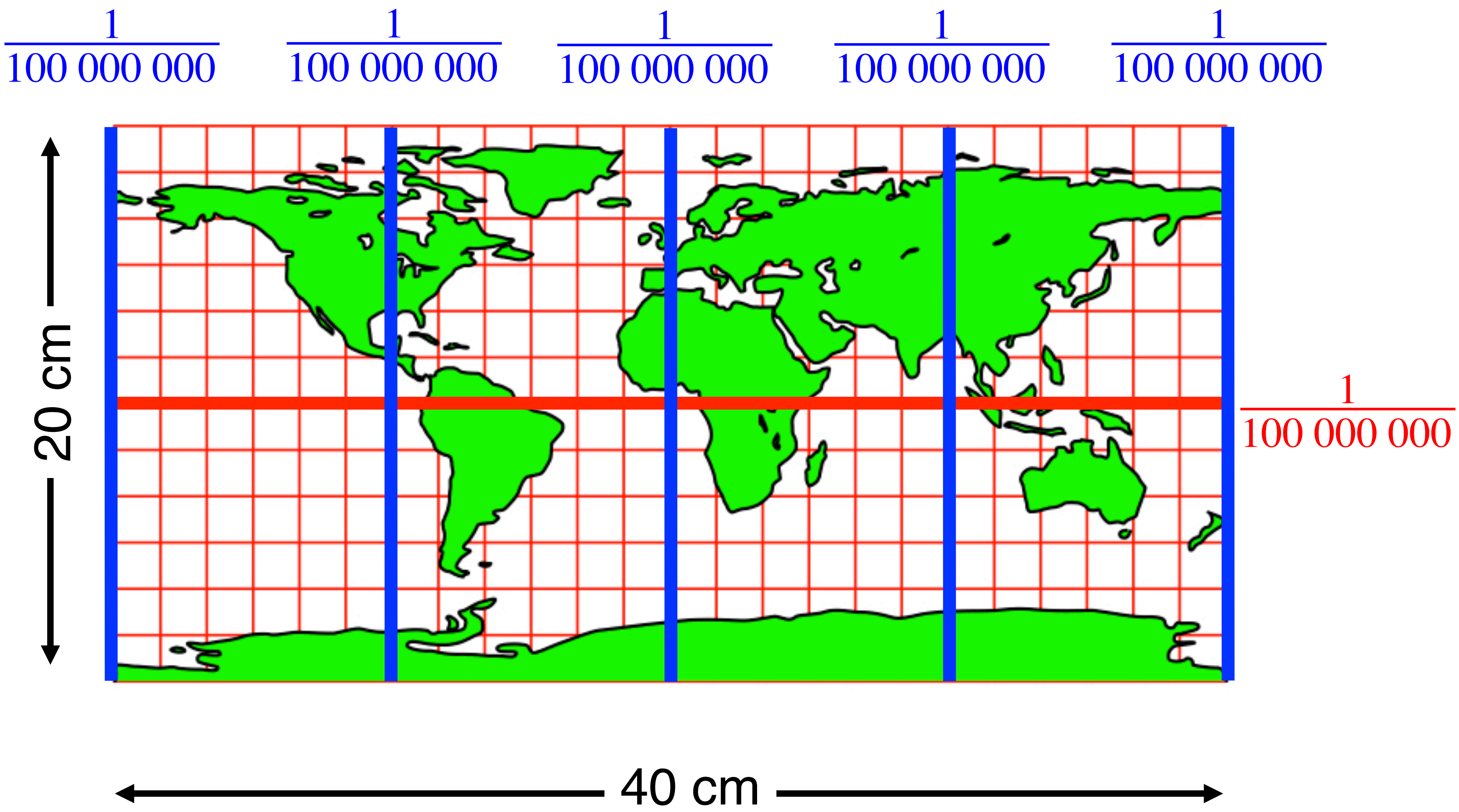
Maßstab eins zu eins?



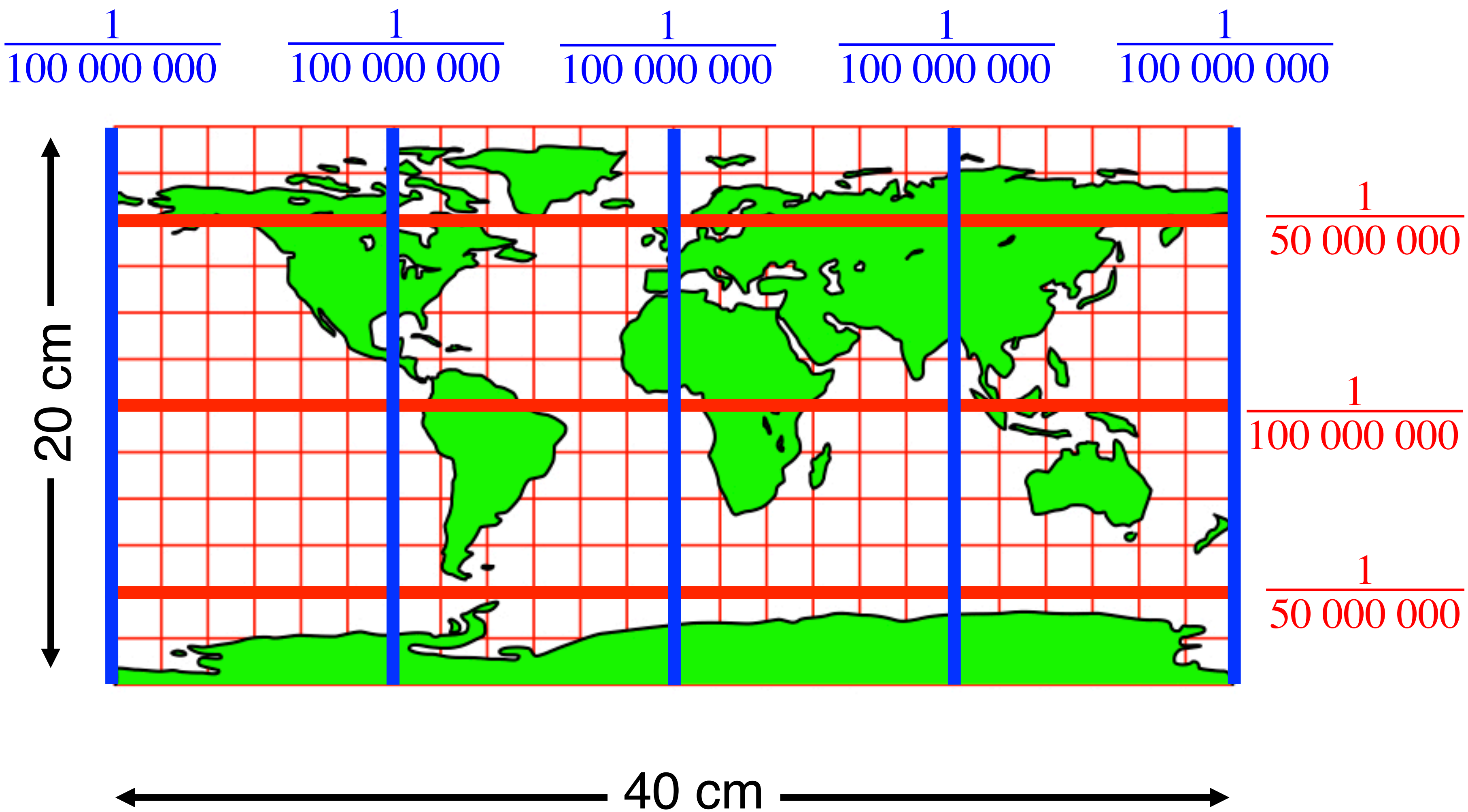
Maßstab eins zu eins?



