

Ancient Measures Converter Diophant v1.0

For the Greek, Roman, Byzantine
& Late Ottoman Measures

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Who was Diophantos (Diophantus)

The Diophant Converter was developed in the memory of the Greek mathematician Diophantos (Diophantus) of Alexandria who is thought to be the father of algebra. What has survived of his work is *Arithmetica*, a study on the solution of algebraic equations and on the theory of numbers. Although, almost nothing is known of his life, we have deduced from fragmentary sources of information that he lived in the 3rd century AD during the so-called 'Silver Age' of Greek mathematical thought.

Diophantos's two-volume *Arithmentica* can be read in classical Greek with Latin translation at:

<http://visualiseur.bnf.fr/Visualiseur?Destination=Gallica&O=NUMM-25248>

<http://visualiseur.bnf.fr/Visualiseur?Destination=Gallica&O=NUMM-25249>

Also on Diophantos see:

Diophantus of Alexandria

<http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Diophantus.html>

Diophantus

<http://www.stetson.edu/~efriedma/periodictable/html/Dy.html>

Diophant Converter Operation

The Diophant Converter will calculate and convert in approximation most Greek, Roman, Byzantine, and Late Ottoman units of measure from one unit into another and into modern units.

Click in Unit A input box and type a number. Then, choose a unit from the Unit A list box located just below the Unit A input box. For ease of identification, a number in ascending order precedes every unit in the list boxes. Choose the unit to convert to from Unit B list box located beside the equal sign. The result is presented in the Unit B output box. The same result in modern measures is shown in the boxes below it. Every calculation is copied to the clipboard and it is available to any other program (with 'Edit\Paste' command or keys 'Ctrl+V') you may have installed (e.g. a text editor) until you make a new calculation.

In order to convert the modern unit result into other modern units, please use the free program 'Convert' by Joshua F. Madison. The software can be downloaded from:

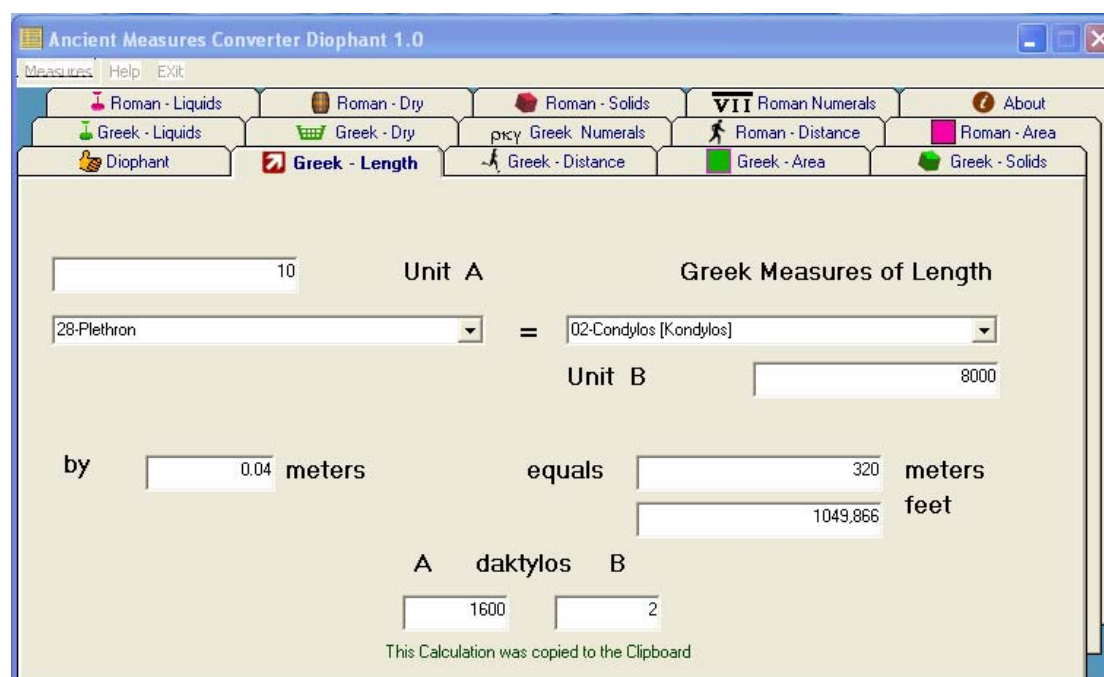
<http://joshmadison.net/software/convert/>

Unit A and B output boxes at the bottom of the Diophant tab window show the number of the smallest units contained in the units you have chosen to convert from and convert to in the software.

