

Chapter 6 “Point, line and direction construction”

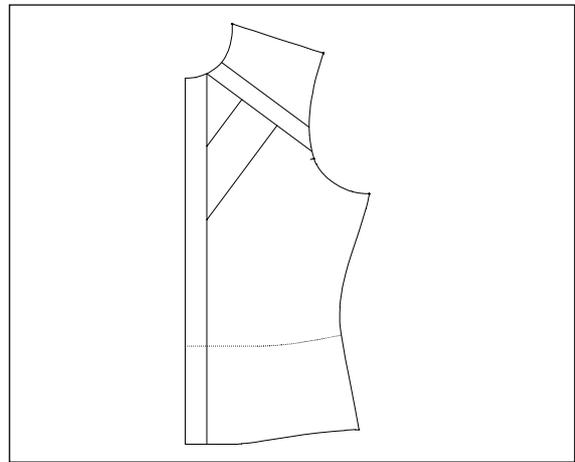
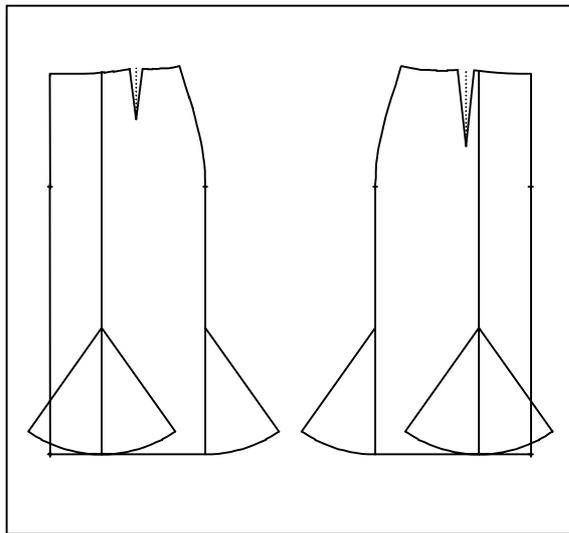
©Friedrich: Grafis – Textbook Part I, Edition 10/2003

Contents

6.1 The sub-menu point construction	2
6.2 Further point construction	5
6.3 Construction of lines	7
6.4 Direction construction and <i>p+dir+lg</i>	10
6.5 Circle arcs	12
6.6 Rectangles.....	13
6.7 Exercises	13

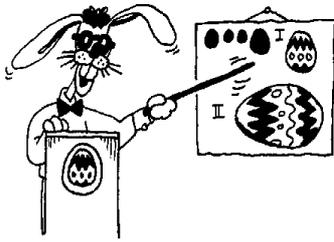
In this chapter you will learn about the essential tools for point and line construction and construction of rectangles and circle arcs. These functions are all contained in the *p+l+c+r* menu (points+lines+circles+rectangles).

The point and direction construction is very important. Therefore, each section already contains detailed exercises. At the end of the chapter all functions are practised in conjunction. Please read the explanations and perform all exercises.



6.1 The sub-menu point construction

Significance of point construction



Each line consists of starting and final point and additional fulcrums, if necessary. The construction of starting and final point

influences the position and shape of the lines during grading with Grafis to a great extent. The advantages of automatic similar construction can only be utilised fully if each construction step and thus, each point construction is carefully thought through in relation to the other sizes. In the base size it makes no difference whether a point is placed 20 mm or 20% down a 100 mm long line. As soon as similar construction is called and the overall length of the line changes between the sizes, there is a difference between the two ways of constructing a point!

The sub-menu point construction

The sub-menu point construction is used for construction of new points as well as being opened automatically for certain construction steps such as

- during construction of the starting point of the cutting line under *separate* and *p+dig*,
- when setting *symbols*
- during *insert* of objects and selecting the insert transformation
- with *transform* objects,
- during construction of starting and final point of *curves*,
- for the construction of new points and lines and much more.

For the construction of a new point the menu is opened via *p+l+c+r | p_____*. First, call the basic block „Grafis Bodice 10“, activate the interactive construction and relocate the bust dart into the side seam by altering the corresponding option. Then, open the point construction sub-menu. The construction of a point can ensue according to eight different principles.

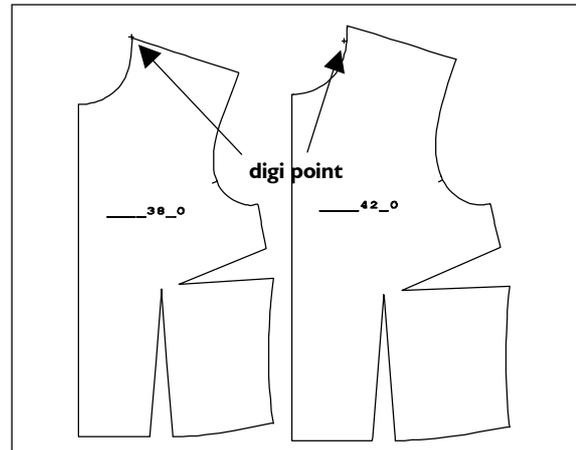
point constr.
dig
click p
click l
click pl
intersectn
p on x&y
x= .0
y= .0
rlg on l
rlg= 50.0
plg on l
plg= 100.0

dig -freehand point

Step-by-step guide

- ⇒ *p+l+c+r | p_____*
- ⇒ Activate the function *dig*
- ⇒ Set the new point freehand

With *dig* a point is set freehand and is located at the same position in all sizes. Freehand points should be avoided and used only as an exception as they do not contain any grading information.



Picture 6-1

In Picture 6-1 a point has been placed at the corner of shoulder/ neckline with *dig* in base size 38. As the x/y co-ordinates of a *dig* point remain unchanged during grading, the point is positioned next to the actual construction in other sizes. The point is not linked to the construction.

click p - point out of an existing point

Step-by-step guide

- ⇒ *p+l+c+r | p_____*
- ⇒ Activate *click p*
- ⇒ Click the point

With *click p* the new point is linked to an existing point and graded with this point.

Reset the construction back to construction step

001. Activate *click p* and move the cursor over the pattern. A thin thread extended from the cursor (thread cursor) marks the position where a new point would be placed after . With *click p* the thread cursor points to existing points of the construction, only. Construct a new point with *click p*. It blots out the existing point of the construction and is invisible on screen. This effect was already explained in section 4.5 relating to lines. Point construction with *click p* is used for the construction of starting and final points of lines and curves, amongst others. Reset the construction record to 001.



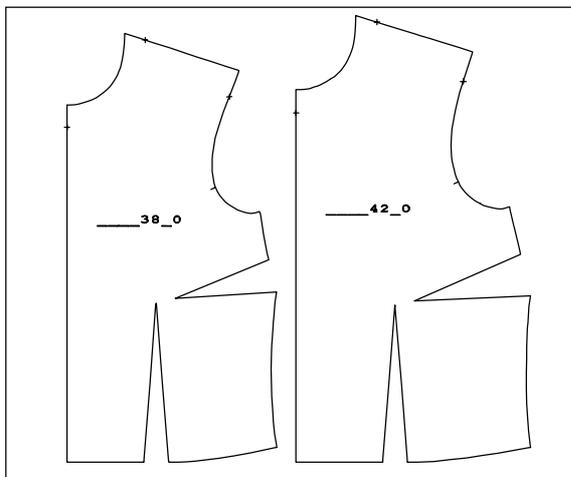
click l - point on line

Step-by-step guide

⇒ $p+l+c+r$ | p _____⇒ Activate *click l*

⇒ Click the line

With **click l** a new point is constructed on a line at the position closest to the cursor. During grading this position is moved **relative** to the length of the line. With this construction option it is important to make sure that the base line is not unnecessarily linked to another line across a corner. A point on the side seam is graded differently if the side seam is linked to the hem. In this case the point is not moved relative to the length of the side seam but relative to the length of the linked side seam plus hem.



