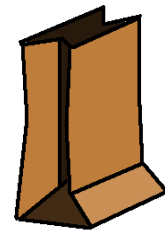
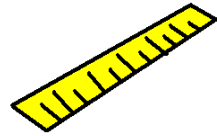




J&H Machine Tools



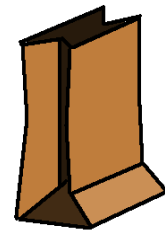
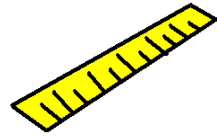
LUNCHEON LEARN

Checking distance

with regard to Rule #1



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ZEISS

LUNCHEON LEARN

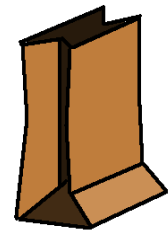
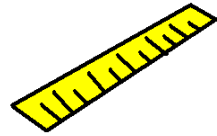
The print.... A Simple Block.
Measure the thickness.



← 10+/-1 →



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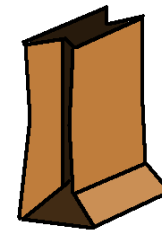
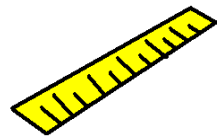


ZEISS

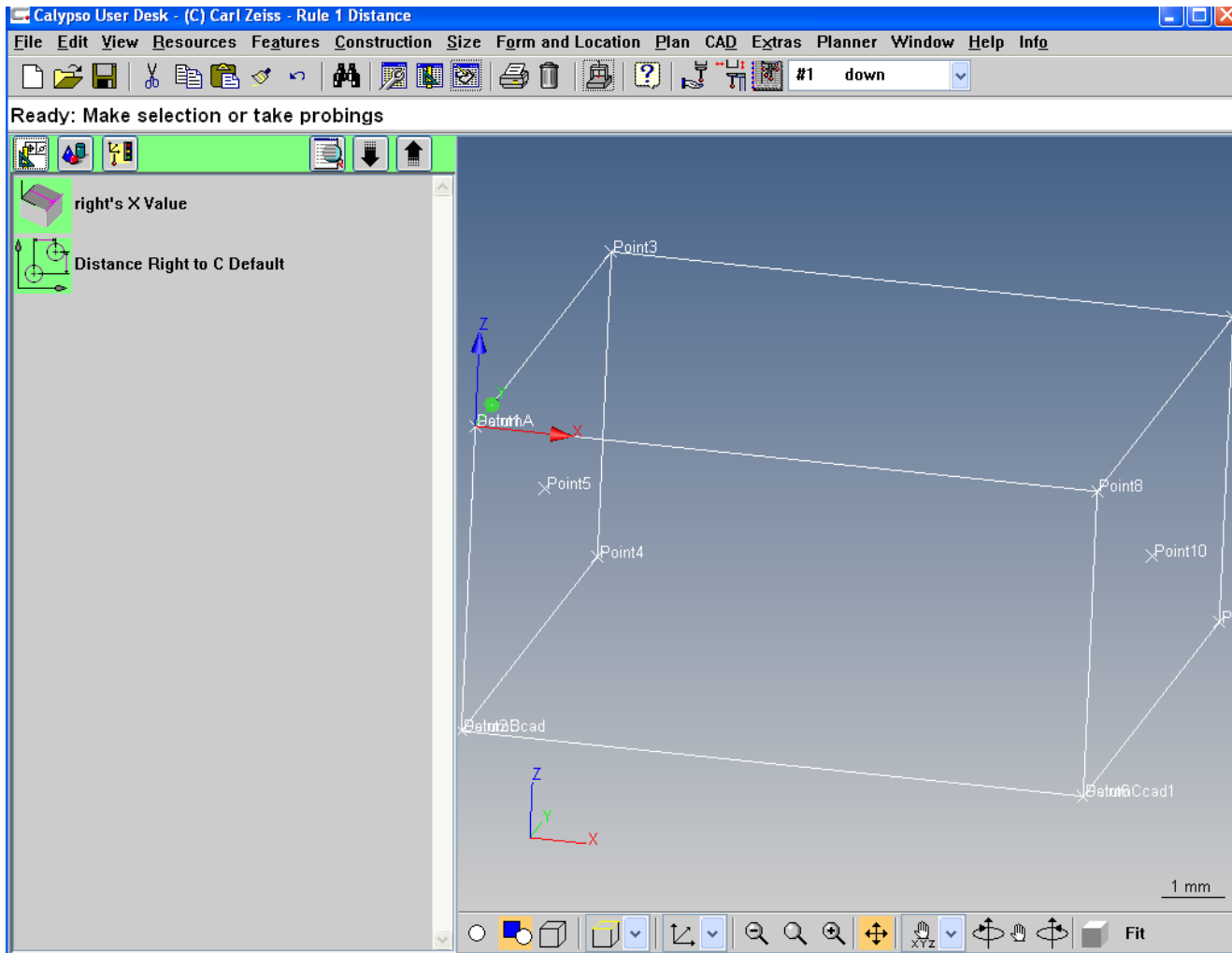
LUNCHEON LEARN

How do YOU do it now?

- Align on the left, report the X of the right?
- Distance between left and right?

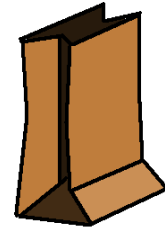
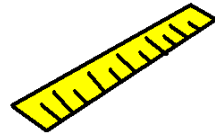


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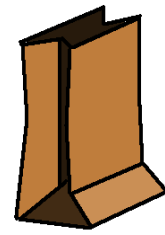
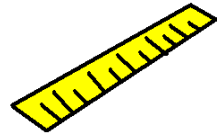
To do this right, we need to understand

RULE #1

Sounds important, doesn't it????



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Definition Time!

“Where on limits of size extent to which size, are allowed cross section shall feature is controlled by

- A) The surface or surfaces
- B) Where the actual local size
- C) There is no requirement for

vary from the true for to the max

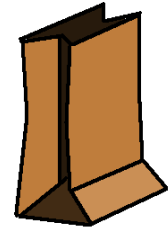
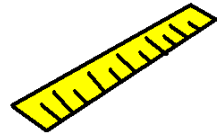


pecified, the describe the form, as well feature at each mm of an individual following three factors: form perfect form at MMC. form is allowed equal to

MC limit of size is permitted to



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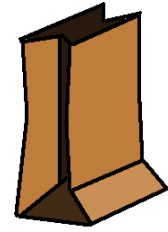
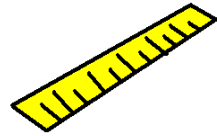
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HEY!!!

WAKE UP!



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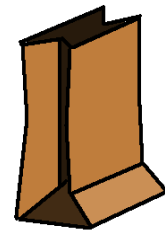
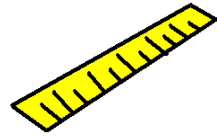


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What does it
mean?



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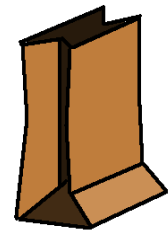
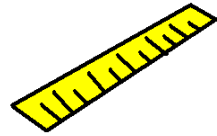
LUNCHEON LEARN

For checking distance between two parallel opposing planes, two things must happen in order for the part to be good:

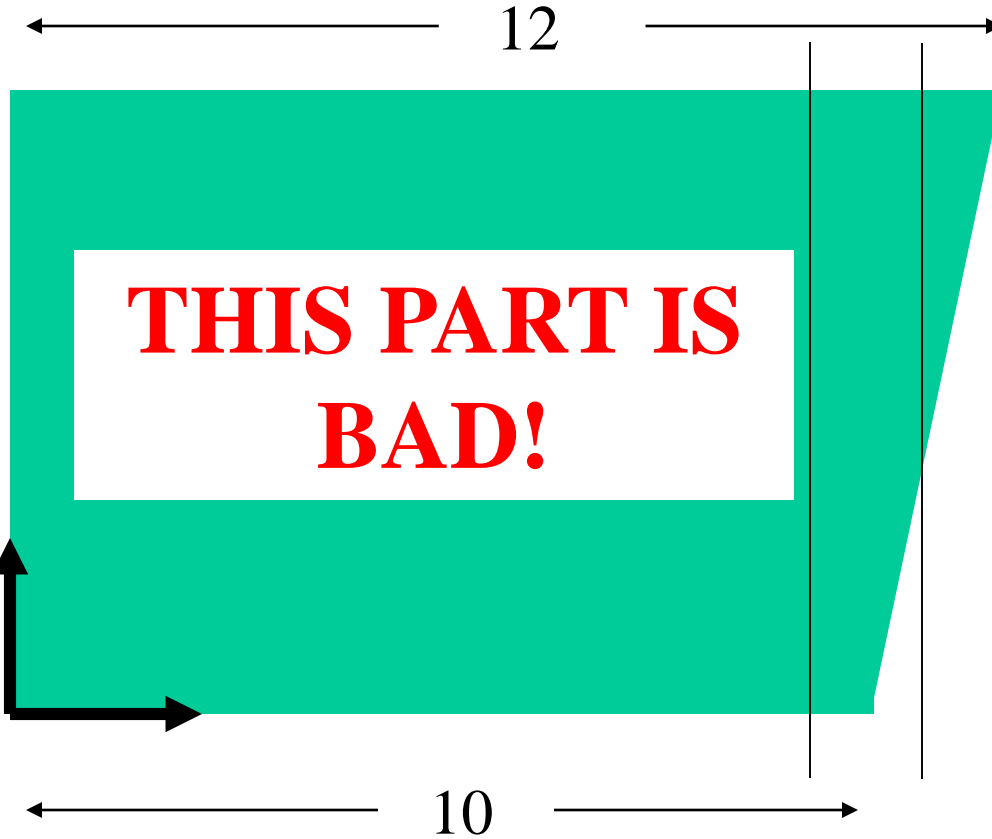
- The part must be able to pass between two parallel planes at the maximum allowable distance apart.
- The “actual local size” of any cross-section on the part must be larger than the minimum allowable distance apart.



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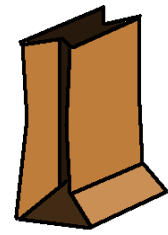
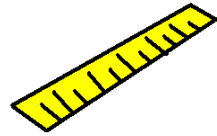


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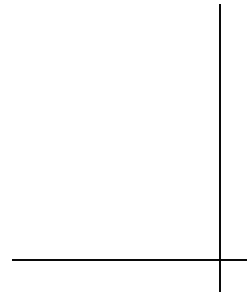
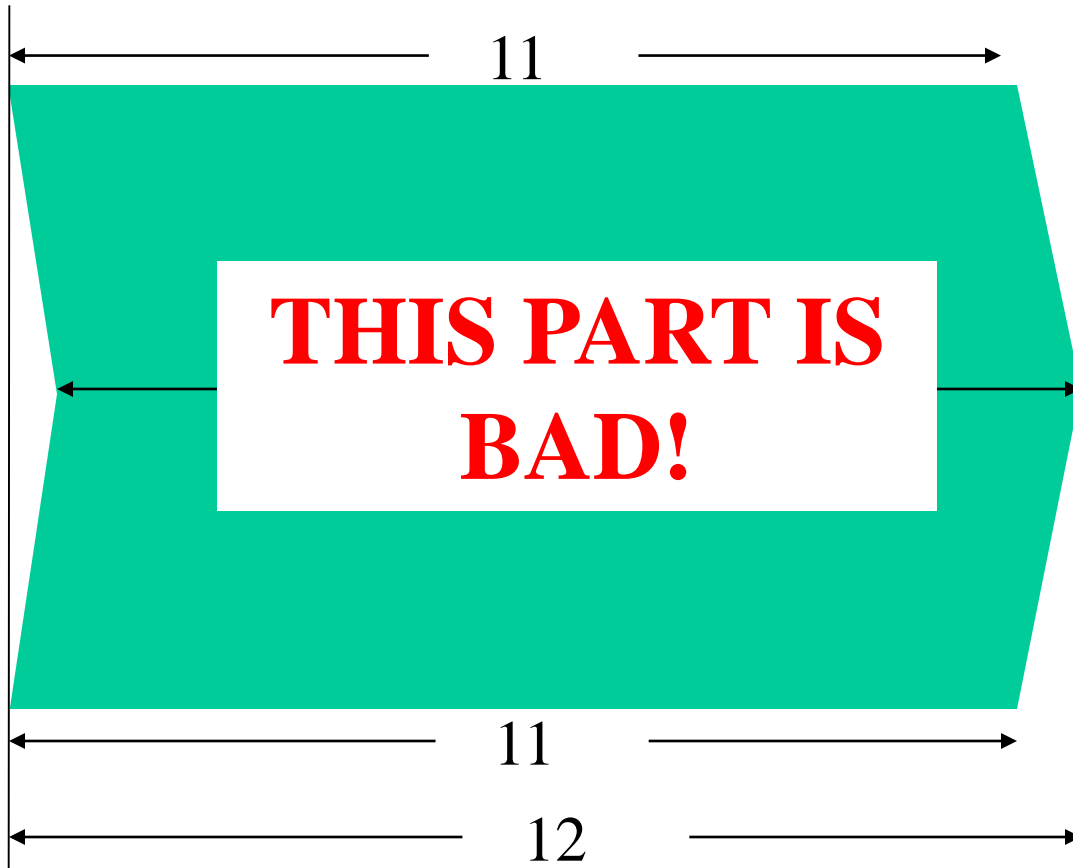
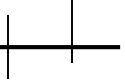
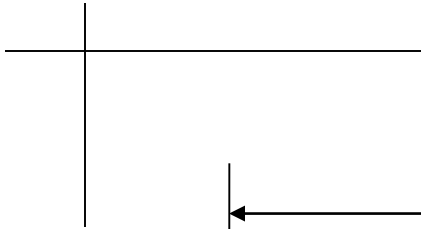


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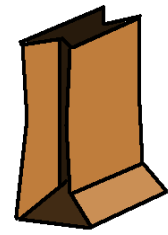
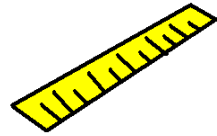
ZEISS