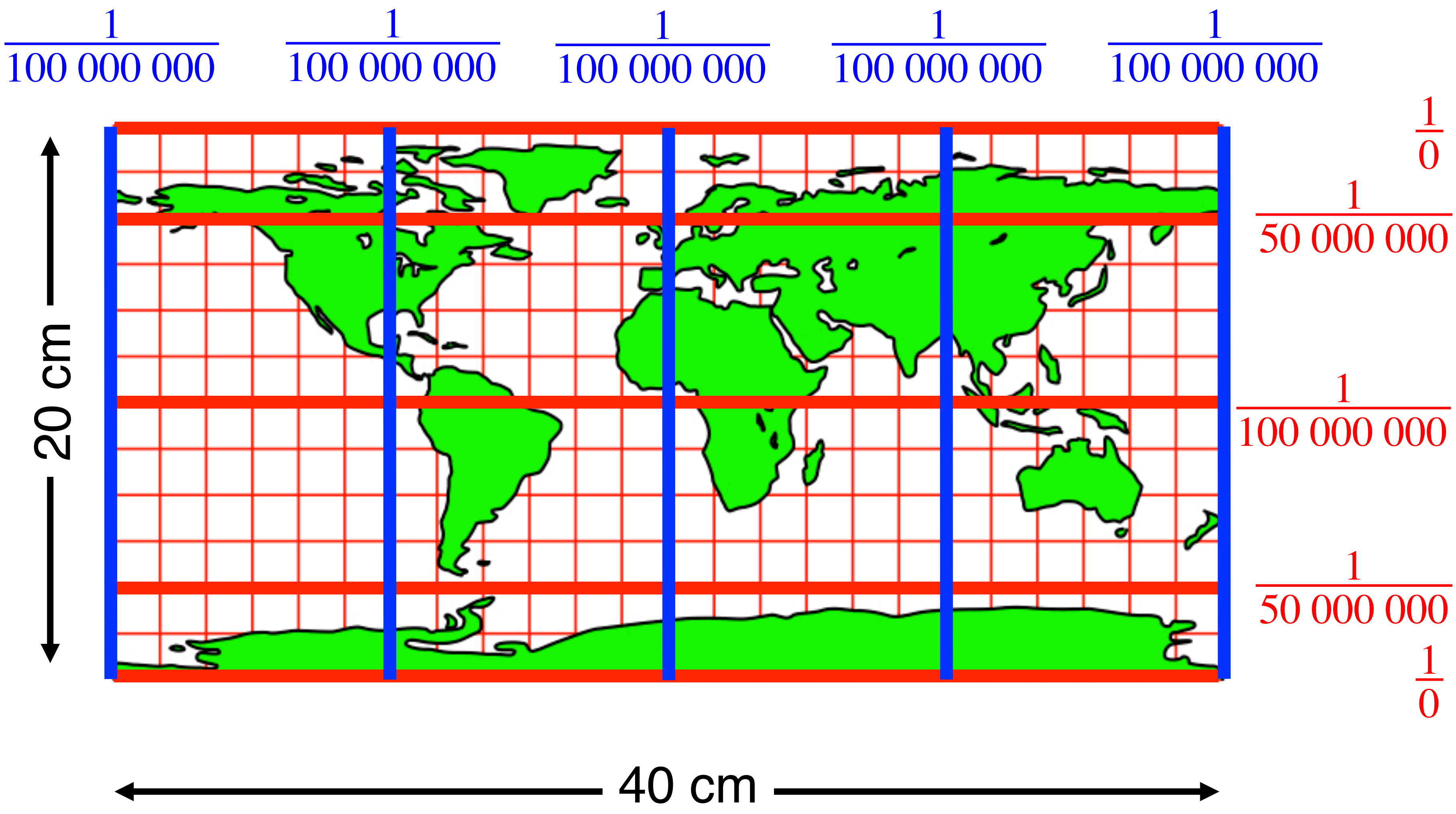
Maßstab eins zu eins?



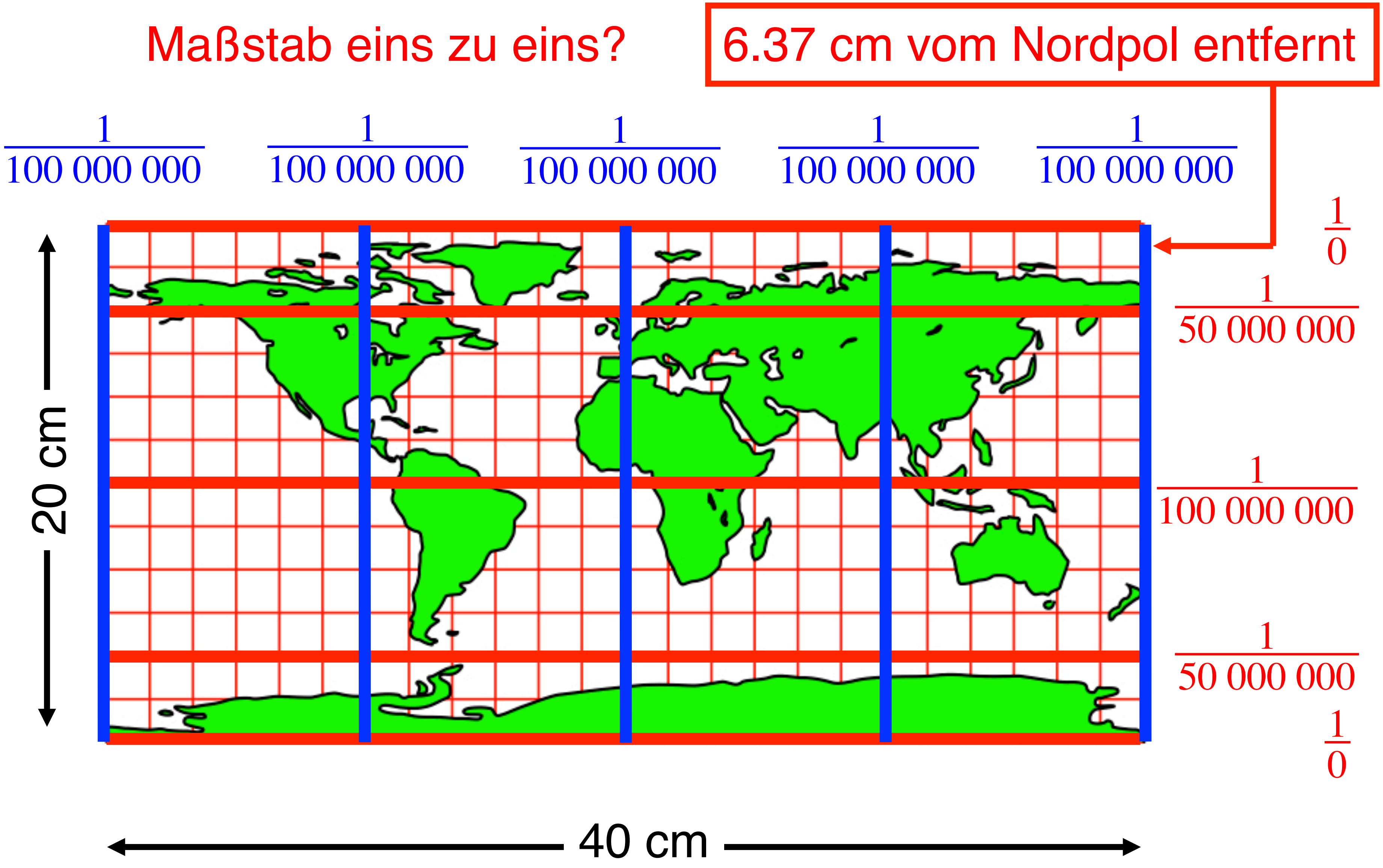
Maßstab eins zu eins?



Maßstab eins zu eins?

