

## Performing Surfacing Operations

I-DEAS™ Tutorials: Fundamental Skills

**Learn how to:**

- project curves to surfaces
- trim surfaces
- create surfaces from wireframe boundaries
- stitch surfaces together

# Before you begin...

---

## Prerequisite tutorials:

1. Getting Started (I-DEAS™ Multimedia Training)

—or—

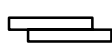
Quick Tips to Using I-DEAS

—and—

Creating Parts

2. Sketching and Constraining
3. Using Sections and Sketch Planes
4. Extruding and Revolving Features
5. Adding Fillet, Shell, and Draft Features
6. Creating Swept Features
7. Modeling Open Parts

If you didn't start I-DEAS with a new (empty) model file, open a new one now and give it a unique name.



*File*

*Open*

Make sure you're in the following application and task:

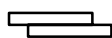


*Design, Manufacturing, or Simulation*



*Master Modeler*

Set your units to mm.



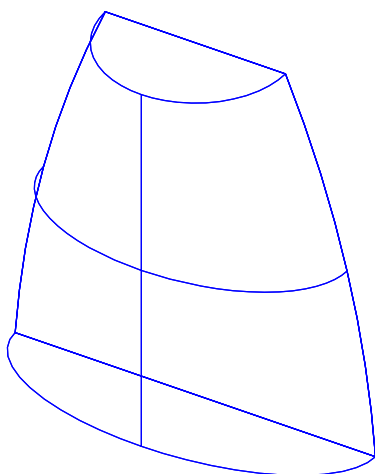
*Options*

*Units*

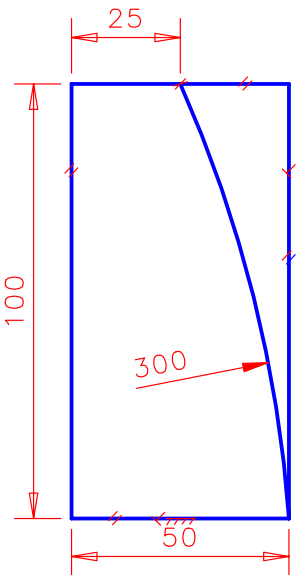
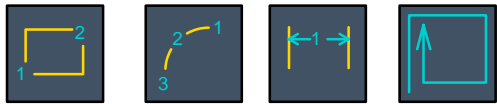


*mm (milli newton)*

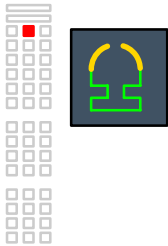
Next, create the basic bottle shape shown below, following the steps provided on the next few pages.



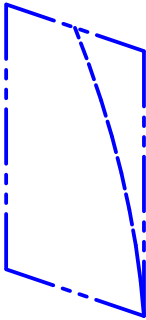
**Step 1.** Sketch a rectangle and an arc. Dimension as indicated below.



**Step 2.** Create reference curves from the wireframe geometry and switch to isometric view.



All



**Save your model file.****Warning!**

If you are prompted by I-DEAS to save your model file, respond:



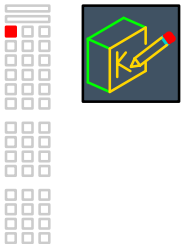
Save only when the tutorial instructions tell you to—not when I-DEAS prompts you for a save.

If you make a mistake at any time between saves and can't recover, you can reopen your model file to the last save and start over from that point.

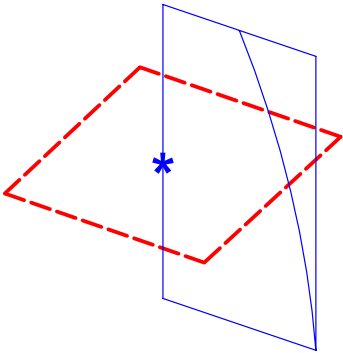
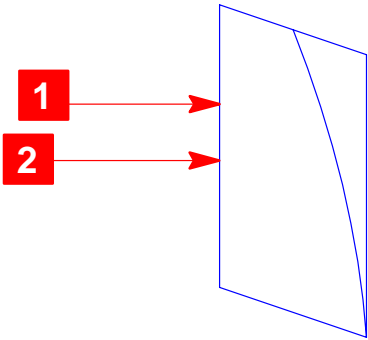
**Hint**

To reopen your model file to the previous save, press Control-z.