Picture 6-2

In Picture 6-2 a total of three **click l** points were placed in the base size 38, on the centre front, the shoulder and the armhole. In size 42 these points were graded proportionally with the altered length of the base line. They are attached to the contour. When setting a **click l** point the thread cursor points towards the nearest line. The colour of the line also changes. Construct the points and grade.

click pl - point on the fulcrum of a line

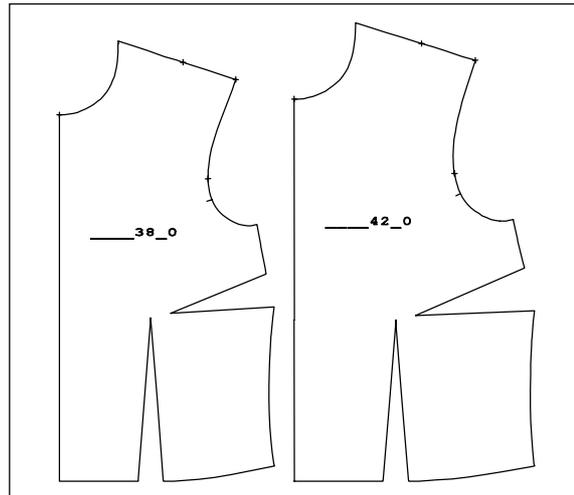
Step-by-step guide

⇒ $p+l+c+r$ | p _____⇒ Activate *click pl*

⇒ Click the line

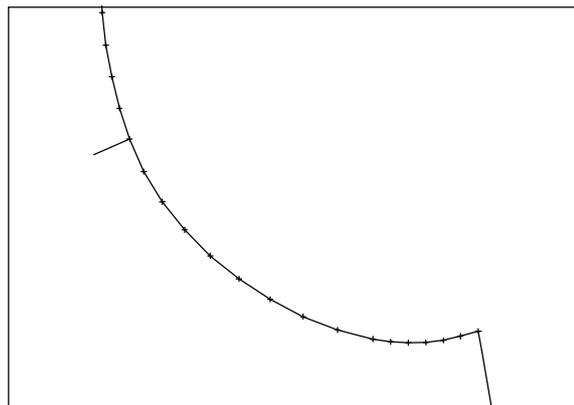
With **click pl** the point is constructed on the nearest fulcrum of a line or curve. Lines usually contain a minimum of two fulcrums, the starting and the final point. In Grafis, curves are saved as polygons, meaning they consist of a number of individual lines (Picture 6-4). The starting and final points of these lines are the fulcrums of the curve. They can be shown with *raster 0*.

In Picture 6-3 a total of three **click pl** points were placed, onto the top end of the centre front, the



Picture 6-3

corner point of the divided shoulder line and the end point of the divided armhole line. When setting a **click pl** point the thread cursor points only to the beginning or end points of a line. Construct the displayed points and then, grade in size 42. The points remain on the end points of the line also in size 42.



Picture 6-4

Zoom in to the lower part of the armhole (Picture 6-4) and move the cursor along the curve. You can see the fulcrums on which a new point would be constructed with **click pl**.

Intersection - point on the intersection of two lines

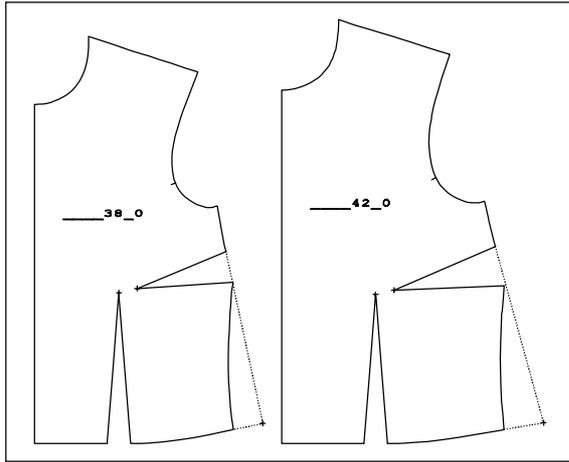
Step-by-step guide

⇒ $p+l+c+r$ | p _____⇒ Activate *intersectn*

⇒ Click the first line

⇒ Click the second line

With **intersectn** a point is constructed on the intersection of two lines or curves. The lines and/or curves are to be clicked one after the other. The first clicked line is highlighted in colour. An intersection point is also constructed if both lines intersect only when extended (max. 500 mm).



Picture 6-5

Set the intersection points on the dart lines of bust dart and waist dart and the intersection point of the extended upper side seam with the extended hem as shown in Picture 6-5. Grade in different sizes.

***p* on *x&y* - point on *x* and *y* co-ordinates**

Step-by-step guide

- ⇒ $p+l+c+r$ | p _____
- ⇒ Enter parameters for $x=...$ and $y=...$
- ⇒ Click on p on $x&y$

The position of all objects relates to the co-ordinate source, see section 4.3. With ***p* on *x&y*** a point is constructed with the *x* co-ordinate entered for $x=...$ and the *y* co-ordinate entered for $y=...$ After having entered the values  on ***p* on *x&y*** constructs the new point.

A point created with *x&y* should only be used for „zero run constructions“ or with construction parameters (Chapters 11 and 12), as otherwise it will behave exactly like a *digi* point.

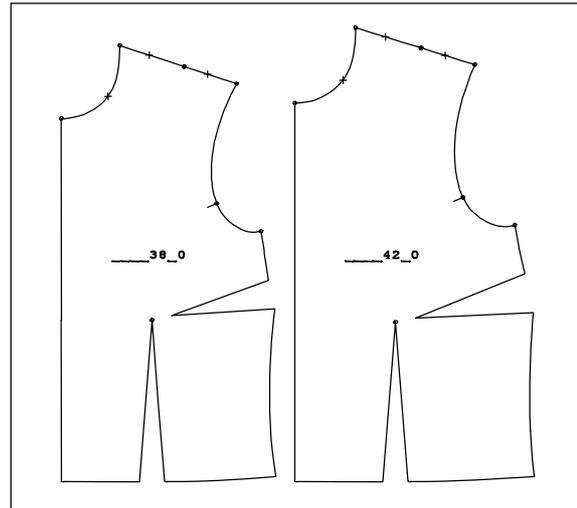
***rlg* on *l* - point on the relative length of a line**

Step-by-step guide

- ⇒ $p+l+c+r$ | p _____
- ⇒ Enter the parameter $rlg=...$
- ⇒ Activate ***rlg* on *l***
- ⇒ Click the line, following the right principle

With ***rlg* on *l*** a point is constructed on the relative length of a line. The relative length in % relates to the total length of the line and is to be entered into the line $rlg=...$ When clicking the line the right principle is to be followed, as the relative length is calculated from the beginning of the line.

In Picture 6-6 the shoulder was linked first and then, points were constructed on the centre of the neckline and on the shoulder at 25% measured from the neckline and the armhole respectively. In other graded sizes these points are positioned accordingly. Note the direction indicator of the cursor when clicking!



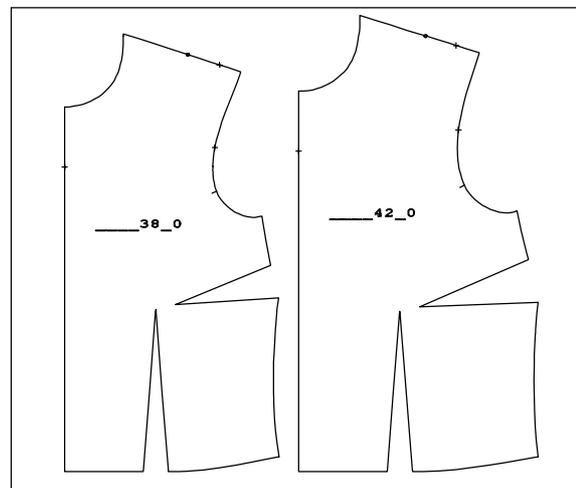
Picture 6-6

***plg* on *l* - point on the partial length of a line**

Step-by-step guide

- ⇒ $p+l+c+r$ | p _____
- ⇒ Enter the parameter $plg=...$
- ⇒ Activate ***plg* on *l***
- ⇒ Click the line, following the right principle

As opposed to ***rlg* on *l***, ***plg* on *l*** generates a point on a partial length of a line. The required length is to be entered in mm in the line $plg=...$ then, click on ***plg* on *l*** above. Here also, the right principle is to be followed as the partial length is measured from the beginning of the line.



