JDS

CHECKSHEET FOR PART MINI-PROJECT (Cover page 1 of 2)

23 /24

NAME: Andrew Hartman

Pre-CAD Plan

- ✓✓ Identify Primary & Secondary Features
- ✓✓ Explain Rationale for Location of Origin
- ✓✓ Pick Effective Front/Top/Side Views
- ✓✓ Order of Feature Implementation
- ✓✓ Identify Key Size Dimensions
- ✓✓ Keep track of ALL Assumptions

8 /8

Above and Beyond (Exemplary)

- ✓✓ Exceptional organization and neatness
- ✓✓ Analysis of steps/features that could prove difficult
- ___ Other:_____

Process Documentation

- ✓✓ Completed Summary and Custom tabs (w/ summary tab overlaid on model)
- ✓✓ Illustration of Modeling Steps
- ✓✓ Explanation of Modeling Steps
- ✓✓ Rationale for Usage of Sketch Tools
- ✓✓ Expanded and Annotated Design Tree
- ✓✓ Compelling Lessons Learned (about this part as well as about SolidWorks)

8 /8

Above and Beyond (Exemplary)

- ✓✓ Exceptional organization and neatness
- ✓✓ Thoughtful use of Reference or Construction Geometry to Simplify Modeling
- ___ Other:_____

Finished Products (based on finished model and drawing)

- ✓✓ Fully-Defined Sketches
- ✓✓ Correct/Accurate Model
- ✓✓ Attractive Visualization of Final Part (include at least 1 color image)
- ✗✗ Mass properties shown ←
- ✓✓ Quality Engineering Drawing(s) on Multiple Sheets (use of part properties, filled out ME template w/ title block items)
- ✓✓ Complete/Non-redundant dimension scheme

7 /8

Above and Beyond (Exemplary)

- ✓✓ Effective use of section view, detail view, or other to assist drawing clarity
- ✓✓ Effective/clean dimension scheme
- ___ Other:_____

PART MINI-PROJECT SELF ASSESSMENT (Cover page 2 of 2)

NAME: Andrew Hartman **SECTION:** 1 **DATE:** 3/10/2021

1. How many total hours did you spend on the part mini-project, including class time? How many in planning? How many in modeling? How many in documentation?

Planning	1.5	
Modeling	2.5	
Documenting	4	Total 8

2. Using the ME 301 grading rubric (1-4), analyze your performance in the following:

1- incomplete, major deficiencies 3 - *complete, meets expectations*
2- complete, some deficiencies 4 - *exemplary, exceeds expectations*

Project Component	**Self Rating**	**Rationale**
Pre-CAD Plan - Identify Primary & Secondary Features - Explain Rationale for Location of Origin - Pick Effective Front/Top/Side Views - Order of Feature Implementation - Locate/Calculate Needed Dimensions - Keep track of ALL Assumptions	3	My identification of key dimensions is hard to follow and the blue outlining of key features is not ideal, but I think I hit most of the requirements.
Process Documentation - Summary Tab Overlaid on Model - Illustration of Modeling Steps - Explanation of Modeling Steps - Rationale for usage of sketch tools - Annotated (i.e., renamed) Design Tree - Lessons/Discoveries (about this part as well as about SolidWorks)	4	I cover all of the requirements. My explanation and illustrations of my modeling steps are in depth and I cover the reasoning behind my main sketch tool usages.
Finished Products - Fully-Defined Sketches - Correct/Accurate Model - Attractive Visualization of Final Part (include at least 1 color image) - Calculation of Mass & Center of Mass - Quality Engineering Drawing(s) on Multiple Sheets (w/complete set of dimensions, use of part properties, and filled out ME template w/ other title block items)	3.5	My model is accurate and I provide enough dimensions and details in my drawing to be able to recreate the part. However, my dimensioning scheme is not the most clean or easy to read in my mind. I have difficulty trying to figure out where to place dimensions.

PART MINI-PROJECT SCHEDULE

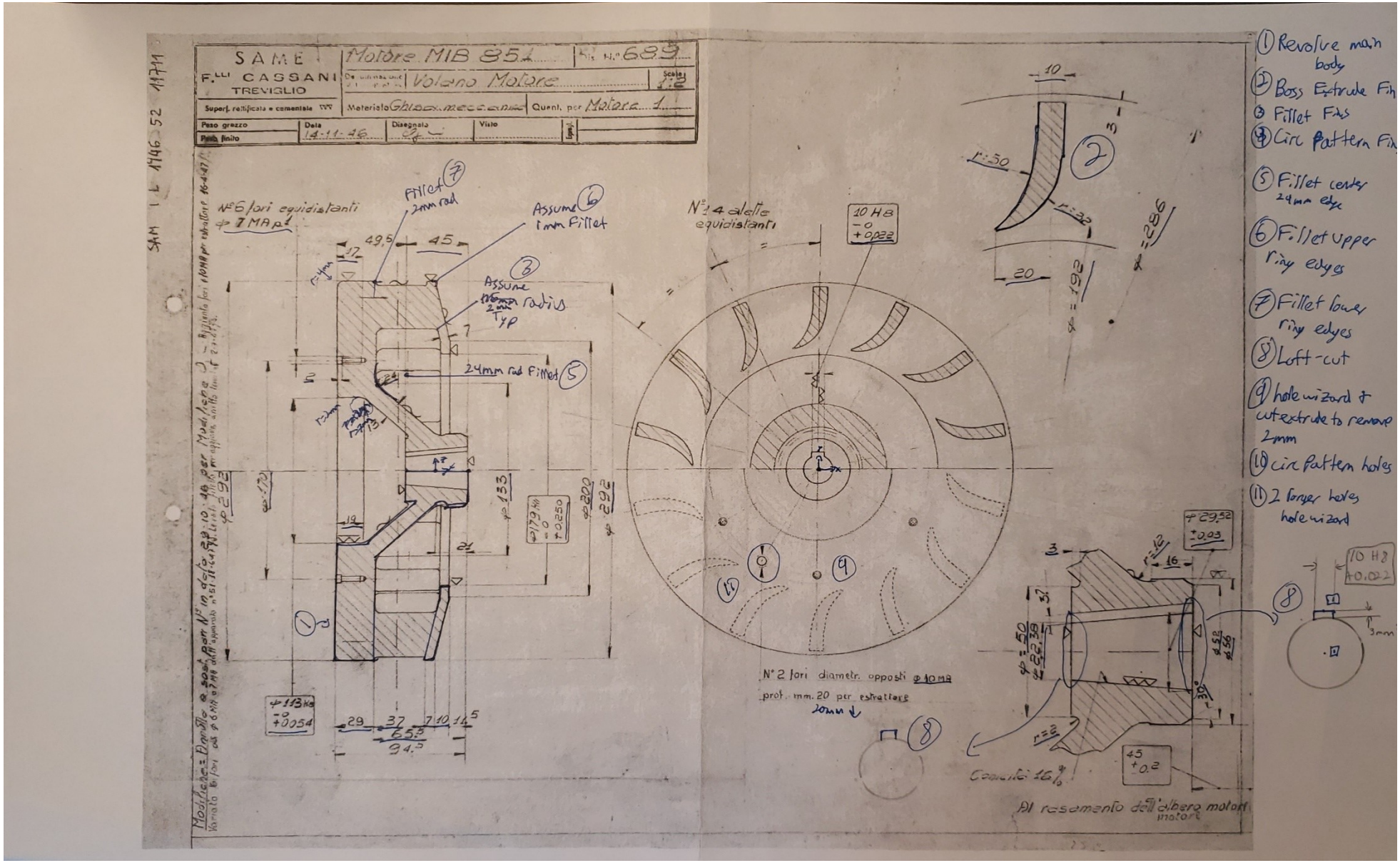
Day 1 - Kick-Off (JEB 331)

