Perfect joins

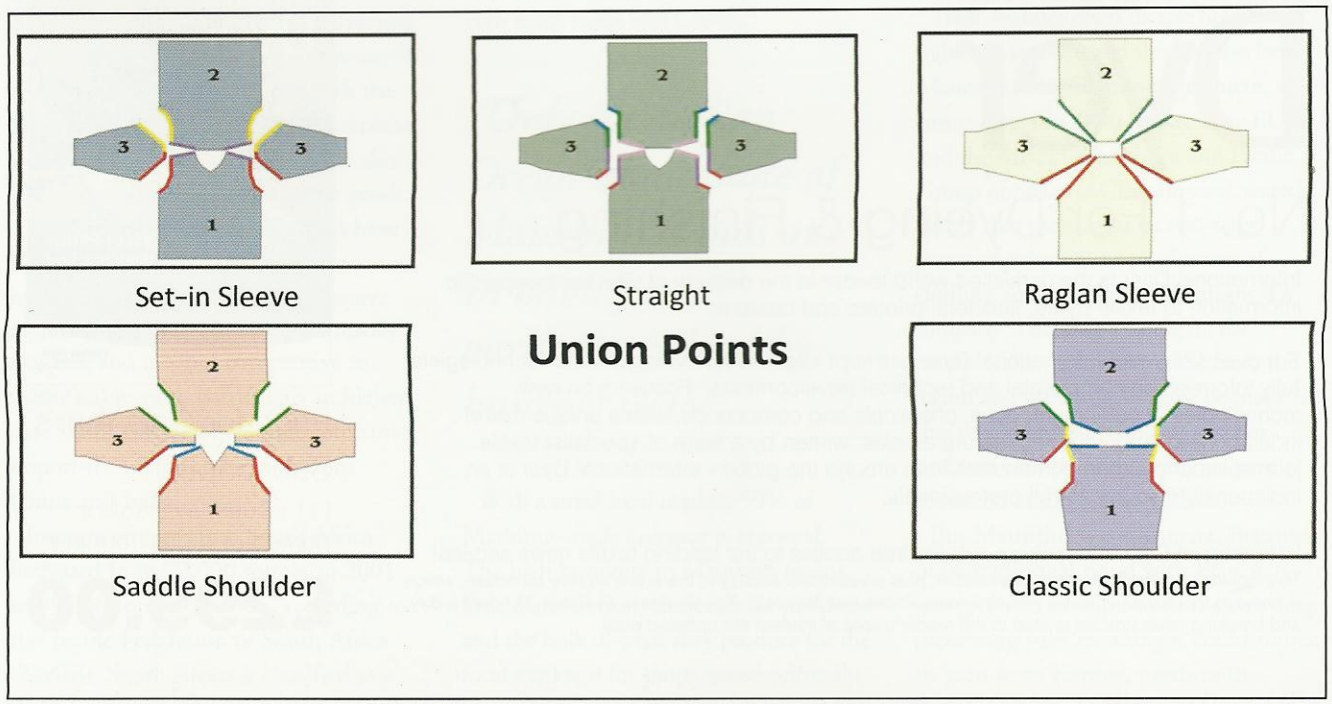
The most important measurement in a sweater is slope of the arm hole, which should equal the sleeve joint angle to avoid puffing out or caving in at the latter, explains **Sunil Kumar Puri**

Fully fashioned sweaters can be classified according to five different shapes: set-in sleeve, straight, raglan, saddle shoulder and classic. The beauty of a knitted garment lies in the accurate fitting of the union points of front, back and sleeves.

As these panels are knitted and not woven, it is often assumed that the loops compensate for deficiencies in shape of front, back and sleeves, however, the garment may measure accurately but the expert eye will always know that because of panel inaccuracy, stitches or knit loops get distorted and are no longer aligned.