Picture 6-7

In Picture 6-7 a total of three points were constructed with ***plg* on *l***. The point on the centre front is positioned at a partial length of 60mm from the neckline. The point on the shoulder was constructed at a distance of 100mm from the neck, the shoulder was linked beforehand. The point on the armhole was measured from the corner of the shoulder with a distance of 80mm measured along the line. These partial lengths remain in tact also in other sizes. Convince yourself by grading and stacking.

6.2 Further point construction

The *p+l+c+r* menu

The *p+l+c+r* menu contains tools for the construction of points, lines, circle arcs and rectangles and can be called directly from the basic menu. Clicking *p* leads into the sub-menu point construction which was explained in the previous section. In this section the four remaining options for point construction are to be introduced.

The remaining functions of the *p+l+c+r* menu for line, circle and rectangle construction are explained in the following sections.

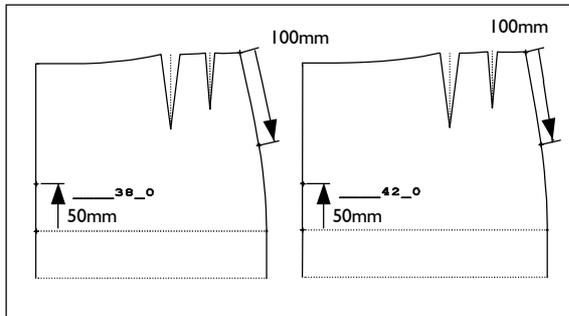
p+l+c+r	
points:	
<i>p</i>	
<i>p+d on line</i>	<i>d = 20.0</i>
<i>p+rel+p on l</i>	
<i>p+rel+p</i>	
<i>rel=</i>	<i>50.0</i>
<i>digi on p+p</i>	
lines:	
<i>p ==> p</i>	
<i>p ==> px</i>	
<i>p ==> py</i>	

p+d on l - point with a distance to a base point on a line

Step-by-step guide:

- ⇒ *p+l+c+r*
- ⇒ Enter the parameter *d=*
- ⇒ Activate the function *p+d on l*
- ⇒ Construct the base point with the sub-menu point construction

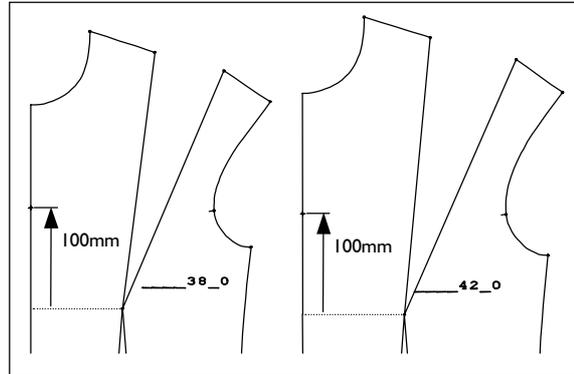
With this function a point is constructed on an existing line with a defined distance to an existing point. The set distance is considered during grading. When clicking the line the right principle is to be followed.



Picture 6-8

In Picture 6-8 two new points were constructed in the basic block “Grafis Skirt 20”, with the function *p+d on l*. For the point on the centre front enter *d=50* below the line *p+d on l* in the *p+l+c+r* menu. Clicking on *p+d on l* opens the sub-menu point construction to define the base point. Click the hip point on the centre front with *click p*. Then the base line is to be clicked. With the right principle you determine the direction in which the point is constructed.

In the example in Picture 6-8 click to the right of the centre front. Construct the point on the side seam, also.



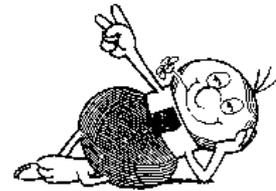
Picture 6-9

Should the base point not be placed on the base line, the construction begins at its perpendicular point on the base line. In Picture 6-9 the bust point is the base point. The new point was measured from its perpendicular point onto the centre front with a distance of 100 mm.

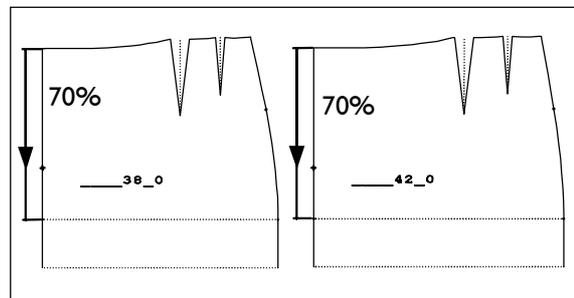
p+rel+p on l - point between two points on a line

Step-by-step guide:

- ⇒ *p+l+c+r*
- ⇒ Enter the parameter *rel=*
- ⇒ Activate the function *p+rel+p on l*
- ⇒ Construct the first base point
- ⇒ Construct the second base point
- ⇒ Click the base line



The new point is constructed on the base line at a relative position between two base points. The distance between the base points is measured along the line.



Picture 6-10

As opposed to the example in Picture 6-8 the new points in Picture 6-10 were constructed at a relative length position. For the point on the centre front enter $rel=70$ below the line $p+rel+p$ in the $p+l+c+r$ menu. Clicking on $p+rel+p$ **on l** opens the sub-menu point construction to define the two base points between which the new point is to be constructed. Click the waist point and then the hip point on the centre front with *click p*. With this succession you define that the distance is measured from the waist. After having clicked the base line, (here: centre front) the new point is constructed

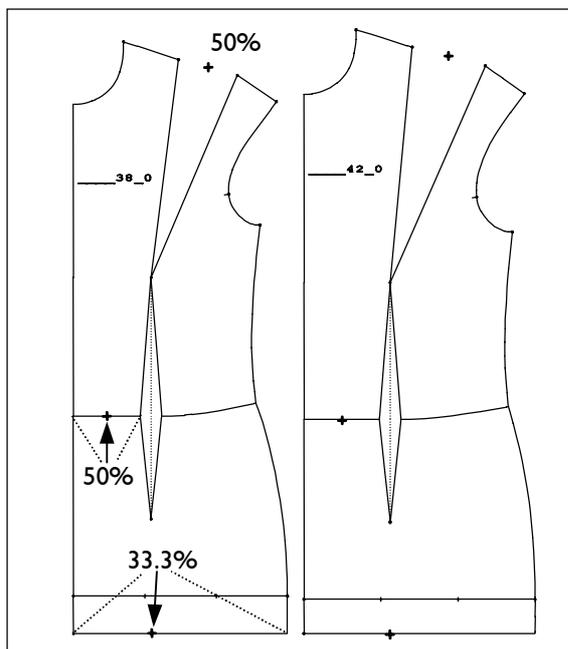
Should the base points not be placed on the base line, their perpendicular points onto the base line are used.

$p+rel+p$ - point between two points

Step-by-step guide:

- ⇒ $p+l+c+r$
- ⇒ Enter the parameter $rel=$
- ⇒ Activate the function $p+rel+p$
- ⇒ Construct the first base point
- ⇒ Construct the second base point

The new point is constructed at a relative position between two base points. No base line is required. The position is determined relative to the first base point.