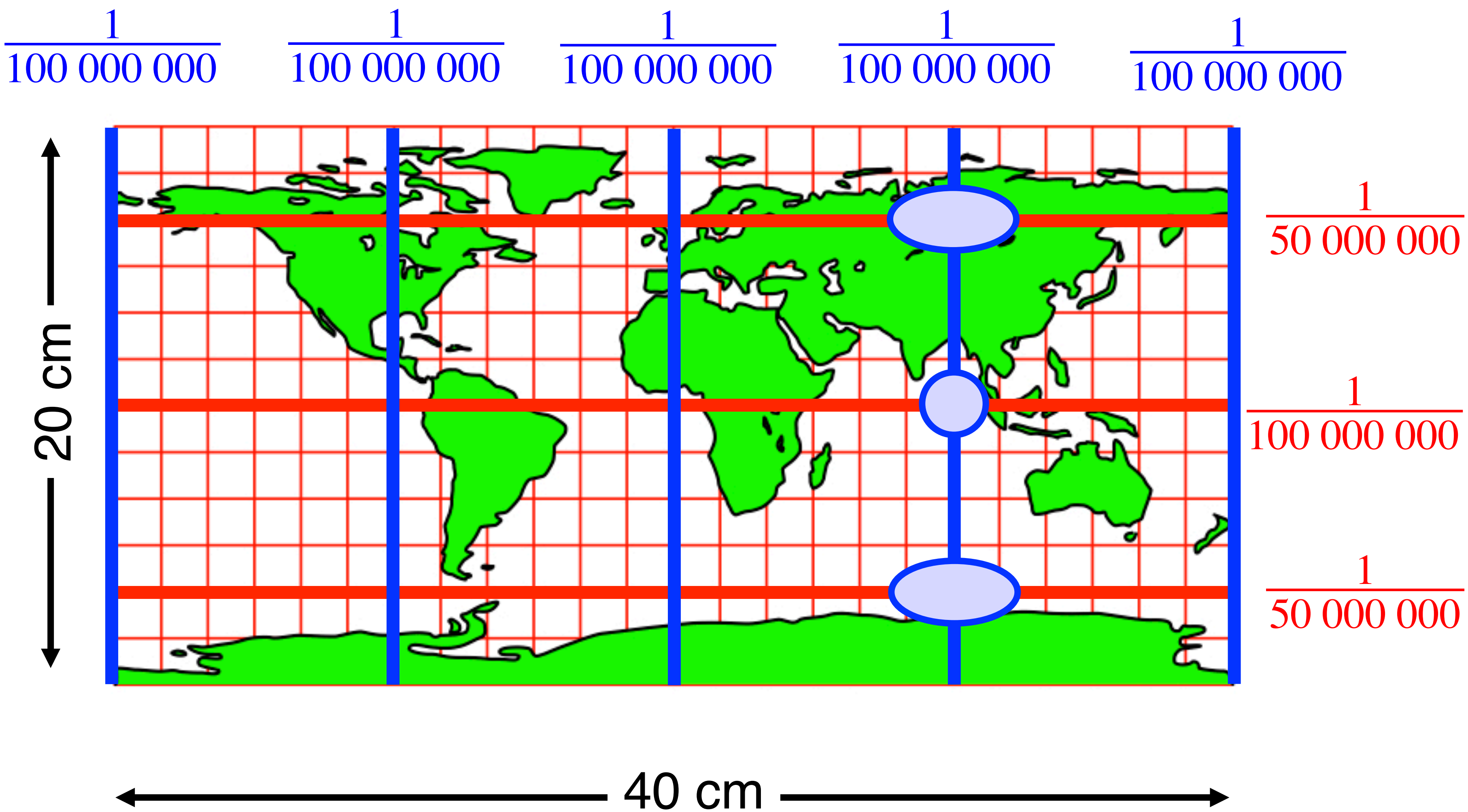


Maßstab eins zu eins?

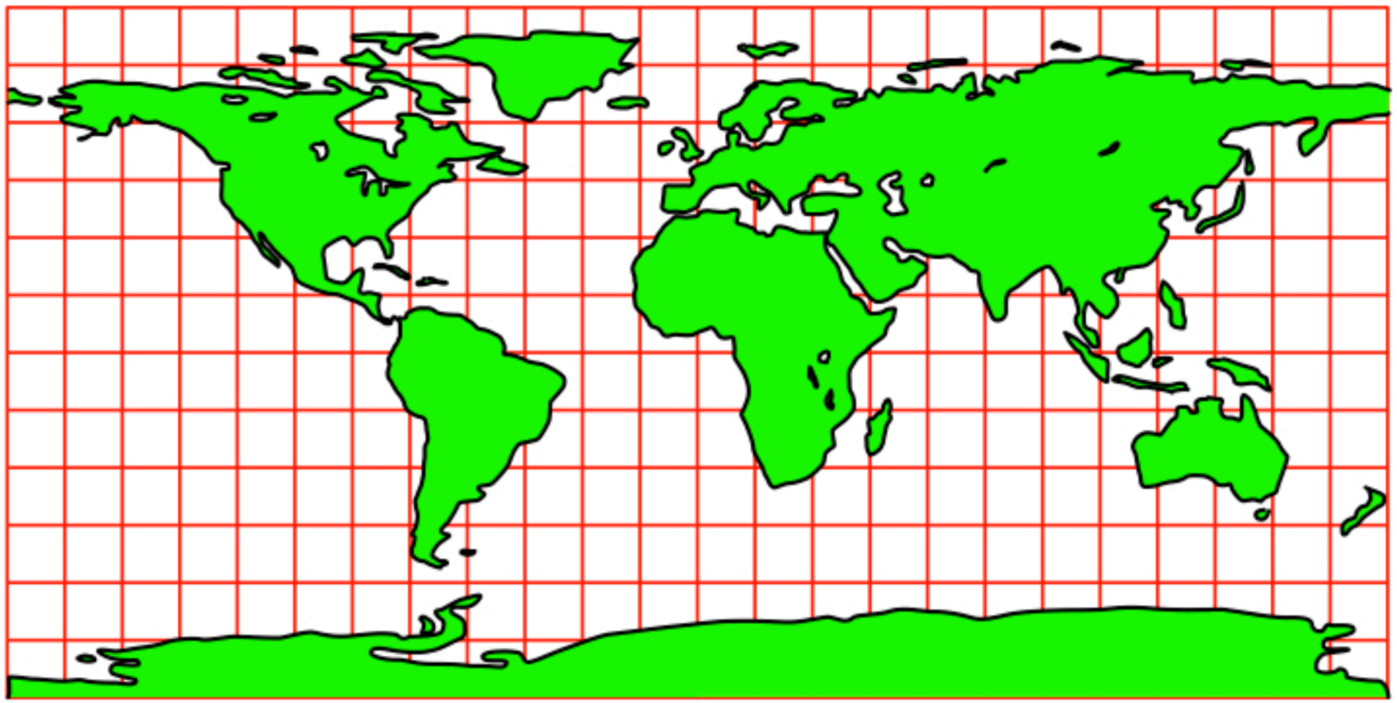


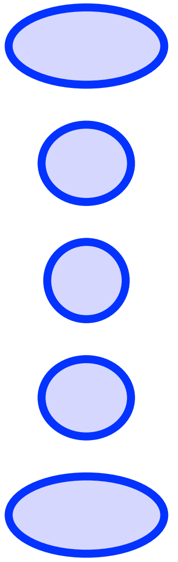
$$\phi = \pm 89.9999994° = \pm 89° \; 59' \; 59.998''$$

Verzerrungsellipse, Tissotsche Indikatrix



Verzerrungsellipse, Tissotsche Indikatrix
Bild des Swimming Pools





verzerrungsfreie,
maßstäbliche

Theorema egregium:

Es gibt keine isometrische Abbildung von der Kugel auf die Ebene.

Carl Friedrich Gauß
1777 - 1855

Carl Friedrich Gauß
1777 - 1855

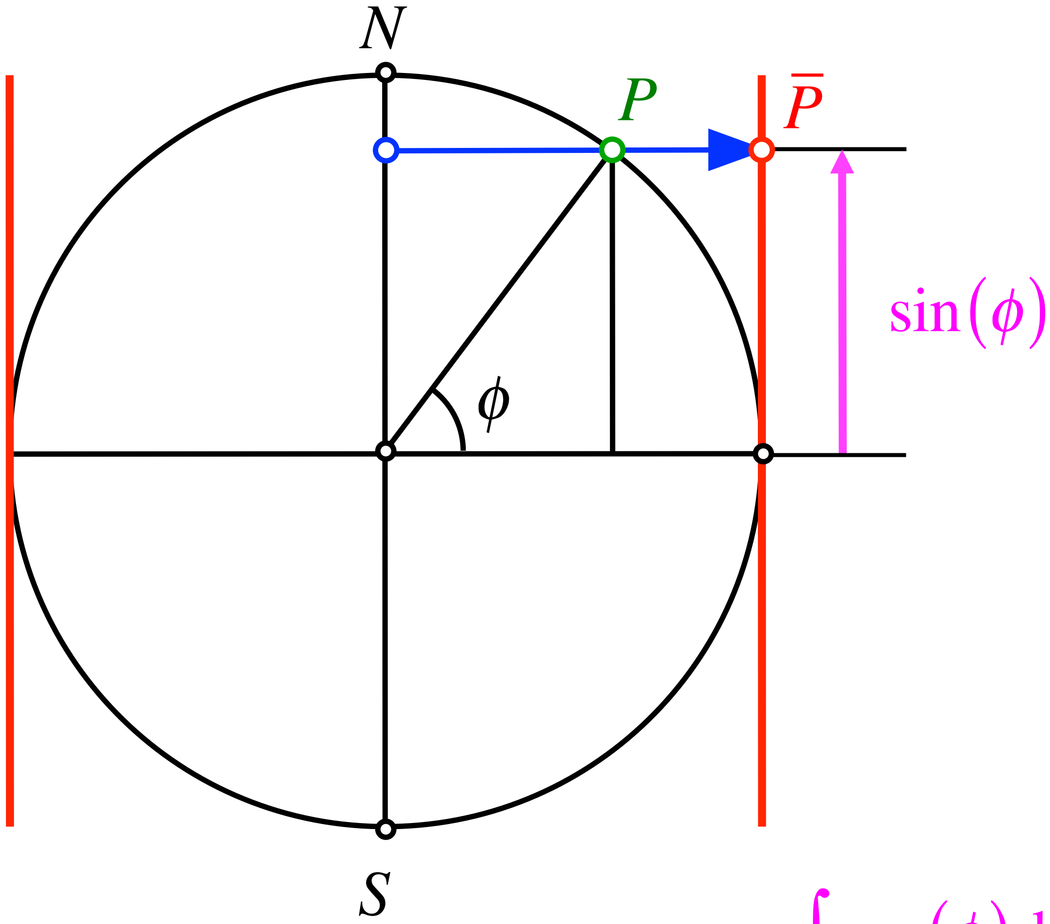
Theorema egregium:

Es gibt keine isometrische Abbildung von der Kugel auf die Ebene.