A nicely made garment, when placed on a table, should have all the courses and whales in straight lines, which at times becomes difficult to achieve and the sweater arms should extend at the same angle as that of the shoulder slope. The sleeves should not puff out at the shoulder joint nor should they cave in. Therefore the most important measurement in a sweater is slope of the arm hole as this should be the sleeve joint angle as well.

The calculations of knitting specifications are based on a combination of simple mathematics and the Pythagoras Theorem of geometry (Fig 2). In most cases dimensions provided by the customer are in two different sets - the first one where the sleeve length is given as under sleeve length and the other in which the sleeve length is given for the upper part of the sleeve.



In both cases measurement of sleeve length up to the part where it has to join the body is not given. Also the side length of the body where the sleeve has to join it is rarely provided by the buyer. However, by simple calculations and by applying the Pythagoras Theorem all calculations can be made precisely and accurately.

Figure 1a, derived from Table 1a, provides a measurement for the under sleeve but does not reveal what length must be knitted to achieve the under arm length.

Similarly it does not tell how much of the sleeve head (crown or cap) must be knitted so that it not only fits in the joint of the front and back properly but also maintains the slope of shoulder angle.

Slight variation will lead to change in the sleeve angle with the horizontal plane that starts from the back of the garment neck. If at this point the sleeve cap is larger than required it will make the angle steeper than that of the shoulder and may also result in a protruding bulge at the shoulder joint. The opposite of this will result in a less steep angle than that of the shoulder slope, giving a wing like shape to the sleeve and the sleeve joint may also show a caved-in effect.

The dimensions in Table 1b also do not tell the knitter anything about the exact length of the sleeve where it has to join the body, measurement of the crown of the sleeve as well as the side length of the body where the sleeve has to be joined, but Pythagoras Theorem can help.

Using the Pythagoras Theorem, if any two values are known, the third can be calculated i.e. if the hypotenuse and the adjacent are known, the value of the opposite can be calculated, if the hypotenuse and the opposite are known, the adjacent can be calculated and if the values of the adjacent and the opposite are known, the hypotenuse can be calculated.

Also by using simple trigonometric functions if the values of either the hypotenuse, the adjacent or the opposite and any angle other than the right angle the value of other sides of the triangle or if the value of any two

Table 1a: Lady's pullover classic shoulder measurements

Description	Size			
	S/38	M/40	L/42	XL/44
Length	62	64	66	66
Shoulder	36	40	44	48
Chest	46	50	54	58
Sleeve length under arm	44	46	48	48
Neck width	17	17	18	18
Armhole	21	22	22	23
Sleeve opening	7.5	8	8	9
Muscle 1in below armhole	18	19	19	20
Front V-neck drop	17	17	17	17
Front R-neck drop	8	8	9	9
Shoulder slope	2	2	2	2
Back neck drop	1.5	1.5	1.5	3/4

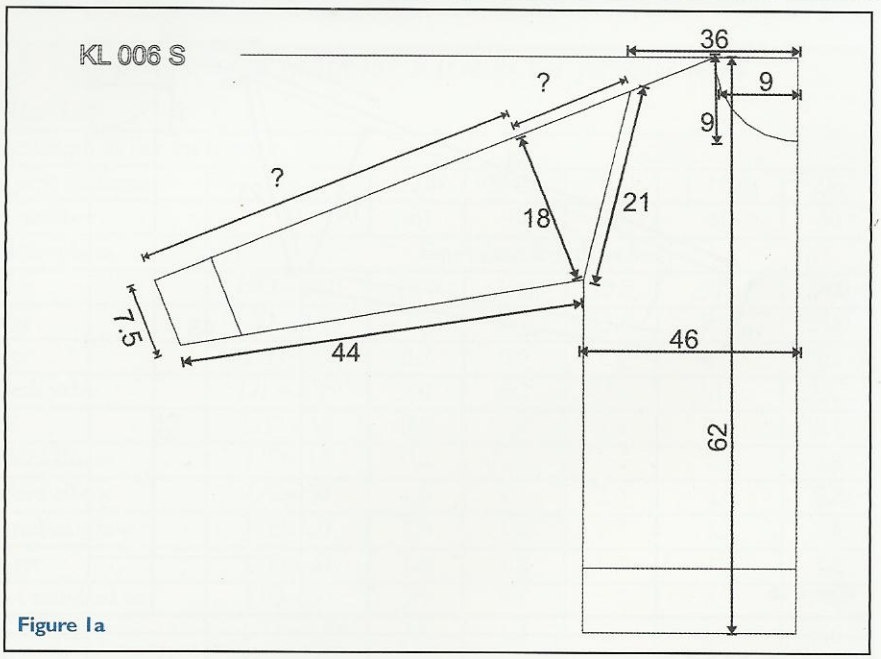
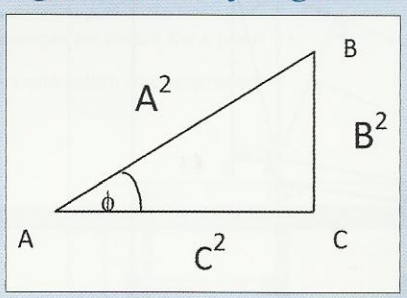