Picture 6-11

In Picture 6-11 three new points are constructed with the function $p+rel+p$ in the basic block „Grafis Bodice 10“. For the bisector of the bust dart enter

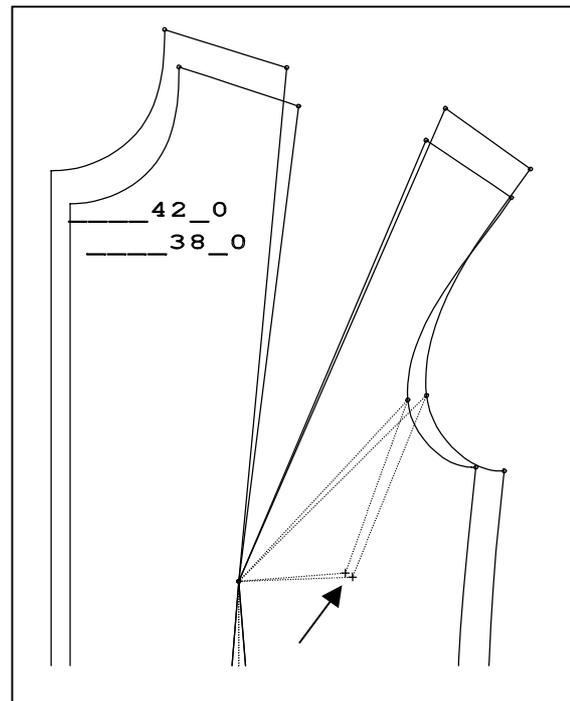
$rel=50$ in the line below $p+rel+p$. After having clicked on $p+rel+p$ and the two final points of the dart line, the new point is constructed. The centre point on the waist line of the front was placed in the same way. The third point is constructed by first linking the hem line and then, defining rel as 33.3. Clicking on $p+rel+p$ and the end points of the hem line constructs the point. The succession in which the points are clicked determines the direction from which the 33.3% are measured.

$digi$ on $p+p$ - $digi$ point, bound onto two points

Step-by-step guide:

- ⇒ $p+l+c+r$ | $digi$ on $p+p$
- ⇒ Set $digi$ point freehand
- ⇒ Construct the first base point
- ⇒ Construct the second base point

A point set freehand with $digi$ on $p+p$ is graded proportionally with the points it is bound to. The point marked in Picture 6-12 is bound onto the bust point and the sleeve point and graded proportionally.



Picture 6-12

Grafis internally constructs a triangle between the three points and changes its size and position during grading but not its shape.

6.3 Construction of lines

The p+l+c+r menu

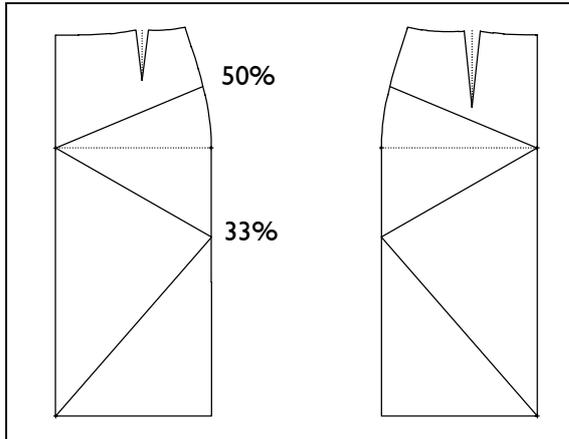
Apart from the functions for point construction which were already discussed in the previous two sections, the p+l+c+r menu also contains functions for the construction of lines, circles and rectangles. The functions for the construction of lines are introduced in this section. A further line construction p+dir+lg is subject of the following section “direction construction”.

p==>p - line between two points

Step-by-step guide

- ⇒ p+l+c+r
- ⇒ Activate p==>p
- ⇒ Construct first point
- ⇒ Construct second point

With p==>p a line is constructed between two points. After having called this line construction the sub-menu point construction is opened for construction of the starting and final point of the line.



Picture 6-13

In Picture 6-13 the following lines were constructed in the style „Straight skirt“ from Section 2.4:

- from the hip point of the centre front and the centre back to the centre of the respective hip curve
- from 33% along the side seam, measured from the hip point to the hip point of the centre front and centre back
- from 33% along the side seam, measured from the hip point to the corner of hem/ centre front and centre back

After having activated p==>p select click pl from the point construction sub-menu and click the hip point. The final point of the line is determined with rlg on l (rlg=50.). The other lines are constructed in the same way, following the right principle when clicking the side seam.

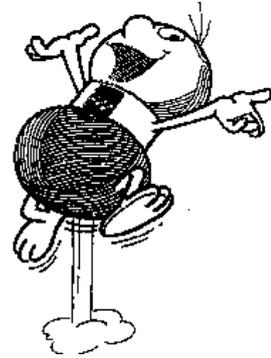
p+l+c+r
points:
p _____
p+d on line
d = 20.0
p+rel+p o.l
p+rel+p
rel= 50.0
digi on p+p
lines:
p ==> p
p ==> px
p ==> py
p + digi
p+dir+lg
lg=200.0
tang.p=>l
perp p=>l
rectangles:

p==>px - horizontal to the x co-ordinate of a point

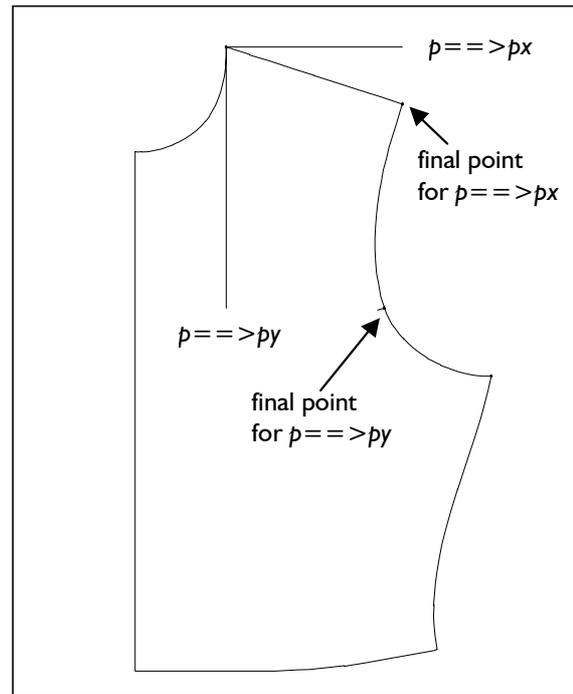
p==>py - vertical to the y co-ordinate of a point

Step-by-step guide

- ⇒ Activate the function p==>px or p==>py
- ⇒ Construct the starting point of the line
- ⇒ Determine auxiliary point for calculation of the final point



The functions p==>px and p==>py construct horizontal or vertical auxiliary lines. After having activated the respective function the starting point of the line is to be defined and then a second point is to be determined for calculation of the final point. For calculation of the final point with p==>px the x co-ordinate of the second point is applied, with p==>py the y co-ordinate is used.



Picture 6-14

In Picture 6-14 the following was constructed in basic block „Grafis Bodice 20“

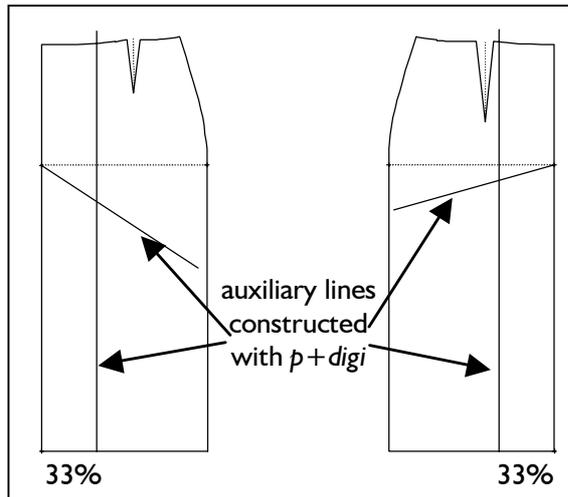
- a horizontal auxiliary line from the corner point neck/ shoulder to the final point of the shoulder and
- a vertical auxiliary line from the corner point shoulder/neck to the construction point of the armhole .