1. Part Mini Project introduction and assignment review.
2. Analyze legacy drawing and ask questions.
3. Pre-CAD: specify planes, origin, axes, reference geometry, and modeling approach. (homework)
4. Begin modeling part. (homework)
5. Log notes/assumptions you make about your part. (homework)
6. Inventory additional consulting questions you would like answered. (homework)

Days 2 & 3 - Computer Lab Consulting (JEB 331)

7. Bring hard copy and electronic documents/files to class on flash drives.
8. Share modeling/drawing rationale and progress to date.
9. Actively participate in individual/group consultations and problem solving.
10. Finish SW model and mass/center-of-mass calculations. (homework)
11. Finish SW drawing(s) w/dimensions and annotations. (homework)
12. Have someone check your drawing and sign off in the title block. (homework)
13. Prepare a complete documentation package. (homework)
    a. pre-CAD plan
    b. process documentation
    c. finished products

Day 4 - Submit Entire Package at beginning of class March 11



1) I will begin by creating a sketch on the top plane to use for the main body and upper ring. It is outlined in blue in the lower left hand side. I plan to keep the origin at the center of the cylinder shaft. All of the corners will be created without fillets which will be added after the revolve. The only curve will be the one near the center below the	**2)** After creating the initial revolve I will create the bass extrude of one fin to connect the lower portion of the revolve to the upper portion. The dimensions in the upper right sketch on the drawing provide exactly how to draw this piece in order to be fully defined. I will extrude up the face of the upper ring portion.

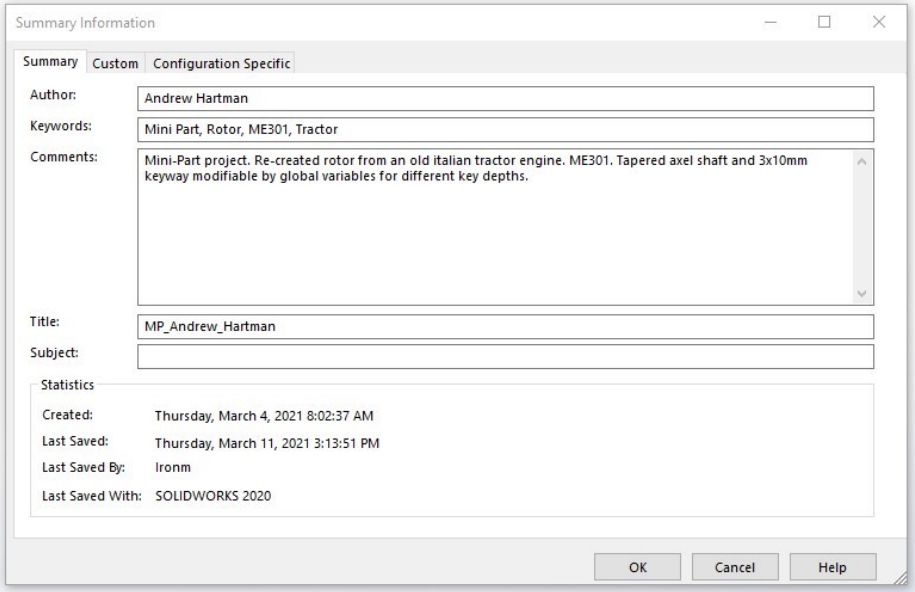
16mm piece which has a dimension of “r=12”. For this I plan on creating a tangent arc but I do not know the best way to make it go in first before arcing out. This is the most critical and also the most difficult sketch of all of them. Making sure to draw the sketch in the correct shape and proportions when beginning will help reduce errors when dimensioning it afterwards.	
3) Once the fins have been extrude I need to add the required fillets. No fillet dimensions are given, but based on size relative to the other dimensions I think the fillets on the connection between the fins and the other rings have a radius of about 1.5mm.	**4)** Once the fillets have been added they will be ready to circular pattern. There are 14 fins, equally spaced around the circle. This will be easy to accomplish using any of the circles of the revolve as the direction reference.
5) The center edge of the piece where the angled piece meets the lower ring needs a fillet with a specified 24mm radius.	**6)** All of the edges of the upper ring above the fins have fillets on the edges. Based on size relative to other dimensions I will assume this is a 1mm fillet.
7) The edges of the lower ring look to have multiple different fillets. I have marked my assumed dimension for each.	**8)** In order to create the cone for the shaft and the keyway I will use a lofted cut. On the upper face of the center piece I will draw the circle and keyway sketch shown on the right of the page and then on the lower face of the center piece I will draw the smaller circle, but same keyway dimension, sketch shown to the left of the lower right view. These will then be loft cut between. The conicity will be defined by the two diameters of the circles, which works out to be the same as the specified 16% conicity.
9) The 6 M7 holes around the backside of the part will be created using a Hole wizard with a M7 Tapped hole to the specified depth. In order to cut away the first 2mm of thread I am going to follow up on each hole with a Cut-extrude of a 7mm circle do a depth of 2mm.	**10)** The previous hole will be circular patterned with 6 equidistant spaced holes around the 170mm diameter circle about the origin.
11) The final step will be to create the two M10 holes using a hole wizard tapped hole. These do not look like they have the threads cut away and look as if they are equally spaced between the other hole pattern.	The dimensions that I felt were key dimensions within each part of the given drawing I underlined in blue. These are what I am going to use to define my sketches.