Hingegen gibt es:

- flächentreue Karten (equivalent)
- winkeltreue Karten (conformal)

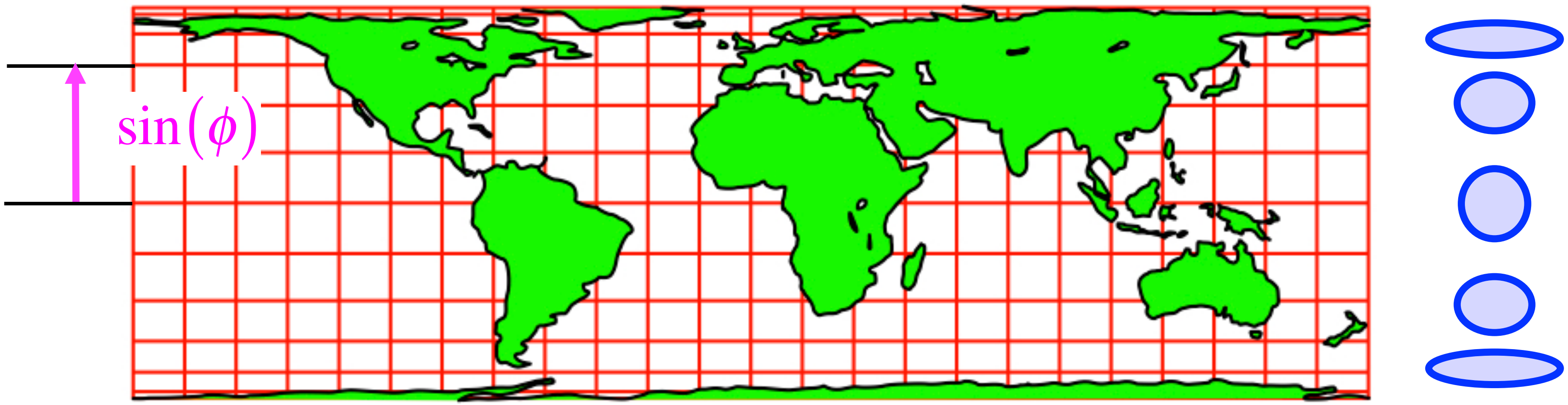
Flächentreu (equivalent), Archimedes / Lambert



$$\int \cos(\phi)\,\mathrm{d}\phi = \sin(\phi)$$

Flächentreu (equivalent), Archimedes / Lambert

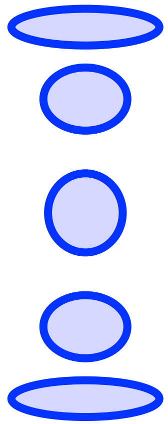
Bild des Swimming Pools



$$\int \cos(\phi)\,\mathrm{d}\phi = \sin(\phi)$$

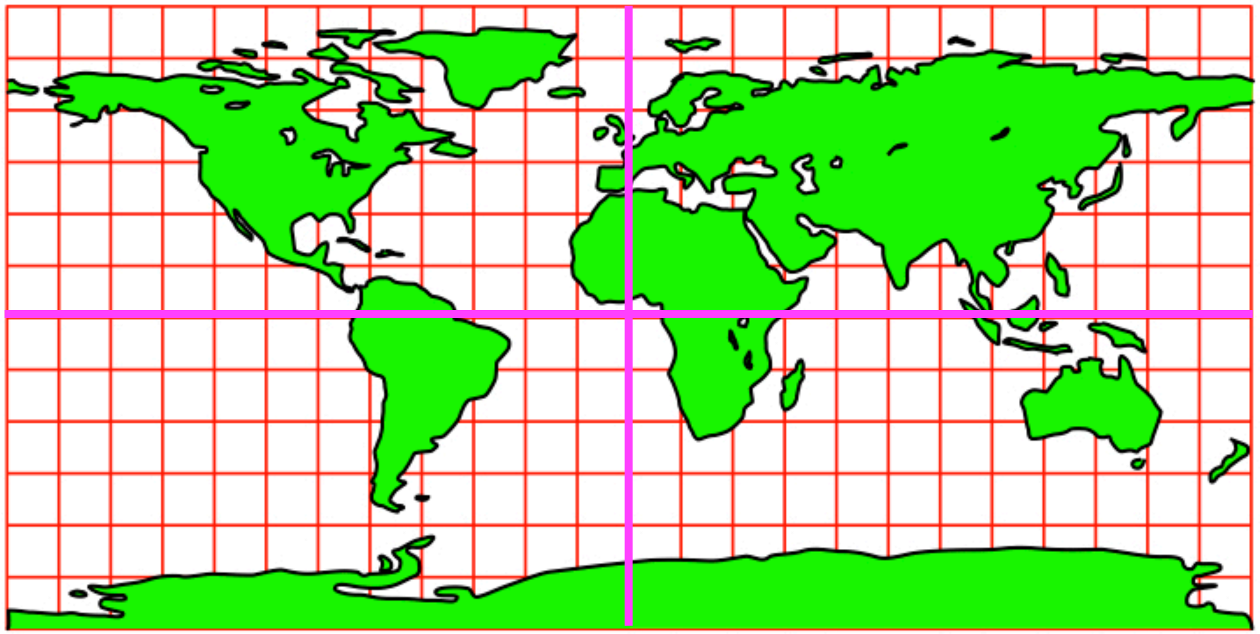
Flächentreu (equivalent), Archimedes / Lambert

Johann Heinrich Lambert
1728-1777



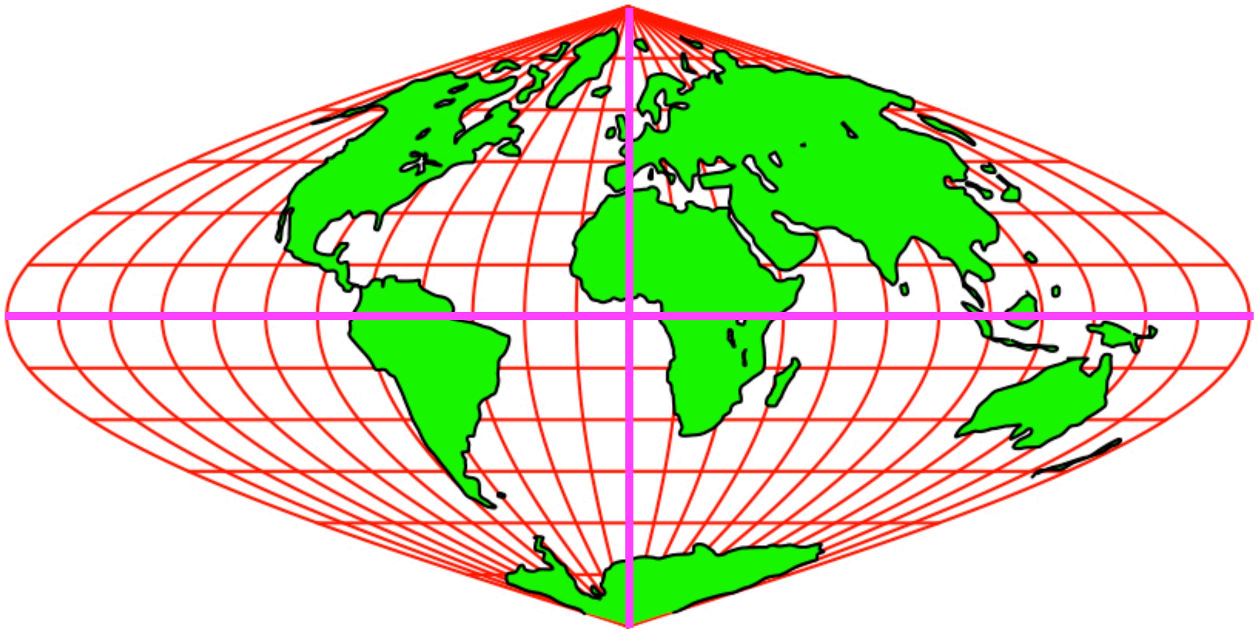
Flächentreu (equivalent), Mercator / Sanson

