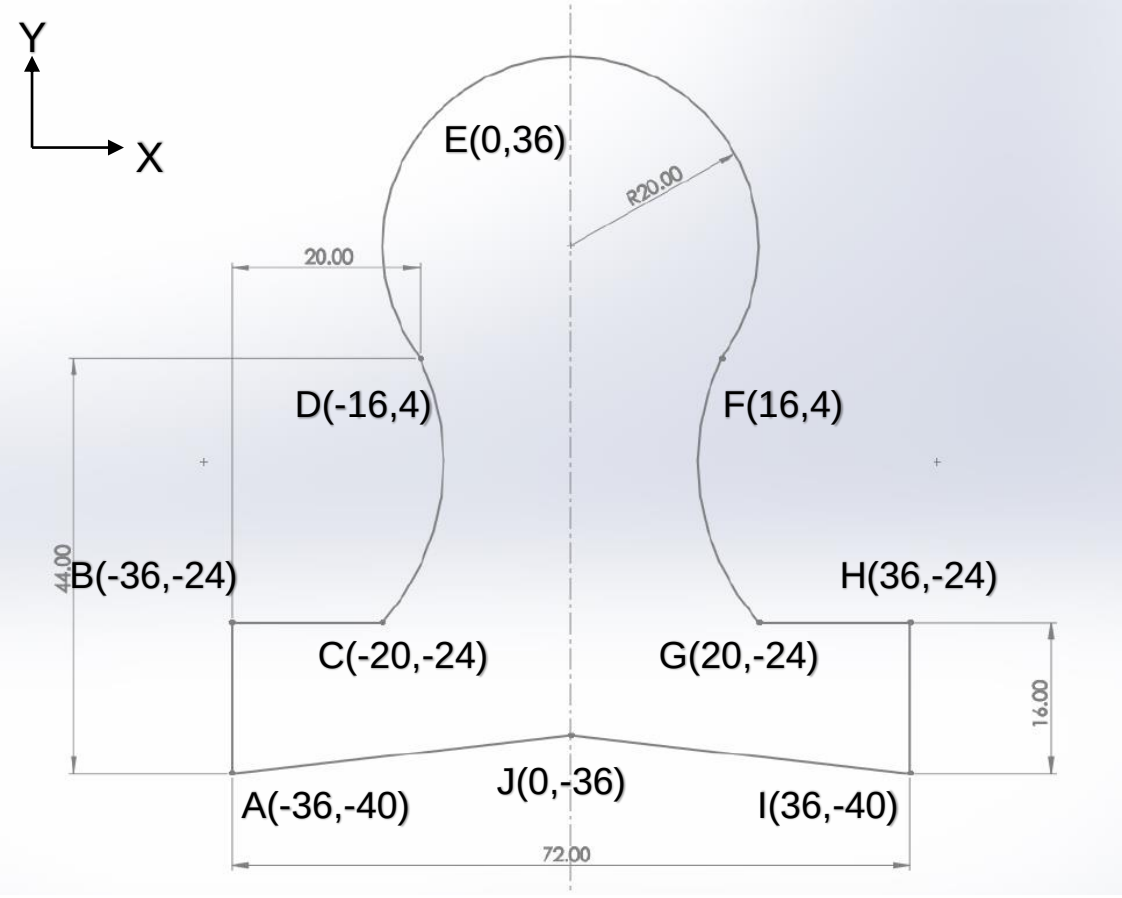
複雜圖形路徑規劃及解析

黃建傑

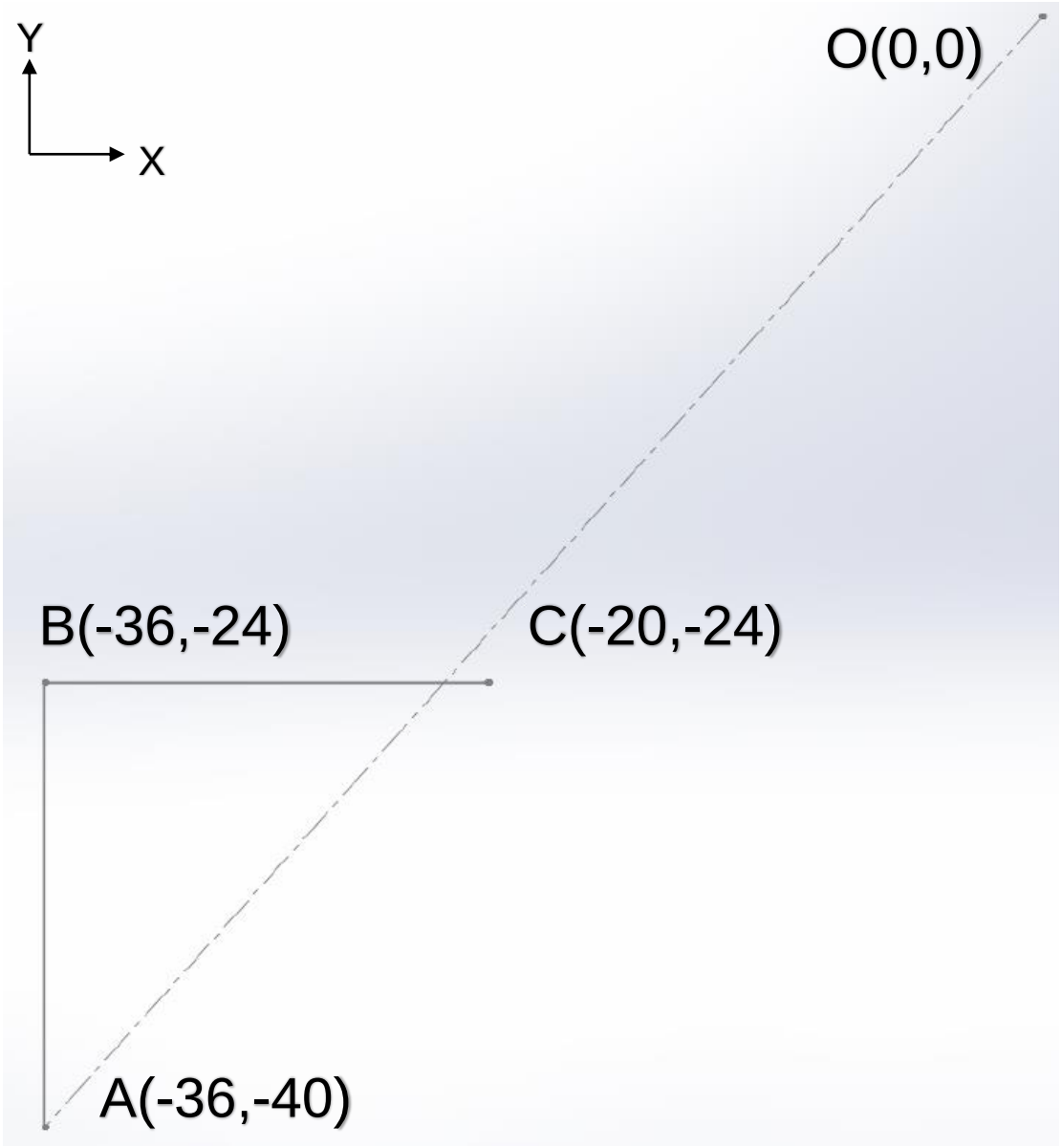
程式編輯 例題4

- 