Figure 1a

Figure 2: The Pythagoras Theorem



According to the Pythagoras theorem the square of the hypotenuse in a right angled triangle is equal to the sum of the squares of both the adjacent and the opposite, i.e. A2= B2 + C2 where A is the line between A and B, also called the hypotenuse, C the line between points A and C, also called the adjacent, and B the line formed between points B and C. The angle between BAC is called Ø and the angle between ACB is a right angle or 90°. Also B/A = Sin and C/A = Cos. The same can also be written as B = A *Sinϕ, C = A* Cosϕ and B/C = Tanϕ.

The values of Sin Ø and Cos Ø can be easily obtained by using a scientific calculator or trigonometric tables.

Table 1b: Lady's pullover classic shoulder measurements

Description	Size			
	S/38	M/40	L/42	XL/44
Length	62	64	66	66
Shoulder	36	40	44	48
Chest	46	50	54	58
Sleeve length upper arm	56	56	60	60
Neck width	17	17	18	18
Armhole	21	22	22	23
Sleeve opening	7.5	8	8	9
Muscle 1" below armhole	18	19	19	20
Front V-neck drop	17	17	17	17
Front R-neck drop	8	8	9	9
Shoulder slope	2	2	2	2
Back neck drop	1.5	1.5	1.5	3/4