Flächentreu (equivalent), Mercator / Sanson



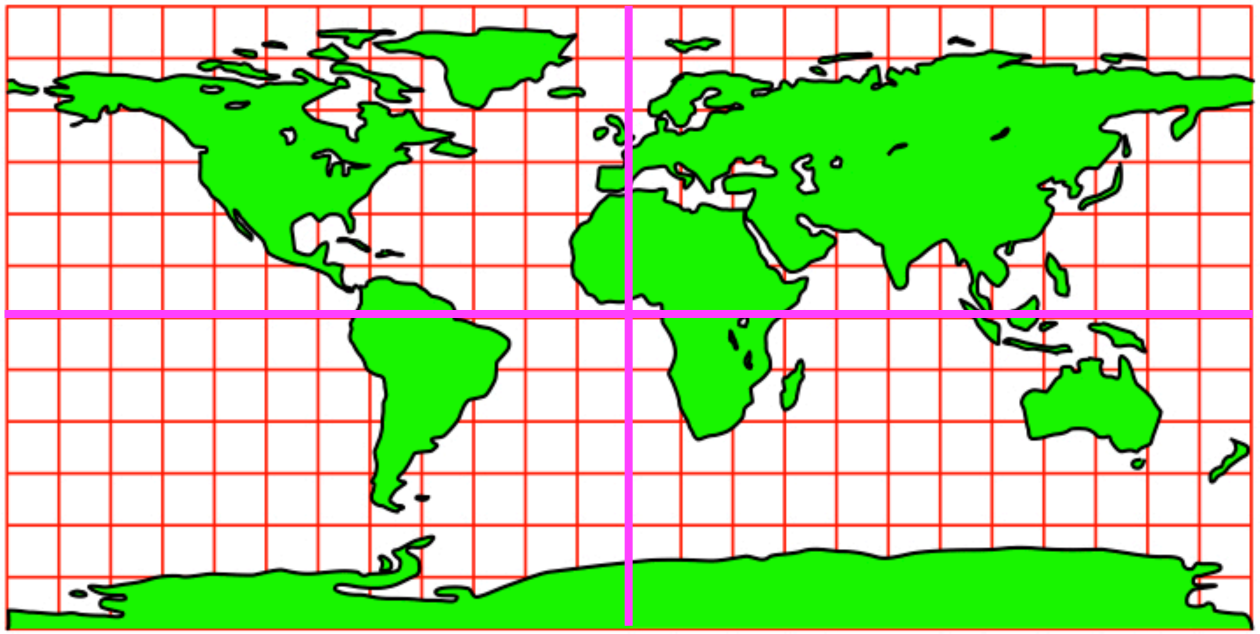
Idee: an den Polen zu Punkt einbrutzeln

Flächentreu (equivalent), Mercator / Sanson



Idee: an den Polen zu Punkt einbrutzeln

Flächentreu (equivalent), Mercator / Sanson



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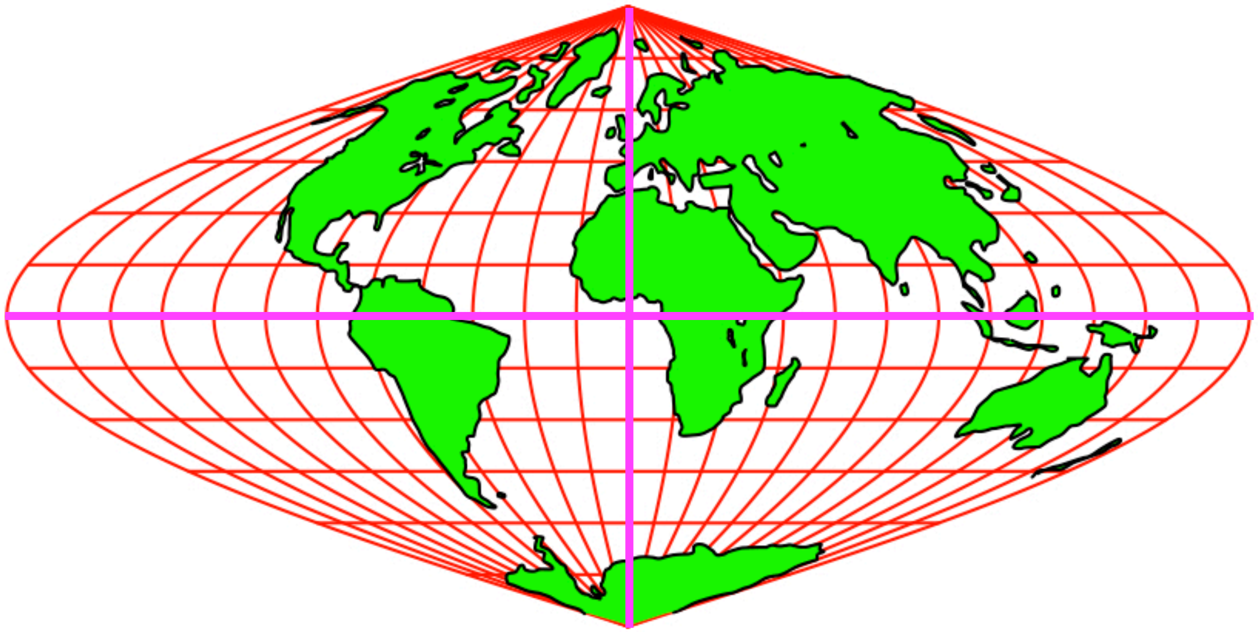
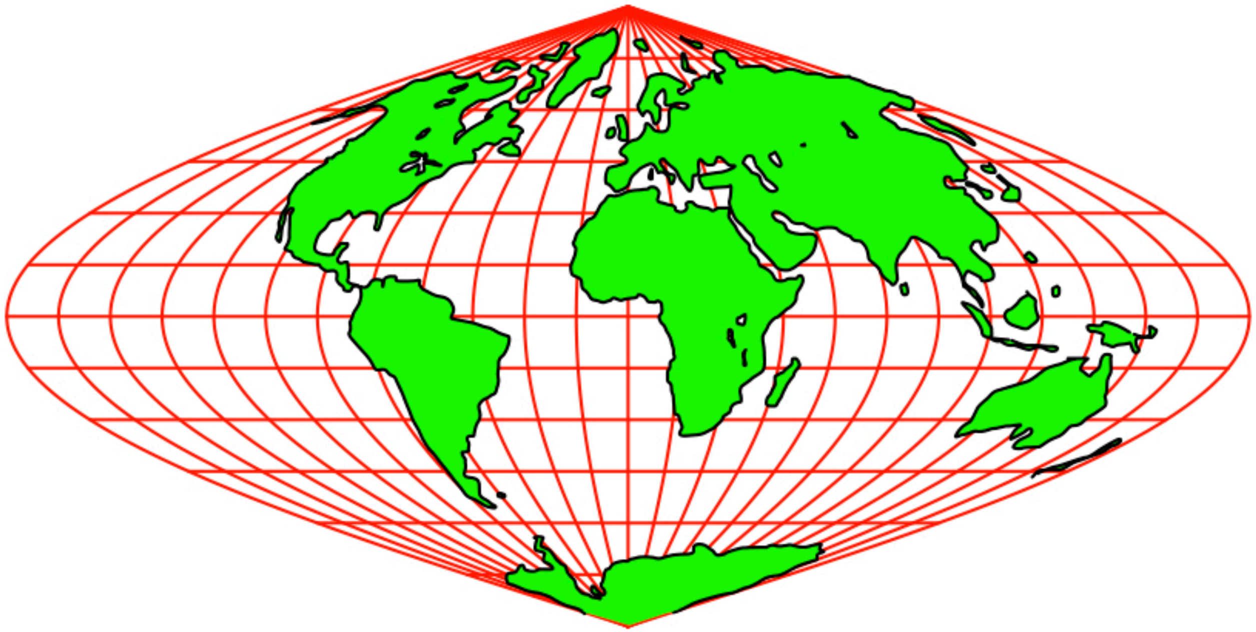
Flächentreu (equivalent), Mercator / Sanson

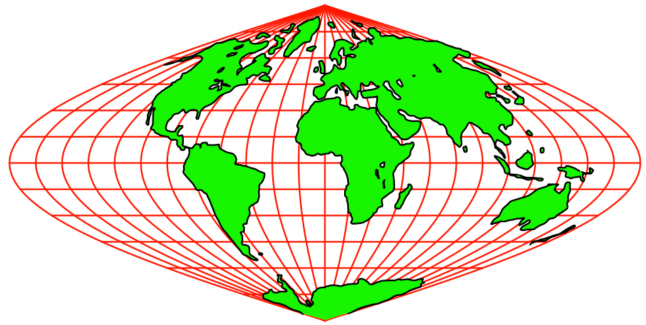


Idee: an den Polen zu Punkt einbrutzeln

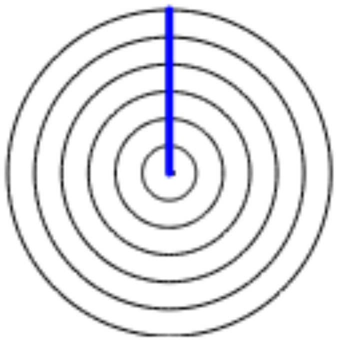
Flächentreu (equivalent), Mercator / Sanson