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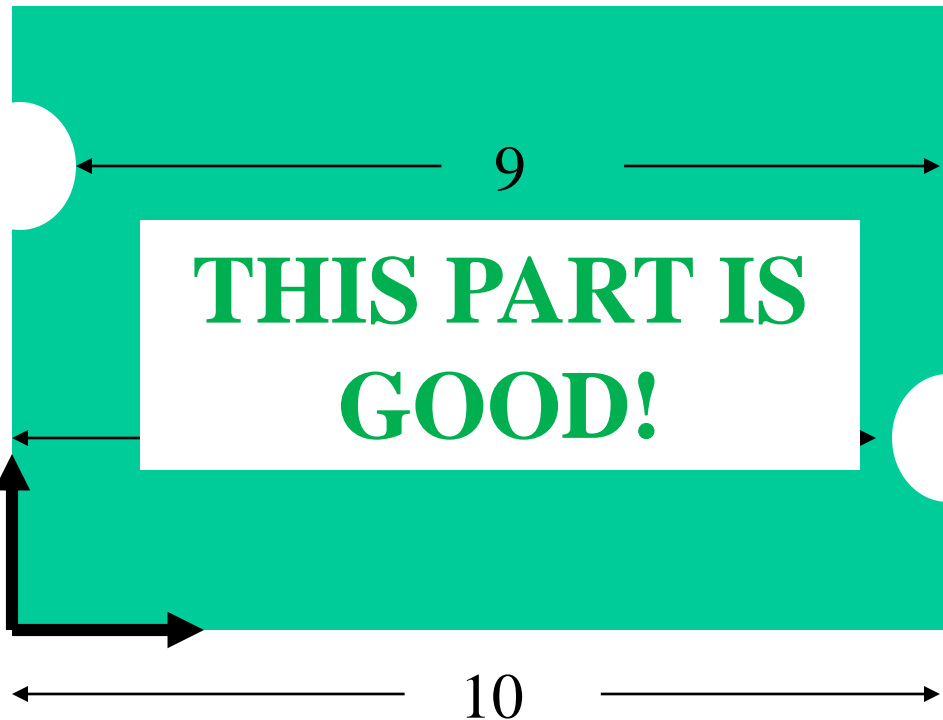


J&H Machine Tools



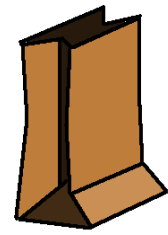
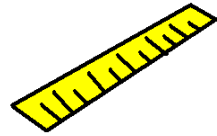
ZEISS

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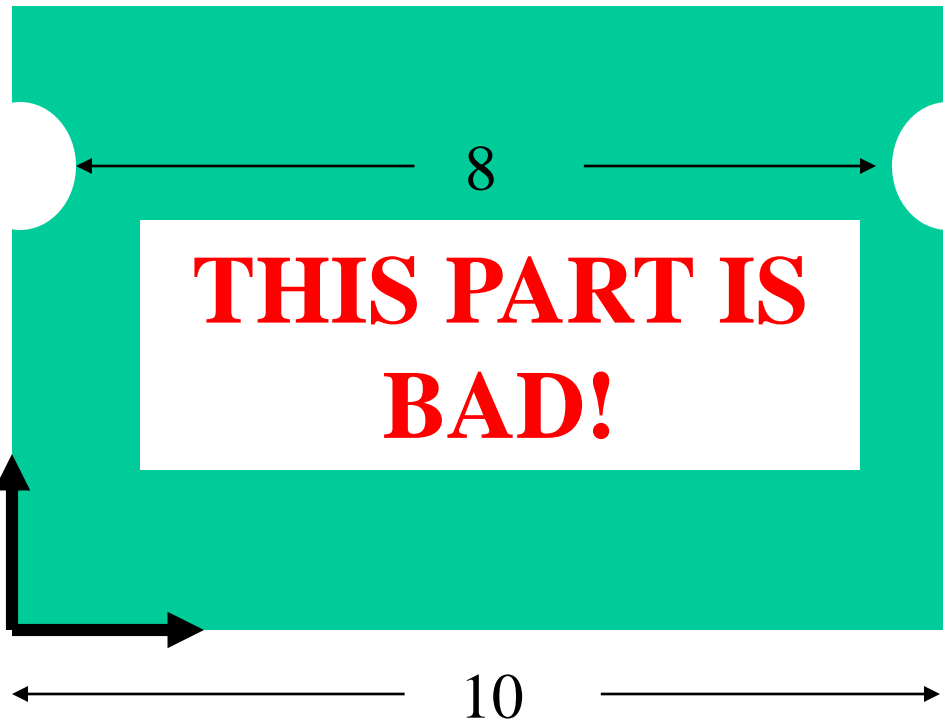


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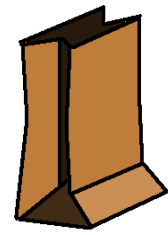
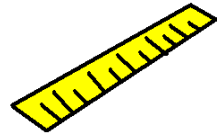
ZEISS

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ZEISS

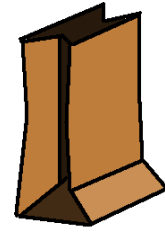
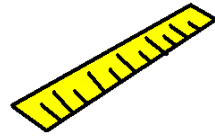
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**Unfortunately, there is no “EASY
BUTTON” way to report distance
between planes correctly to “Rule #1”.**

**“Rule #1” establishes a functional
“go-no go” method of evaluating
distance, not a solid numeric result,
which CMMs are good at generating.**



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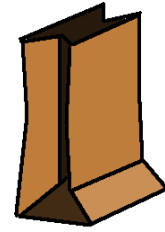
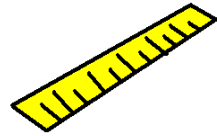
Let's evaluate a few methods of checking distance and rate them on a scale of 1 to 5 for ease of use (practicality) and "correctness" considering "Rule #1".

5 is easiest and most "correct"

1 is hardest and least "correct"



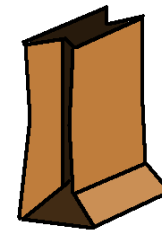
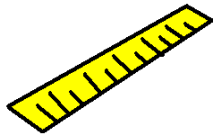
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Method 1:

Checking the “X” value.



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Calypso User Desk - (C) Carl Zeiss - Rule 1 Distance

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window Help Info

Define Nominal Geometry (Probe, Enter, or Read)

Features

right

Comment Strategy Evaluation...

Clearance Group Nominal Definition Alignment

Recall Feature F Alignment1

Tolerance For:	Nominal	Actual
<input checked="" type="checkbox"/> X	10.0000	10.0000
<input type="checkbox"/> Y	0.0000	-0.0000
<input type="checkbox"/> Z	-5.0000	-5.0000
<input type="checkbox"/> A1 Y/X	0.0000	-8.5308
<input type="checkbox"/> A2 Z/X	0.0000	-0.0000

Space Axis X

Length 1 10.0000 10.1119

Length 2 5.0000

Start Angle 0.0000 0.0000

Sigma	Form	Points
0.0000	0.0000	5

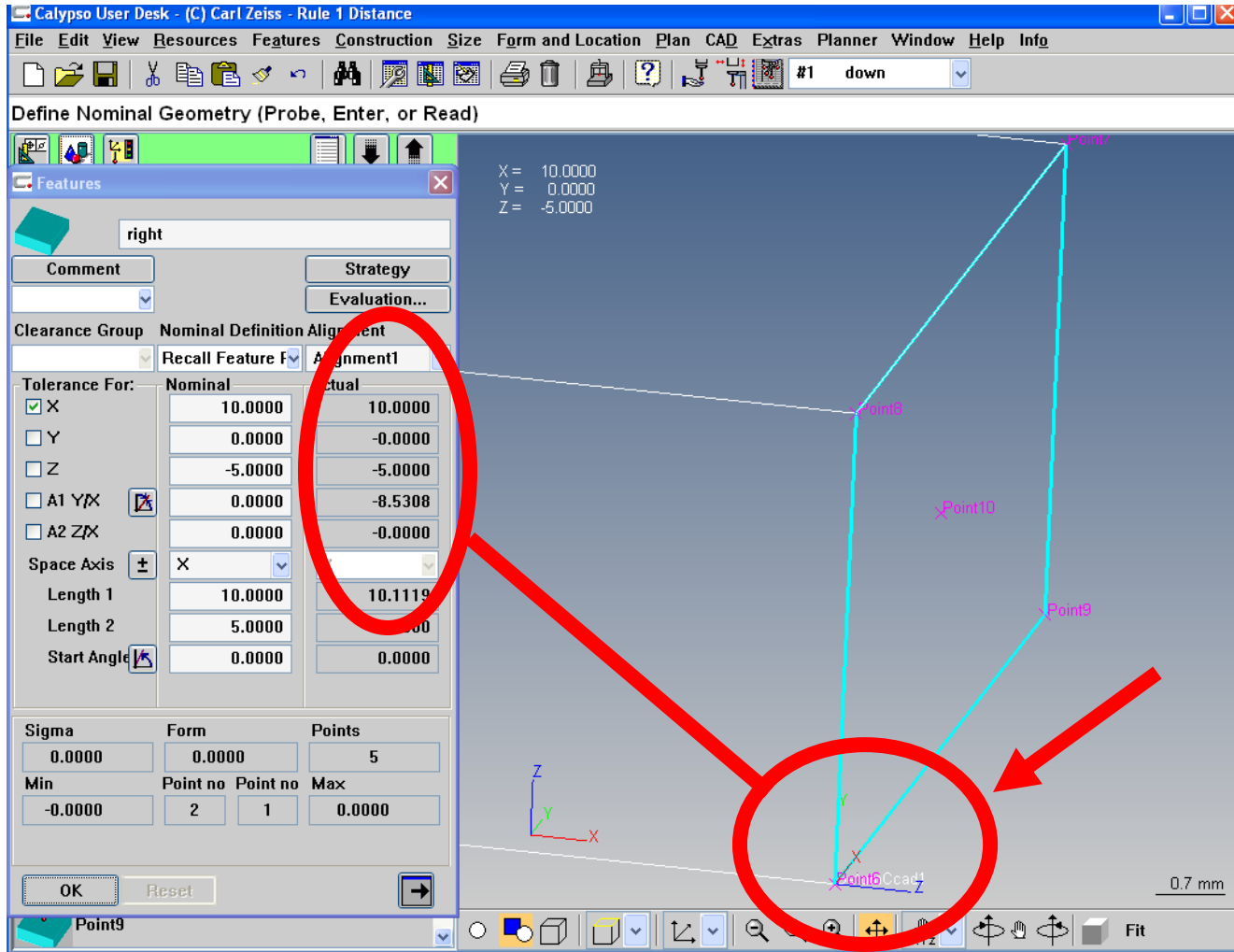
Min	Point no	Point no	Max
-0.0000	2	1	0.0000

OK Reset

X = 10.0000
Y = 0.0000
Z = -5.0000

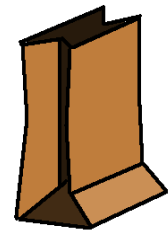
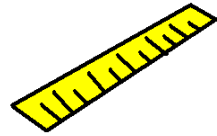
Point7
Point8
Point10
Point9
Zentao Coad7

0.7 mm



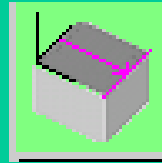


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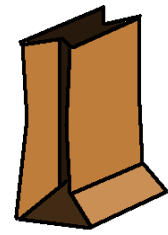
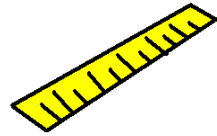


**THIS PART IS
GOOD!**

10

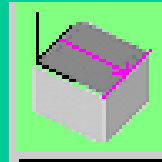


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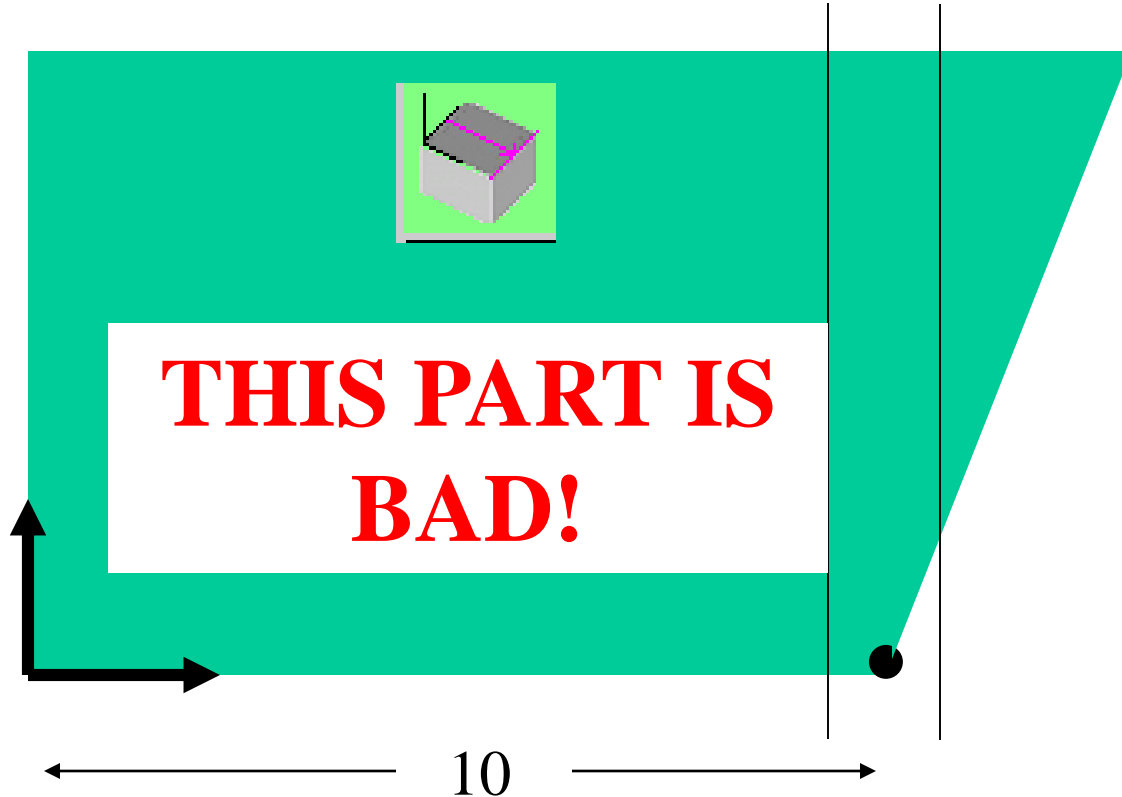