**Step 3.** Sketch on path as shown to create a plane perpendicular to the vertical line.

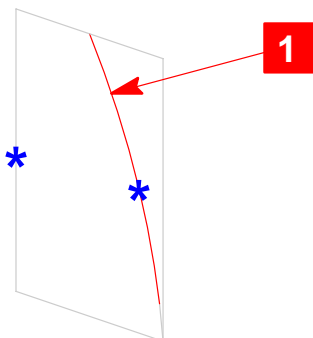


*Sketch On Path*





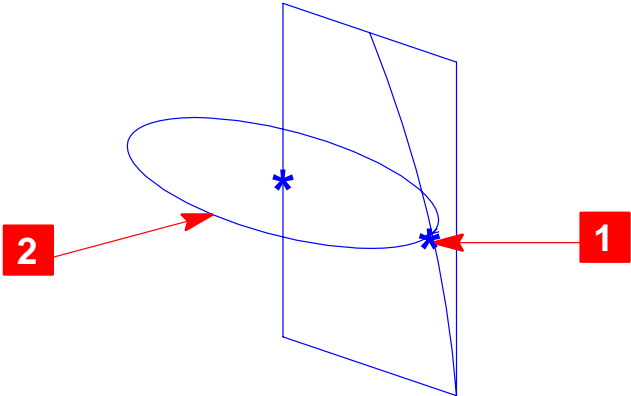
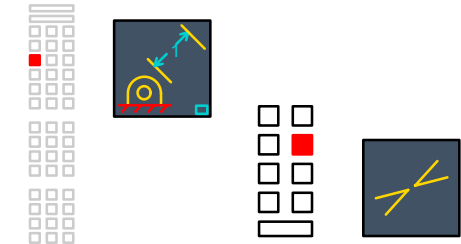
1



The diagram illustrates the four steps of the RANSAC algorithm for line fitting:

- Step 1:** A set of points (blue asterisks) and a set of lines (gray) are shown. The points are scattered around a central point.
- Step 2:** A red rectangle highlights a subset of points, representing the selection of a random sample.
- Step 3:** A red line is drawn through the points in the rectangle, representing the fitting of a model to the sample.
- Step 4:** A red ellipse highlights the points that are outliers relative to the line, representing the rejection of outliers.

**Step 5.** Constrain the end of the ellipse to go through the intersect point so that when you use the variational sweep command, the ellipse will always pass through the rail.

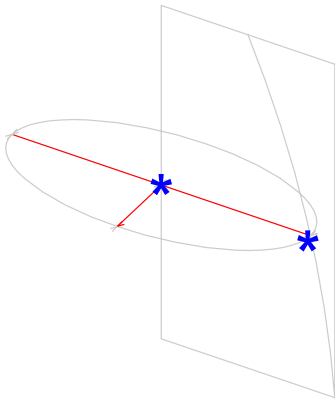


Recovery Point

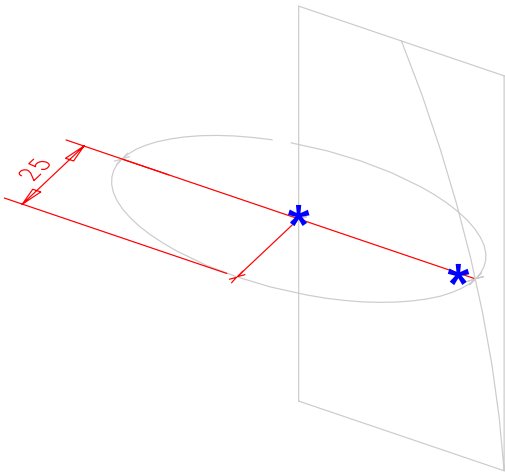




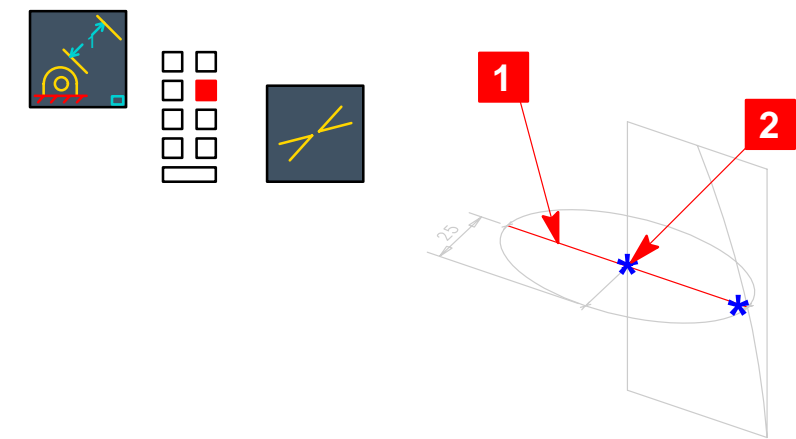
**Step 6.** Draw two lines as shown below in order to add a dimension to the ellipse. (Make sure the two lines are perpendicular.) Fix the angle on the long line so it can't rotate.