Erinnerung an die Schule

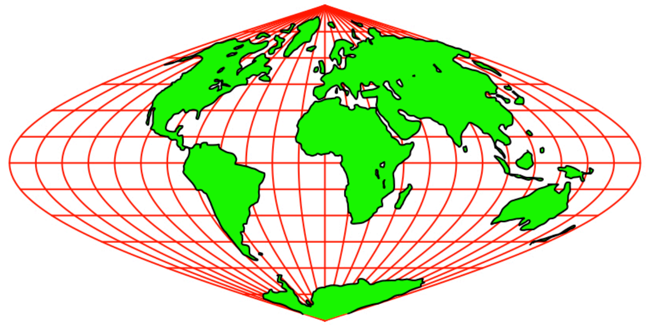


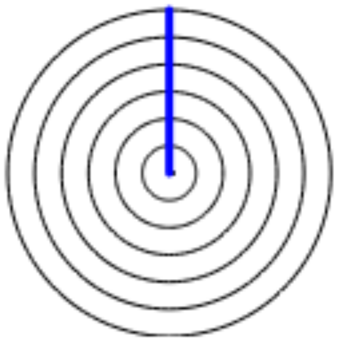
Kreis und Dreieck

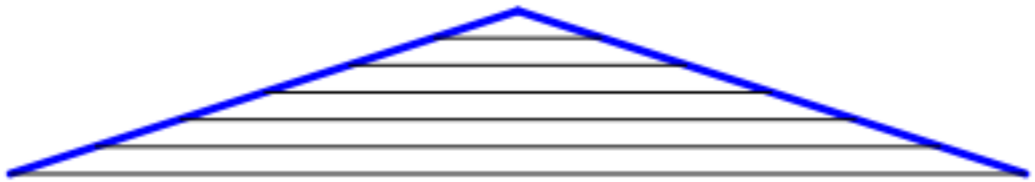


Erinnerung an die Schule

Kreis und Dreieck







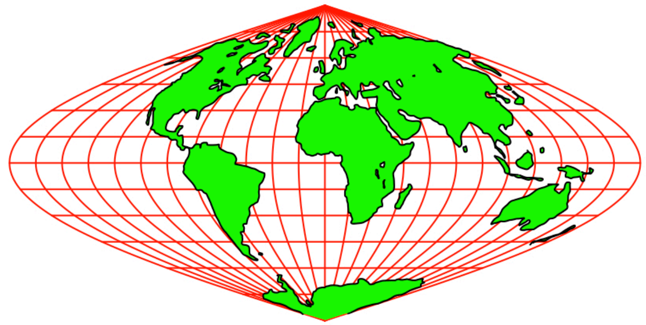
$$\text{Grundlinie} = 2r\pi$$

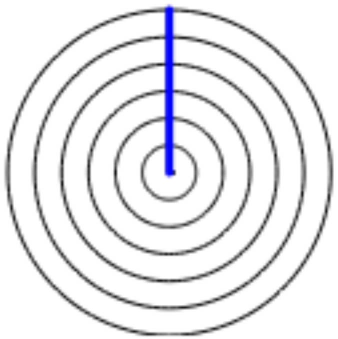
$$\text{Höhe} = r$$

$$\text{Flächeninhalt} = \frac{2r\pi \cdot r}{2} = r^2\pi$$

Erinnerung an die Schule

Kreis und Dreieck





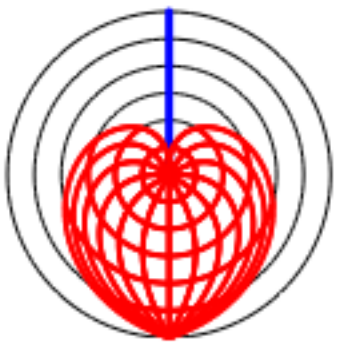
Grundlinie $= 2r\pi$

Höhe $= r$

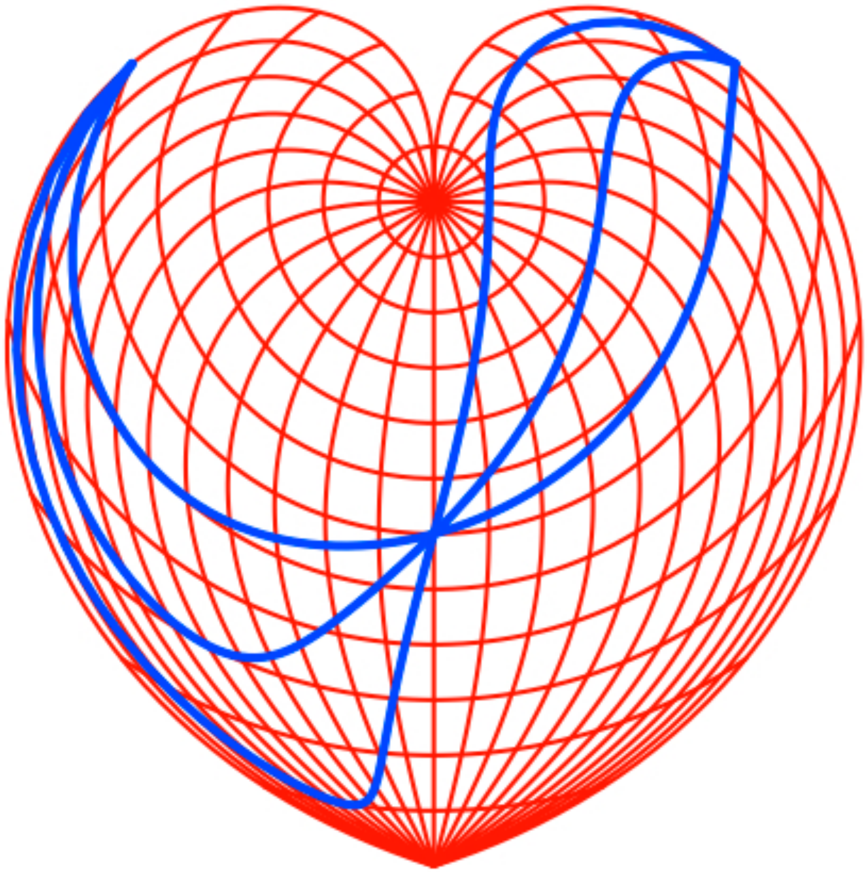
Flächeninhalt $= \frac{2r\pi \cdot r}{2} = r^2\pi$

Erinnerung an die Schule

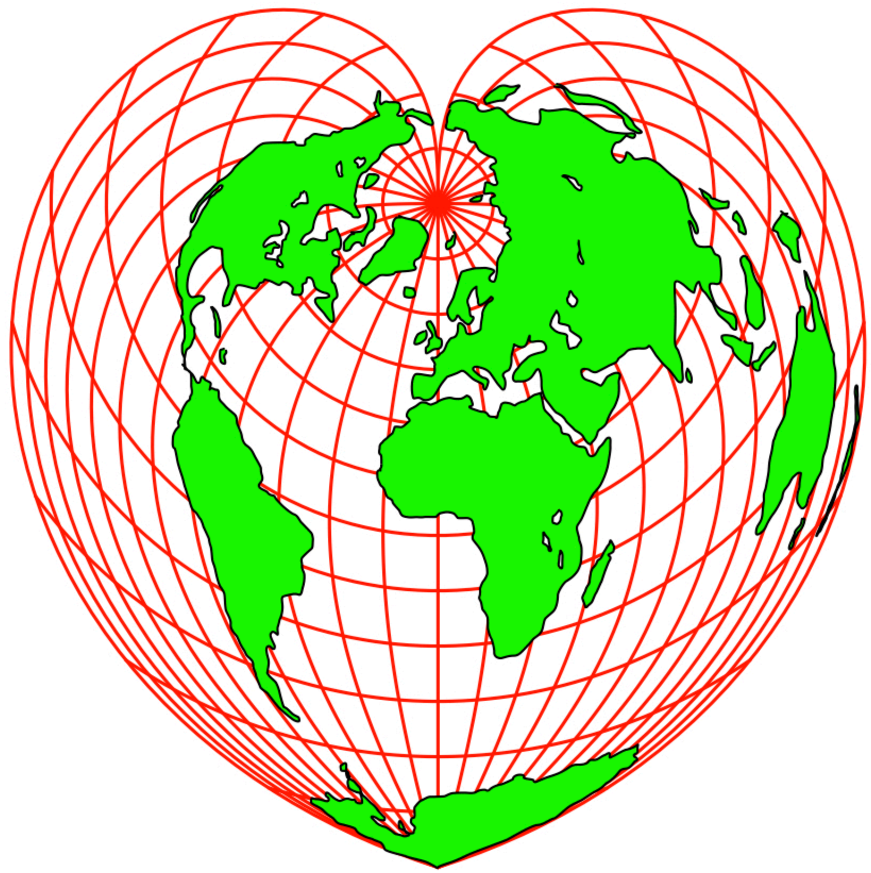
Kreis und Dreieck



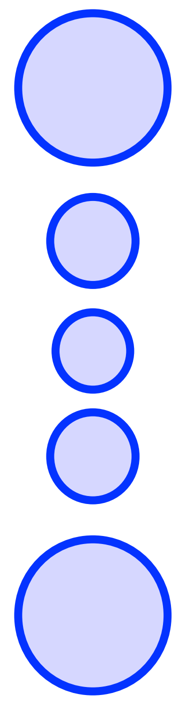
Flächentreu (equivalent), Herzkarte von Stab / Werner 1514