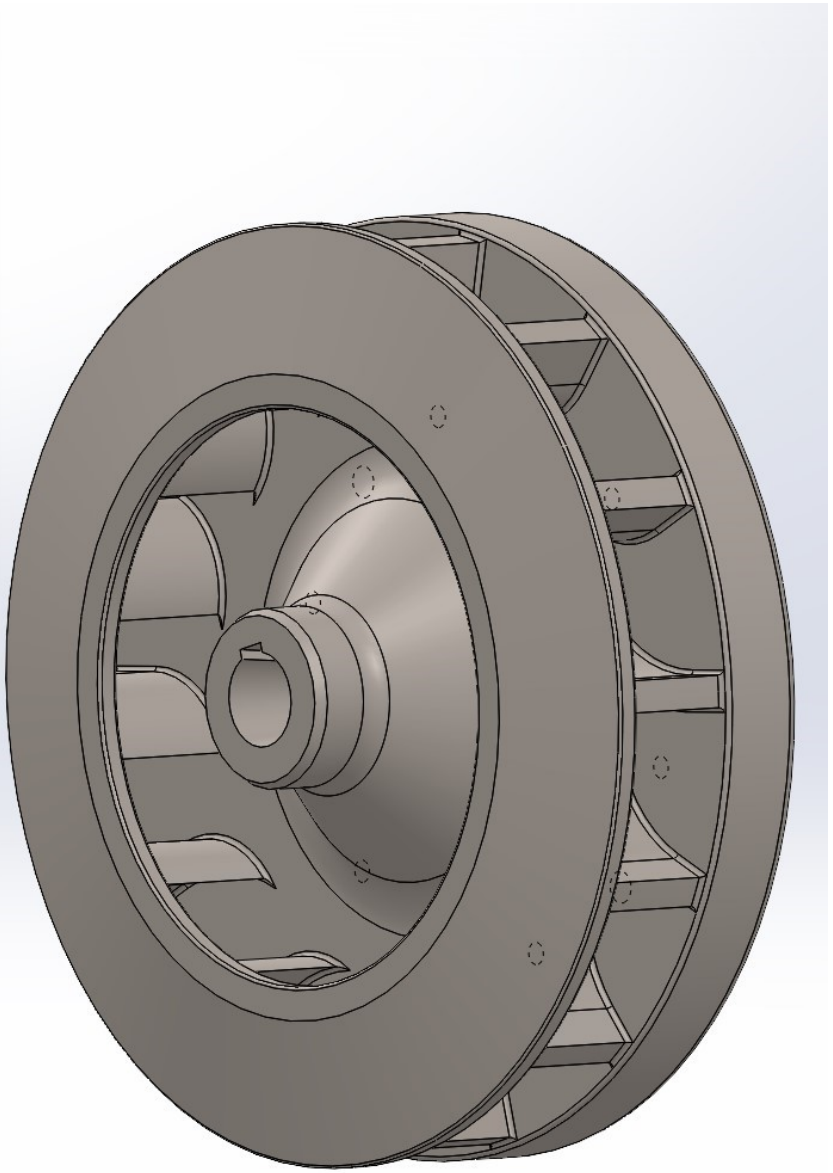
Assumptions:

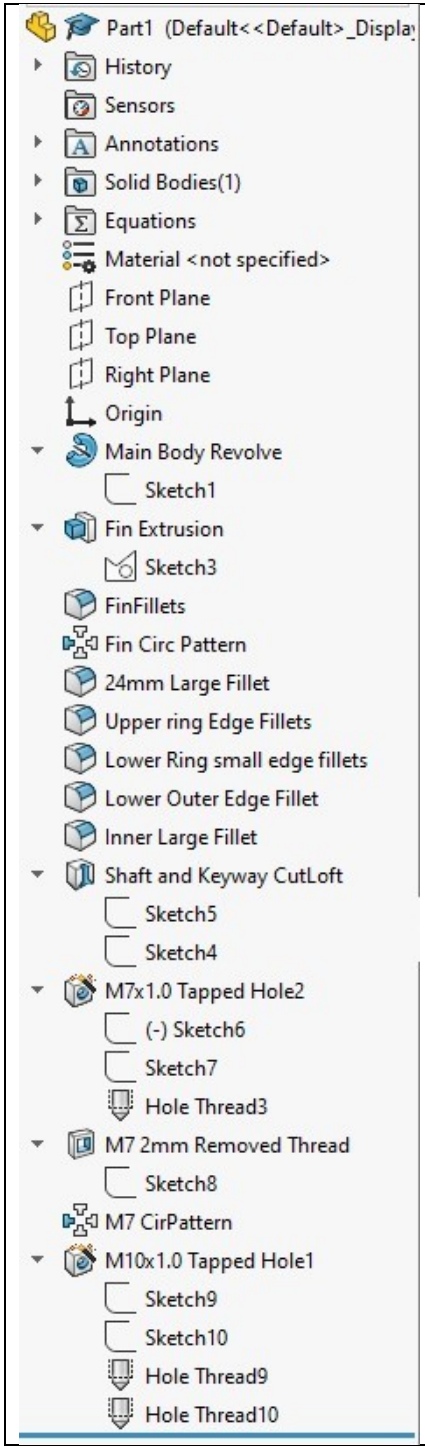
- The “r=12” circle in my first step is tangent to the angled piece of the revolve and the 16mm straight edge.
- That the fin has a radial segment as the back edge instead of being horizontal because it is drawn on a 286mm diameter circle.
- That the edges of the fins that connect into the lower and upper rings are all 1.5mm radius fillets.
- The fillets of the upper ring’s edges are all 1mm based on the size of the sketch.
- The outer edge of the lower ring has a 4mm fillet, the inner edge has a 2mm fillet, and the upper inner edge has a 7mm fillet based on the size of the curves in the sketch.

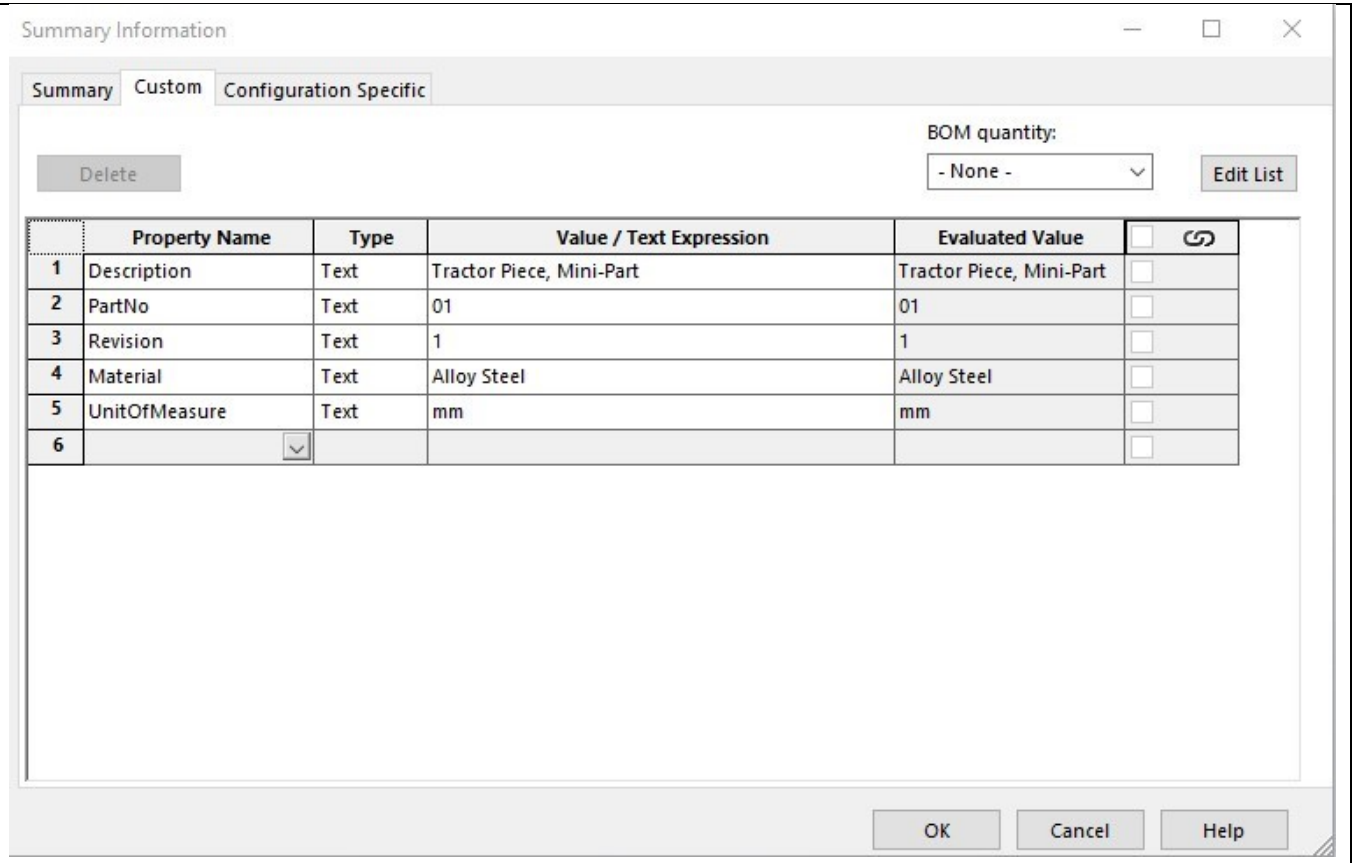
- The keyway has a height dimension given as “3?” which I am going to assume is just 3mm but could vary based on the key used. I will make it a global to be able to change later.
- The M10 holes are equally spaced between the two closest M7 holes and do not have the first 2mm of thread cut away.