**Step 7.** Add the dimension as shown below, and modify its value to 25.



**Step 8.** Constrain the lines to pass through the center point.

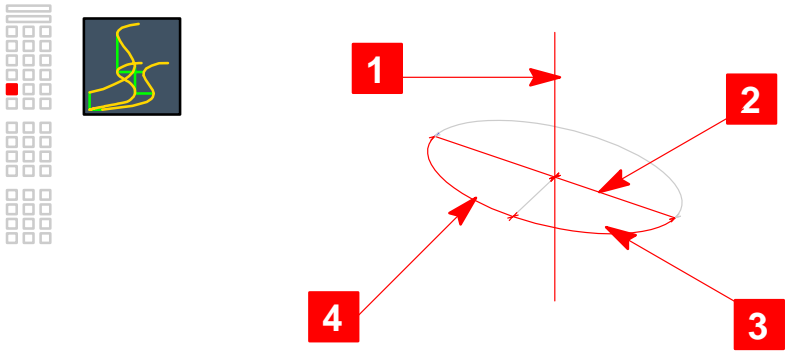


**Hint**  
You can test that the geometry is properly constrained by modifying the 25mm dimension to a larger value. The ellipse should remain centered, with the two lines intersecting at the centerpoint. Set the value back to 25mm before you continue.

**Recovery Point**

 *File*  
*Save*

**Step 9.** Use variational sweep to create half of the bottle shape.



Section Options...



Planar sections only (on)



Autochain (off)

1



Section Options...



Autochain



Stop at intersections

2

3

4

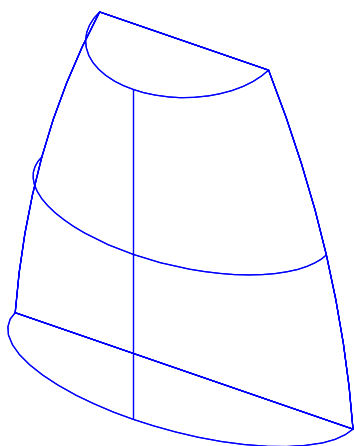


(Done)

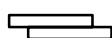
## Create Surface form

*OK*

## Result



## Recovery Point

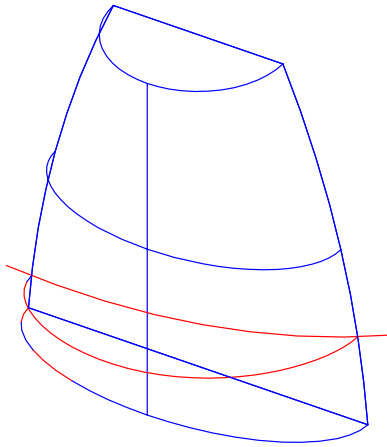
*File**Save*

In surfacing you often want to use curves on surfaces to trim surfaces. There are several different ways to create curves on surfaces.

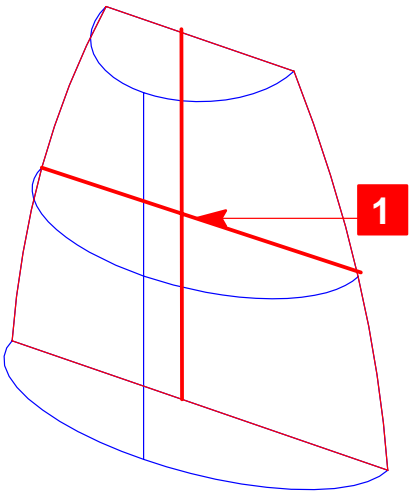
Some important ways are:

- create a curve at the intersection of two surfaces
- create a curve at the silhouette line (useful for mold design to create parting lines)
- project curves onto a surface
- create curves through points on the surface

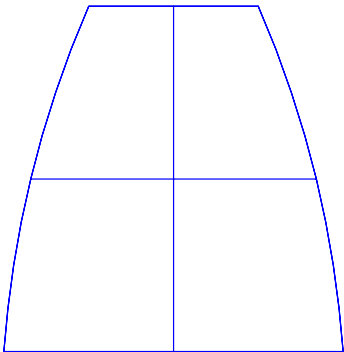
In this section, you will project curves onto the surface.