Having selected p==>px click the corner point neckline /shoulder with click pl and then, the end point of the shoulder or the sleeve pitch with click pl or click p.

$p+dig$ - freehand line bound onto a point**Step-by-step guide**

- ⇒ Activate the function $p+dig$
- ⇒ Construct the starting point
- ⇒ Determine the final point freehand

This function creates a line with a fixed length in any direction. Length and direction are constant throughout all sizes. $p+dig$ is particularly suitable for horizontal, vertical or oblique auxiliary lines.



Picture 6-15

In Picture 6-15 a total of four lines was constructed with $p+dig$. After having activated $p+dig$ the starting point of the line is to be defined with the point construction sub-menu. Length and direction of the line can then be determined by moving the cursor freehand. The preferred directions horizontal and vertical act like a magnet, the line “jumps” to these directions.

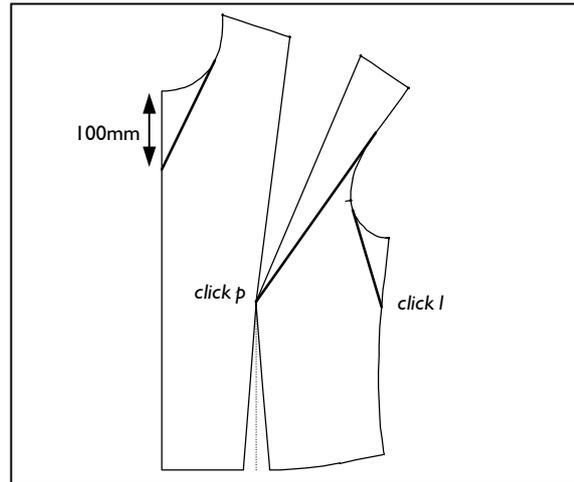
Construct all lines depicted in Picture 6-15 in the style „Straight skirt“ from Section 2.4. The lines can be extended to the side seam or cut off at the waist with *separate*. Grade sizes 40 and 44.

 $tang.p=>l$ - line as tangent to a line**Step-by-step guide**

- ⇒ Activate the function $tang.p=>l$
- ⇒ Construct the starting point
- ⇒ Click the line to which the tangent is to be created

With $tang.p=>l$ a tangent to a line is constructed. After having activated $tang.p=>l$ the starting point of the tangent is to be determined. Then, the line to which the tangent is to be generated is to be clicked. If no tangent can be created Grafis does not react.

In Picture 6-16 the neckline was designed as a tangent to the neck curve. A further line begins at the bust point and ends as a tangent at the upper armhole curve. The third line begins at the side seam and ends as a tangent at the lower armhole curve.



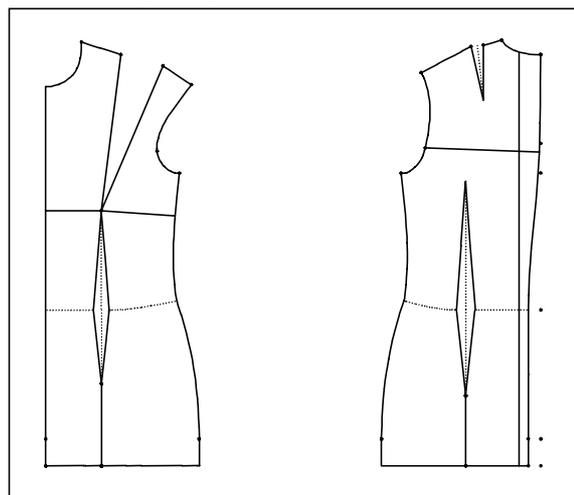
Picture 6-16

After having called basic block „Grafis Bodice 10“ and having activated $p+l+c+r | tang.p=>l$ the starting point of the tangent is to be determined (left: plg on l with $plg=100$). The tangent is constructed when the neck curve is clicked. Construct also the two other lines.

 $perp p=>l$ - perpendicular onto a line**Step-by-step guide**

- ⇒ Activate the function $perp p=>l$
- ⇒ Construct the starting point
- ⇒ Click the line onto which the perpendicular is to be dropped

With $perp p=>l$ a perpendicular is dropped from a point onto a line. After having activated the function $perp p=>l$ the starting point is to be determined, first. Then the line onto which the perpendicular is to be dropped must be clicked. The perpendicular takes on a right angle to the clicked line.



Picture 6-17

Construct the perpendiculars in basic block „Grafis Bodice 10“ shown in Picture 6-17:

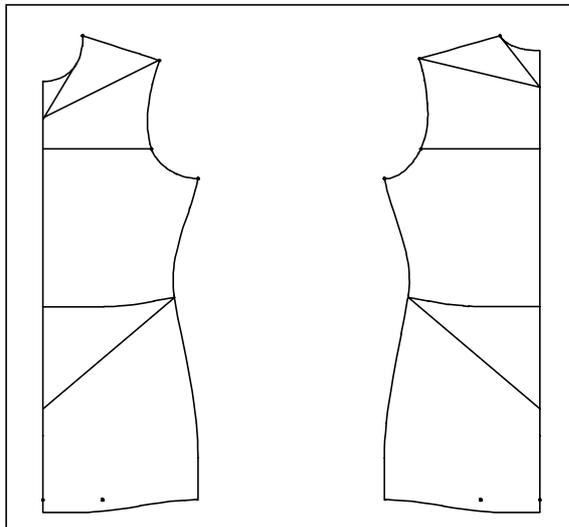
- the perpendicular from the bust point onto the centre front,
- the perpendicular from the bust point onto the side seam,
- the perpendicular from the darts onto the hem in front and back,
- the perpendicular from the sleeve pitch to the centre back and
- the perpendicular from 50% of the neckline onto the hem.

Exercises

1st Exercise

Call the basic block „Grafis Bodice 20“ and construct the following lines:

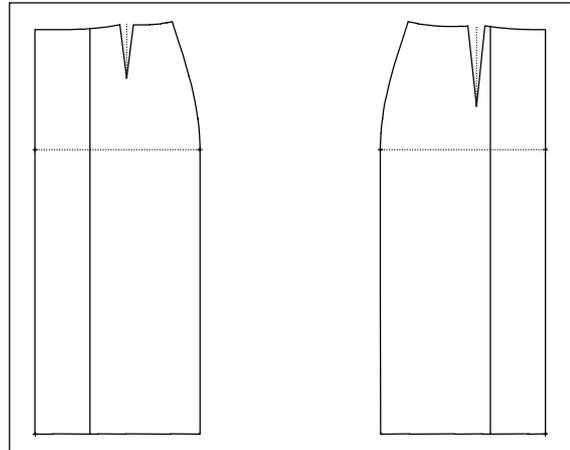
- from the corner shoulder/armhole onto the centre front, measured 60mm from the neck
- from the corner shoulder/armhole onto the centre back, measured 60mm from the neck
- a tangent from the lines just constructed onto the respective necklines
- the perpendicular from the respective sleeve pitches onto the centre front and centre back
- from the intersection of the side seam and the waist to the centre of the lower sections of the centre front and centre back. Note: the centre front and centre back are separated at the waist.



Picture 6-18

2nd Exercise

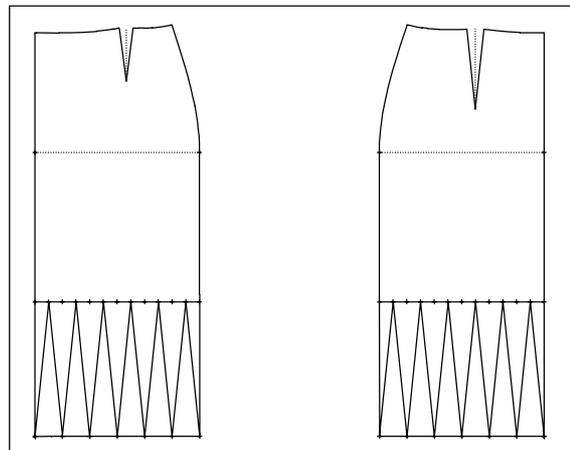
In the style „Straight skirt“ from Section 2.4 construct vertical panel seams starting at 33.3% of the hem, measured from the centre front or centre back. Use the function $p + digi$ and cut the two lines at the waist.