Example

Use the 'Greek Length' tab to convert 10 plethron units into condylos units.

Type number 10 in the Unit A input box and choose the unit 28-Plethron in the Unit A list box. Now choose the unit 02-Condylos in the Unit B list box. The result should be that 10 plethron equal 8000 condylos, 320 meters (8000 by 0.04 m.) or 1049.866 feet in the imperial system. The Unit A bottom box shows that a plethron contains 1600 daktylos (smallest unit in the Greek length measures) and the Unit B bottom box that the condylos contains 2 daktylos.



In order to find just the equivalent of an ancient measure in modern units select in both the A and B Unit list boxes the same unit. For example, in order to find the equivalent of 10 daktylos in meters just select in both A and B Units the '1-Daktylos' unit. The result will be 0.2 m. or 0.656 ft.

Generally, every unit is expressed in multiples of a base unit and conversions are with the use of that base unit. For example, let us see how Diophant will convert 10 attic pous units into condylos through the 'Greek-Length' tab. The software will multiply 10 by 16 daktylos = 160 daktylos and will divide the result by 2 daktylos to come up with the following shown result: 10 attic pous equals 80 condylos. However, in some cases conversions may have no meaning as, for example, converting Aristotelian stadion into Olympic stadion as both contain 600 pous. The result will be in Olympic stadion unit. A comparison between the attic pous and the hellenistic-roman pous, though, will show that their proportion is 1.081081 hellenistic-roman to 1 attic.

3.999996E+07 and 4.166667E-02 (Exponential results)

If you come up with a number such as 3.999996E+07, it means that Diophant can express the result only in exponential form. However, the number after the + sign (7 in this case) shows that your result can be transcribed as 39,999,960. In other words you can have the actual number by moving the decimal point 7 places to the right until you reach the letter E(=exponential) and replacing any missing numbers with zeros.

If you come up with a number such as 4.166667E-02, it means that the number after the - sign (2 in this case) shows that your result can be transcribed as 0.04166667. In other words you can have the actual number by moving the decimal point 2 places to the left and adding any missing numbers with zeros.

Nota Bene

Not all of the known units have been included in Diophant especially when their relation to other units is not known. Some of the submultiples and multiples in all units are derived from the information given in sources for some of the units and are not yet verified. However, I have used only those that can somehow safely be derived from the units mentioned in the sources.

The Diophant user should be aware that historical and archaeological research has proven that there is fluctuation by time and region in the measurement units and therefore the shown results are approximate.

The bibliography (see further down) that was studied for the building of the conversion tables in use by Diophant can be used as a starting point for further research in ancient metrology.

Check Diophant Converter site at <http://www.anistor.gr/history/diophant.html> for a complete list of tables with all the ancient measure units and their modern equivalents as they are used in Diophant Converter.

Notes on the Greek Measures

The Greeks did use specific measures and their multiples as it is shown on the two metrological reliefs that have been unearthed in Greece (see bibliography). However, there has been no absolute uniformity of standards both geographically and chronologically in the ancient Greek world. It seems that in buildings, for example, they did not follow a kanon (=rule) religiously and this explains minor variations in the proportions of constructions. It is well known that the base unit (pous=foot) and its derivatives have varied widely by time and region in Greek antiquity. For example, the Greeks used at least twelve variations of the daktylos (finger), which measured from 0.016 m. (rounded) all the way to 0.020 m. (rounded). It seems that in Attica the daktylos (finger) measured 0.02 m. (rounded) and the pous (foot) 0.32 m. (rounded). Therefore, in Diophant, I had to compromise and use the rounded attic measures of length to facilitate the conversion of units. For educational purposes I have adopted the condition 1 daktylos (finger)=0.02 m. and 1 pous (foot)=0.32 m. This convention will also serve quick conversions for general use.