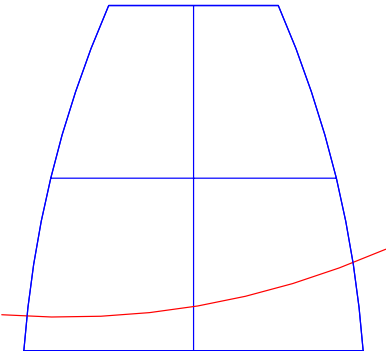
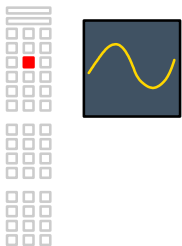
Sketch on the back plane of the bottle.



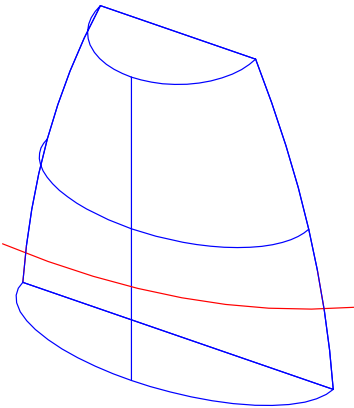
Switch to front view.



Sketch a spline on this plane as shown below.



Switch to isometric view.



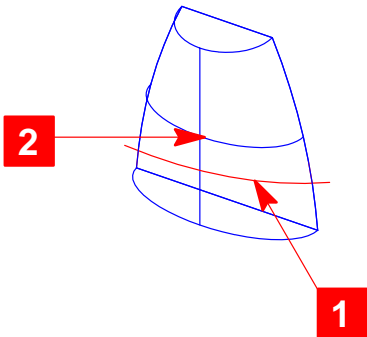
Project the spline curve onto the bottle surface.



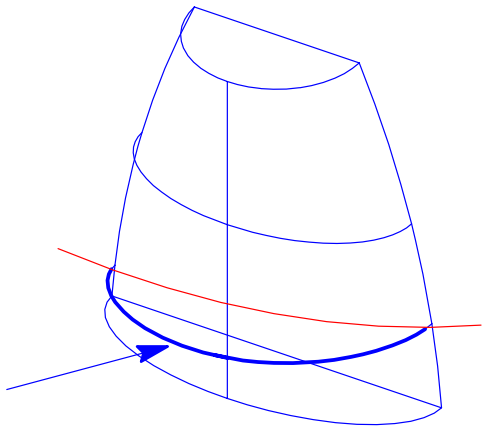
**1** pick spline



**2** pick front surface



Project Curve on Surface form





Next, you will trim the front surface at the projected curve. The software will prompt you to pick:

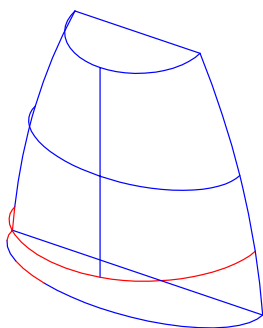
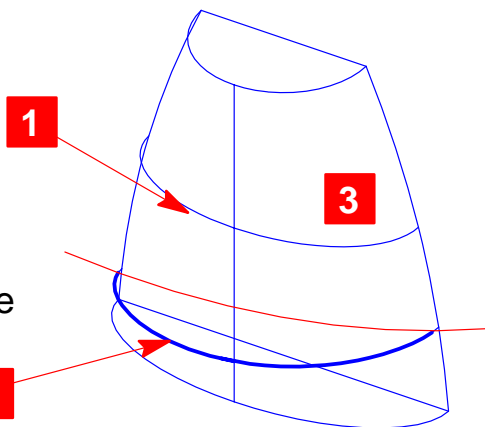
- the surface to trim
- the curve to trim with
- then, the region(s) to keep on the surface

2



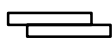
3

(done)



Use a hidden line removed or shaded image to verify that you have kept the upper region of the surface and trimmed away the bottom as shown above.

## Recovery Point

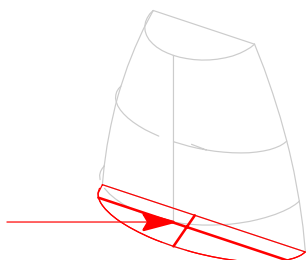


*File*  
*Save*

In this step you will trim the bottom surface of the bottle.

