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Narayanmiti - A Formula for Triangle and Quadrilateral Area

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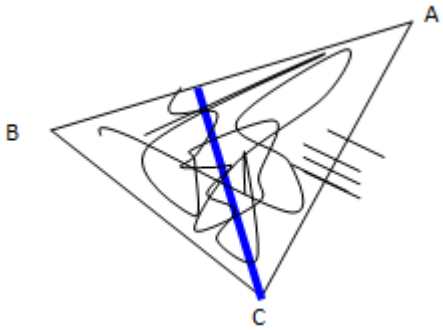
Author: ***In this work author created a table of the nearest value of all angles from 0 to 180 degrees, and on its basis has rendered new formulas for calculated of area of the triangle and the quadrilateral and determining the length of the triangle and the quadrilateral. This is a my unique discovery in the mathematical area for common man.***

Keywords: nɵ = value of angle which must be kept from table N

1. Mathematical Problems and research of Narayan Tables or Table N

My main work is land related, It has to be measured and the area of different terrains has to be calculated. There was a lot of challenges in this field before me, sometimes it was not possible to go through the field with a prickle tree or water pond, many such problems encountered in me in the field are some of the following types:

Problems related to the triangle - If you have a triangular area of which you can't measure all the three sides, and you can't measure between them, how will you know its horizon?



In the given picture, if you want to find the horizontal between the point ABC, and the barrier between the point AC can't be measured and can't be measured from point C to AB, what will you do?

You have only one support that you have to measure the side AC in some way, or in some way you have to put the perpendicular to AB, for which you will have to remove the interrupt, which is not immediately possible, it may be not possible to remove the blockage. Or you will have to find a solution with the help of trigonometry, if your angle is 30,45,60 or 90 degrees, then you can solve but if your angle is 17,29,46,120, or 137 degrees then it is not possible is.

2. Problems related to the quadrilateral

If you have a quadrangular zone with its four sides, you can measure it in between. If you can't see a diagonal, then how will you know its horoscope?

For this, you have to first measure the size of the four sides and measure of the angle and then you have to put the perpendicular lines and diagonal in the middle, then you can solve it.

I continued to search for ways to solve these problems, after making great efforts, I had success in my work, after all I reached the conclusion **that the angle formed on the other side from the base side of a triangle is less than 90 degrees. Or if it grows, its height decreases.**

If 1cm side of the length makes an angle of 90 degree to 1cm base in triangle then its height is 1 cm But when the arm makes an angle of 89 degrees or 91 degrees, its height remains 0.9984 cm. Similarly, I created a table of the nearest value of each degree from 0 to 180, which has been named as **Narayan table or table N**, then I created a formula mixed with the formula of trigonometric formula and ½ base X height, I am resolving my above problems. Thus, the formulas created by me have been named as **Narayan Sutra or Formula N**. Which are used further.

Table N

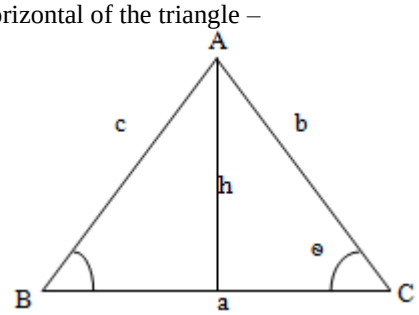
Angle degree		Value	Angle degree		Value	Angle degree		Value	Angle degree		Value
0	180	0	24	156	0.4044	48	132	0.7442	72	108	0.95
1	179	0.0164	25	155	0.42	49	131	0.7566	73	107	0.955
2	178	0.0328	26	154	0.436	50	130	0.769	74	106	0.96
3	177	0.0492	27	153	0.452	51	129	0.7792	75	105	0.965
4	176	0.0656	28	152	0.468	52	128	0.7894	76	104	0.9684
5	175	0.082	29	151	0.484	53	127	0.7996	77	103	0.9718
6	174	0.0998	30	150	0.5	54	126	0.8098	78	102	0.9752
7	173	0.1176	31	149	0.5144	55	125	0.82	79	101	0.9786
8	172	0.1354	32	148	0.5288	56	124	0.8292	80	100	0.982
9	171	0.1532	33	147	0.5432	57	123	0.8384	81	99	0.984