Flächentreu (equivalent), Herzkarte von Stab / Werner 1514

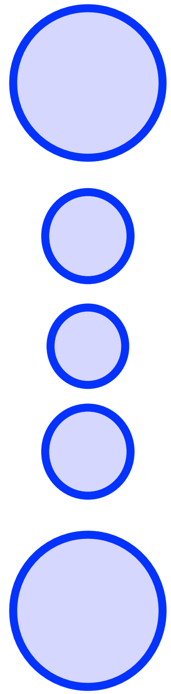


Winkeltreu (conformal), Mercator, 1569

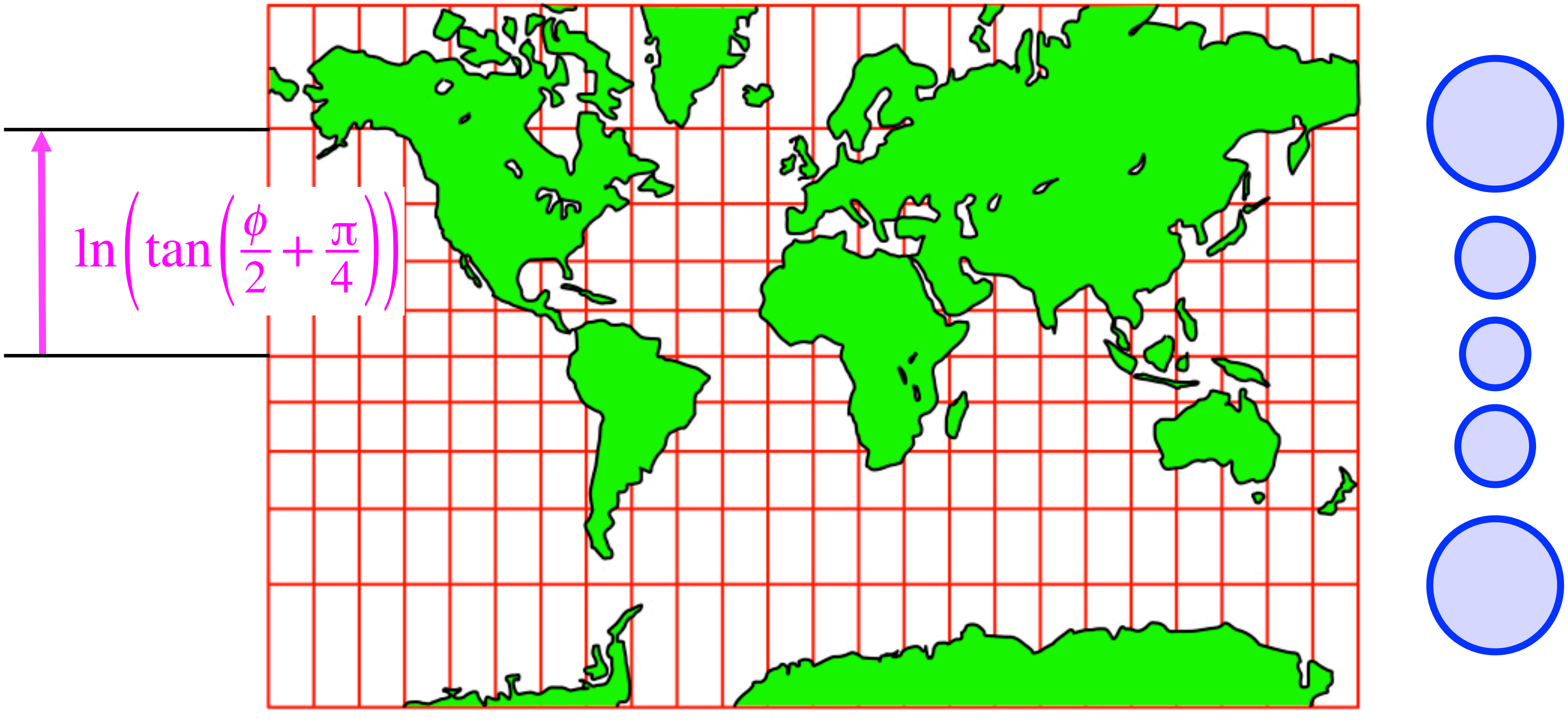


Winkeltreu (conformal), Mercator, 1569

Gerhard Mercator
1512 - 1594



Winkeltreu (conformal), Mercator, 1569

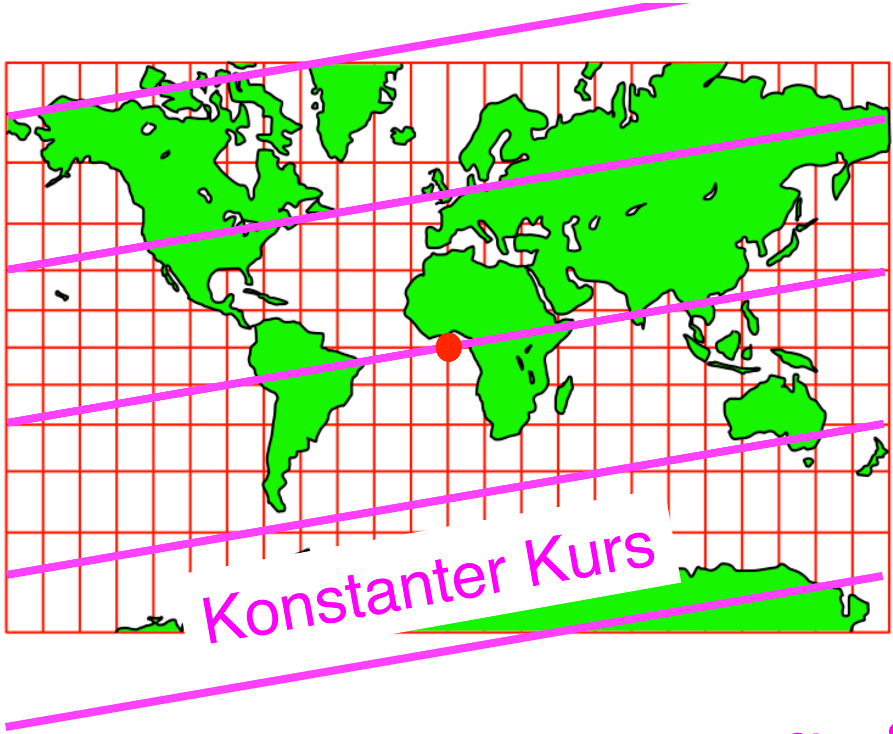


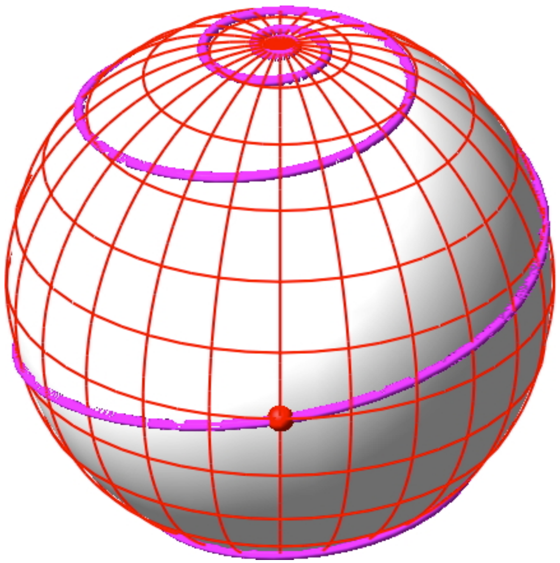
$$\int \frac{1}{\cos(\phi)}\,d\phi = \ln\left(\tan\left(\frac{\phi}{2}+\frac{\pi}{4}\right)\right)$$

Winkeltreu (conformal), Mercator, 1569

Loxodrome:

