1. We want to evaluate the cost of a turning operation. The following data have been collected about the process.

Cutting speed = 300 ft/min (91 m/min)	Tool life = 50.5 min
Feed = 0.007 in/rev (0.178 mm/rev)	Depth of cut = 0.100 in. (2.54mm)
Workpiece diameter = 3 in. (76.2 mm)	Length of cut = 18 in. (457.2 mm)
Operating cost = $35/hr	Tool cost per edge = $1.75
Non production time /piece = 1.8 min	Tool changing time = 2 min.

(a) Calculate the tool life to yield minimum machining cost hen a carbide tool (n=0.23) is used.
(b) Calculate the optimal cutting speed to minimize the machining cost for this turning process
(c) Determine the total machining cost at the optimal cutting speed determined in part (a).

2. Cutting parameters are to be designed for turning of 1020 alloy steel with a carbide insert. The part diameter needs to be reduced from 50 mm to 48 mm. The followings are the known information pertaining to the process and the machine:

- max. available power of the machine = 10 KW
- efficiency of the machine = 0.8
- desired surface finish = 2 μm in Ra
- maximum allowable cutting force = 1000 N
- specific cutting energy of the workpiece = 0.05 KW/cm^3/min = 3 W/mm^3/sec
- allowable range of feed for the insert = 0.025 mm ~ 0.4 mm
- nose radius of the insert = 0.8 mm

(a) Determine the max. feed allowable based on the surface roughness requirement and max. allowable cutting force (hint: choose the smaller of two).
(b) Determine maximum material removal rate this machine would allow in machining 1020 alloy steel without exceeding the power limit.
(c) Determine the maximum speed that can be used for this process with the feed in selected in part (a) to achieve the maximum material removal rate determined in part (b))

3. A blanking die is to be designed to blank the part shown in Figure 1. The material is 5/32 in thick 302 stainless steel.

(a) Determine the force required to perform this blanking.
(b) Determine the appropriate punch and die diameters. Assume that the clearance of 0.08t is needed between the punch and die for this operation, where t is the thickness of the 302 stainless steel.

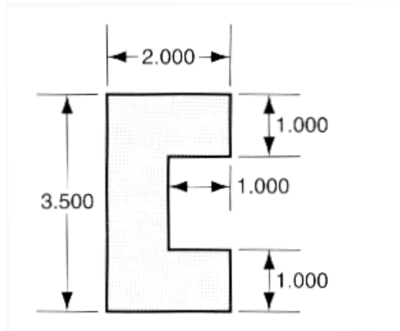

Figure 1. Blanking part geometry.

4. A straight bead is being formed on a 2 mm thick aluminum sheet in a 20-mm diameter die as shown in Figure 2. Let Y=120 MPa and E=70 GPa.

(a) Considering the springback, calculate the outside diameter of the bead after it is formed and unloaded from the die.
(b) What should be the die diameter if the final desired radius of the bead is 20 mm.
(c) Determine the percentage area reduction of the bead for part (b).

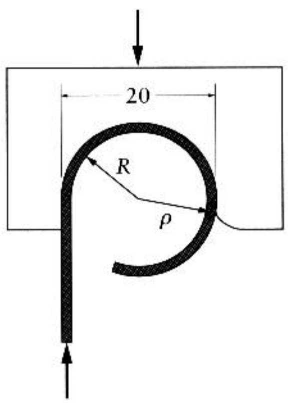

Figure 2 Bead Forming with a Die.