如圖所示，請用程式指令完成下方圖形輪廓，假設雷射起點在程式原點(0,0)上，點A的絕對座標為(-36,-40)，其中圓弧CD與FG的半徑為√650分別利用絕對座標與相對座標完成圖形。

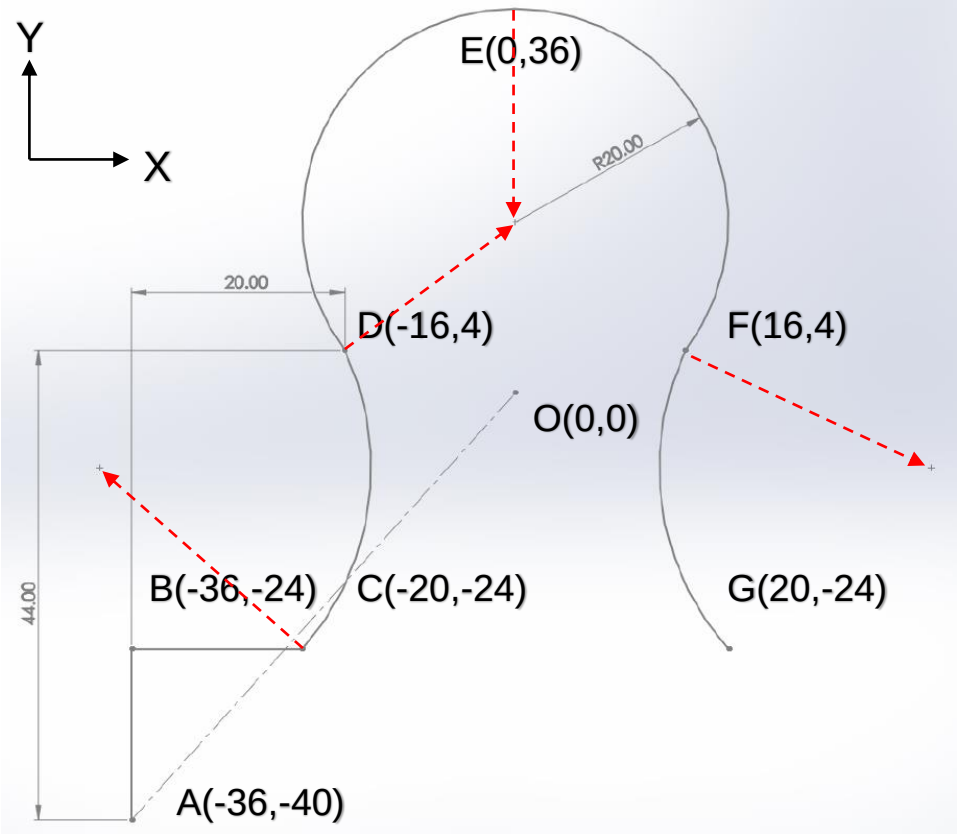


絕對座標 (G90)