10	170	0.171	34	146	0.5576	58	122	0.8476	82	98	0.986
11	169	0.1886	35	145	0.572	59	121	0.8568	83	97	0.988
12	168	0.2062	36	144	0.5856	60	120	0.866	84	96	0.99
13	167	0.2238	37	143	0.5992	61	119	0.8744	85	95	0.992
14	166	0.2414	38	142	0.6128	62	118	0.8828	86	94	0.9936
15	165	0.259	39	141	0.6264	63	117	0.8912	87	93	0.9952
16	164	0.2756	40	140	0.64	64	116	0.8996	88	92	0.9968
17	163	0.2922	41	139	0.6534	65	115	0.908	89	91	0.9984
18	162	0.3088	42	138	0.6668	66	114	0.9144	90	-	1.00
19	161	0.3254	43	137	0.6802	67	113	0.9208			
20	160	0.342	44	136	0.6936	68	112	0.9272			
21	159	0.3576	45	135	0.707	69	111	0.9336			
22	158	0.3732	46	134	0.7194	70	110	0.94			
23	157	0.3888	47	133	0.7318	71	109	0.945			

Note - The given value is quite long after the decimal, which is summarized to the nearest four digits after the decimal. So that simple calculations can be made from the nearest value

3. Calculation from Table N

Calculation from table N is very easy, it can be understood in the following way.
(1) The horizontal of the triangle –

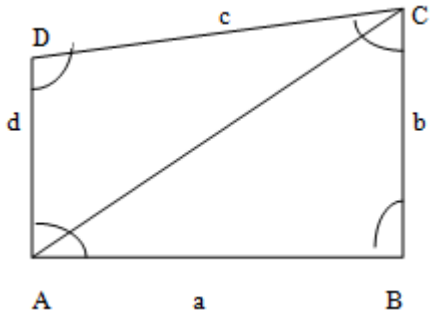


In the given diagram ABC is a triangle, and a, b, c has its sides. And angle ɵ is In this triangle, the side is "a" base arm and if angle between the a and b is in the arm then its height will be obtained by multiplying the value of angle from the side b. the height (h) = side b x nɵ

According to the prevailing formula of the horizontal plane of triangle = ½ base X height,

The horizontal of the triangle = (a x b x nɵ) / 2
(Here nɵ, angle will be the value of ACB, which must be kept from table N.)
This formula for finding the alphabet is called **Narayan formula or Formula N.**

(2) Area of quadrilateral -

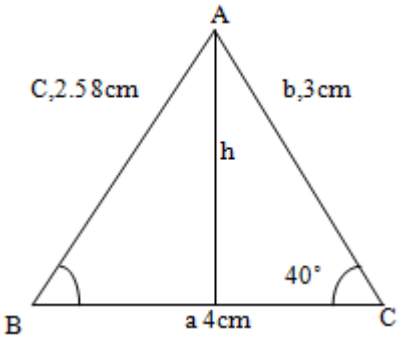


In the given picture, ABCD is a quadrilateral, and a, b, c, d have its sides. And angle ɵ is In this quadrilateral, two triangles will be formed after inserting a point from point A to C (1) △ABC (2) △CDA And 2 angles will be obtained (1) angle ABC = n1ɵ and (2) angle CDA = n2ɵ area of △ABC from Formula N= $\frac{a\,X\,b\,X\,n1ɵ}{2}$, And △ CDA area= $\frac{c\,X\,d\,X\,n2ɵ}{2}$

so the area of the quadrilateral ABCD= $\frac{a\,X\,b\,X\,n1ɵ}{2}$ + $\frac{c\,X\,d\,X\,n2ɵ}{2}$ = $\frac{(a\,X\,b\,X\,n1ɵ)+(c\,X\,d\,X\,n2ɵ)}{2}$

Finding the horizontal of the triangle and comparing the study with other formulas

Here I am giving some such triangles which have been compared to Formula N by finding alphabet from different formulas -
Example 1



The given △ ACB has side A = 4cm, b = 3cm and c = 2.58 cm and angle ACB = 40 degree then-

Method (1) from Formula N

$$= \frac{a\,X\,b\,X\,nɵ}{2}$$
$$= \frac{4\,X\,3\,X\,n40}{2}$$
$$= \frac{4\,X\,3\,X\,0.64}{2}$$
$$= \frac{7.68}{2}$$