Process Documentation:






Part1 (Default<<Default>_Displa
History
Sensors
Annotations
Solid Bodies(1)
Equations
Material <not specified>
Front Plane
Top Plane
Right Plane
Origin
Main Body Revolve
Sketch1
Fin Extrusion
Sketch3
FinFillets
Fin Circ Pattern
24mm Large Fillet
Upper ring Edge Fillets
Lower Ring small edge fillets
Lower Outer Edge Fillet
Inner Large Fillet
Shaft and Keyway CutLoft
Sketch5
Sketch4
M7x1.0 Tapped Hole2
(-) Sketch6
Sketch7
Hole Thread3
M7 2mm Removed Thread
Sketch8
M7 CirPattern
M10x1.0 Tapped Hole1
Sketch9
Sketch10
Hole Thread9
Hole Thread10


Summary Information
Summary
Custom
Configuration Specific
BOM quantity:
- None -
Edit List
Delete
Property Name
Type
Value / Text Expression
Evaluated Value
1 Description Text Tractor Piece, Mini-Part Tractor Piece, Mini-Part
2 PartNo Text 01 01
3 Revision Text 1 1
4 Material Text Alloy Steel Alloy Steel
5 UnitOfMeasure Text mm mm
6
OK
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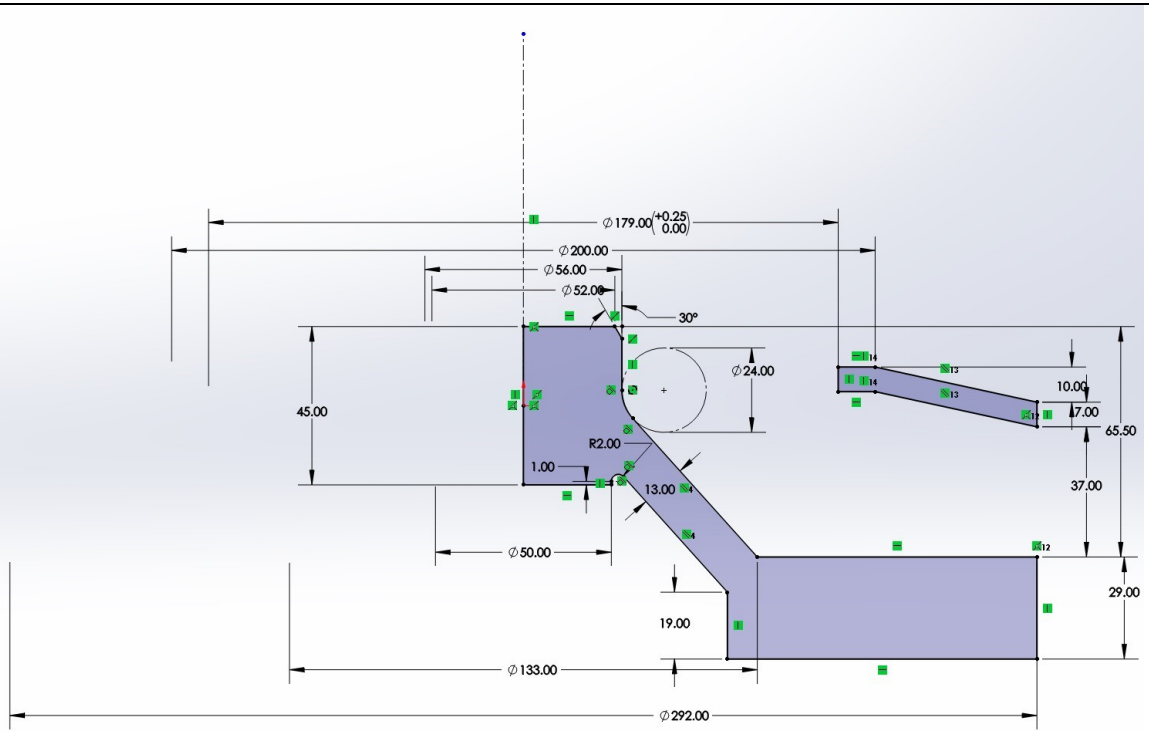
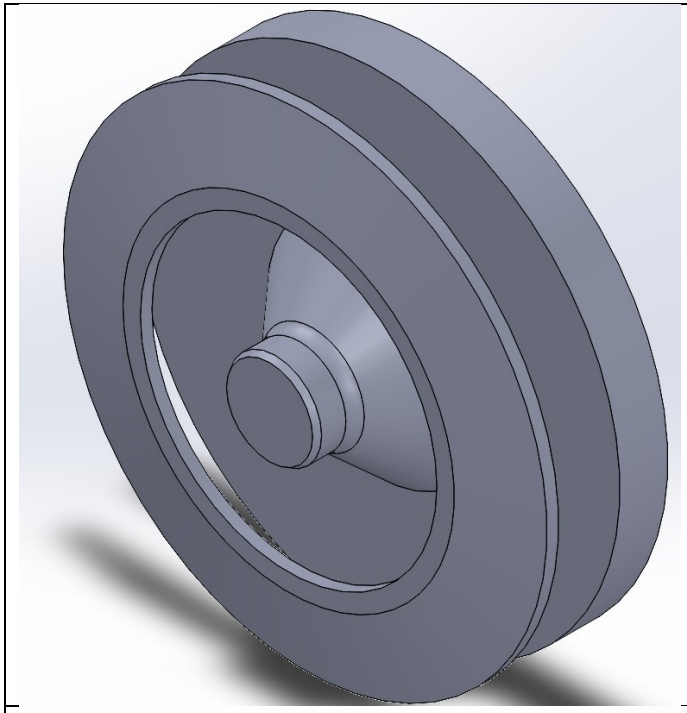
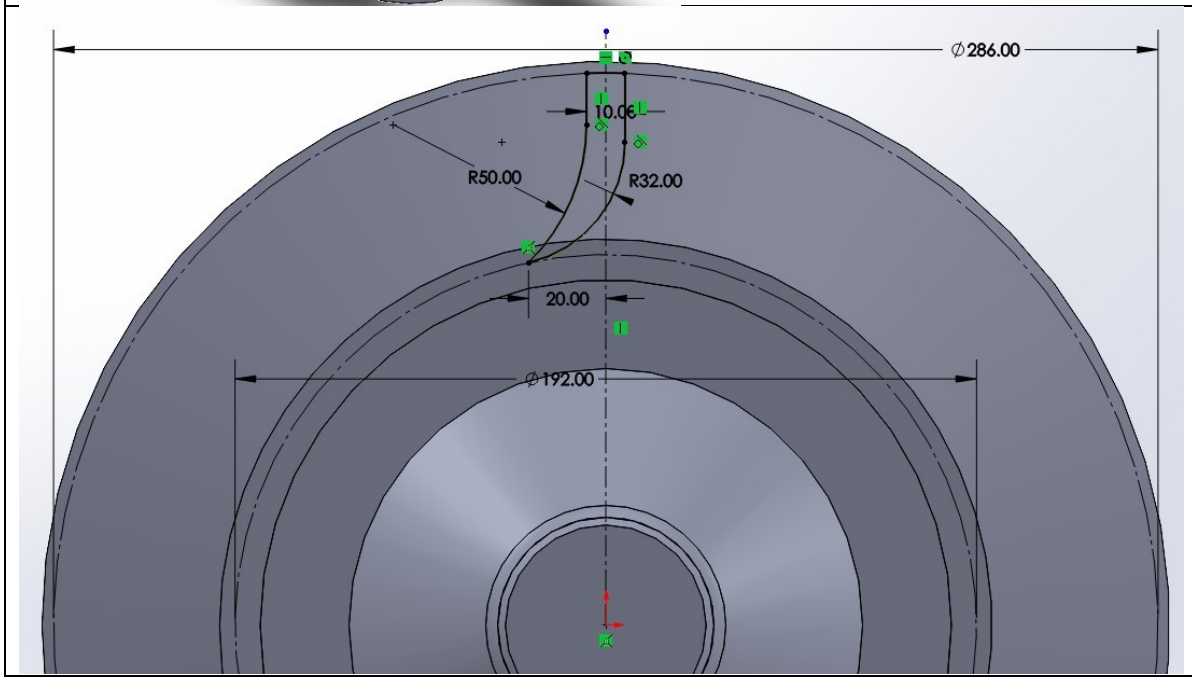
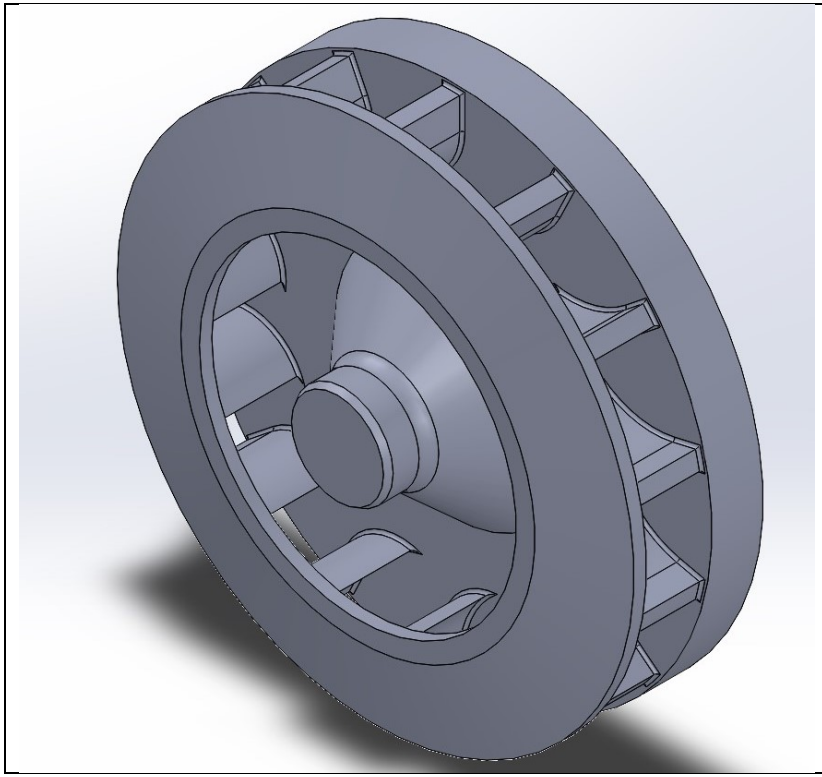


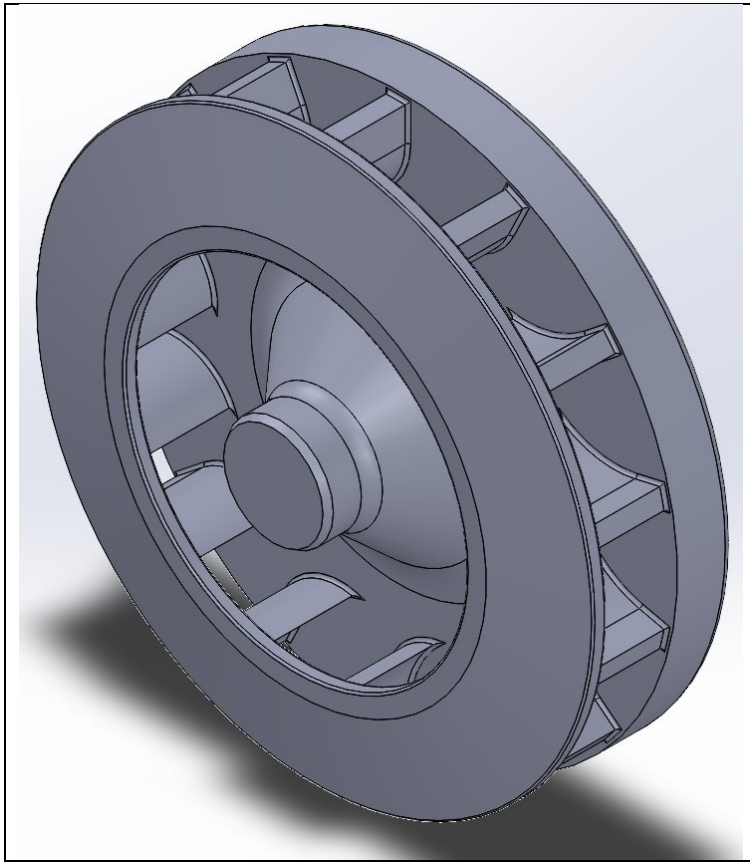
The sketch for the base revolve was the most complicated portion to implement. Most of the width dimensions are done based on a centerline at the origin to ensure they are dimensioning the diameter. I had initially planned to only include the curve of the 24mm circle but added in the fillet under the bottom edge. It had a radius of 2mm but had a dimension to the upper inner portion of it from the bottom as 3mm. So, I added a 1mm vertical piece before adding a tangent arc with a radius of 2mm. The center of the piece, where the hole and keyway will eventually go was left empty to use a lofted cut afterwards.