ZEISS

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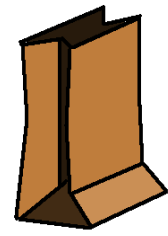
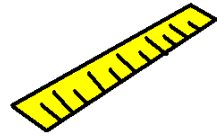


**THIS PART IS
BAD!**



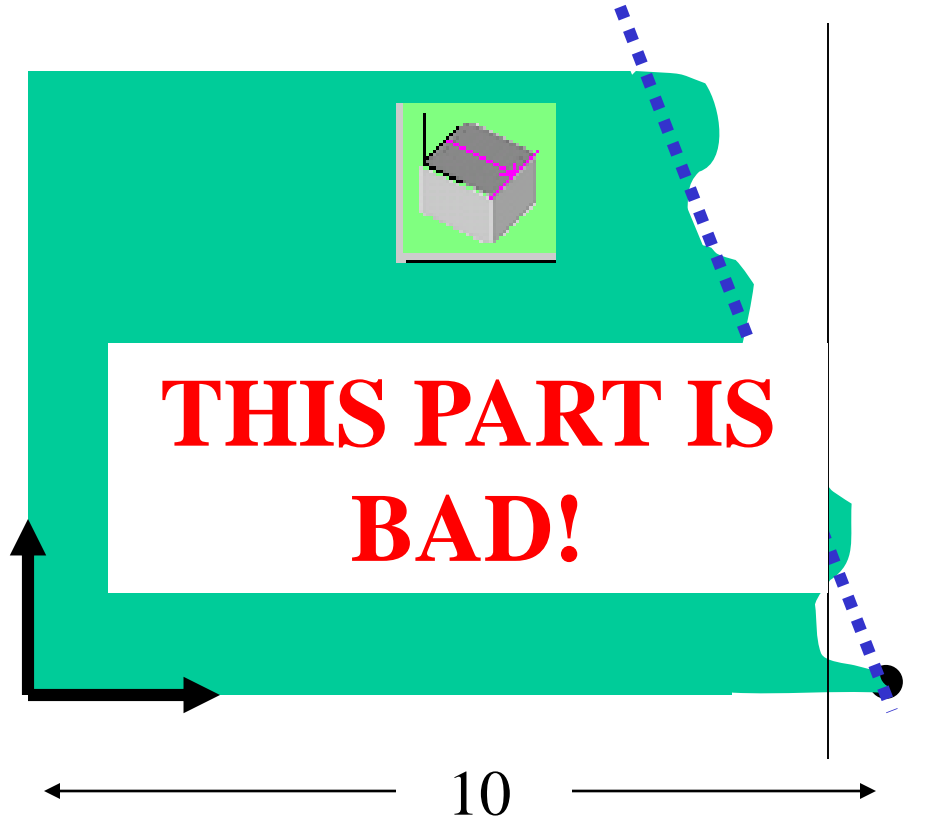


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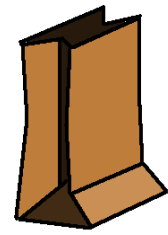
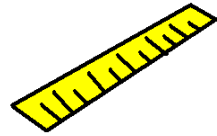
ZEISS

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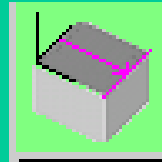


J&H Machine Tools

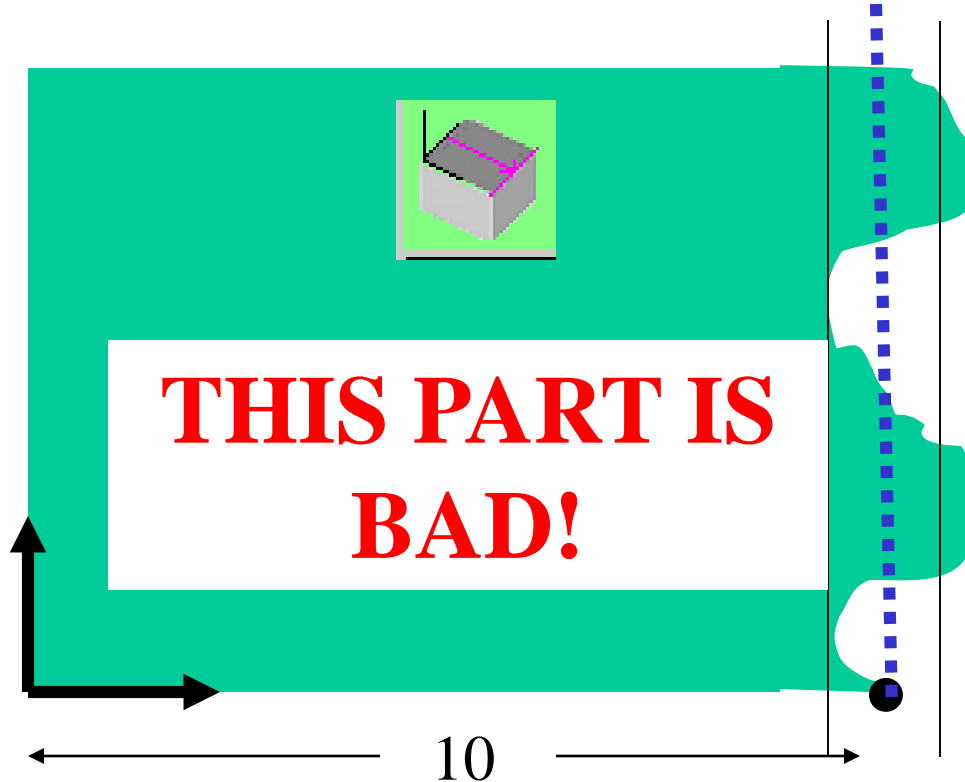


ZEISS

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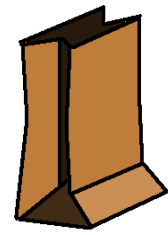
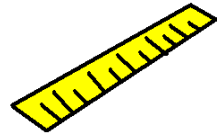


**THIS PART IS
BAD!**



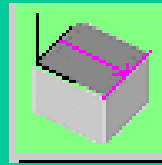


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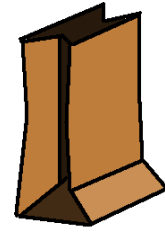
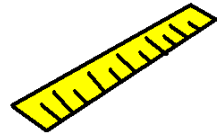


**THIS PART IS
BAD!**

11



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Method 1:

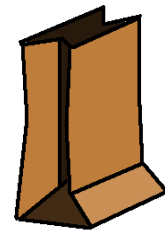
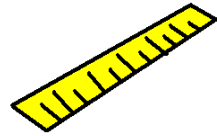
Checking the “X” value.

Ease/Practicality: 5

“Correctness”: 1



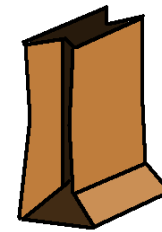
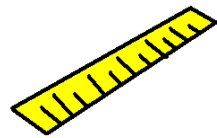
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Method 2:

Cartesian Distance



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Calypso User Desk - (C) Carl Zeiss - Rule 1 Distance

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window Help Info

#1 down

Cartesian Distance

Distance Right to C Default Comment

Fine

Nominal

ISO286

Upper Tolerance None

Lower Tolerance None

Feature 1

Feature 2

Primary Datum

Secondary Datum

Actual

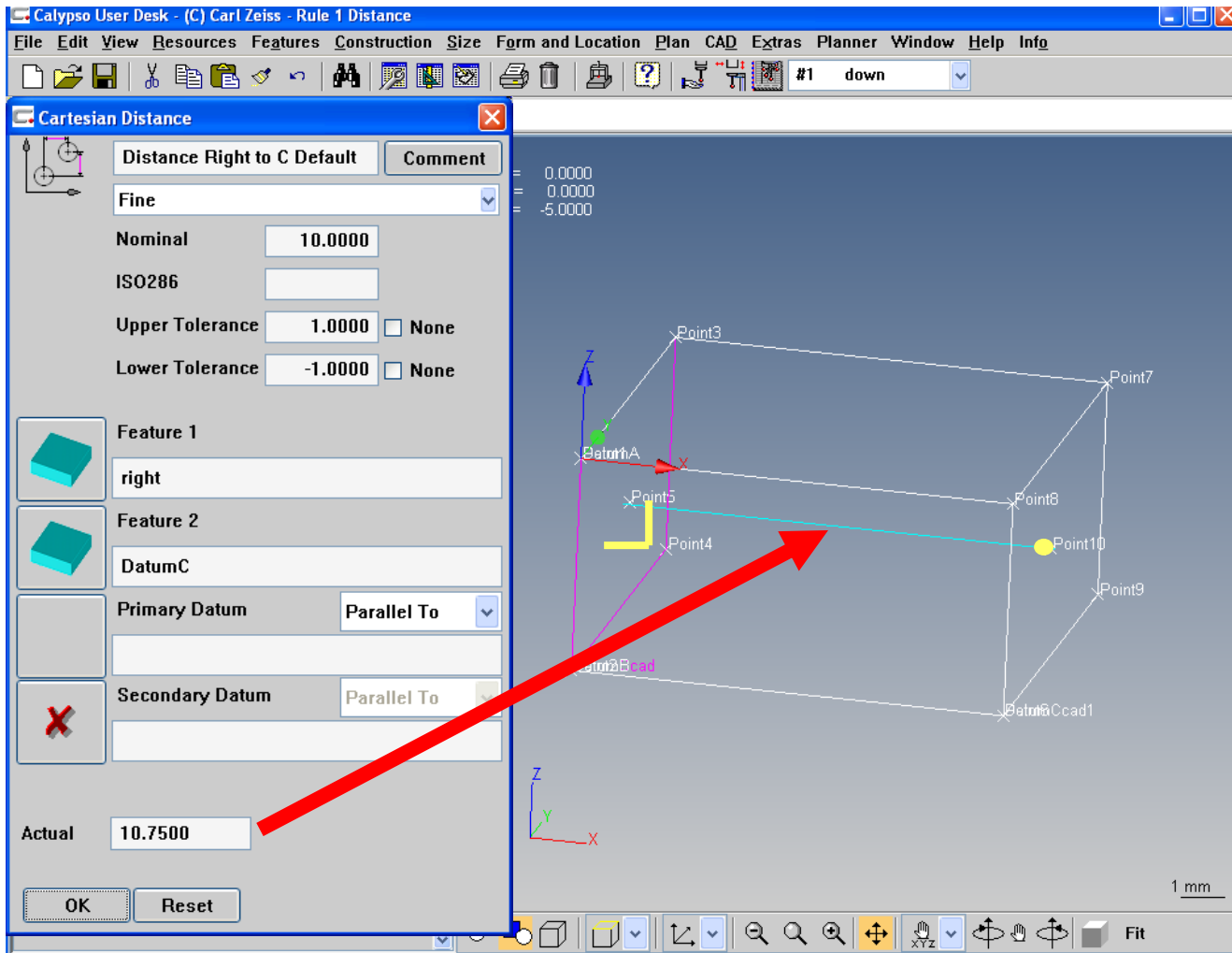
OK Reset

0.0000
0.0000
-5.0000

Point3
Point7
Point8
Point10
Point9
DatumCcad1
DatumA
Point5
Point4
DatumBcad

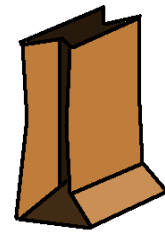
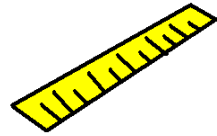
1 mm

Fit

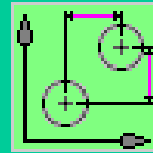




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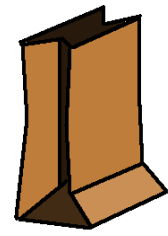
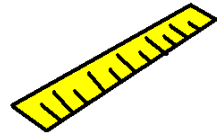


10

**THIS PART IS
GOOD!**

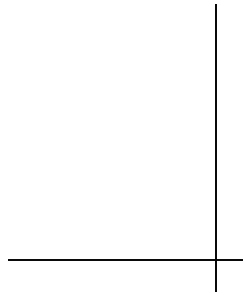
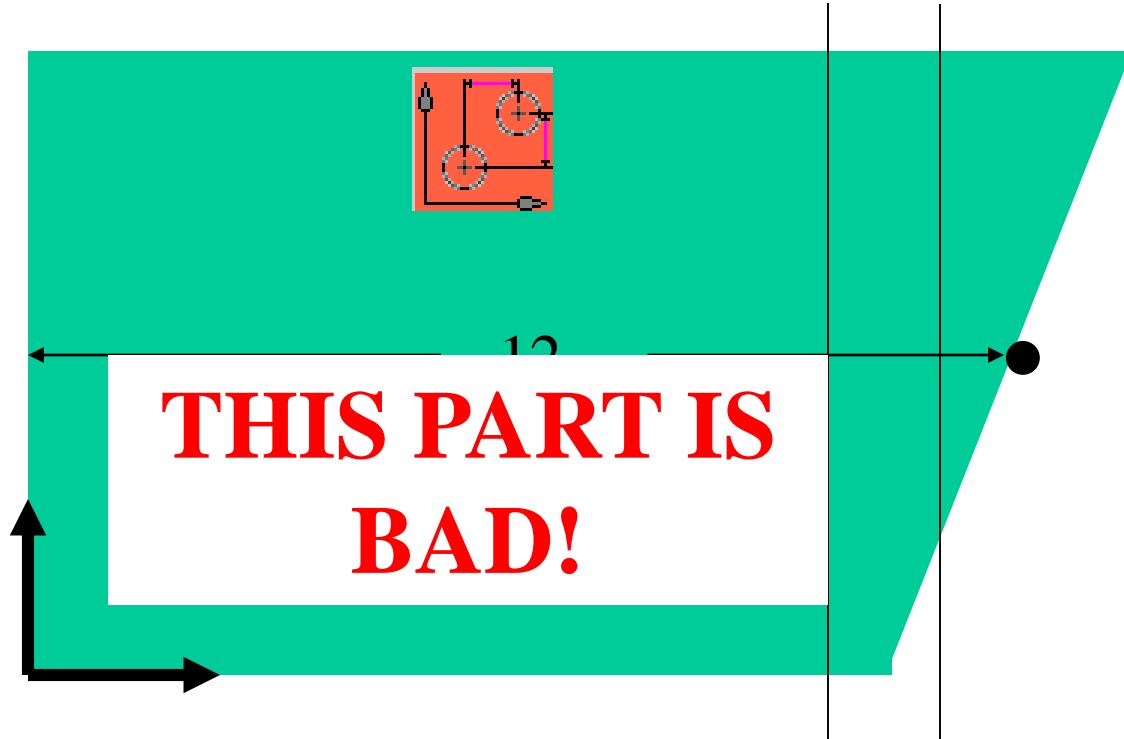
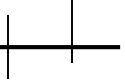
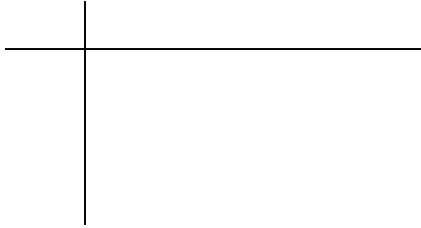


