Ausgabe am 02. November 2020
Besprechung in den Tutorien am 11. November 2020

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http://exp-astro.de/mechanik

Übungen zur Experimentalphysik Ia (Mechanik)
Aufgabenblatt 1 von 6
Abgabe im OLAT: Montag, 09.11.2020, 18:00 Uhr

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

1) Units

Convert the following expressions to SI units (kg, m, s):
a) 0.17 cm, b) 37 cm^2, c) 1 liter, d) 43 ng, e) 2 years, f) 50 km/h.

2) Units

Marc and Tina want to go on vacation and take the more economical car. Marc's car uses 5.3 liter per 100 km on average. Tina's car is from the US, where the mileage is given in miles per gallon. Tina's car runs 41 miles/gallon. Which car uses less fuel?
(Hint: 1 gallon = 3.7854 liter and 1 mile = 1.609 km)

3) Differential calculus

a) The volume $V(r)$ of a sphere is given as a function of the radius r:

$$V(r) = \frac{4}{3}\pi r^3$$

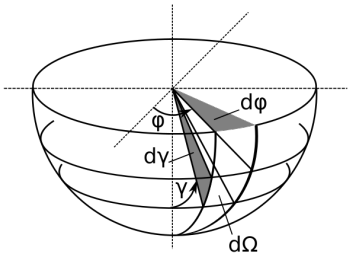
Calculate the derivative with respect to r. Which characteristic of the sphere is described by the result?
b) The surface $A(r)$ of a circle is given as a function of the radius r:

$$A(r) = \pi r^2$$

Calculate the derivative with respect to r. Which characteristic of the circle is described by the result?

c) Calculate the total solid angle Ω by integration:

$$\Omega = \int_0^{2\pi} \int_0^{\pi} \sin(\gamma) d\gamma \; d\phi$$



4) Volumes

The workshop constructs a box with inside dimensions of 20 cm × 30 cm × 50 cm for you. The machines can cut the metal sheets only with an accuracy of 4 mm.
a) Which capacity does the box have and what is its uncertainty?
The thickness of the sheets is (5 ± 0.5) mm.
b) Calculate the surface (outer side) of the box and its uncertainty.