Picture 6-19

3rd Exercise

In the style „Straight skirt“ from Section 2.4 construct a parallel to the hem at a distance of 200mm respectively in the front and back skirt. Construct 7 equally distributed points on the hem and 13 equally distributed points on the parallels to the hem. Construct the lines according to Picture 6-20. Use the function $p = => p$.



Picture 6-20

6.4 Direction construction and $p+dir+lg$

When is the sub-menu direction construction required?

Grafis calls this sub-menu automatically when it is required for the solution of a problem, e.g.

- construction of a line to be aligned parallel to another line,
- construction of curves,
- alignment of symbols and many more..

Step-by-step guide

⇒ Set the basic direction with the upper group of functions

- Entry of an angle in the line $dir= ____.0$ or
- *click l* and clicking a line or
- *click p=>p* and constructing two points

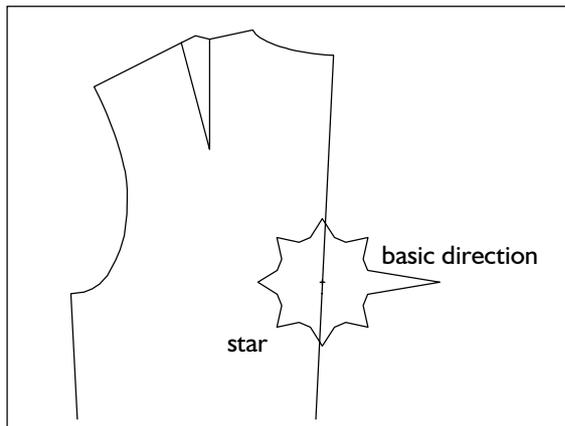
⇒ Adjust the difference angle with the lower group of functions

- Click the star and/or
- Click + and - next to the numbers 1, 5, 15, 45, 90 in the menu

basic dir:	dir=	.0
	<i>click l</i>	
	<i>click p=>p</i>	
diff-angle	is:	0.
-	90	+
-	45	+
-	15	+
-	5	+
-	1	+
	nil	
-	radius	+

Star with basic direction and derived direction

An important element of the direction construction is the star. This star works like a protractor. The long point of the star gives the basic direction and corresponds to the base line of the protractor.



Picture 6-21

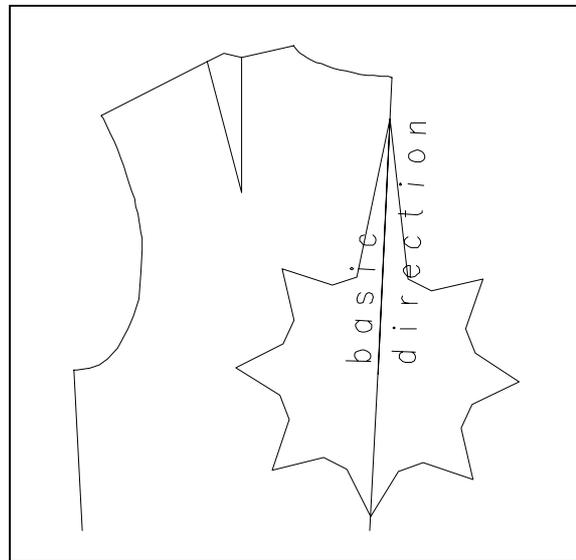
The basic direction is originally aligned in direction $dir=...$ (Picture 6-21 with $dir=0.$). If the new line is to be aligned at a certain angle to the centre back for example, the basic direction is now to be aligned to the centre back.

The basic direction can be adjusted by

- clicking on $dir=...$ and entering an angle,
- clicking on *click l* and clicking a line, considering the right principle or

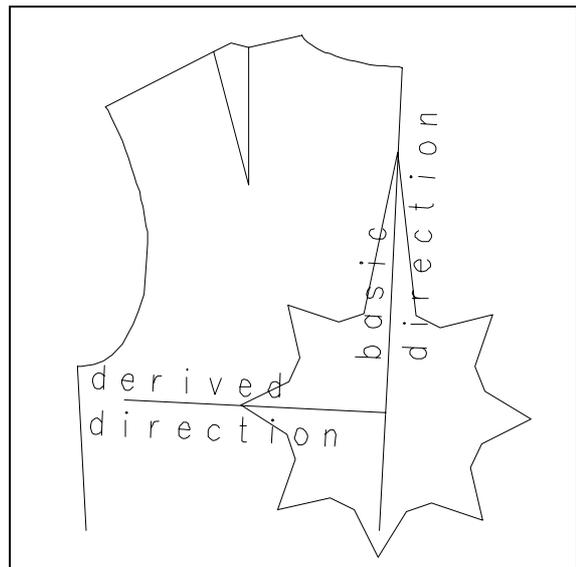
- clicking on *click p=>p* and construction two points; the basic direction is aligned along the connection of those two points.

The long peak of the star, then, points in the direction of the current basic direction (Picture 6-22). For the example in Picture 6-22 the centre back was clicked with *click l*.



Picture 6-22

After having aligned the basic direction the derived direction in which the new line is to be constructed must be adjusted. At first, the derived direction in form of a long stripe (see also Picture 6-23) points in the basic direction. It is altered by changing the difference angle between the basic direction and the derived direction. This procedure corresponds to marking an angle on the aligned protractor.



Picture 6-23

The difference angle can be adjusted

- by clicking + or - next to an angle value,
- manually, by clicking the star. For ease of use, the star is equipped with points. The inner points

are arranged with a distance of 15° and the outer points at a distance of 45° to one another.

The line *is: 0*. shows the adjusted difference angle. Clicking *nil* re-aligns the derived direction along the basic direction.

Clicking + or - next to *radius* increases or decreases the star to adapt the size of the star to the screen.

The sub-menu direction construction can be quit with .

During work with the sub-menu direction construction the functions for adjustment of the basic direction and difference angle are active at all times. Thus, clicking the star close to a line can lead to re-alignment of the basic direction.



$p+dir+lg$ - line out of point, direction and length

This line construction is also contained in the menu $p+l+c+r$ and requires the direction construction explained above. The function is explained in the following.

With the function $p+dir+lg$ a line with a given length is constructed from an existing point. The direction of the line can be adjusted with the sub-menu direction construction in relation to a basic direction.

lines:
$p ==> p$
$p ==> px$
$p ==> py$
$p + digi$
$p+dir+lg$
$lg=200.0$
$tang.p=> $
$perp.p=> $

rectangles:

Step-by-step guide

- ⇒ Enter length of the line in $lg=...$
- ⇒ Construct starting point of the line
- ⇒ Construct the direction of the line with the sub-menu direction construction

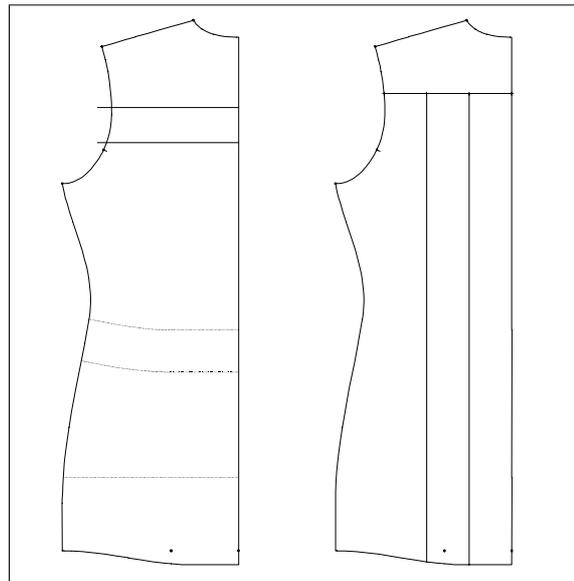
First, enter the length for the new line under $lg=...$ (below $p+dir+lg$) and click $p+dir+lg$. Grafis now expects the construction of the starting point with the sub-menu point construction. The star appears with the sub-menu direction construction. Adjust the basic direction and then the difference angle. Quit the sub-menu with  and the new line appears in your construction.