= 3.84 cm² = 4 cm² Closest value

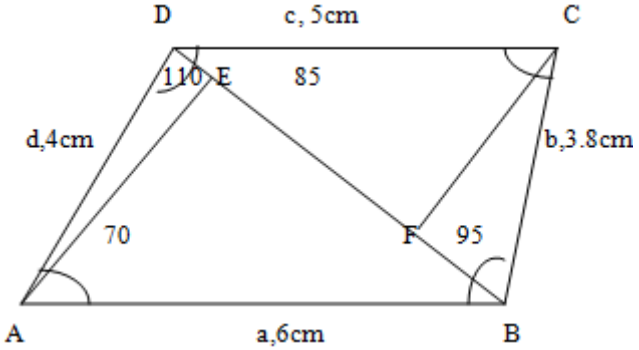
Method (2) from formula ½ base x height

$$= \frac{a\,X\,h}{2}$$ (h=1.92)
$$= \frac{4\,X\,1.92}{2}$$
$$= \frac{7.68}{2}$$

= 3.84 cm² = 4 cm² Closest value
Method (3) the formula of Heron

$$s = \frac{a+b+c}{2},$$
$$s = \frac{4+3+2.58}{2}, = 4.79$$
$$= \sqrt{4.79(4.79-4)(4.79-3)(4.79-2.58)}$$
$$= \sqrt{4.79(0.79)(1.79)(2.21)}$$
$$= \sqrt{14.9695}$$
$= 3.86$ cm² = 4 cm² Closest value

4. Finding the horizon of the quadrilateral and comparative study with other formulas



Example

The given ☐ ABCD has side a = 6cm, b= 3.8cm c = 5 and d= 4 cm, angle ABC = 95˚ and angle CDA = 110˚ then-

Method (1) from Formula N

$$= \frac{(a\ X\ b\ X\ n1\theta)+(c\ X\ d\ X\ n2\theta)}{2}$$
$$= \frac{(6\ X\ 3.8\ X\ n95)+(5\ X\ 4\ X\ n110)}{2}$$
$$= \frac{(6\ X\ 3.8\ X\ 0.992)+(5\ X\ 4\ X\ 0.94)}{2}$$
$$= \frac{(22.6176)+(18.8)}{2}$$
$$= \frac{41.4176}{2}$$
= 20.7088 cm² = 21 cm² Closest value

Method (2) If angle BCD = 85˚ and angle DAB = 70˚ then- from Formula N

$$= \frac{(c\ X\ b\ X\ n1\theta)+(a\ X\ d\ X\ n2\theta)}{2}$$
$$= \frac{(5\ X\ 3.8\ X\ n85)+(6\ X\ 4\ X\ n70)}{2}$$
$$= \frac{(5\ X\ 3.8\ X\ 0.992)+(6\ X\ 4\ X\ 0.94)}{2}$$
$$= \frac{(18.848)+(22.56)}{2}$$
$$= \frac{41.408}{2}$$
= 20.704 cm² = 21 cm² Closest value

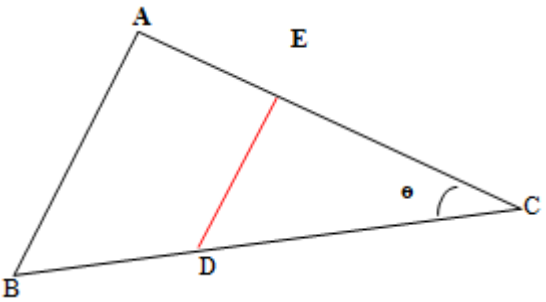
Method (3) from formula ½ diagonal X sum of the Offset

$$= \frac{(BD)\ X\ (AE+CF)}{2}$$

(here BD = 5.95 diagonal, and AE = 3.78 , CF = 3.2 is Offset on diagonal BD)

$$= \frac{(5.95)X(3.78+3.2)}{2}$$
$$= \frac{(5.95)X(6.98)}{2}$$
$$= \frac{41.531}{2}$$
= 20.765 cm² = 21 cm² Closest value

5. Find the length of the side of the triangle from Formula N

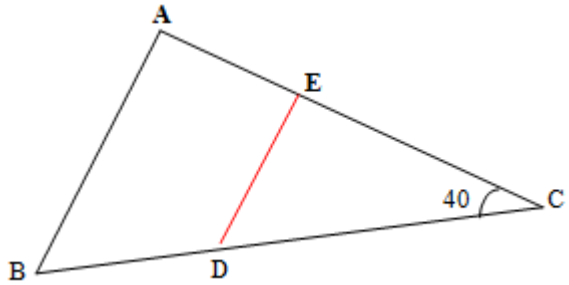


If the given picture ABC is to separate the plot DCE square of a² area, and the length of DC = L and angle C = ɵ, then what is the length of CE?