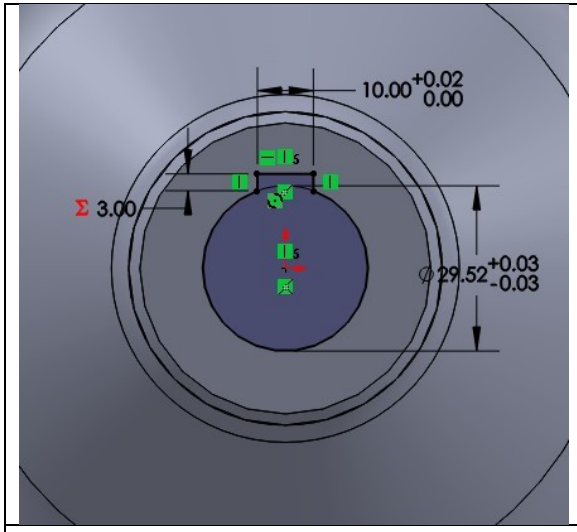
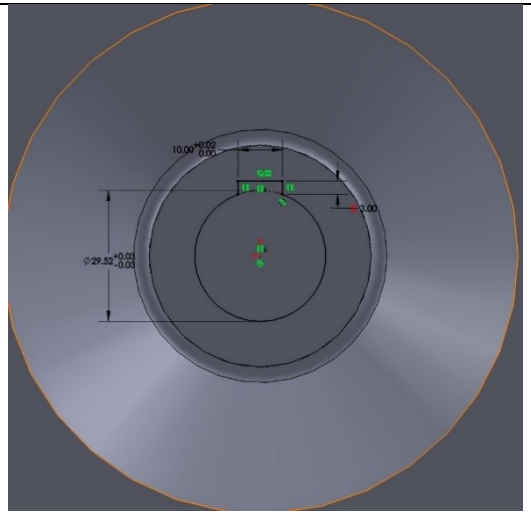
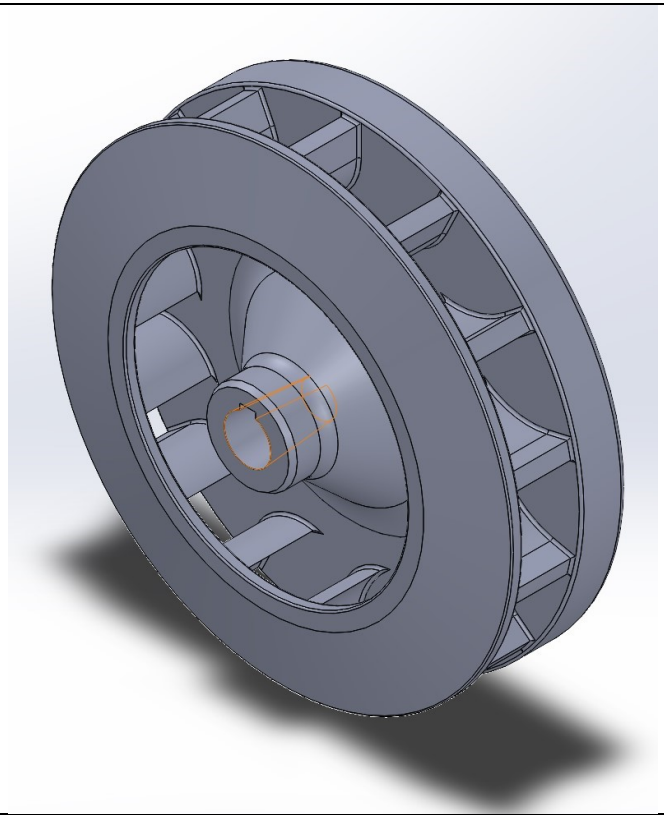
The majority of the straight lines were either horizontal or vertical, the ones that weren't I made sure to make parallel to each other and provide the appropriate dimensions to get the correct angles.

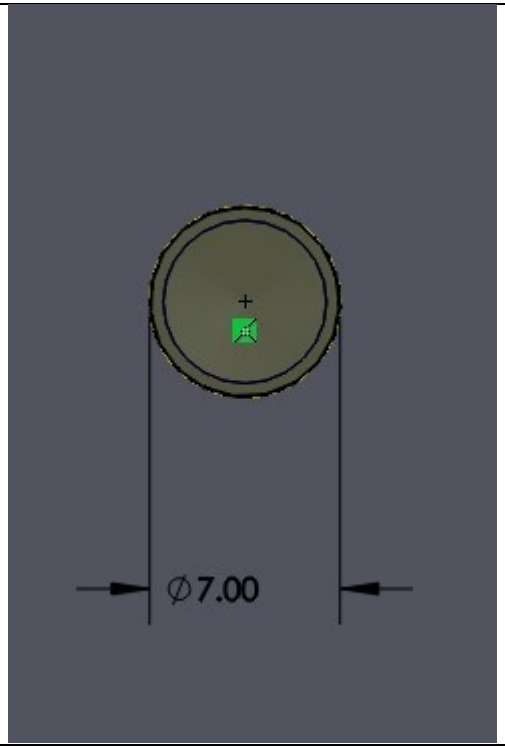
Before I had added the 24mm tangent arc circle to create the curve I had dimensioned down 16mm. This caused the vertical line to not meet up with the circle, so I ended up deleting the 16mm dimension and extended the line to the curve. Instead of 16mm the line is now 18mm.