Exercise on $p+dir+lg$

1st Exercise

In „Grafis Bodice 20“ construct two lines of 200mm length at a right angle to the centre back. The lines

are to begin at 100mm and 150mm from the neck on the centre back (Picture 6-24 left).



Picture 6-24

Having constructed the starting point of the line, the star appears and the basic direction is to be determined. In this case the line is to run at a right angle to the centre back (in the following CB). Activate *click l* and click to the right and left of the CB. The long point is adjusted upwards and downwards along the CB. Follow the right principle and determine the basic direction neck-->hem.

The difference angle is to be adjusted so that the derived direction points to the left. Click on the signs + or - next to the row of values for the difference angle. The long point of the star remains in its place but the derived direction changes. Click also near the star and on *nil*. After some experimenting adjust the difference angle to -90° and terminate with .

2nd Exercise

In „Grafis Bodice 20“ construct a yoke at a right angle to the centre back (in the following CB), starting 80mm from the neck on the CB. Extend the line to the armhole and then, construct 4 equally distributed points.

Then, construct two spread lines parallel to the CB (Picture 6-24 right). Activate $p+dir+lg$ with $lg=600$, activate *click p* and click the starting point of the spread line. Activate *click l* and click the CB. Follow the right principle and define the basic direction neck --> hem.

The derived direction is identical to the basic direction. Therefore, the difference angle remains at 0° , press  and the spread line appears on screen. Grafis will repeat these steps for each size so that the spread lines are always parallel to the CB. Extend the spread lines to the hem.

6.5 Circle arcs

The $p+l+c+r$ menu

In the previous paragraphs of this chapter you learned about the powerful functions for point and line construction. In the lower part of the $p+l+c+r$ two options for the construction of circle arcs follow.

$cp + p$ - circle arc out of centre point and periphery point

Step-by-step guide

- ⇒ Click the line $cp+p$
- ⇒ Construct the centre point for the circle
- ⇒ Construct a periphery point

Clicking $cp + p$ opens the sub-menu point construction with which the centre point for the circle arc and then the periphery point can be determined. The clicked periphery point is exactly in the middle of the new circle arc.

Both options for the construction of circle arcs generate half circles only. If a complete circle is required a second circle arc is to be constructed or the circle arc is to be mirrored with the functions in the *transform* menu.



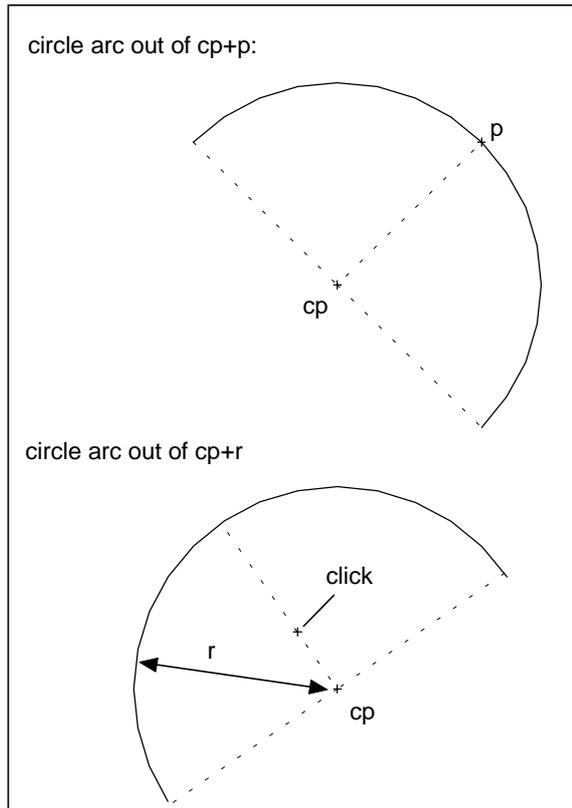
$cp + r$ - circle arc out of centre point and radius

Step-by-step guide

- ⇒ Enter radius for the circle in the line $r=50.0$
- ⇒ Construct centre point for circle
- ⇒ Click direction in which the circle arc is to be constructed

For this function the required radius for the circle arc is to be entered in the line $r= 50.0$ below $cp+r$ (click, type and <ENTER>). Clicking $cp+r$ opens the sub-menu point construction with which the centre point for the circle arc is to be determined. The direction for the circle arc is determined free-hand. In picture 6-25 the point for the direction of the circle arc is called “click”.

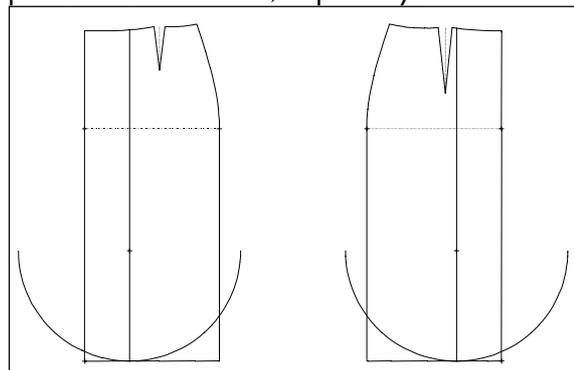
perp p=>l
circle arcs:
cp + p
cp + r
r= 50.0
rectangles:
p+w+h
w= 100.0
h= -50.0
reset
measure



Picture 6-25

Exercise on constructing circle arcs

In the style „Straight skirt“ from Section 2.4 construct a panel seam at 33.3% from the centre front and the centre back, extend the lines to the waist. Then, construct a point on the panel seam 200mm from the hem. The two circle arcs are constructed with $cp+p$. The centre point is the new point and the periphery point is the intersection between the panel seam and the hem, respectively.



Picture 6-26

6.6 Rectangles

The $p+l+c+r$ menu

Construction of rectangles in the lower part of the $p+l+c+r$ menu is the conclusion of this chapter.

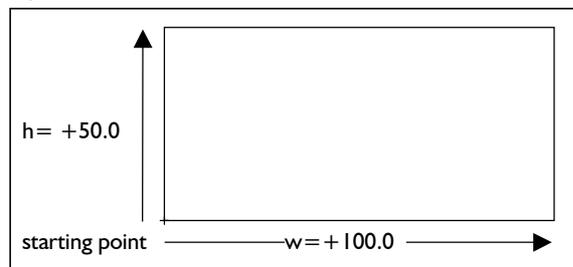
The function *reset* is used for resetting the last construction step of point, line, circle or rectangle construction.

$p+w+h$ - rectangle out of width and height

Step-by-step guide

- ⇒ Enter the width of the rectangle in the line $w = 100.0$
- ⇒ Enter the height of the rectangle in the line $h = -50.0$
- ⇒ Click the line $p+w+h$
- ⇒ Construct the starting point

The width and height of the required rectangle are to be entered in the lines below the function $p+w+h$. After having activated $p+w+h$ the rectangle is constructed from the starting point. w is calculated as width in x direction, h as height in y direction. If w and h are positive the rectangle is constructed upwards to the right (Picture 6-27). If both values are negative, the rectangle is constructed downwards to the left from the starting point. The signs in front of w and h can be different.



