Once again, Archimedes

Own activity

Move the world? Law of the lever and centre of gravity.

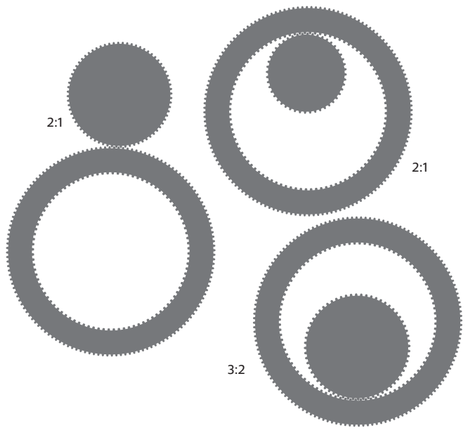
Among many treatises, Archimedes also wrote one on the topic of levers and the centre of gravity.
The following example provides an insight into his ingenious train of thought on the law of the lever.

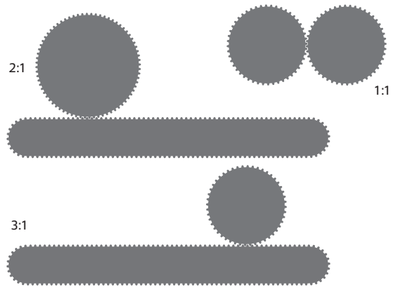
1. Where is the centre of gravity of the two weights?

2. If one releases the double cone at left below, it will roll to the right and upwards under the influence of gravity alone! How can this deceptive phenomenon be explained?

The fascination of π.

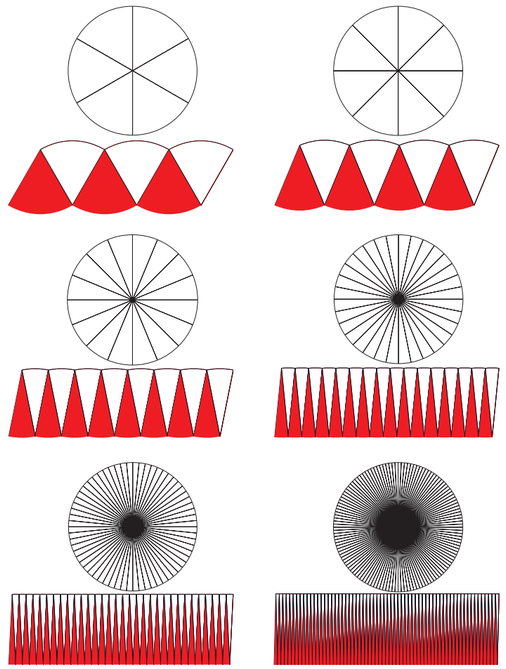
Below, the ratio of circumferences is given for each pair of gears. **Imagine** rolling one wheel along the circumference of the other.





3. How often has the rolling wheel turned?
Confirm or disprove your thoughts by experiment.
Explain any unexpected results.

Here you can find an illustrative method to calculate π and the circumference and area of a circle: a circle is dissected into sectors. These are arranged to form a strip.

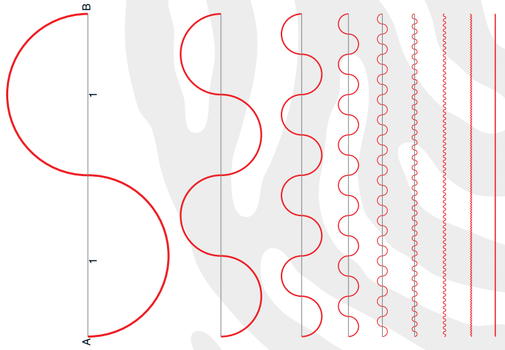


4. Explain the method. What approximation of π can be obtained using this method?

5. Imagine a rope bound around your waist and another bound around the Earth's equator (≈ 40,000 km). Then the two ropes are lengthened by one metre each. What will be the distance of the equally distributed rope around your waist and around the equator?
Estimate. Then calculate. Interpret the example. Would you have expected that result?

Once bitten, twice shy!

In Archimedes' method of exhaustion, why is the circumference (and the area) of the circle approached from above **and** from below, given that both sides approximate π infinitely? The following illustration shows you how fallacies may wait just around the corner.



6. Each of the nine wave-lines consisting of semi-circles has the length π. The curves approach the line AB, which has a length of 2. Thus: $\pi = 2$!
Where is the snag?

The Fermat point.

7. Consider practical applications of the property which the Fermat point has in the triangle ABC.
This triangle must not be too obtuse - why?