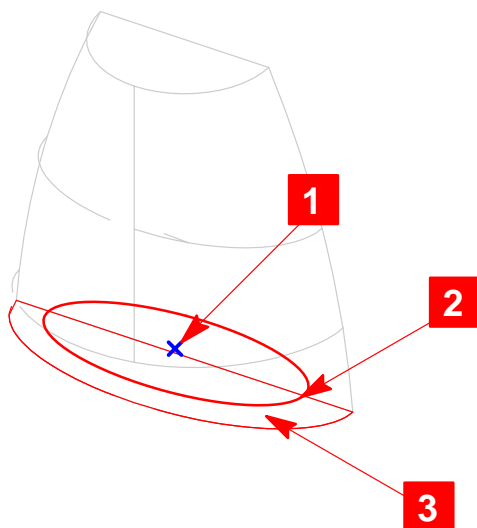
First sketch in place on the bottom surface.

## Hint



Use *Ellipse by Center* to define the bottom of the bottle.

## Hint



Trim the bottom surface. Keep the center region.



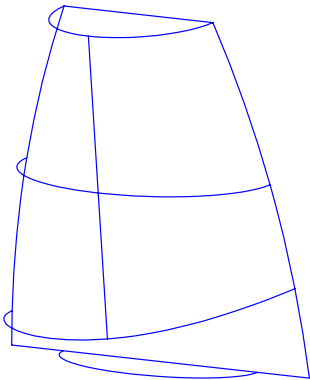
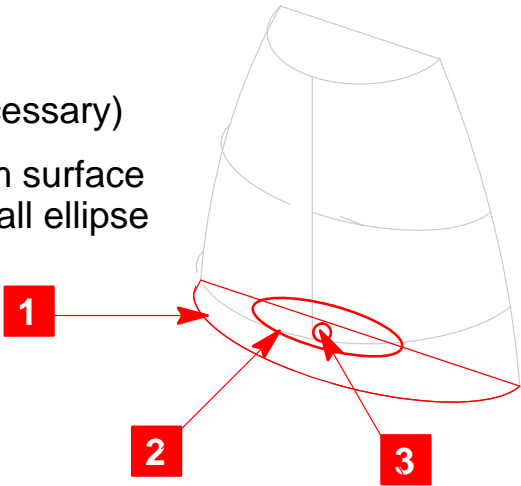
1

2



(Done, if necessary)

3 pick on bottom surface  
inside the small ellipse



Recovery Point

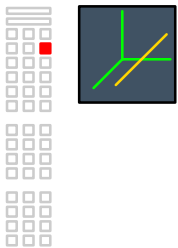
File  
Save

There are several “bottoms-up” methods to create surfaces directly from wireframe curves:

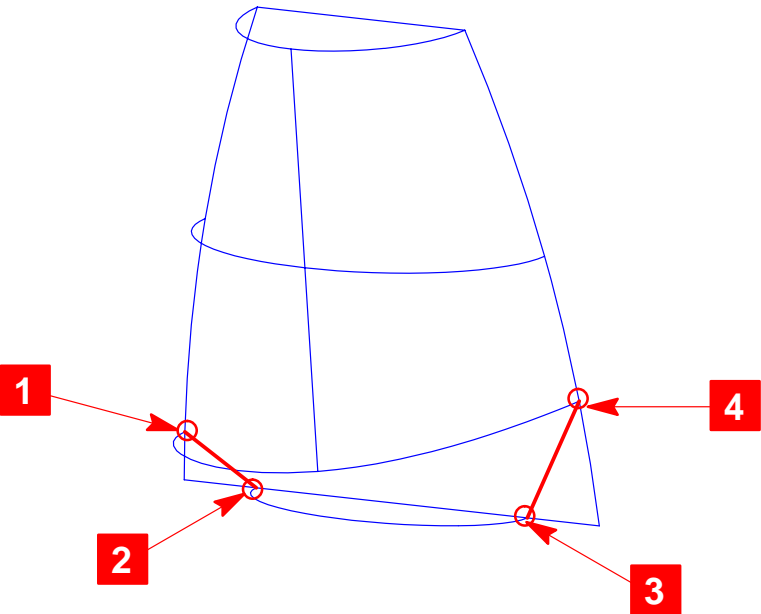
- *Mesh of Curves*
- *Surface by Boundary*
- *Sweep*
- *Variational Sweep*
- *Loft*

In this section, you will use *Surface by Boundary* to create a surface between the bottom and the side of the bottle.