J&H Machine Tools



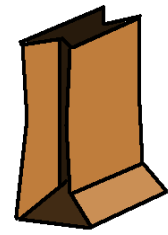
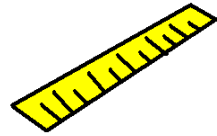
ZEISS

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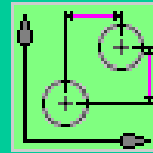


J&H Machine Tools



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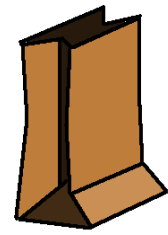
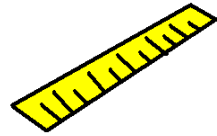


10

**THIS PART IS
BAD!**

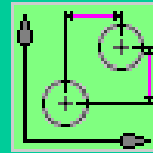


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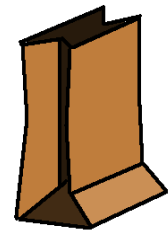
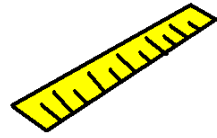


10

**THIS PART IS
BAD!**

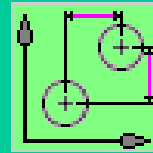


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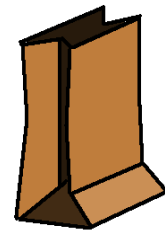
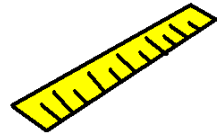


**THIS PART IS
BAD!**

11



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Method 2:

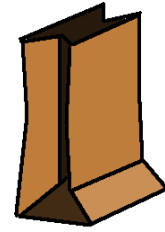
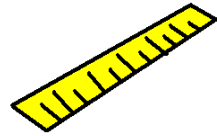
Cartesian Distance

Ease/Practicality: 4

“Correctness”: 2



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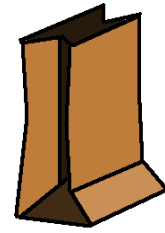
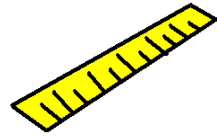
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Method 3:

**Report Cartesian Distance
and Parallelism**



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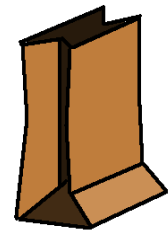
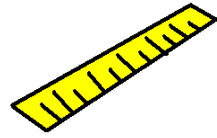
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Remember...

Parallelism = Distance between two planes, parallel to the datum, that contain all points of the evaluated plane.

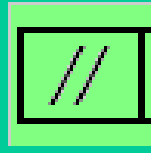
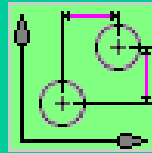


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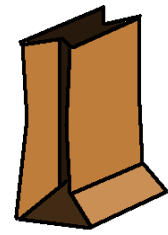
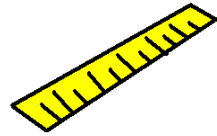


10

**THIS PART IS
GOOD!**

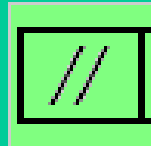
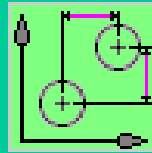


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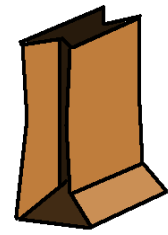
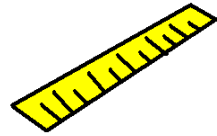


10.5

**THIS PART IS
GOOD!**

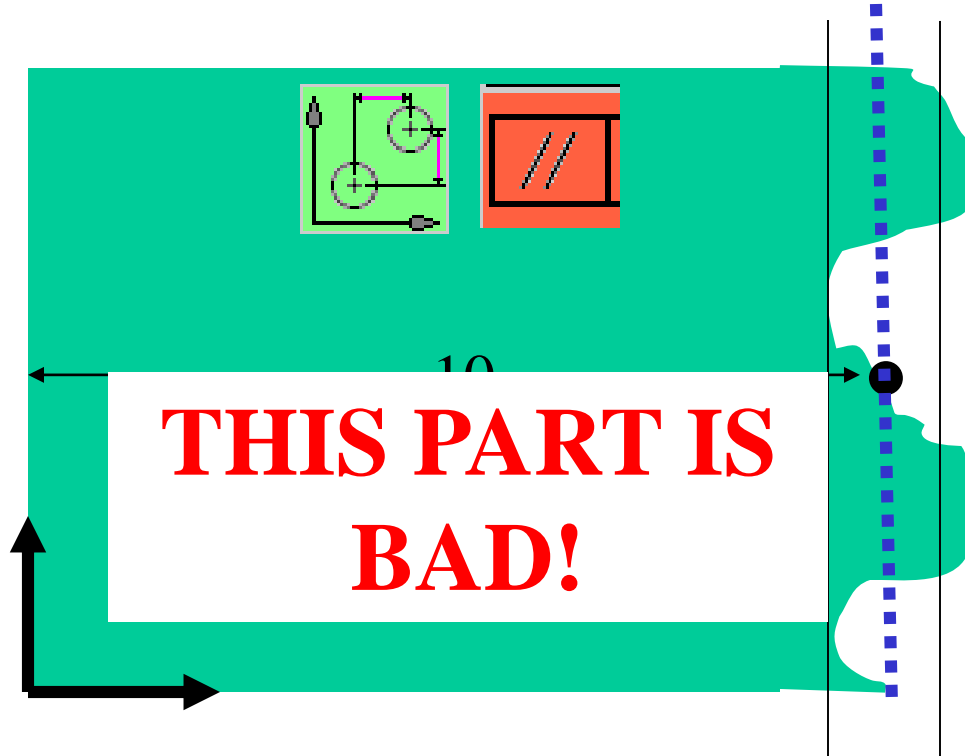


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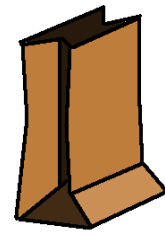
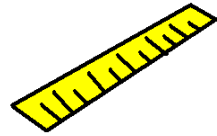
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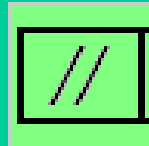
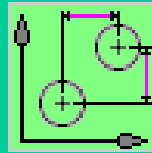


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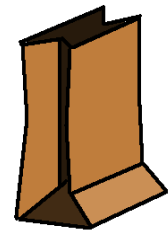
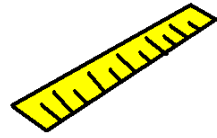


10.8

**THIS PART IS
BAD!**

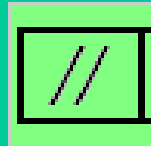
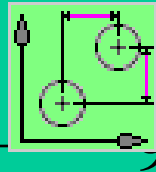


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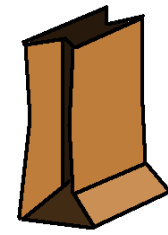
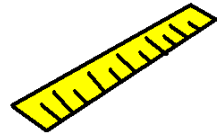
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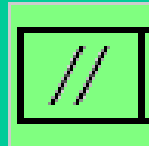
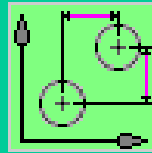
**THIS PART IS
BAD!**



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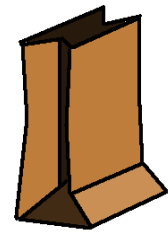
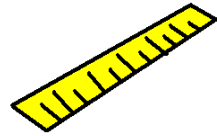


**THIS PART IS
BAD!**

11



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Method 3:

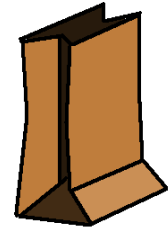
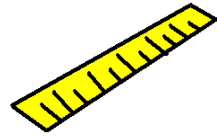
**Report Cartesian Distance
and Parallelism**

Ease/Practicality: 3

“Correctness”: 3



J&H Machine Tools



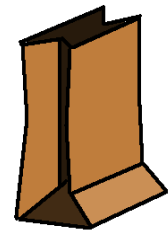
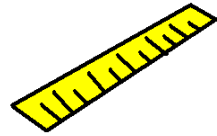
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Method 4:

**Cartesian Distance and
TWO Parallelisms**

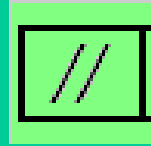
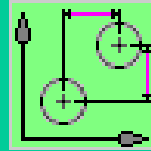
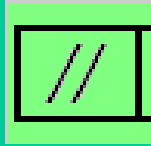


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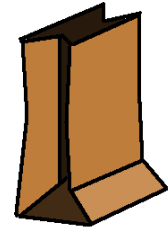
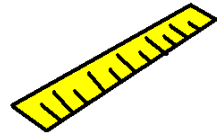


10

**THIS PART IS
GOOD!**

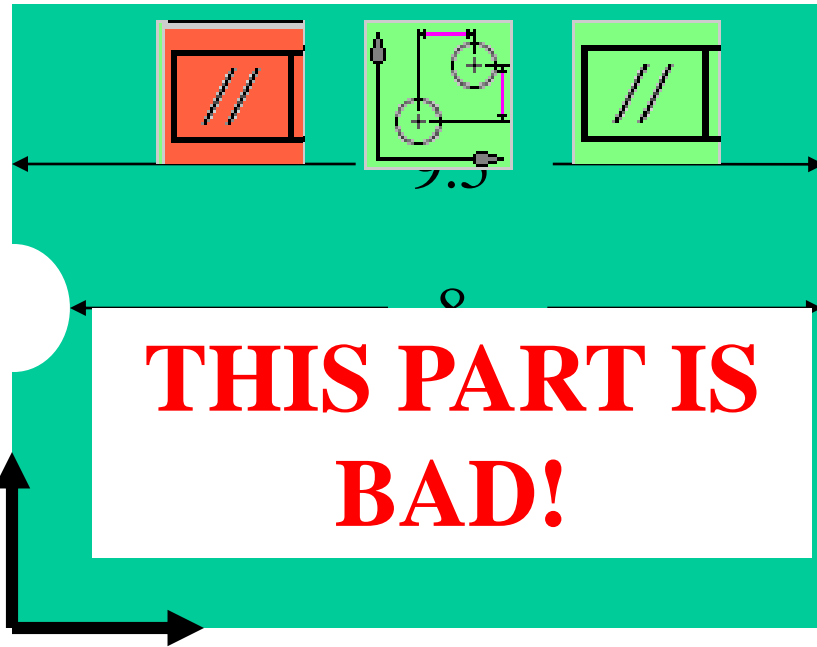


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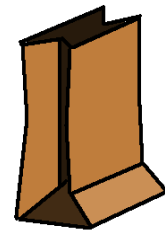
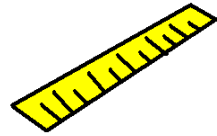
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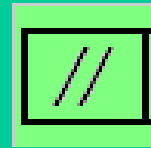
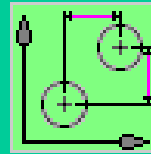
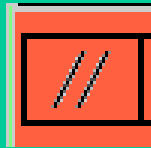


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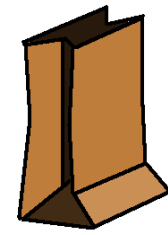
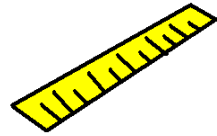


11

**THIS PART IS
GOOD!**

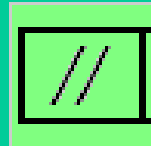
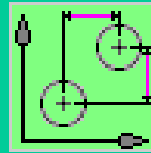
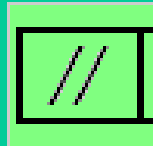


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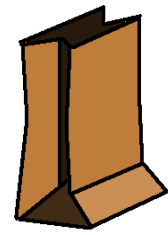
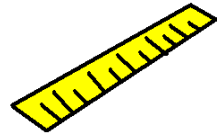


10.8

**THIS PART IS
BAD!**

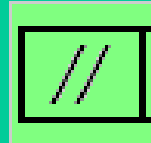
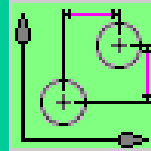
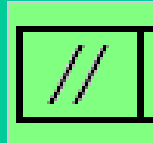


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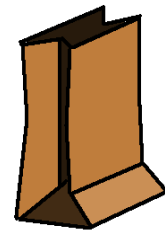
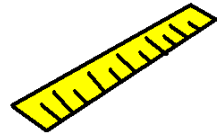
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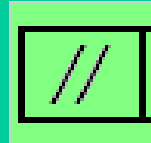
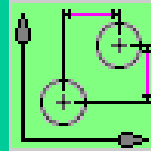
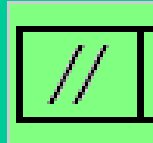
**THIS PART IS
BAD!**



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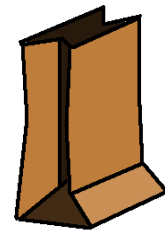
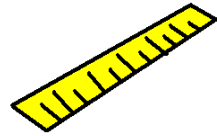


**THIS PART IS
BAD!**

11



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Method 4:

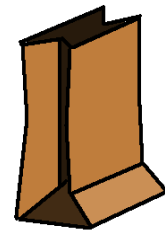
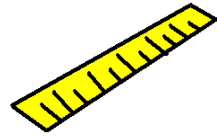
**Cartesian Distance and
TWO Parallelisms**

Ease/Practicality: 2

“Correctness”: 4



J&H Machine Tools



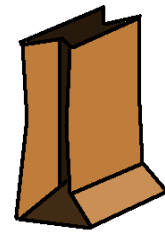
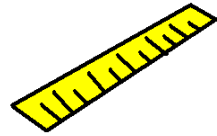
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Method 5:

Following the Standard



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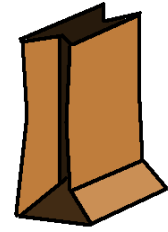
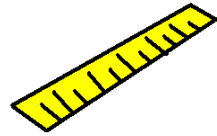
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Remember how to check distance, following Rule #1:

- The part must be able to pass between two parallel planes at the maximum allowable distance apart.
- The “actual local size” of any cross-section on the part must be larger than the minimum allowable distance apart.