Kurve mit konstantem Winkel α gegenüber Meridianen

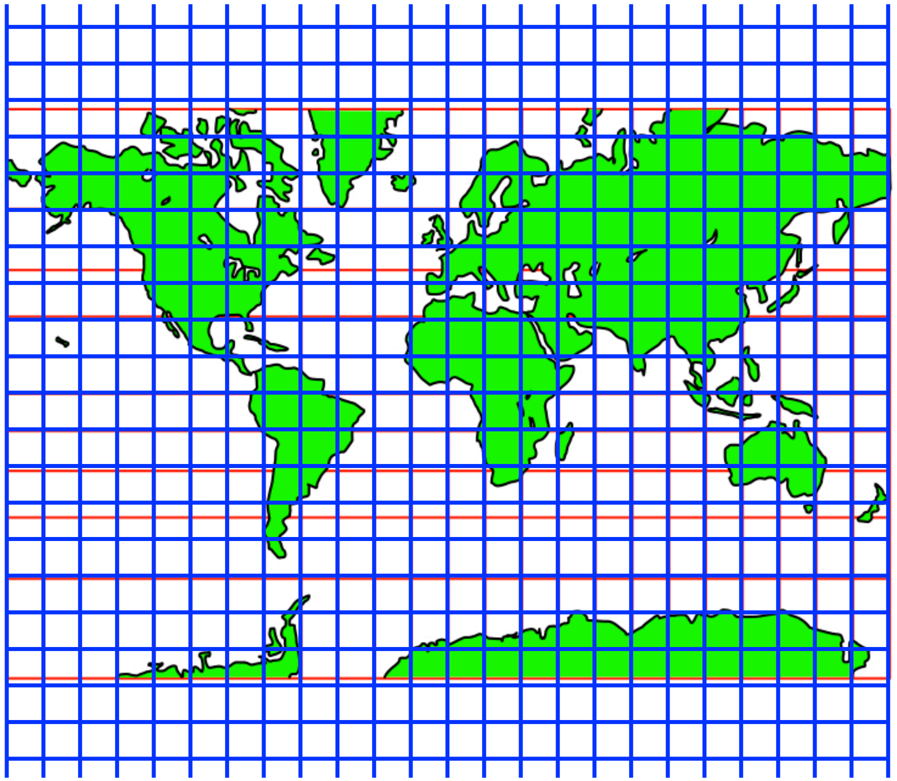


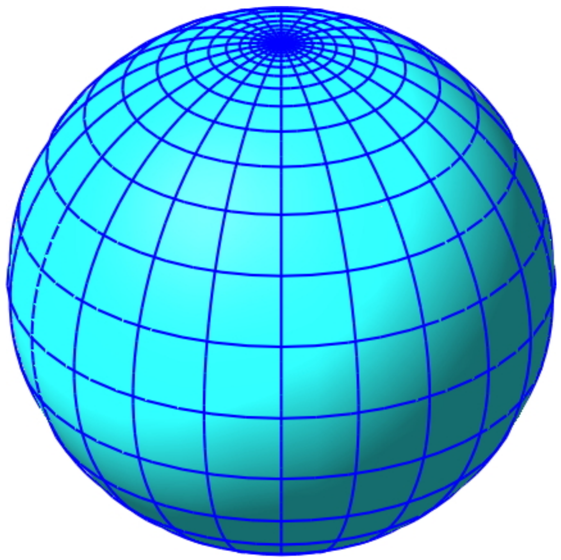


$\alpha = 80°$

Winkeltreu (conformal), Mercator, 1569

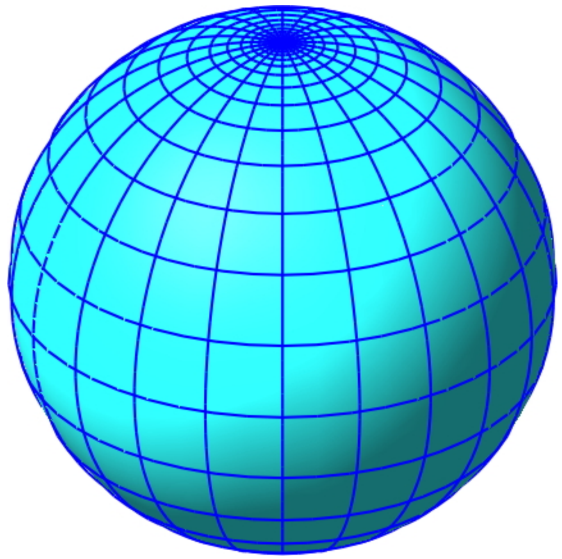
Schöne Kugel: Quadratraster Seekarte —> Kugel



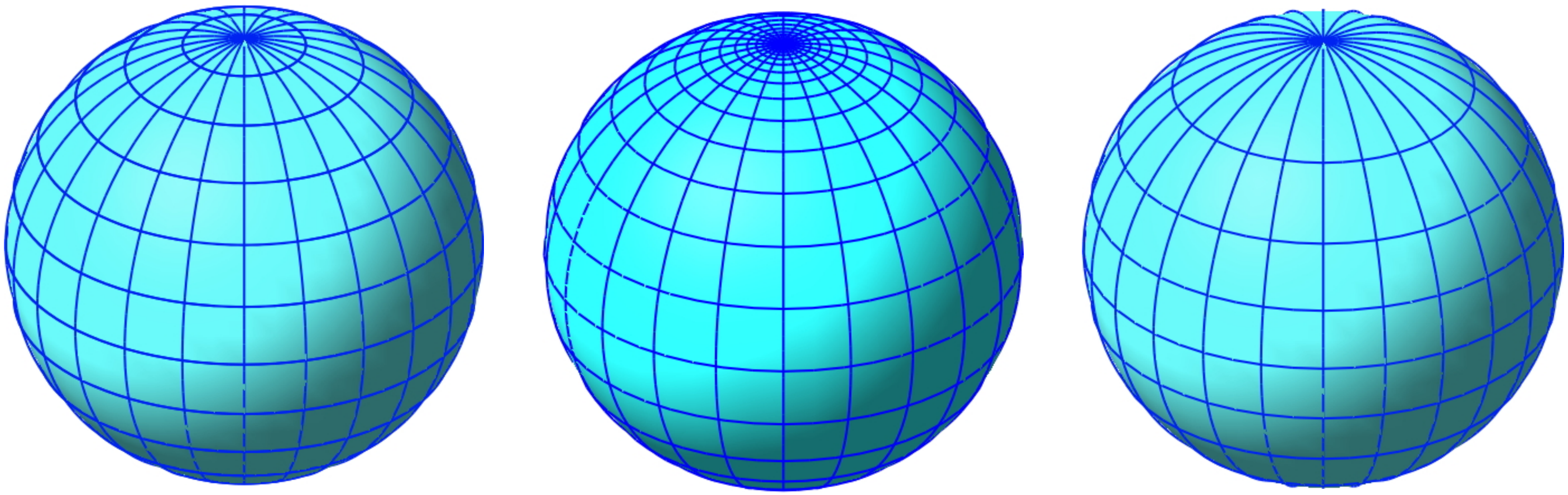


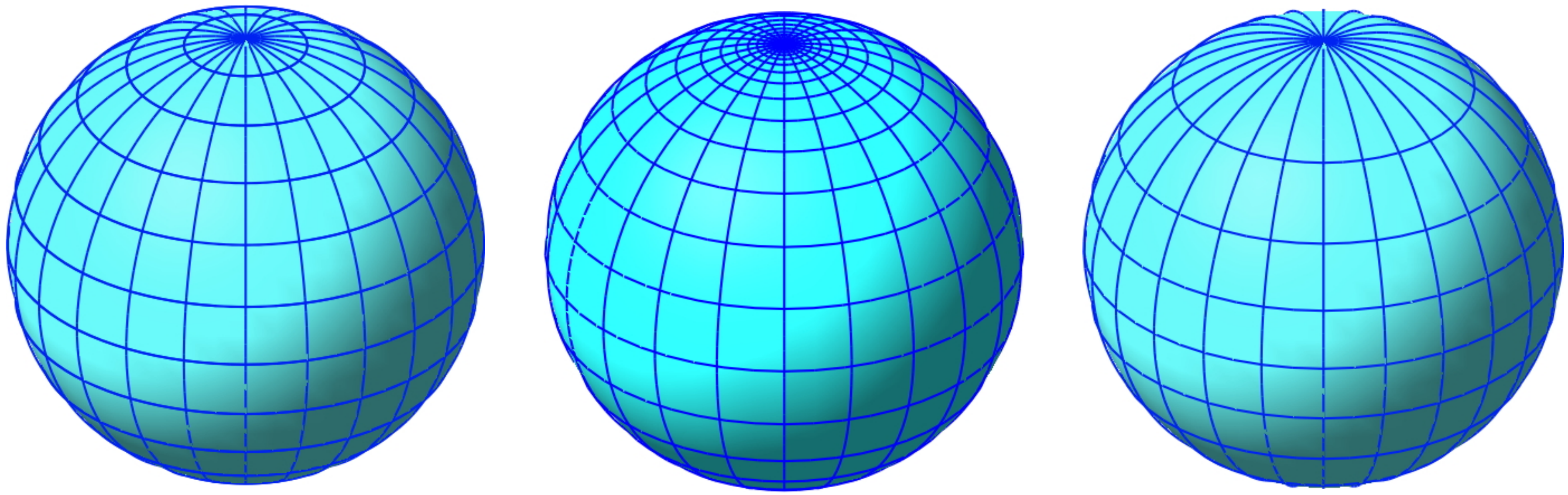
Winkeltreu (conformal), Mercator, 1569

Schöne Kugel: Quadratraster Seekarte —> Kugel



Welches ist die schönste Kugel?





Danke