Another example of the variety of measures in the Greek world is the stadion, which was used to calculate long distances. The actual length of the stadion depended on the

way the Greek philosophers and scientists calculated the circumference of the earth. For example, Aristotle calculated that 1 stadion was 1/400.000 of the circumference of the earth (=100 m.) and Eratosthenes calculated it to be 1/252.000 (=158.73 m.). Well, the cited bibliography proves that the problem of Greek measures is not simple at all. Nevertheless, the calculations by Diophant can be at least used for education purposes and quick conversions.

Dihās and Lihās. Dihās means half and can be actually used to refer to the half of any unit. However, it seems that was usually used to refer to half a pous (foot). Lihās is the distance between the thumb and the index finger (shown as the Diophant initial tab image in front of the tab title 'Diophant'). Although lihas must have been the same as dihas=8 daktyloi (fingers), there is at least one reference to the lihas measuring 10 daktyloi (fingers).

There is some confusion in the sources on the actual length of the xylon and the kalamos. Ancients may have used different lengths at different times.

Although different stadion units result in different lengths in modern equivalents, the stadion always contains 600 pous as there is no literary source claiming the opposite.

In the 'Greek-Distance' tab, units marked with an asterisk (*) in the list boxes are not based on the equation 1 pous=0.32 m. but on a different pous length. However, if the same unit is chosen in both A and B Unit list boxes, Diophant can produce a result in modern meters or feet.

In the 'Greek-Distance' tab some units are accompanied by their article ('he' for feminine and 'ho' for masculine) as they differ.

There is contradictory information in the sources on what was the size of cochliarion, cheme, cogkhe and mystron. It seems to me that they varied; they were used to weigh very small quantities; they were most probably used in pharmacology.

Both greek and roman weight conversions can be accessed through the 'Measures' menu or by hitting the F2 computer key.

Notes on the Roman Measures

The conversions in the Roman measures section are safer as they are better documented. The relevant bibliography has proven that they were standardized and used for a long historical period.

The roman measures generally derive from the Greek ones and in the 'Roman-Distance' tab I have given in parenthesis the Greek equivalents.

One must be very careful with the use of the uncia and the libra. They may be used to measure weight (stathmic units) or volume (metric units).

'As' was generally called in the roman period the base unit.

Both Greek and roman weight conversions can be accessed through the 'Measures' menu or by hitting the F2 computer key.

Notes on the Byzantine Measures

The volume conversions must be used with great caution as the equivalent to modern litters must be considered hypothetical. Our fragmentary and scanty information given in the sources do not allow us to construct safe conversion tables. The main hypothesis is that the libra equals 2.1818 lt. and it is the same as the roman stathmic libra.

As the Byzantine litra-libra varied I have used the theoretical absolute equivalent of 327.60 grams.

Both Byzantine and Late Ottoman conversions can be accessed through the 'Measures' menu or by hitting the F3 computer key.

Notes on the Late Ottoman Measures

The Late Ottoman measures in Diophant were mainly used in the Balkan part of the Ottoman Empire even after its disintegration. In Modern Greece, for example, they were in full use until the mid 20th century when they were replaced by the metric system units.

Both Byzantine and Late Ottoman conversions can be accessed through the 'Measures' menu or by hitting the F3 computer key.

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EXPLANATION AND NOTES ON THE NAMES OF UNITS**Greek Units (in alphabetical order)**

Unit name	Explanation	Notes
Akaina	Spike	A ten-foot measuring rod
Amma (article=to)	Cord	Measure of length
Amphora	(vessel)	Measure of volume. Vessel of specific capacity
Apoun (bema)	Single	Single step
Bema	Step	Distance of a man's step
Cheme	Mussels/cockles	Measure of the size of the cheme shells
Choinix/Choenix	-	Dry measure especially for corn
Chous/choeus	(vessel)	Measure of volume. Vessel of specific capacity
Cochliarion	Tea-spoon	Measure of volume
Cogkhe	Mussels/cockles	Measure of the size of the koghe shells
Condylos	Knuckle	Length of the circumference of the knuckle
Cotyle	Cup	Measure of volume
Cyathos	Ladle	Measure of volume
Daktylos	Finger	Finger's breadth
Diaulos	-	Track running up one side of a stadium and back down the other
Dichoron	-	Measure of wine in Egypt
Diploun (bema)	Double	Double step
Dolichos	The long course, in racing	Measure of distance
Gyes	the curved piece of wood in a plough	Measure of area
Hekteus	One sixth	Measure of volume
Hemi	Half	Half of any unit
Hemina	Half	In sicily =cotyle
Hippikon	Of riding	Measure of distance
Hora	Hour/time	Measure of distance
Kalamos	Reed	A measuring-rod
Keramion	(vessel)	Measure of volume
Kophinos	Basket	Dry measure for corn
Lihos	Span	Distance between thumb and index finger
Medimnos/Medimnus	-	Dry measure for corn
Metretes	-	Measure of volume
Milion	Mile	Measure of distance
Modios	(vessel)	Measure of volume. Vessel of specific capacity
Mystron	Spoon	Measure of volume
Orguia/Orgyia	Fathom	Length of the horizontally outstretched arms from the left finger-tips to the right