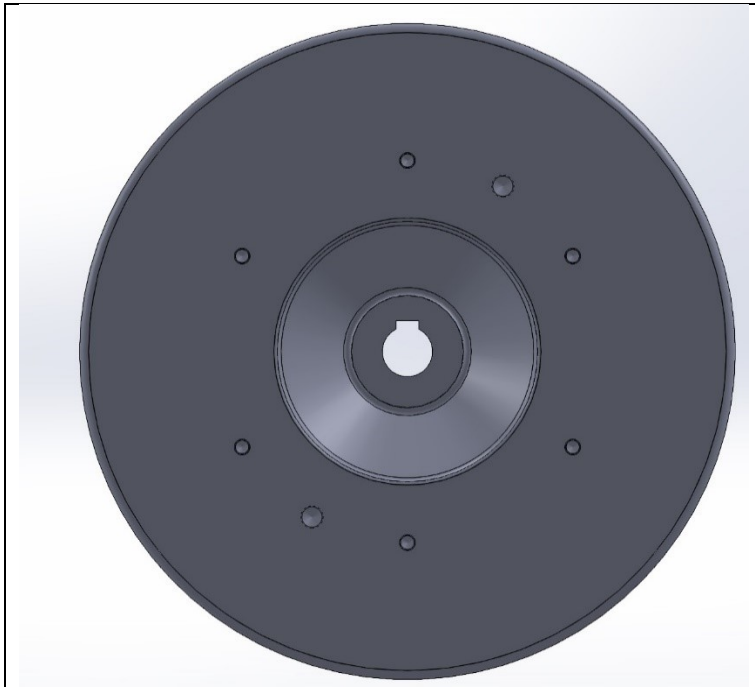
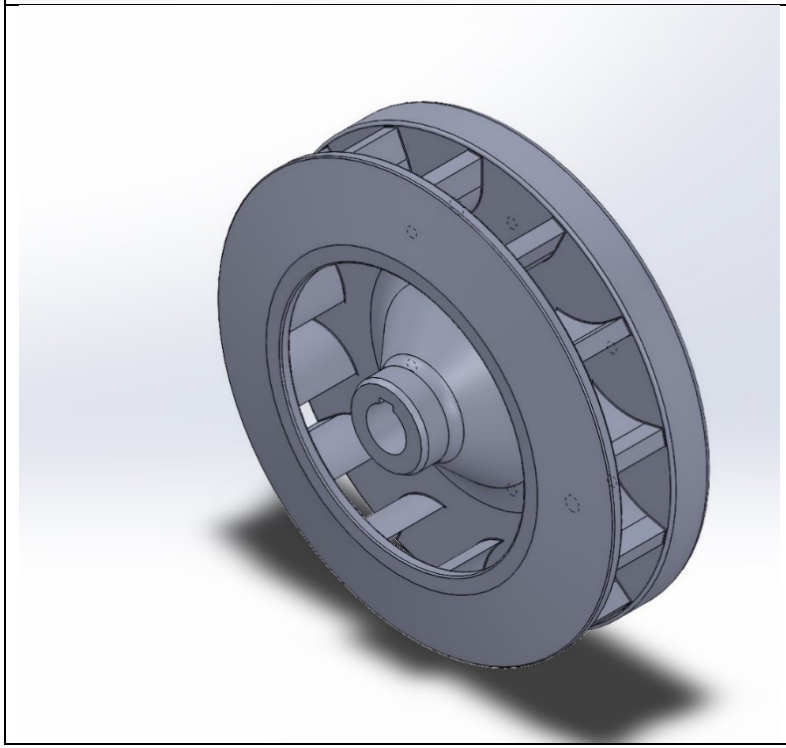
	This whole sketch was revolved about the centerline 360 degrees to create two bodies that formed the majority of the part.
	The next sketch was to create one fin which could be circular patterned. I sketched on the face of the lower disk. The outside edge of the fin was defined using a 286mm circle and then two vertical lines were brought down off of the circle. Two tangent arcs were added at the end of the lines and then connected into a point on the other end. Using the given dimension of 192mm the end point was constrained. Then the two arc radii and width dimensions were added, fully defining the sketch.

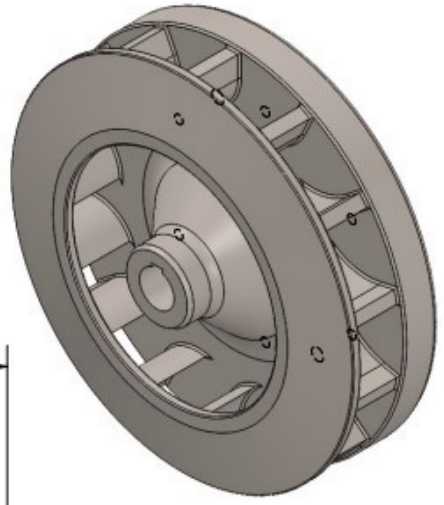
		The sketch from before was extruded to the bottom face of the upper ring. Then, 1.5mm radius fillets were added around the lower and upper edges of the single fin. Once the fin had been extruded and filleted, both features were circular patterned to create the 14 instances of the fins, all with the same fillets.

		The next feature was adding fillets to the edges of the upper ring. Based on the drawing, I assumed all of the fillets were the same and added 1mm fillets to all of the edges. Along the edge closest to the back of the fins as well as the lower inner edge I added 1.5mm fillets. Along the lower outside edge I added a 4mm fillet based on the drawing. I also added a 24mm fillet at the base of the inner cone as called out in the drawing. Finally, I added a 7mm radius fillet on the underside edge opposite of the 24mm fillet.

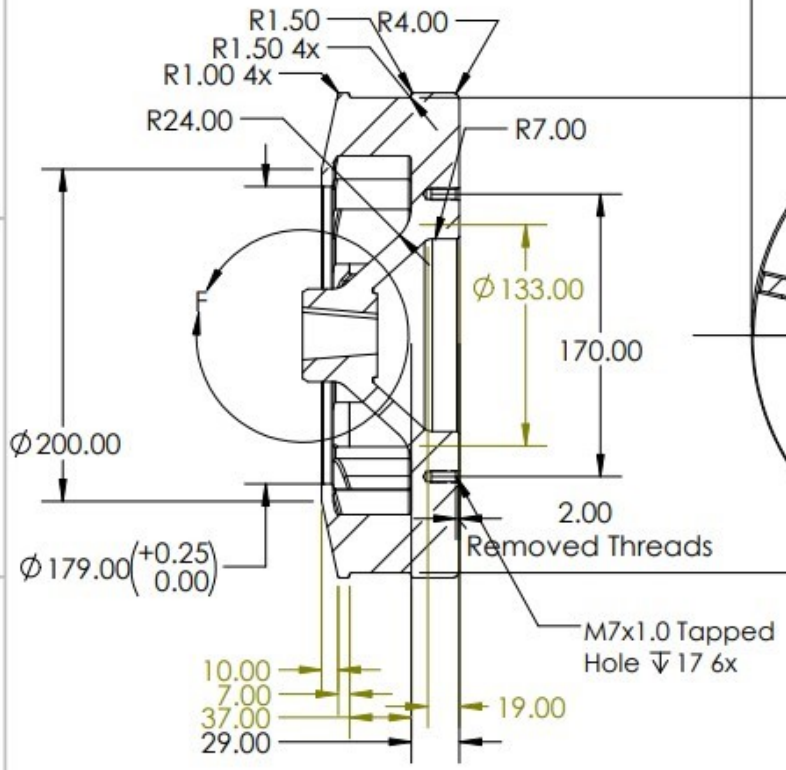
		To create the cut through the center of the part for the shaft and keyway I used a lofted cut. Two sketches were drawn, one on the top face and one underneath. The circles have the defined diameters from the drawing to create the appropriate conicity. The keyway was made using two vertical lines and then a horizontal line coming off the top of the circle. The midpoint of the horizontal line was constrained vertical above the origin.
		A lofted cut was created between these two sketches.

		In order to create the M7 hole pattern I used the hole wizard to make one hole and a cut extrude to remove the first 2mm of thread then circular patterned both features. My hole wizard was a M7x1.0 tapped hole to the depth of 17mm. I then created a cut extrude using a 7mm circle concentric with the tapped hole and cut it down 2mm to remove the first 2mm of thread.

