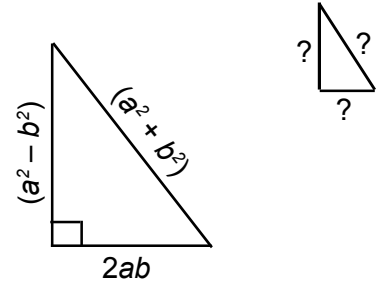


# Doss GANITHA

## 7.1.7 None Given

Assume two arbitrary numbers.  
The three sides are given by:

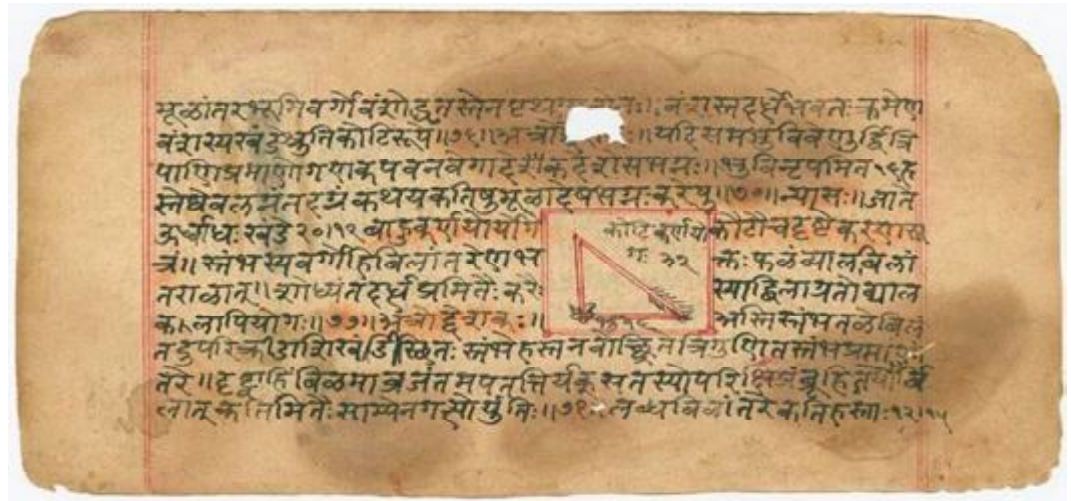
- Twice their product;
- Difference of their squares;
- Sum of their squares;



### EXAMPLES:

Assumed nos		bhuja Twice their prod $2ab$	coti Diff of sqs. $(a^2 - b^2)$	karna Sum of sqs $(a^2 + b^2)$
$a$	$b$			
1,	2	4	3	5
2,	3	12	5	13
2,	4	16	12	20
3,	7	42	40	58
11,	35	770	1104	1346

**Note:** You may like to see author's **DossQuick Mathematics** or **DossMagic Mathematics** for a very detailed and comprehensive treatment of triples.



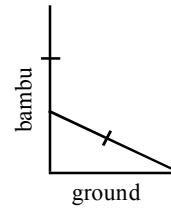
An image of a page from a manuscript of Lilavati date from 1650 A.D.

The broken bambu problem (next page)

Thanks to *Mathematics Association of America Digital Library* - Washington D. C.

### 7.1.8 Bhuja & Sum of Other Two Given

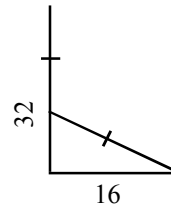
The square of the ground intercepted between the root and tip, is divided by the [length of the] bambu; and the quotient severally added to, and subtracted from, the bambu: the moieties [of the sum and difference] will be the two ortions of it representing karna and coti.



(Imagine a vertical bambu breaks at some point and the tip touches the ground)  
 Divide square of 'ground' by 'bamboo', add to bambu, half of this is karna;  
 Subtract above quotient from bambu, half of this is coti.

#### EXAMPLE 01:

If a bambu measuring 32 cubits and standing upon level ground, be broken in one place, by the force of the wind, and the tip of it meets the ground at 16 cubits away from its root: say, mathematician, at how many cubits from the root is it broken?



bambu 32, ground 16, coti ?

Square 16 and divide by 32, get 8; half of 32 and 8 is **20**  
 Half of 32 less 8 is **12**.

#### EXAMPLE 02:

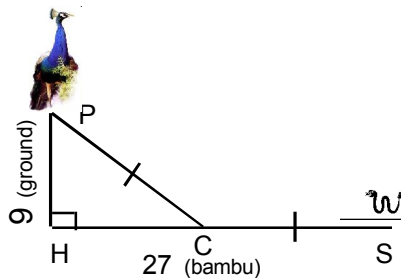
A snake's hole is at the foot of a pillar, 9 cubits tall and a peacock is perched on its summit. Seeing a snake, at the distance of thrice the pillar, gliding towards his hole, he pounces obliquely upon him. Say quickly at how many cubits from the snake's hole do they meet, both proceeding an equal distance?

bambu 27, ground 9, coti ?