For this, we will use formula N, which is considered CE = x,

$$a^2 = \frac{DC\ X\ CE\ X\ n\theta}{2}$$
$$a^2 = \frac{L\ X\ x\ X\ n\theta}{2}$$
$$L\ X\ x\ X\ n\theta = 2\ a^2$$
$$x = \frac{2\ a^2}{L\ X\ n\theta}$$

Example –1



In the given picture ABC, BC = 60 meters length is to construct a plot DCE of 384 square meters for DC = 40 meters length and if the angle DCE = 40 degrees, then how much is the length of CE to be taken?

Solution - Suppose that is CE = x, Given - a² = 384, L = 40, nɵ = 40 degrees

According to Formula N

$$x = \frac{2\ a^2}{L\ X\ n\theta}$$
$$x = \frac{2(384)}{40\ X\ n40}$$
$$x = \frac{768}{40\ X\ 0.64}$$

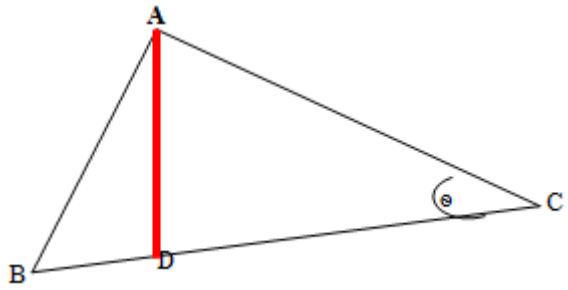
(Here, keep the value of n40 from the table N)

$$x = \frac{768}{25.6}$$

x = 30 Meter

Thus, the length of CE should be 30 meters.

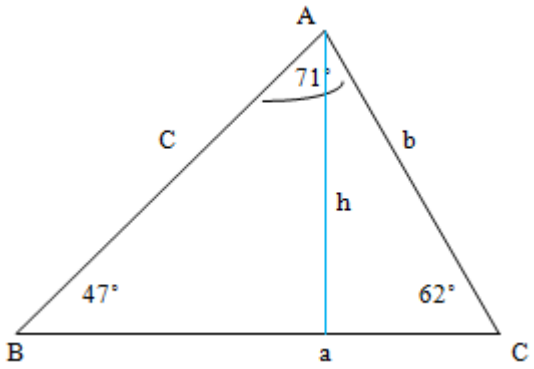
1. Comparative study of the length of the perpendicular to the base side from the top point of the triangle and the perpendicular to the two sides angle of the base side.



If given the picture in ABC, how long will the length of perpendicular AD is placed on point BC from point A? While angle ACB = ɵ For this, it has been stated in the past that if the angle formed on the other side from the base side of a triangle is less than 90 degrees or increases, then its height decreases.

Here BC is base arm make the angle of ɵ degree with the arm AC, then its height or length of the perpendicularity (h) = side AC x nɵ.

Example -
The given △ ACB has side a = 9 cm, b= 7 cm and c= 8.4 cm, angle ABC =47˚, ACB = 62˚, BAC = 71˚ then-

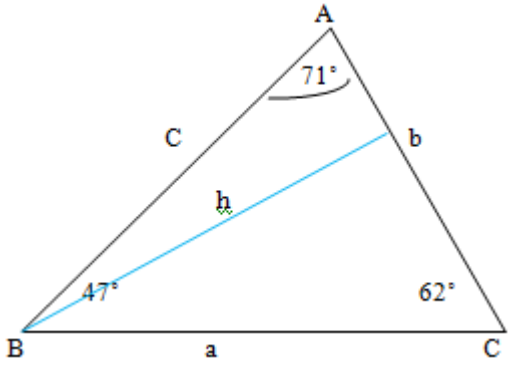


If the base side a, then the length of the perpendicular to the two angles, the corresponding comparison, the length of the perpendicular to the first angle