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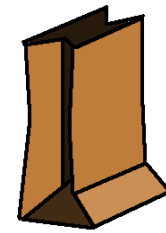
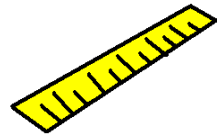


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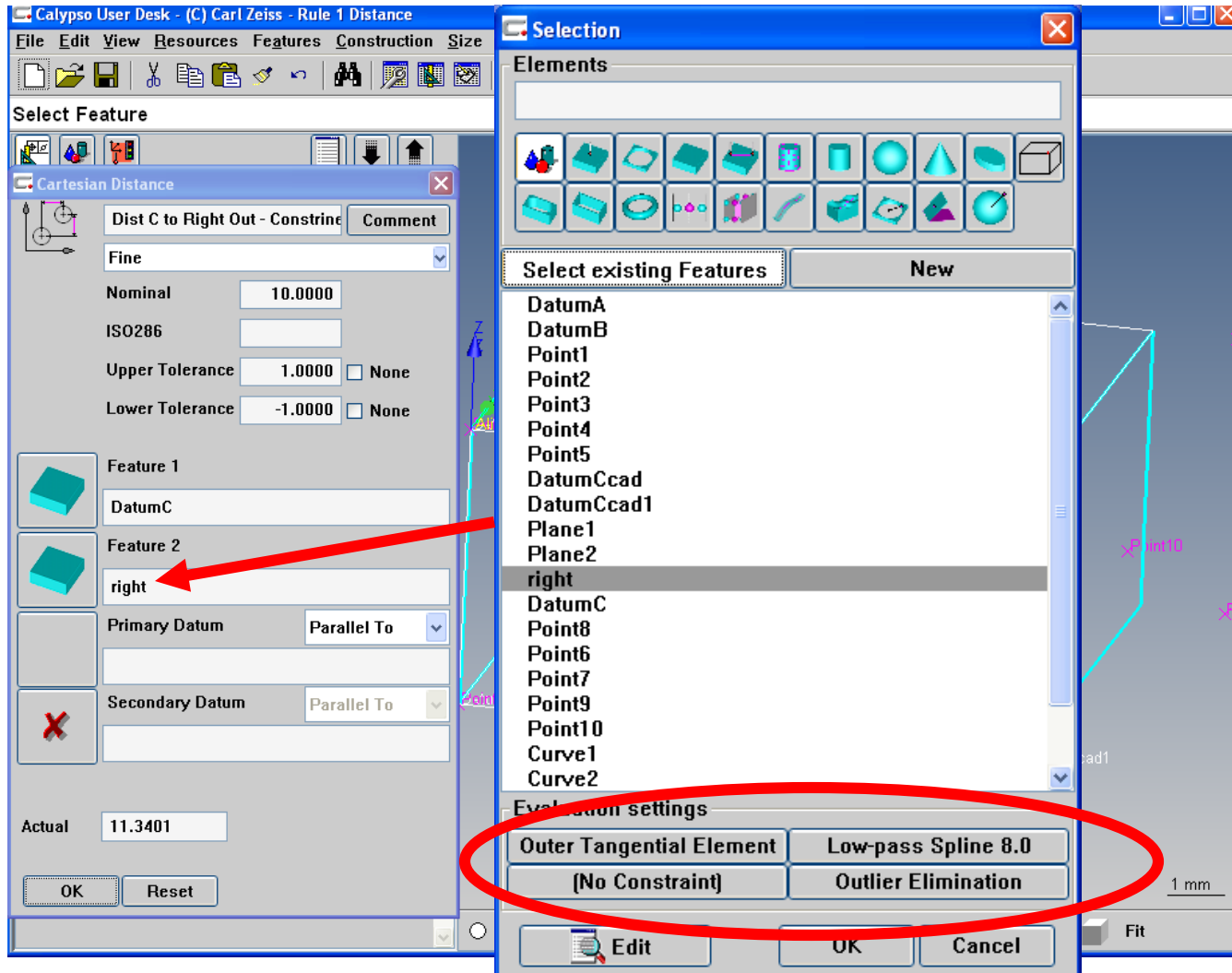
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First Part:

The part must be able to pass between two parallel planes at the maximum allowable distance apart.



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The screenshot displays the Calypso User Desk interface. The main window is titled "Calypso User Desk - (C) Carl Zeiss - Rule 1 Distance". The "Selection" dialog is open, showing a list of elements including DatumA, DatumB, Point1 through Point10, DatumCcad, DatumCcad1, Plane1, Plane2, right, DatumC, Point8, Point6, Point7, Point9, Point10, Curve1, and Curve2. The "right" element is highlighted. The "Evaluation settings" section at the bottom of the Selection dialog is circled in red, containing the following options: "Outer Tangential Element", "Low-pass Spline 8.0", "(No Constraint)", and "Outlier Elimination".

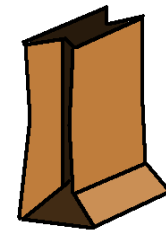
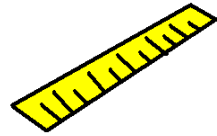
The "Cartesian Distance" dialog is also visible, showing the following settings:

- Dist C to Right Out - Constrain: Comment
- Fine
- Nominal: 10.0000
- ISO286: [empty]
- Upper Tolerance: 1.0000 None
- Lower Tolerance: -1.0000 None
- Feature 1: DatumC
- Feature 2: right
- Primary Datum: Parallel To
- Secondary Datum: Parallel To
- Actual: 11.3401

Buttons for "OK", "Reset", "Edit", "OK", "Cancel", and "Fit" are visible at the bottom of the dialog windows.



J&H Machine Tools



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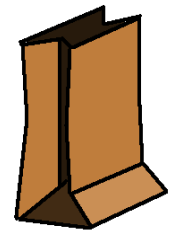
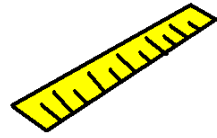
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The screenshot displays the Calypso User Desk interface with several dialog boxes open:

- Calypso User Desk - (C) Carl Zeiss**: The main application window showing a menu bar (File, Edit, View, Resources, Fe) and a toolbar. The 'Select Feature' panel is active, showing 'Cartesian Distance' and 'Dist C to Right Out -' with a 'Fine' tolerance. A red arrow points to 'DatumC' in the 'Feature 1' list.
- Selection**: A dialog box with 'Elements' and 'Select existing Features' sections. A red arrow points to 'DatumC' in the list.
- Evaluation... - Dist C to Right**: A dialog box for 'Feature 1' with 'DatumC' selected. It has tabs for 'General', 'Filter', and 'Outlier Elim'. The 'Evaluation Constraints' section has 'Take constraints from' checked. A red arrow points to the 'Feature reference' field containing 'right'.
- Selection**: A second dialog box with 'Elements' and 'Select existing Features' sections. A red circle highlights the 'Evaluation settings' section, which includes buttons for 'Outer Tangential Element', 'Low-pass Spline 8.0', '[No Constraint]', and 'Outlier Elimination'.

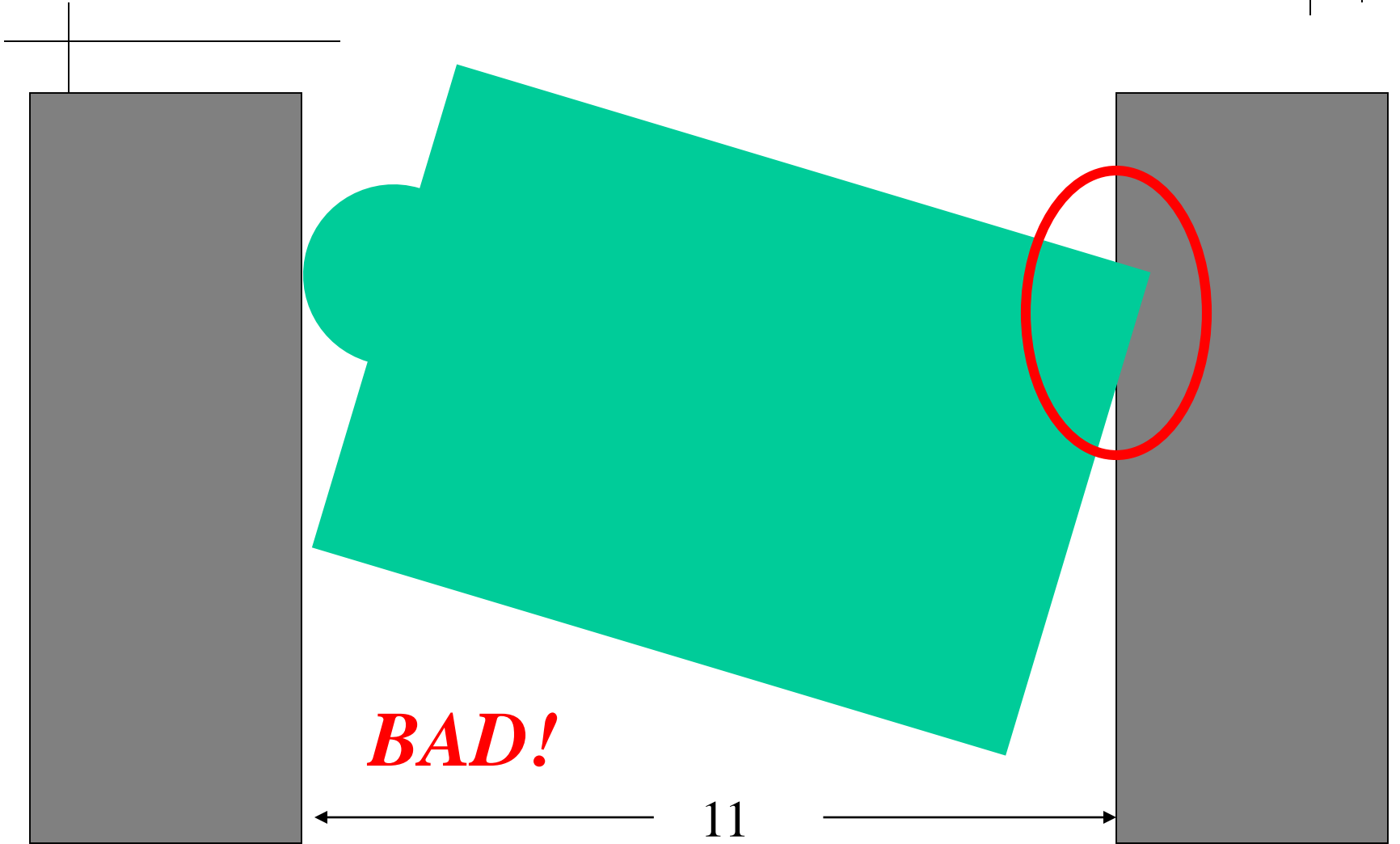


J&H Machine Tools



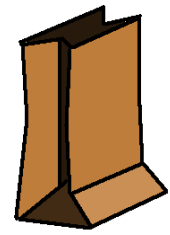
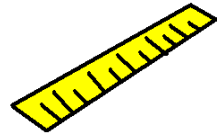
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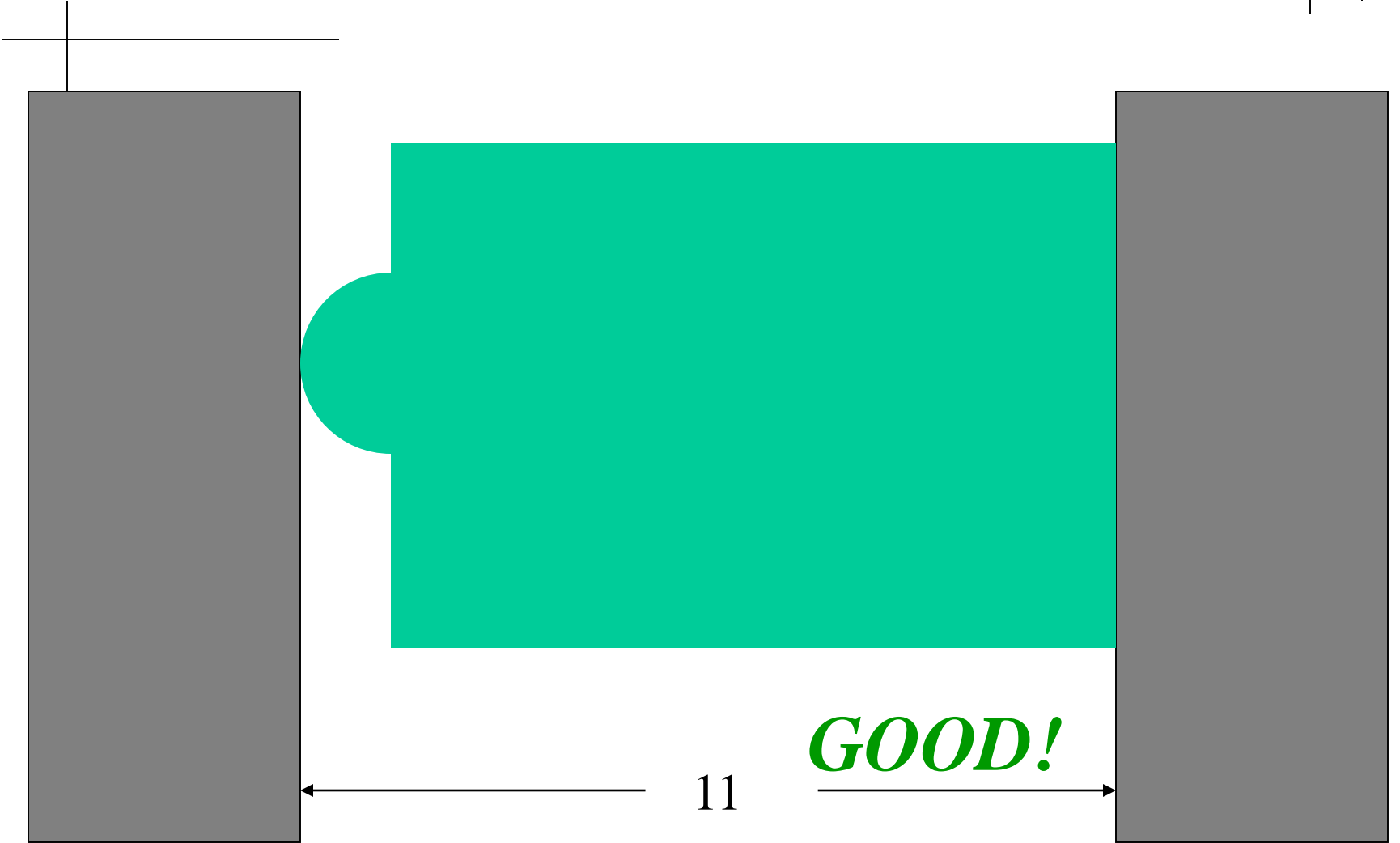