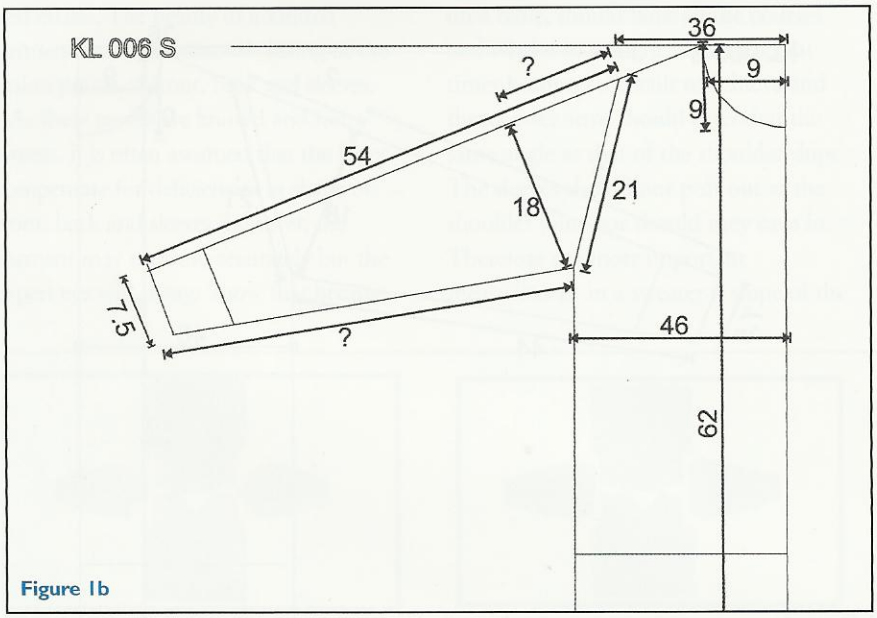


Figure 1b

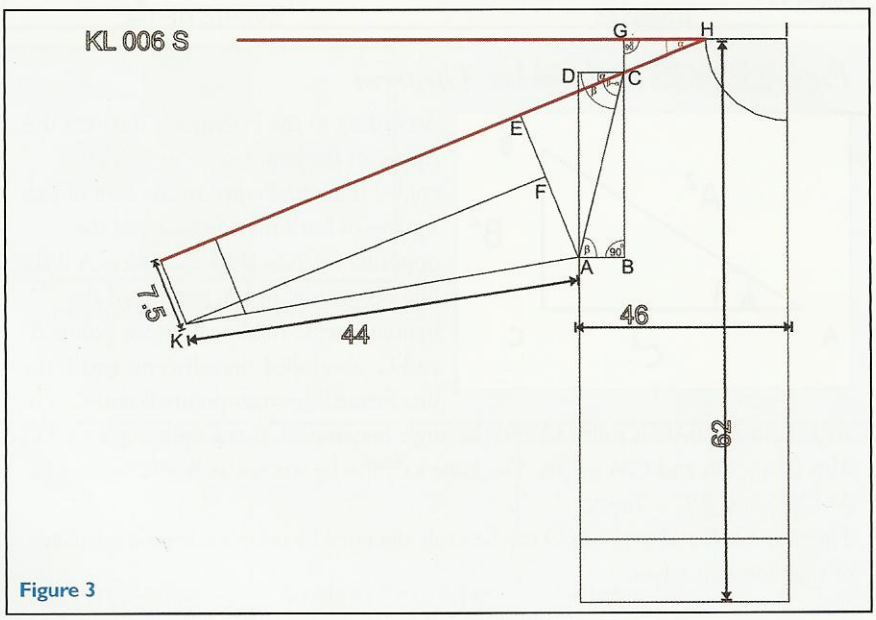


Figure 3

sides of the triangle are known, the value of the third and also the angle of the triangle can be calculated.

As discussed earlier, to knit a good sweater the arms should be at the same angle as that of the shoulder slope, making it necessary to ascertain the shoulder slope angle. Normally the buyer provides shoulder drop as a measurement for all sizes. If the drop is kept the same for all sizes, the angle will vary between sizes.

In cut and sew garments there is no problem but for the three basic fully fashioned garment styles i.e. raglan, saddle shoulder and classic, the shoulder slope angle must be maintained and therefore it is necessary to understand how to obtain the shoulder slope angle and angle that regulates measurement of the sleeve cap or crown and its width.

In Figure 3 the triangle GCH represents the shoulder slope angle. If we know the value of the shoulder drop, GC we can easily deduce the value of the adjacent, GH. GH = (shoulder width - neck width)/2. We also know the value of the opposite i.e. GC. The angle between GHC can be easily calculated using simple trigonometric formulas. The simple way to find the angle would be opposite/adjacent = Tan F.

If the shoulder drop is 2cm and adjacent = (shoulder - width of the neck)/2 = (36 - 17)/2 = 9.5 then 2/9.5 is the tan value of angle ϕ, which would be 2/9.5 = 0.21052. The degrees of angle ϕ of this triangle GHC, where angle HGC is a right angle, can be calculated using any scientific calculator e.g. the default calculator provided by Microsoft Windows using the scientific view. Entering the value 0.21052, then selecting the Inv key followed by the Tan key gives the angle value. The angle of the shoulder slope is approximately 12°.

In part two, calculating the angle of the arm hole will be discussed.

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