		finger-tips
Orthodoron	Span	Length from the wrist to the finger-ends
Oxyvaphon	Saucer	Measure of volume
Palaste/palaiste/ Palame	Palm	Breadth of the palm of the hand
Parasagges	(Persian word)	Measure of distance
Pechus/pechys	Cubit	Distance from the elbow to the tip of middle finger
Plethron	-	Measure of length and area
Pous	Foot	Length of the foot
Pygme	Fist	Distance from the elbow to the knuckles
Pygon	-	Distance from the elbow to first joint of the middle finger
Schoinion/Sokarion	Rope	Measure of length
Schoinos	Rush	Measure of distance
Spithame	Span	Distance between thumb and little finger
Stadion	Race-course	Notably length of Olympia stadion
Xestes	Sextarius (roman word)	Measure of volume. One sixth and cup of that size.
Xylon	Wood	Measure of length

Roman Units (in alphabetical order)

Unit name	Explanation
Acetabulum	Small cup (especially for vinegar)
Acnua	(acaina. see Greek units)
Actus	[ago] Cart-track
Amphora	(see Greek units)
Arura	Field
Arvum	Arable land
As	1 unit (e.g. uncial, libra)
Bes	2/3 of a unit
Centuria	100
Clima	Direction
Congius	Vessel. Measure of liquids
Cotyla	(see Greek units)
Cubitus	Cubit
Culeus	Leather sack
Cyathus	(see Greek units)
Deunx	11/12 of a unit
Dextans	10/12 of a unit
Digitus	Finger
Dodrans	3/4 of a unit
Duella	Fight/arms
Duorum	Twice
Gradus	Step
Hemina	(see Greek units)
Heredium	Heir/heirress
Jugerum	Jugum=yoke
Leuga/Leuka	Measure of Gallic origin
Libra	Balance
Ligula	From lingua, shaped like a small tongue
Milliarium	1000
Obolus	Greek weight
Palmus/Palma/ Palmipes	Palm
Passus	Pace
Pertica	Perch
Pes	Foot
Pollex	Thumb
Porrecta	Porrectus=extended
Pugnus	Fist
Quadrans	1/4 of a unit
Quadrantal	Cube
Quadratus	Squared
Quartarius	1/4 of a sextarius
Quincunx	5/12 of a unit
Saltus	Leap
Scrupulum/scrupulum	Smallest fraction of unit
Semis/Semissis	Half of a unit

Semisextula	Half of a sextula
Semuncia	Half of an uncia
Septunx	7/12 of aunit
Sescuncia/Sescunx	One and a half of uncial
Sestertius	Semis-tertius, two and a half of a unit
Sextans	1/6 of a unit
Sextarius	1/6 of a unit of volume
Sextula	1/6 of an uncial
Sicilicus	Sicilian, from the island of Sicily
Siliqua	Pod, carat
Teruncius	1/4 of uncial
Triens	1/3 of aunit
Ulna	Forearm
Uncia	1/12 of a unit
Urna	Pot, water jar

Byzantine Units (in alphabetical order)

Unit name	Explanation
Dekapodon	10 feet
Doxariou bole	Distance traveled by an arrow
Foukta	Handful
Hodos hemeras	Distance covered by a footman in a day
Sabbatou hodos	Distance covered by a footman in a week (by Saturday)

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