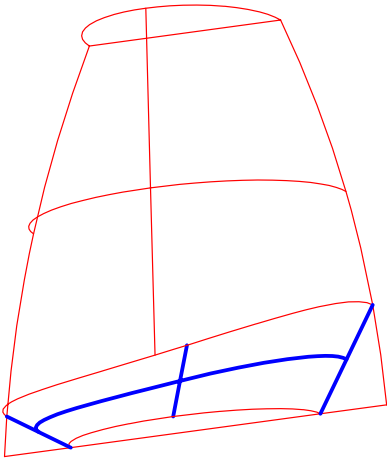
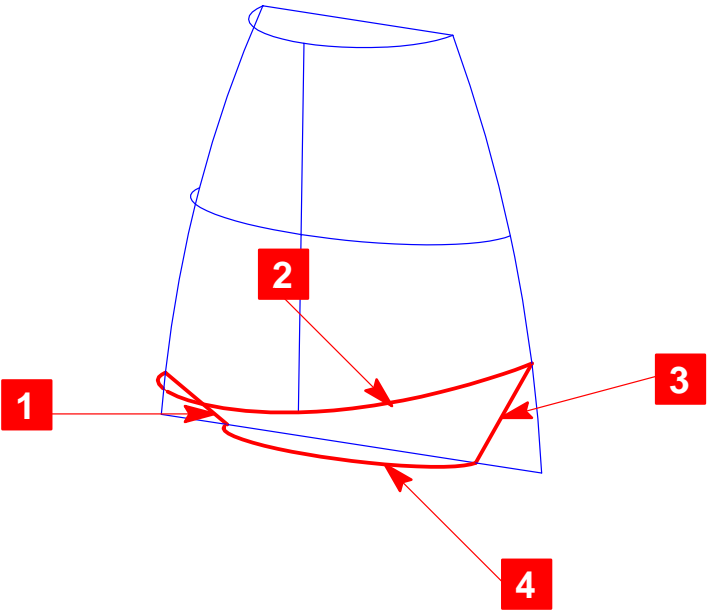
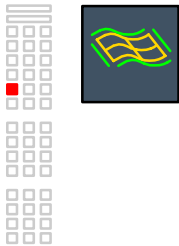
Create two 3D lines to connect the bottom surface to the front surface. These lines will be used as the boundary for a new surface.



Single Line

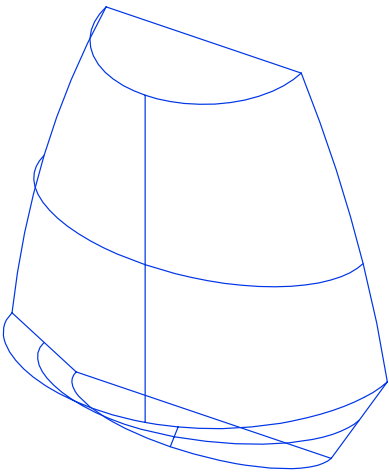
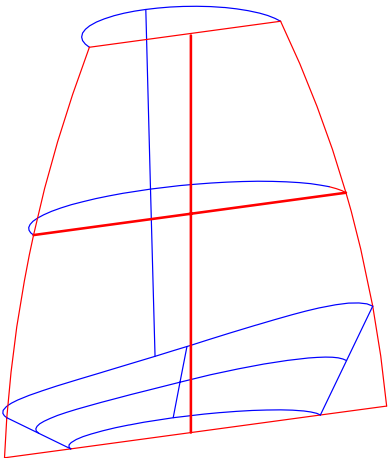


Create a surface by using the *Surface by Boundary* command.

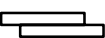


Delete the back face of the bottle.

Hint



Recovery Point

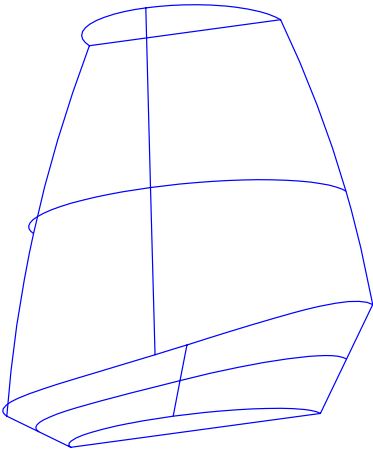


File  
Save

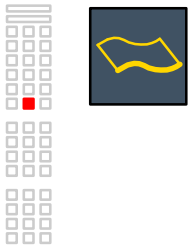


After creating surfaces you need to stitch them together into one part defining an enclosed volume.