Picture 6-27

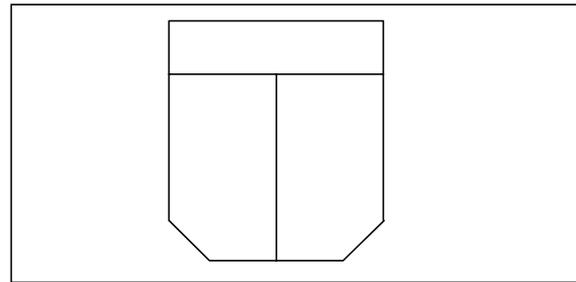
6.7 Exercises

1st Exercise

Construct a 160mm wide and 180mm high pocket. Create a corner with straight line at the two bottom corners with a distance of 30mm before and after the corner. Construct a parallel of 40mm to the upper edge and drop a perpendicular from the centre of the parallel onto the bottom edge.

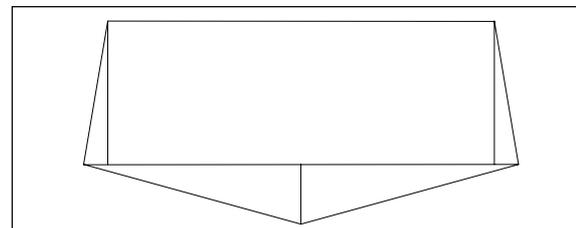


perp $p = > $
circle arcs: cp + p cp + r r = 50.0
rectangles:
$p+w+h$ $w = 100.0$ $h = -50.0$
reset
measure

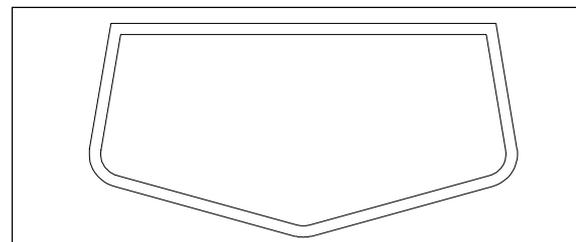


2nd Exercise

Construct a pocket flap from a 160mm wide and 60mm high rectangle by lengthening the base line to the right and left by 10mm respectively. Construct an auxiliary line of 25mm length vertically downwards from the centre of the base line and construct the displayed auxiliary lines.

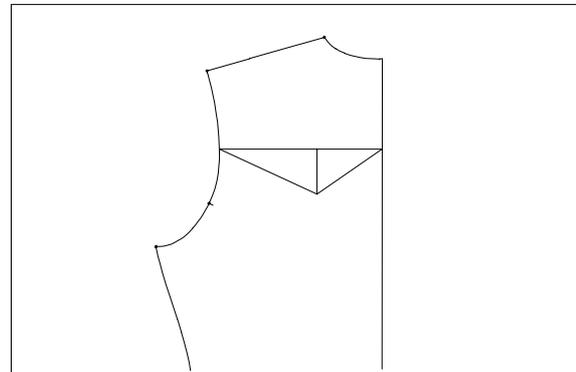


Complete the pocket flap as shown in the next picture by deleting the auxiliary lines, curving the corners with a radius of 10mm and creating a parallel of 5mm all the way around.



3rd Exercise

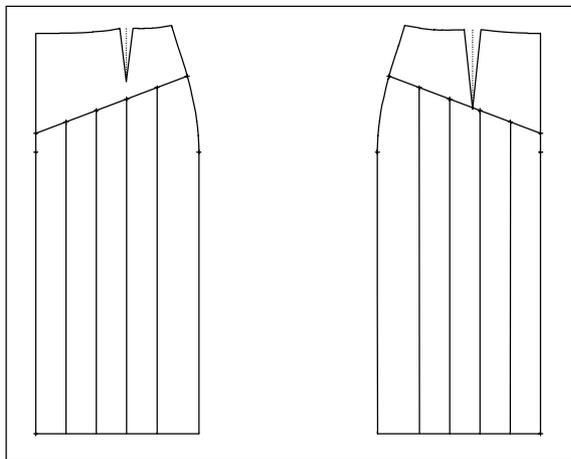
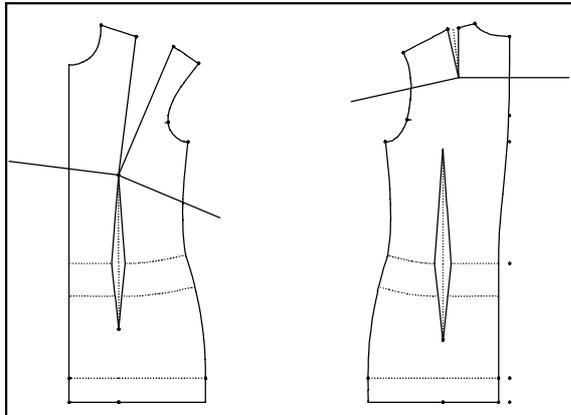
In the „Grafis Bodice 20“ construct a yoke of 200mm length, starting 100mm from the neck on the centre back. The line is to run at a right angle to the centre back. Cut the line at the armhole.



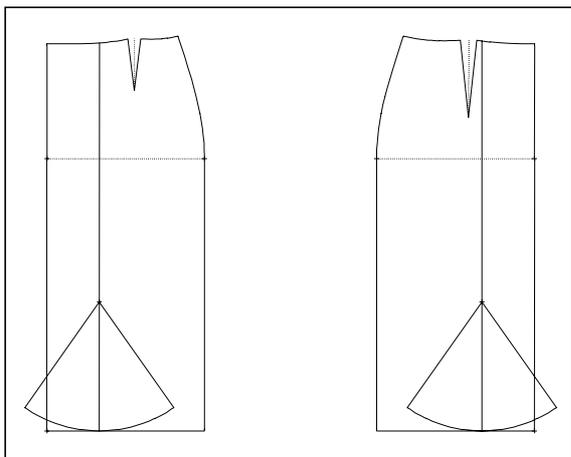
Construct a further line of 50mm length on the yoke, starting at 40% from the centre back. Construct the two other connecting lines.

4th Exercise

In „Grafis Bodice 10“ construct the four lines shown at a right angle to the respective dart lines of bust dart and back shoulder dart.

**5th Exercise**

From the style „Straight skirt“ from Section 2.4 construct a skirt with separate godets. The godet height is 200mm from the hem. The angle of the godets is $\pm 35^\circ$ from the panle seams.

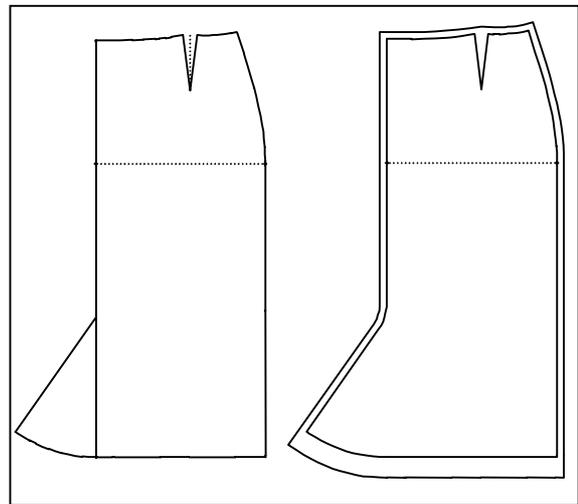
**6th Exercise**

From the style „Straighth skirt“ from Section 2.4 construct a skirt with spread lines. Construct an auxiliary line in the front skirt for a yoke, starting at

150mm on the centre front and ending at 80mm on the hip curve, measured from the waist. In the same way, the line in the back skirt is to start at 150mm on the centre back and to end at 80mm on the hip curve. Create a total of 6 equally distributed points on the yoke line and drop perpendiculars from the four internal points onto the hem.

7th Exercise

In the style „Straight skirt“ from Section 2.4 construct a grown-on godet at the centre front with a height of 200mm and an angle for the goedt of 35° to the centre front. Link the godet and the centre front with *link with curve*. Construct a seam allowance of 10mm and a hem of 30mm. Close the corners.

**8th Exercise**

Shorten the bust dart of „Grafis Bodice 10“ by 30mm. First, construct the bisector of the bust dart and then, the point for the new dart apex and the two new dart lines.