Same as the bambu sum.  
 Just turned around.

Square 9 and divide by 27, get 3;  
 (half of 27 and 3 is **15**)  
 half of 27 less 3 is **12**.

They met at **12** cubits from the snake's hole.



# Doss GANITHA

## 7.1.9 Bhuja & Difference of Other Two Given

The quotient of the square of the side divided by the difference between the hypotenuse and coti is twice set down, and the difference is subtracted from the quotient [in one place] and added to it [in the other]. The moieties [of the remainder and sum] are in their order the coti and karna.

Divide square of bhuja by 'difference';  
Add the difference to above ratio, half the sum is karna;  
Subtract the difference from above ratio, half this is coti.



given  
karna  
& diff.

EXAMPLE:

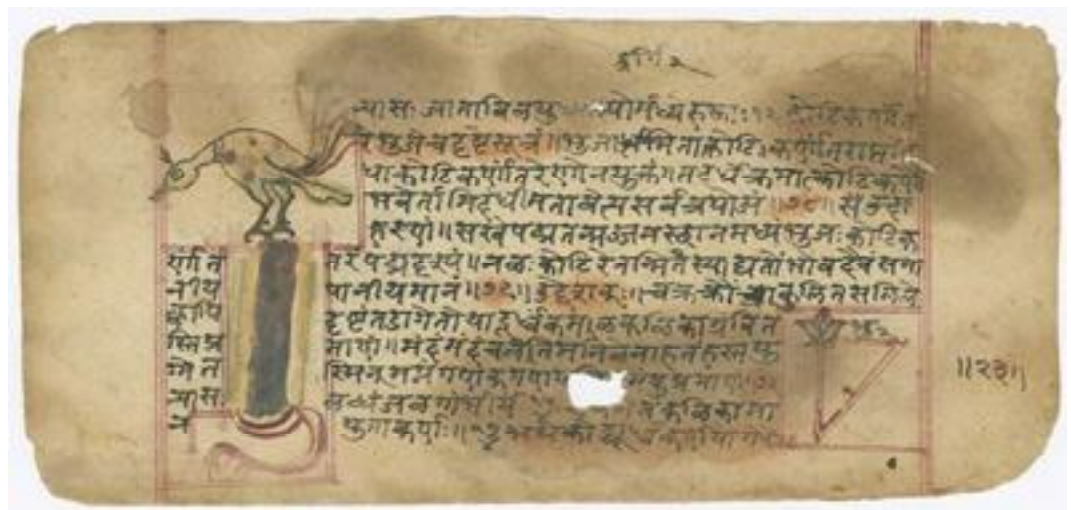
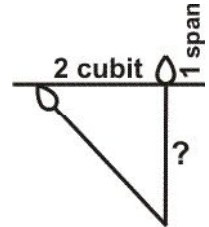
In a certain lake swarming with ruddy geese and cranes, the tip of a bud of lotus was seen a span above the surface of the water. Forced by the wind, it gradually advanced, and was submerged at the distance of two cubits. Compute quickly, mathematician, the depth of water.

[Note the distance from the lotus to the spot it submerged is the bhuja; the lotus above the water (1 span) is the 'difference'; the stem is the coti as also the depth of water; stem with lotus is karna, ]

bhuja 4 span (2 cubits), Diff 1 span, Depth ?

Square 4, divide by 1, get 16; karna is half of 16 and 1;

Coti is half of 16, less 1, get  $\frac{15}{2}$  spans



### 7.1.10 Karna & Sum of Other Two Given

From twice the square of the karna subtract the sum of the coti and side multiplied by itself, and extract the square-root of the remainder. Set down the sum twice, and let the root be subtracted in one place and added in the other. The moieties will be the measures of the bhuja and coti.



given  
karna  
& sum

Square karna, double; Subtract square of sum; Take square-root;  
Half sum and difference of this root and given sum are the bhujas.

EXAMPLE:

1) Where karna is seven above ten; the sum of the bhuja and coti, three above twenty; tell them to me, my friend.

karna 17,      sum of others 23,      coti ?,      bhuja ?

square 17, 289; double this, 578, square 23, 529. difference, 49; square-root, 7  
half of 23, 7 is **15**; half of 23 less 7 is **8**.      or  $[23 - 15 = 8]$

### 7.1.11 Karna & Difference of Other Two Given

RULE SAME AS PREVIOUS (*above*).



given  
karna  
& diff

EXAMPLE:

Where karna is seven above ten; the sum of the bhuja and coti, three above twenty; tell them to me, my friend.

karna 13,      difference of others 7,      coti ?,      bhuja ?

square 13, 169; double this, 338, square 7, 49. difference, 289; square-root, 17  
half of 17, 7 is **12**; half of 17 less 7 is **5**.      or  $[17 - 7 = 10]$

On the left: Image of another page from the Lilavati manuscript

The 'peacock-snake' and 'lotus in a tank' problems (previous two pages)

Thanks to *Mathematics Association of America Digital Library* - Washington D. C.