In many cases (such as this bottle example), the software will automatically stitch the surfaces together. However, it is a good habit to check for free edges and stitch where needed.



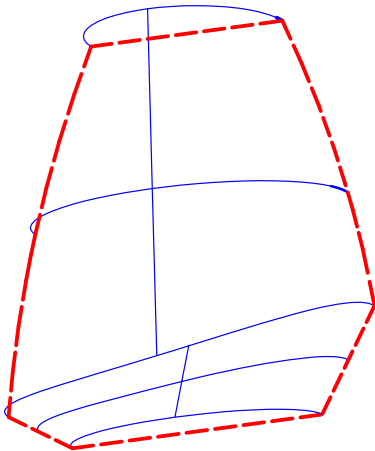
First, check for free edges.



All



(done)



Things to notice

Free edges of surfaces that are not stitched to another surface are highlighted. Notice that the surface you just created was already stitched to the bottom and front surfaces.

The only free edges should be the edges that connected to the back face that you just deleted.



Exploding the display is useful to find out if you have any small sliver surfaces that were unintended, or were too small to see in a line display.



*All*



*Surface*



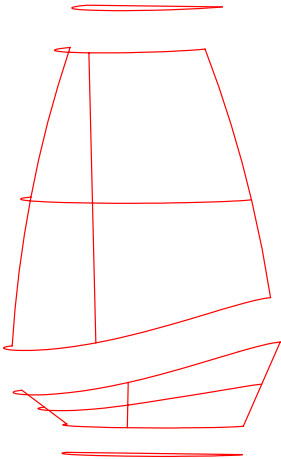
(Done\_with\_All)



(Done)



(accept default)

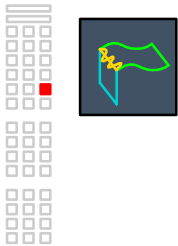


Things to notice

Notice that there are four surfaces.



If necessary, follow these steps to stitch together the adjacent unstitched surfaces.



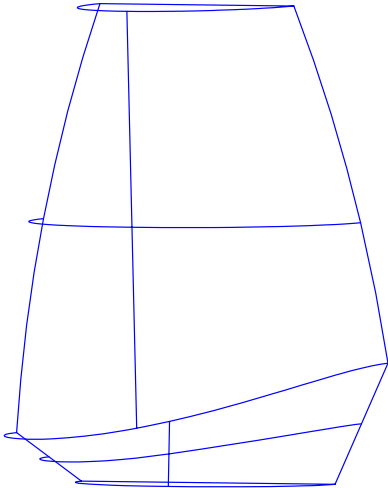
*Pick Surfaces*



*All*



*(done)*



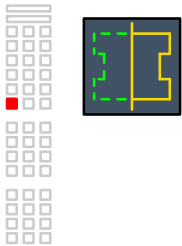
Things to notice

An I-DEAS error should state that there are no edges that overlap.

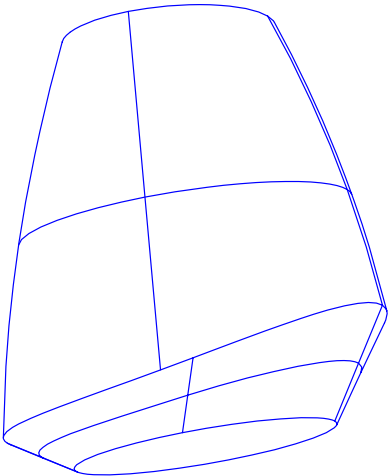


*Continue*

Finish creating the bottle. To finish creating the bottle, use the *Reflect* command.

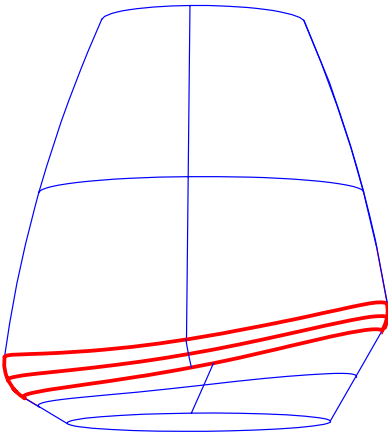


Pick a plane using the *Three-Point* method.