(h) = side c x nɵ
= 8.4 *X* *n*47
= 8.4 *X* 0.7318
= 6.14712 cm
= 6.15 cm

The length of the perpendicular to the second angle

(h) = side b *X* *n*ɵ
= 7 *X* *n*62
= 7 *X* 0.8828
= 6.1796 cm
= 6.15 cm

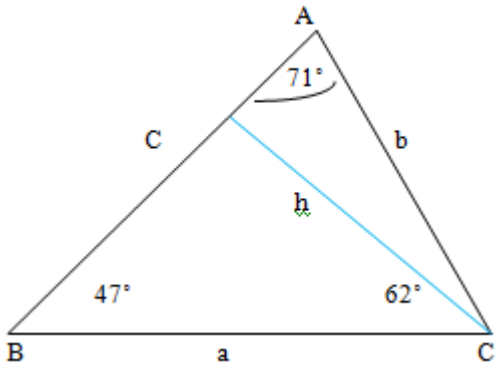


(1) If the base side b, then the length of the perpendicular to the two angles, the corresponding comparison, the length of the perpendicular to the first angle

(h) = side *c* *X* *n*ɵ
= 8.4 *X* *n* 71
= 8.4 *X* 0.945
= 7.938 cm
= 7.94 cm

The length of the perpendicular to the second angle

(h) = side a *X* *n*ɵ
= 9*X* *n* 62
= 9 *X* 0.8828
= 7.9452 cm
= 7.94 cm



(1) If the base side c, then the length of the perpendicular to the two angles, the corresponding comparison, the length of the perpendicular to the first angle

(h) = side b *X* *n*ɵ
= 7 *X* *n* 71
= 7 *X* 0.945
= 6.615 cm
= 6.6 cm

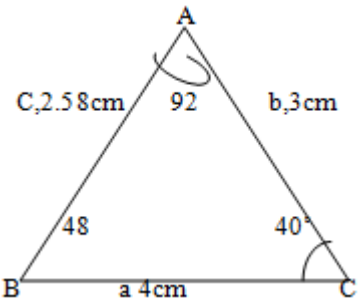
(2) The length of the perpendicular to the second angle

(h) = side a *X* *n*ɵ
= 9*X* *n* 47
= 9 *X* 0.7318
= 6.5862 cm
= 6.6 cm

6. Comparative Studies from All Three Angles of the Triangle

Here, we are presenting a comparative study of the three angles of the triangle for the horizontal obtained from the Formula N, which is almost equal to the calculation in all three ways, (the difference can be up to a fraction of a decimal)

Example 1



The given △ACB has side a = 4cm, b= 3cm and c= 2.58 cm

Method (1) angle ACB =40˚ then- by formula N

$$= \frac{a\ X\ b\ X\ n\theta}{2}$$

$$= \frac{4\ X\ 3\ X\ n40}{2}$$

$$= \frac{4\ X\ 3\ X\ 0.64}{2}$$

$$= \frac{7.68}{2}$$

= 3.84 cm²

Closest value = 4 cm²

Method (2) angle ABC =48˚ then- by formula N

$$= \frac{a\ X\ c\ X\ n\theta}{2}$$

$$= \frac{4\ X\ 2.58\ X\ n48}{2}$$

$$= \frac{4\ X\ 2.58\ X\ 0.7442}{2}$$

$$= \frac{7.68}{2}$$

= 3.84 cm²

Closest value = 4 cm²

Method (3) angle BAC =92˚ then-by formula N

$$= \frac{c\ X\ b\ X\ n\theta}{2}$$

$$= \frac{3X\ 2.58\ X\ n92}{2}$$

$$= \frac{3\ X\ 2.58\ X\ 0.9968}{2}$$

$$= \frac{7.715232}{2}$$

= 3.85 cm²

Closest value = 4 cm²

7. Finely find formula – called Narayan formula or Formula N.

1) The area of the triangle = **(a x b x nθ) / 2**
2) Area of the quadrilateral ABCD= $\frac{(a\ X\ b\ X\ n1\theta)+(c\ X\ d\ X\ n2\theta)}{2}$
3) Length of the side of the triangle, $x = \frac{2a^2}{L\ X\ n\theta}$
4) Height or length of the perpendicularity in triangle (h) = side AC x nθ.

(Here BC is base arm make the angle of θ degree with the arm AC)

8. Utility of Table N and Formula N

Table N and Formula N are very useful for us; With the help of these, we can easily find the horizontal of any triangle or quadrilateral, it is useful for every person working in the mathematical area.

9. Summary

The table N and formula N this table is quite easy to use for common man, not everyone can understand the higher level of mathematics, Sin, cos, ten, cot, sec, cosec or other high level value are beyond understanding for the common man. in such a way my little formula will prove to be very useful to them.

References

There are no reference any book, this is my idea and my work in this area and I face many problems so I thought this idea and get new formulas.