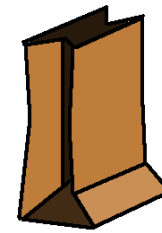
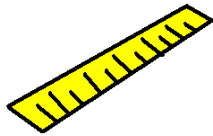
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Cartesian Distance

Dist C to Right Out - Constrain

Fine

Nominal

ISO286

Upper Tolerance None

Lower Tolerance None

Feature 1

Feature 2

Primary Datum

Secondary Datum

Actual

Since there's
no Datum,
Gotta check
both!

Cartesian Distance

Dist Right to C Out - Constrain

Fine

Nominal

ISO286

Upper Tolerance None

Lower Tolerance None

Feature 1

Feature 2

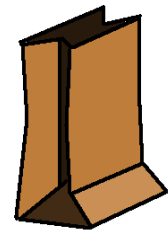
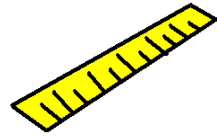
Primary Datum

Secondary Datum

Actual



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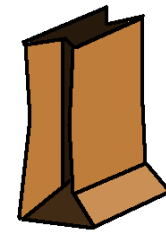
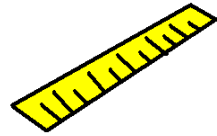
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Second Part:

The “actual local size” of any cross-section on the part must be larger than the minimum allowable distance apart.

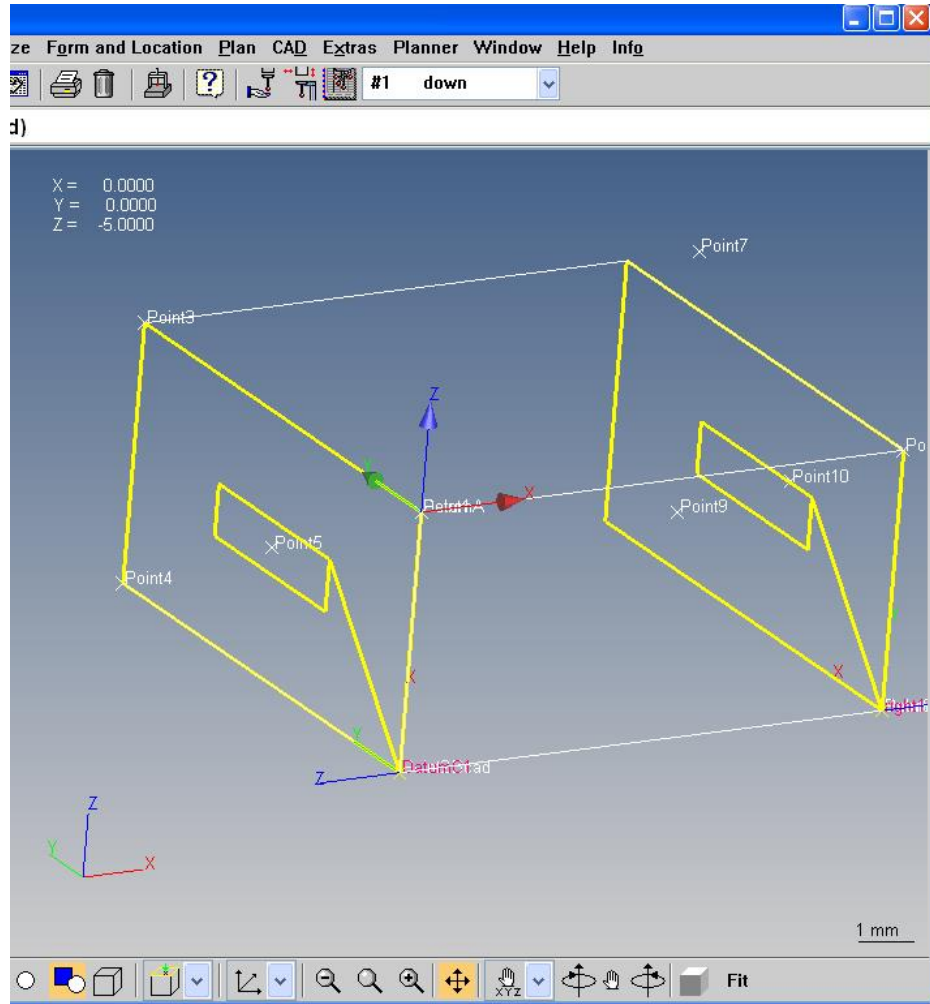


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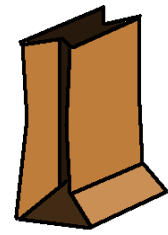
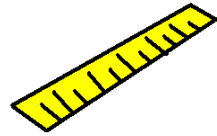
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Measure the two planes with identical opposing measurement strategies.





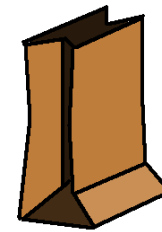
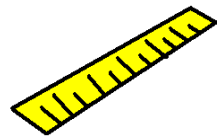
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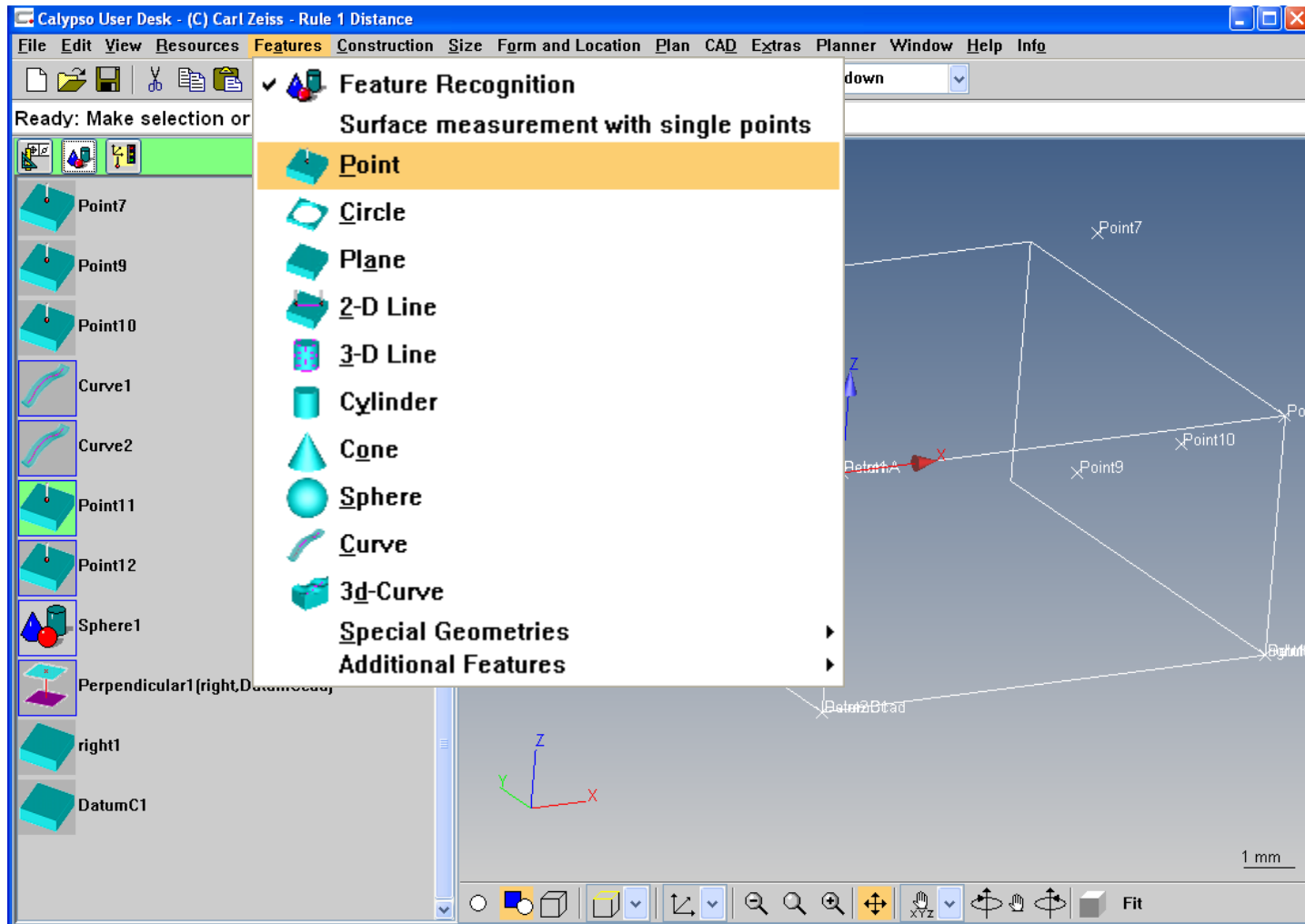
ZEISS

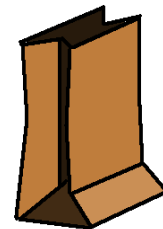
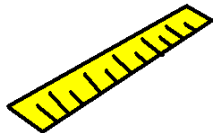
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**Now, we need to
individually test the
distance between all the
points of a plane to the
opposing point on the
other plane. Report the
smallest case.**

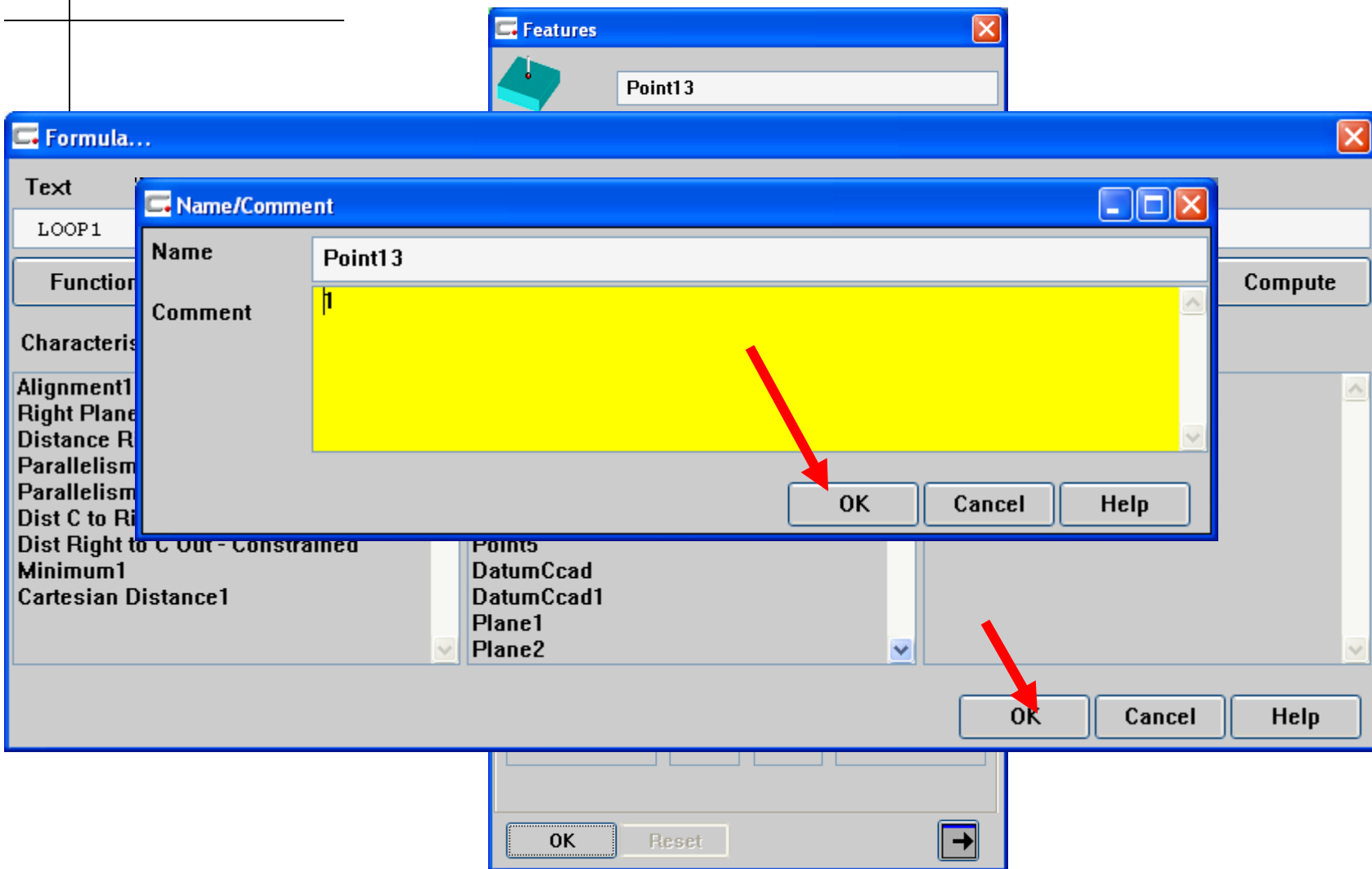


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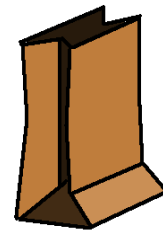
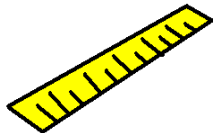




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The image shows a screenshot of a CAD software interface with several dialog boxes open. At the top, a 'Features' dialog box is visible with a small 3D model icon and the text 'Point13'. Below it, a 'Formula...' dialog box is open, showing a list of features on the left: Text (LOOP1), Function, Characteristics, Alignment1, Right Plane, Distance R, Parallelism, Parallelism, Dist C to R, Dist Right to C Out - Constrained, Minimum1, and Cartesian Distance1. On the right side of the 'Formula...' dialog, there are 'Compute', 'OK', 'Cancel', and 'Help' buttons. A red arrow points to the 'OK' button. Overlaid on the 'Formula...' dialog is a 'Name/Comment' dialog box. This dialog has a 'Name' field containing 'Point13' and a 'Comment' field containing the number '1'. The 'Comment' field has a yellow background. Below the 'Name/Comment' dialog are 'OK', 'Cancel', and 'Help' buttons, with a red arrow pointing to the 'OK' button. At the bottom of the screen, another dialog box is partially visible with 'OK', 'Reset', and a right-pointing arrow button.