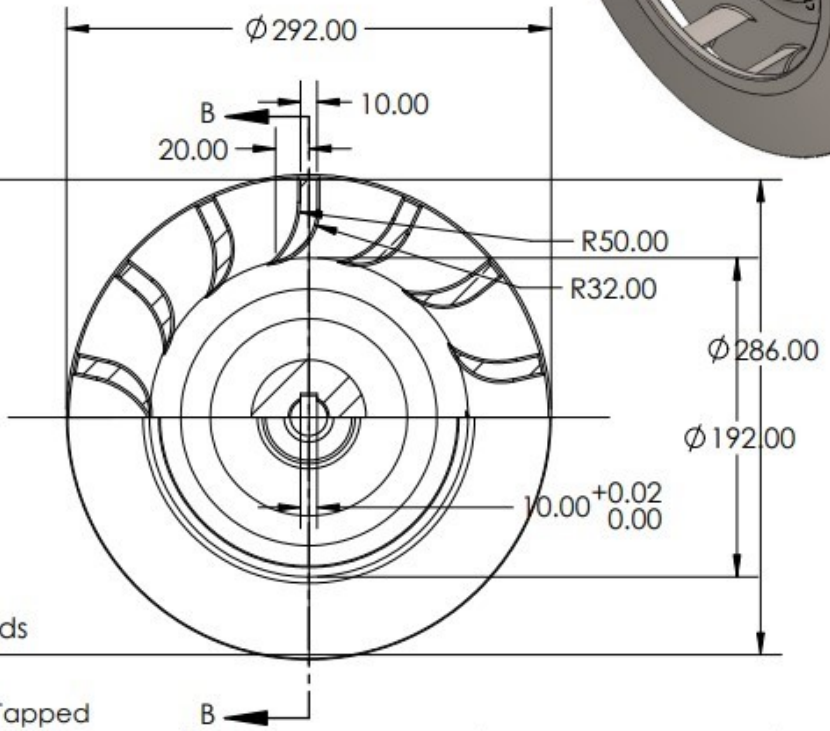
	The two M10 Holes were also made using hole wizard and then placed opposite each other. I assumed the holes were equidistant from the M7 holes around them.
	Here is a screen capture of the final part. The hole threads can be seen through the part because I checked the cosmetic thread checkbox. After this I modified the material to be Alloy Steel. **Lessons Learned:** • The hole wizard has multiple different ways to view threads, it can actually cut away to the OD, cut away to the ID and show the threads as hidden lines, or just cut the ID and show no threads. • When creating a part from a drawing some dimensions may not be given and creating educated assumptions is important. Compare sizes to other defined dimensions to figure it out. • You can create a feature, this time a revolve, that creates multiple bodies that are separated. Those bodies can then be re-combined later.



SECTION B-B



Front



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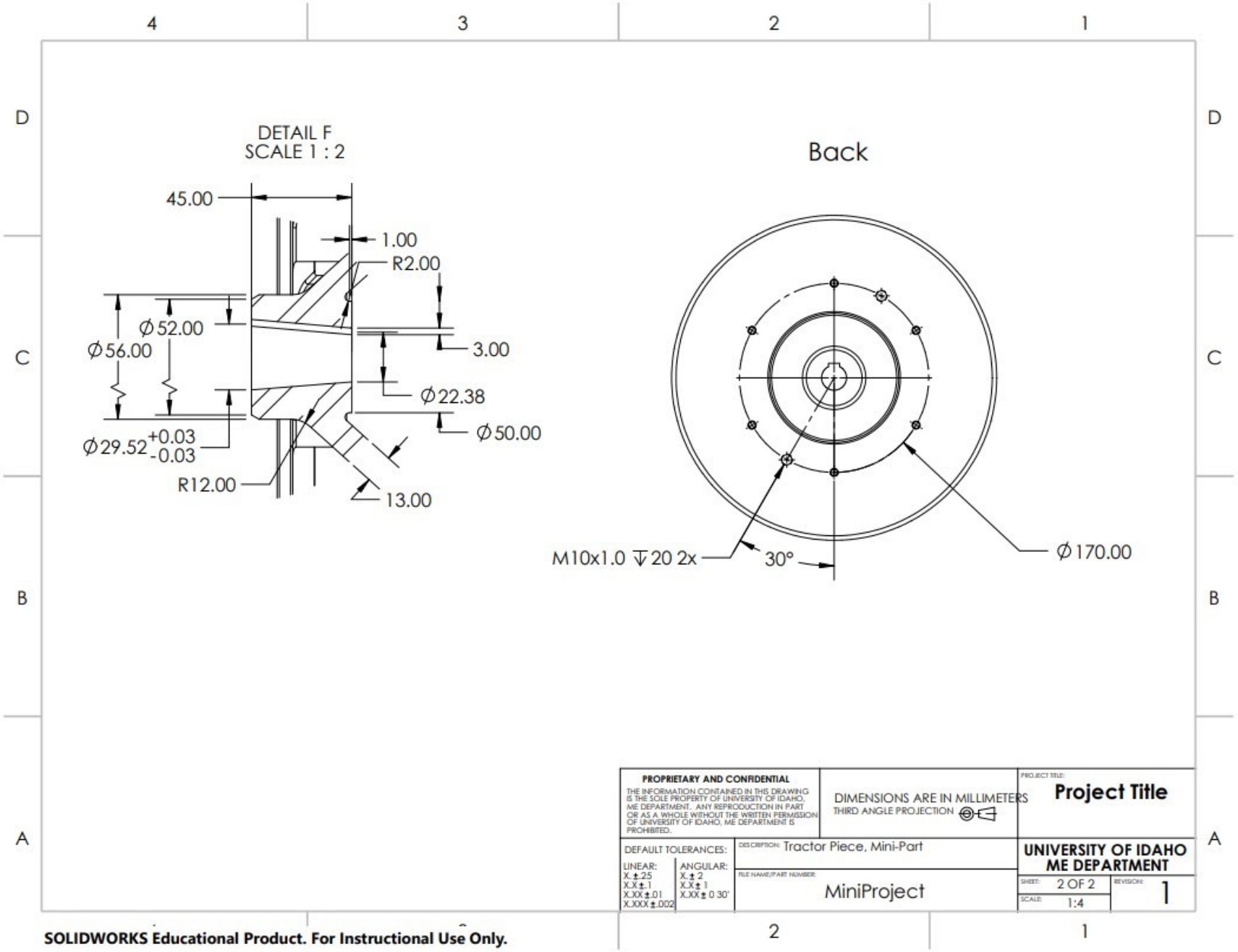
DEFAULT TOLERANCES: LINEAR: X. ± .25, X.X ± .1, X.XX ± .01, X.XXX ± .002 ANGULAR: X. ± 2, X.X ± 1, X.XX ± 0 30'	DESCRIPTION: Tractor Piece, Mini-Part FILE NAME/PART NUMBER: MiniProject	**UNIVERSITY OF IDAHO ME DEPARTMENT** SHEET: 1 OF 2 REVISION: 1 SCALE: 1:4



I ran into an error and crashed anytime I tried to enter the “title block fields” to move the dimensions callout after changing it to millimeters. This meant that I was unable to move it so that millimeters didn’t cross the cell’s edge.