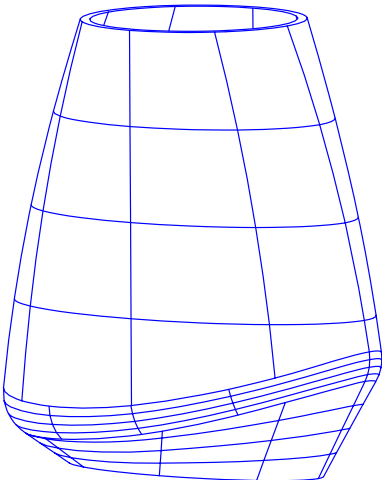
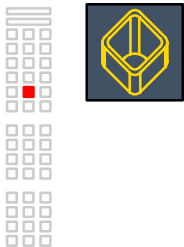
Next fillet the intersections shown below.

Hint



Optional: Shell the bottle. Leave the top open.

Hint



## Tutorial wrap-up

---

You have completed the Performing Surfacing Operations tutorial.

Delete or put away the parts. These parts are not used in any other tutorials.

### See also...

For additional information on many of the concepts covered in this tutorial, see the following in the I-DEAS *Help* facility:

 *Help, Manuals, Table of Contents*

Design User's Guide

Design Concepts

Modeling Parts

Surface Creation

I-DEAS Design Techniques and Examples

Feature Examples

Surfacing Techniques

Variational Sweep Techniques

Shape Design Techniques

Design Reference Guide

Surfacing

Surface Creation

### What's next?

After exiting, choose the Fundamental Skills tutorial that is next in the learning path you are following.

To exit this tutorial, select:

 *File*  
*Exit*

### Warning!

Do not use the menu in the *I-DEAS Icons* window to exit. Use the menu in the Acrobat Reader window.

## I-DEAS Master Series™ Online Tutorials

This online information content, is licensed to the user for the period set forth in the applicable license agreement, subject to termination of the license by Structural Dynamics Research Corporation (SDRC®) at any time, and at all times remains the intellectual property of SDRC. The information contained herein is confidential to SDRC and shall not be copied or reproduced in any form whatsoever, nor be disclosed to anyone other than an authorized representative of the user's employer who is contractually obligated not to disclose same, without express prior written consent of SDRC. The user of this tutorial and the computer program(s) referred to herein retains full control over and is solely responsible for the mechanical design of the user's equipment, machinery, systems, and products. SDRC makes no warranties of any kind, including the warranty of merchantability or fitness for a particular purpose in respect to the equipment, machinery, systems, and products derived or resulting hereunder, and the user assumes all risks and liability for results obtained by the manufacturing, use or implementation of the computer program(s) described herein, whether used singly or in combination with other designs or products. SDRC shall not be liable for any special or consequential damages. SDRC makes no warranty that the equipment, machinery, systems, and products derived or resulting hereunder will not infringe the claims of domestic or foreign patents and further does not warrant against infringement by reason of the use thereof in combination with other design, products, or materials or in the operation of any process. Users shall protect, indemnify and hold harmless SDRC of and from any loss, cost, damage or expense arising from any claim that is in any way associated with the computer program(s) described in this tutorial. Data presented in examples do not necessarily reflect actual test results and should not be used as design criteria.

By acceptance of I-DEAS Master Series, the user agrees to the above conditions and further agrees that this intellectual property will not be exported (or reexported from a country of installation), directly or indirectly, separately or as part of a system, without user or user's employer, at its own cost, first obtaining all licenses from the United States Department of Commerce and any other appropriate agency of the United States government as may be required by law.

© Structural Dynamics Research Corporation 1979, 1980, 1983, 1984, 1986, 1988, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998

© Maya Heat Transfer 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system without permission in writing from SDRC.

Federal Acquisitions: Commercial Computer Software  
Use governed by terms of SDRC's Software License and Service Agreement.

SDRC has worked to verify the accuracy of the information contained in this manual as of its publication date; however, such information is subject to change without notice and SDRC is not responsible for any errors that may occur in this document.

This software is a Licensed Product of and distributed by SDRC and may only be used according to the terms of that license on the system identified in the License Agreement.

**SDRC and SDRC I-DEAS are registered trademarks of Structural Dynamics Research Corporation.**

**The following are trademarks of Structural Dynamics Research Corporation**

I-DEAS, I-DEAS Master Series

All other trademarks or registered trademarks belong to their respective holders. All questions or requests should be addressed to:

Structural Dynamics Research Corporation  
2000 Eastman Drive  
Milford, Ohio 45150  
(513) 576-2400