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Recall Feature Points

Feature Point Recall DatumC

Formula...

Number
LOOP1

Function Loop Nominal **Actual** Compute

Characteristics

- Alignment1
- Right Plane's X Va
- Distance Right to C
- Parallelism Right t
- Parallelism C to Ri
- Dist C to Right Out
- Dist Right to C Out
- Minimum1
- Cartesian Distance

Plane2

OK Cancel Help

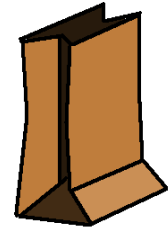
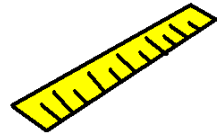
OK Cancel

OK Reset

OK, OK, OK, OK
To close out of point



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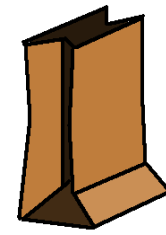
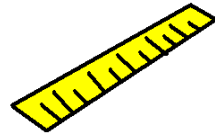
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Repeat the same procedure to
create a new point for the
opposing plane.

- New point
- Comment - Formula - LOOP1
- Recall Feature Points - PLANE
- Add Limits - Formula - LOOP1



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Calypso User Desk - (C) Carl Zeiss - Rule 1 Distance

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window Help Info

Ready: Make selection or take probings

Alignment1
Right Plane's X Value
Distance Right to C Default
Parallelism Right to C
Parallelism C to Right
Dist C to Right Out - Constrained
Dist Right to C Out - Constrained
X_{Min} Minimum1
(1,5,1) Cartesian Distance1

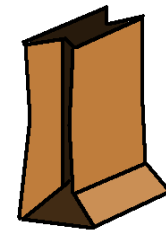
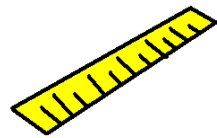
- Roundness
- Roundness Ang
- Waviness
- Flatness
- Flatness Ref
- Straightness
- Straightness Ref
- Cylindricity
- Profile
- Line Profile
- Form
- Curve Form
- True Position
- Concentricity
- Coaxiality
- Perpendicularity
- Parallelism
- GDT Symmetry
- Angularity
- Rugout
- Distance
- Angle between Features

down

XPoint7
XPoint10
XPoint9
Poi
Retract

Polar 2D
3-D Polar
Cartesian
Distance_Symmetry
Space Point Distance
Simple distance

1 mm



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Cartesian Distance

Cartesian Distance2 Comment

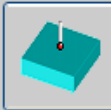
Fine

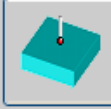
Nominal 10.0000

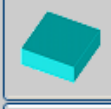
ISO286

Upper Tolerance 0.1000 None


Lower Tolerance -0.1000 None

 Feature 1
Point11

 Feature 2
Point12

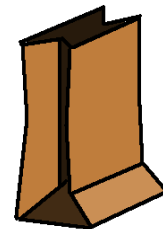
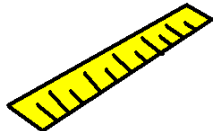
 Primary Datum **Perpendicular**

DatumC

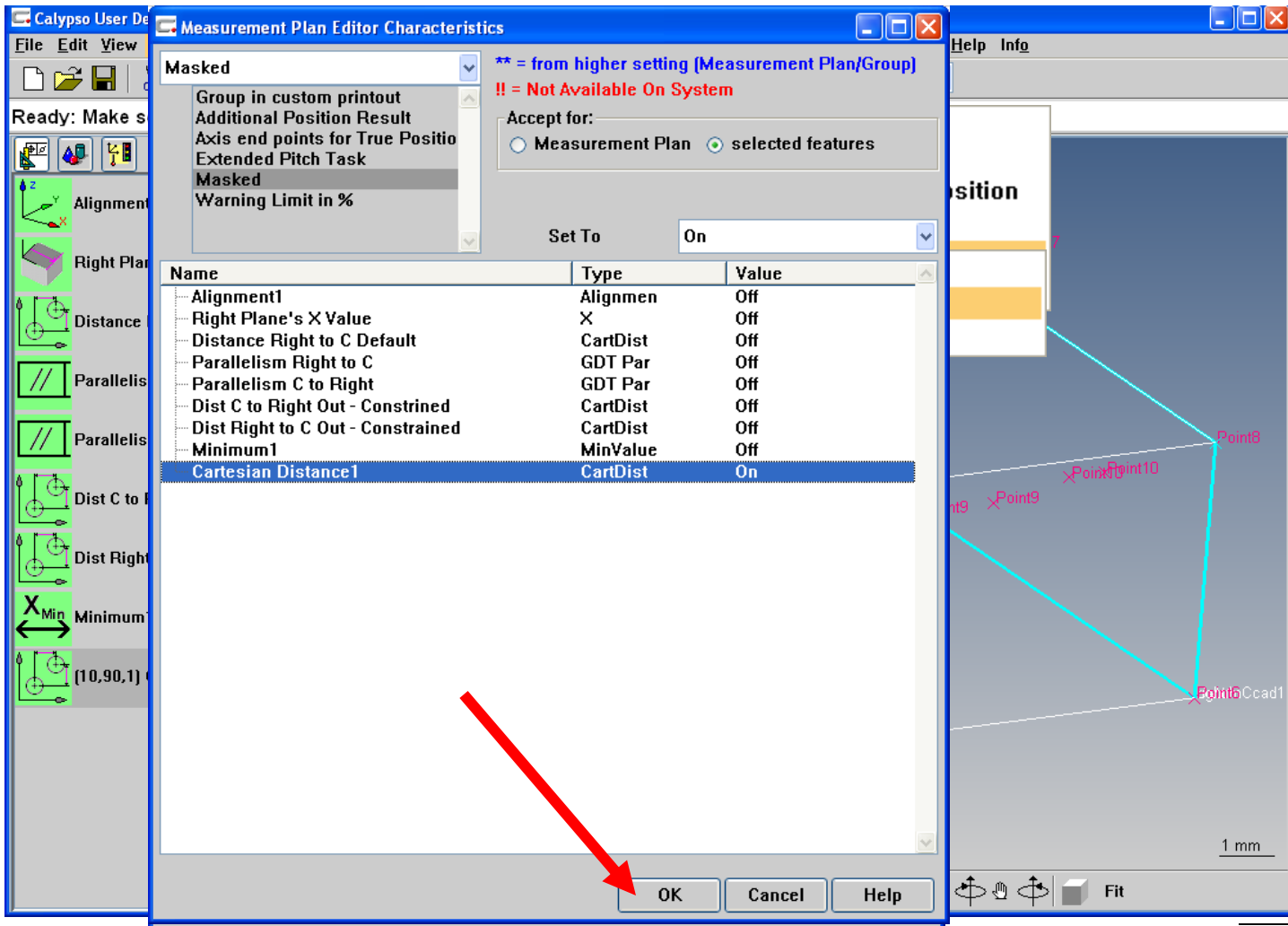
 Secondary Datum Parallel To

Actual 10.0000

OK Reset



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Calypso User De Measurement Plan Editor Characteristics

File Edit View

Ready: Make s

Alignment

Right Plan

Distance

Parallelis

Parallelis

Dist C to f

Dist Right

Minimum

(10,90,1)

Masked

Group in custom printout

Additional Position Result

Axis end points for True Positio

Extended Pitch Task

Masked

Warning Limit in %

** = from higher setting (Measurement Plan/Group)

!! = Not Available On System

Accept for:

Measurement Plan selected features

Set To On

Name	Type	Value
Alignment1	Alignmen	Off
Right Plane's X Value	X	Off
Distance Right to C Default	CartDist	Off
Parallelism Right to C	GDT Par	Off
Parallelism C to Right	GDT Par	Off
Dist C to Right Out - Constrained	CartDist	Off
Dist Right to C Out - Constrained	CartDist	Off
Minimum1	MinValue	Off
Cartesian Distance1	CartDist	On

OK Cancel Help

Position

Point9

Point10

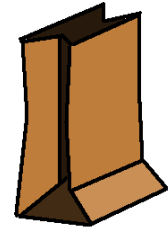
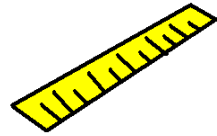
Point8

Point6Ccad1

1 mm



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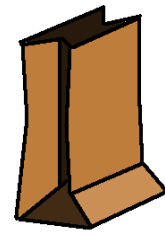
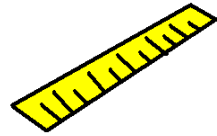
That's it.

Easy, huh?

It's really not all that bad.

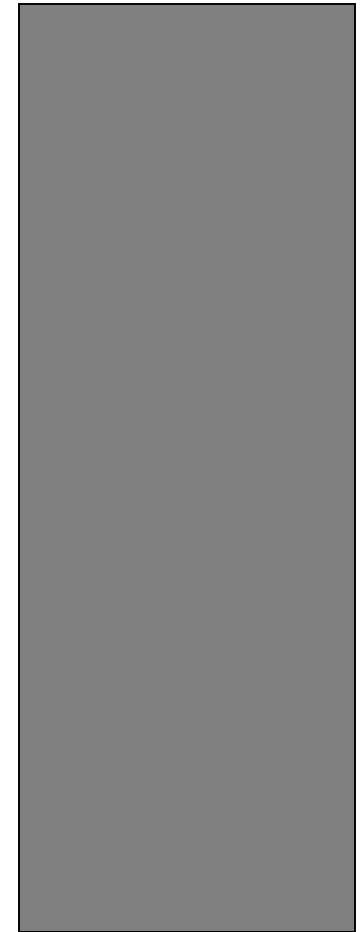
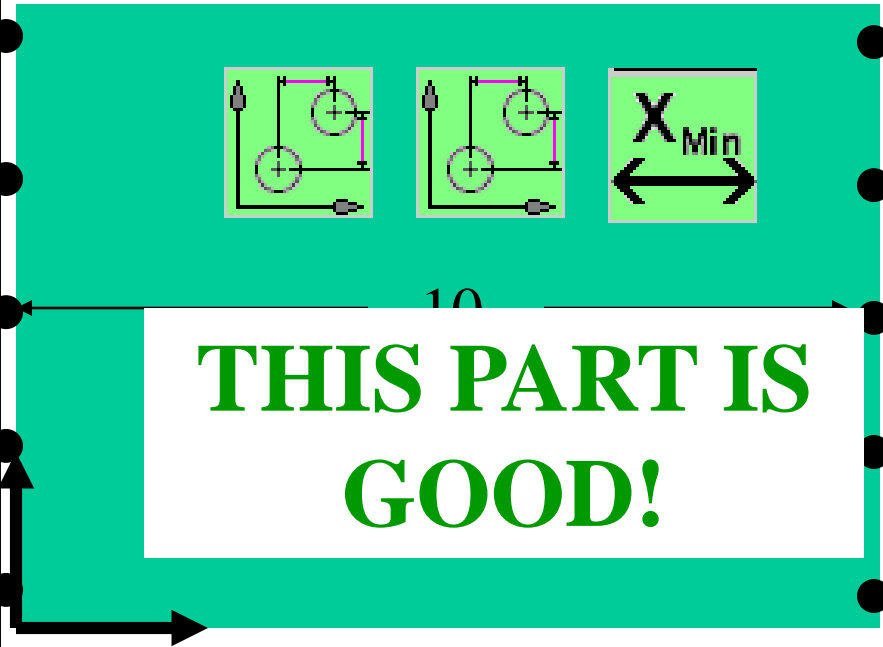
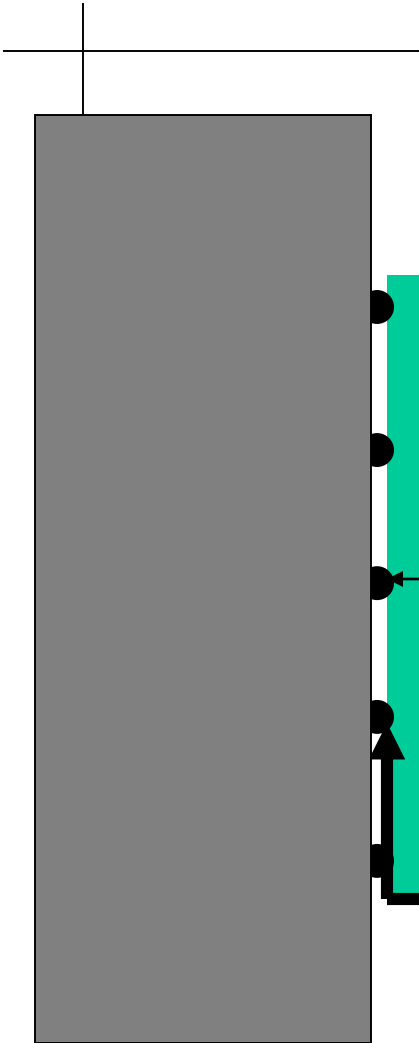


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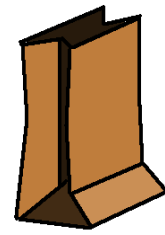
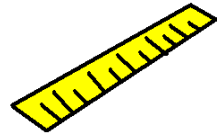
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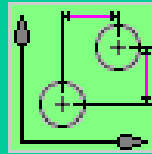
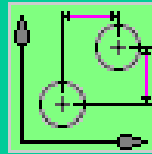


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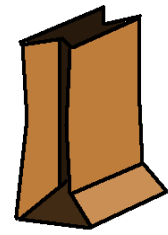
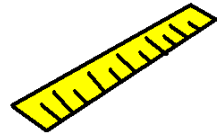
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**THIS PART IS
BAD!**

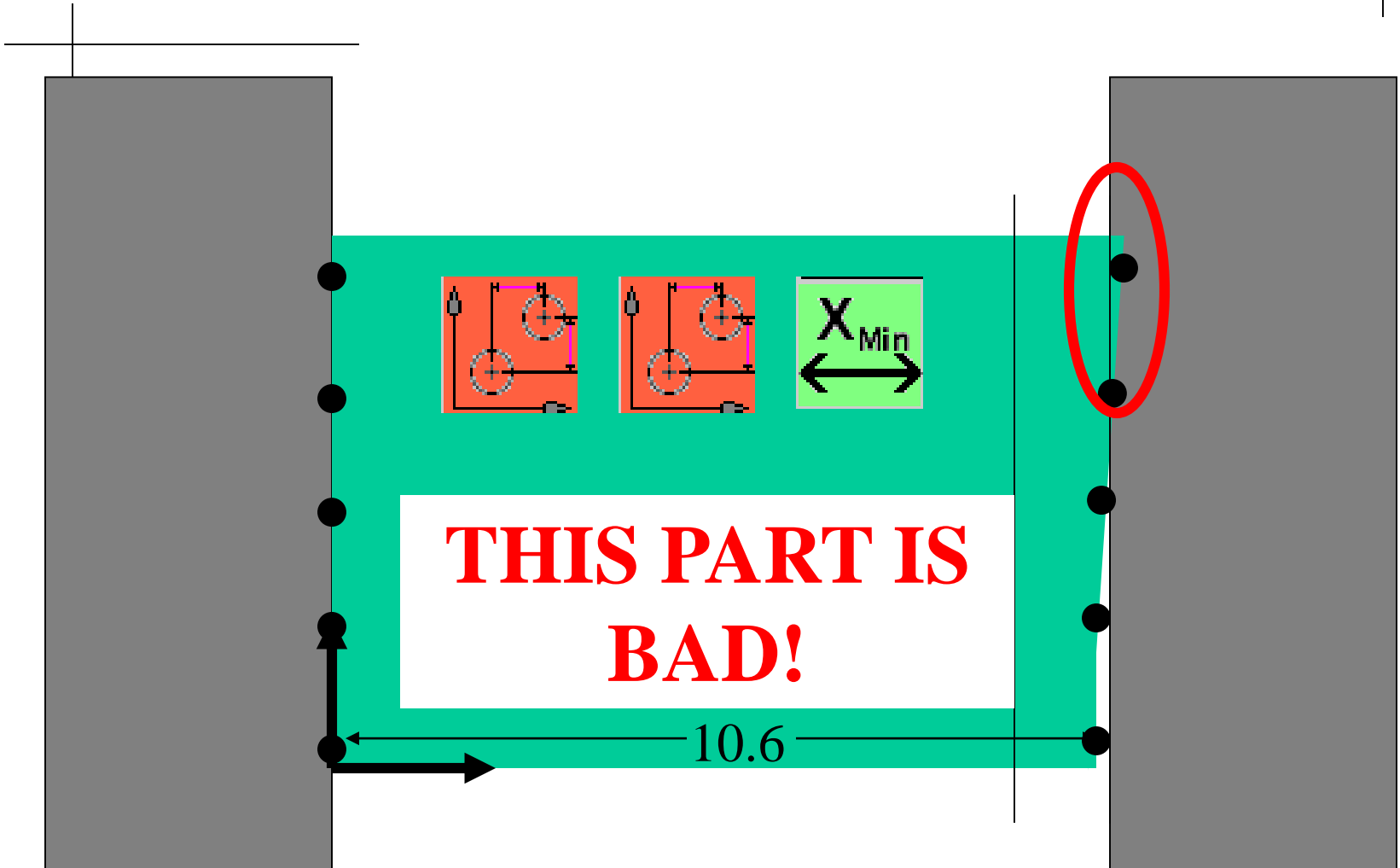


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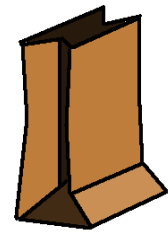
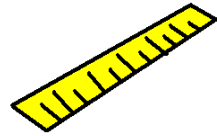
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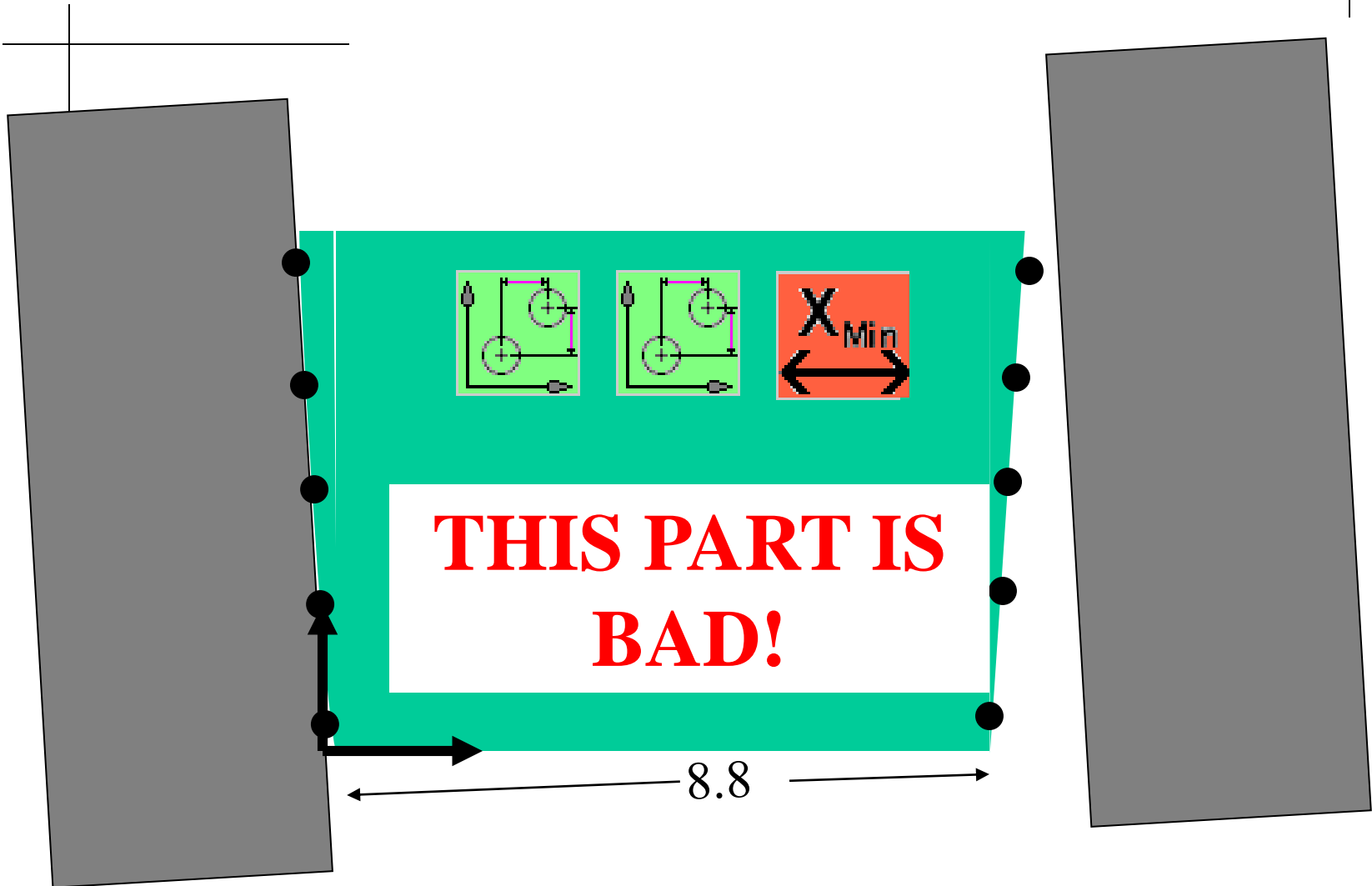


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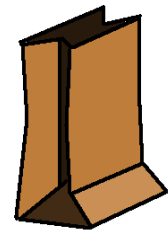
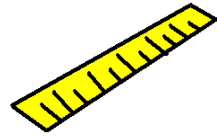
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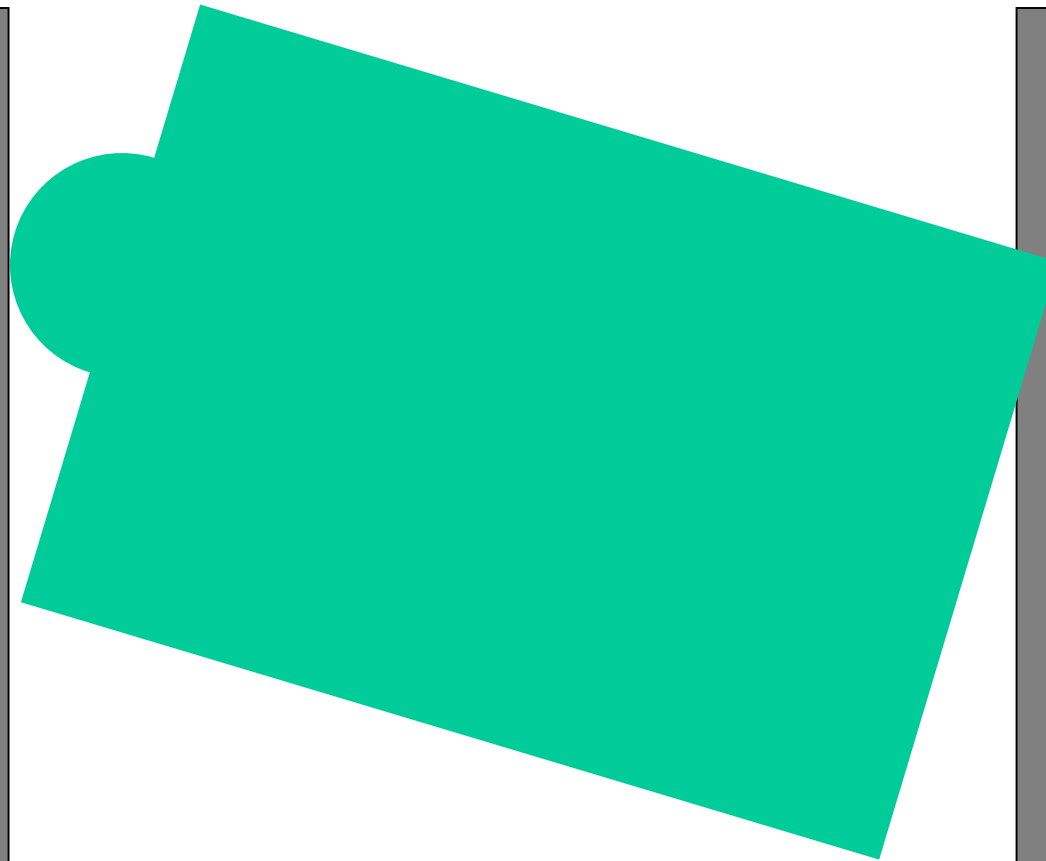




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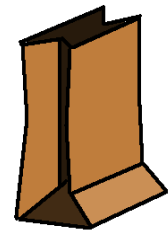
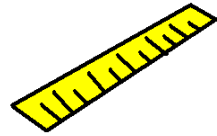


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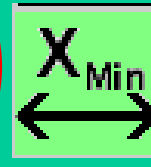
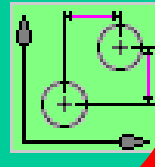
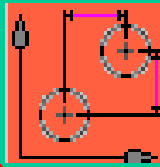


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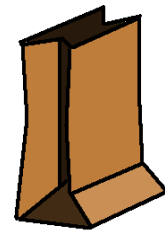
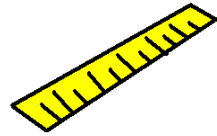
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**THIS PART IS
GOOD!**



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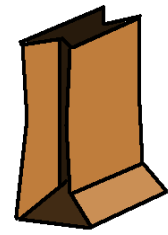
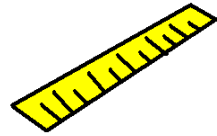
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Method 5:

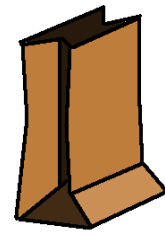
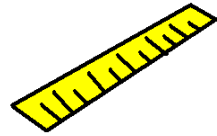
Following the Standard

Ease/Practicality: 1

“Correctness”: 4.9



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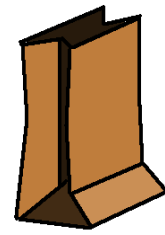
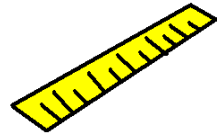
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Checking distance
with regard to Rule #1

Questions?