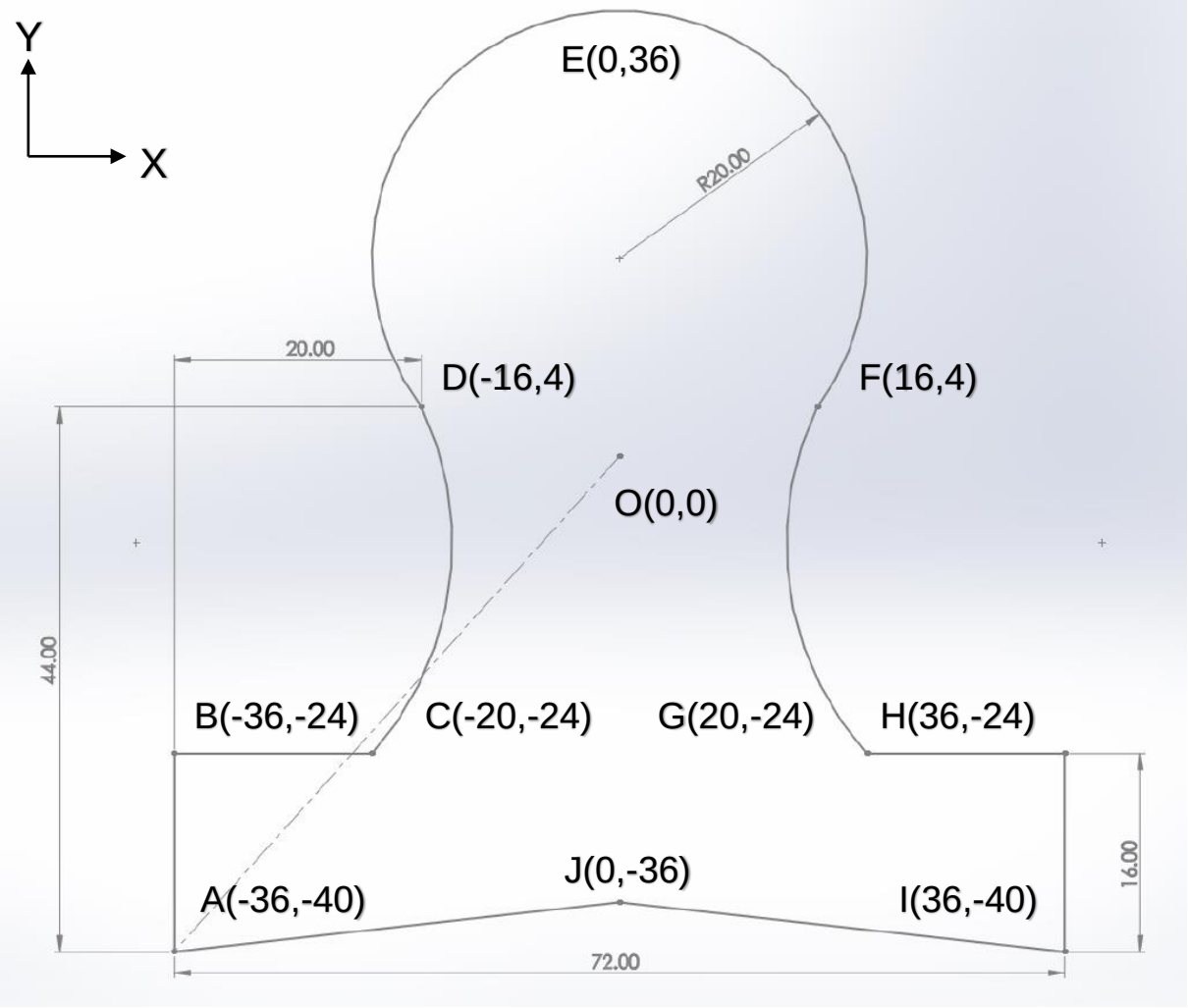
- M05 S0
- G90
- G21
- G1 F600
- G0 X-36. Y-40.
- G4 P0
- M03 S255
- G4 P0
- G1 F600
- G1 X-36. Y-24.
- G1 X-20. Y-24.



- **G3 X-16. Y4. I-19. J17**
- **G2 X0. Y36. I16. J12.**
- **G2 X16. Y4. J-20.**
- **G3 X20. Y-24. I23. J-11.**

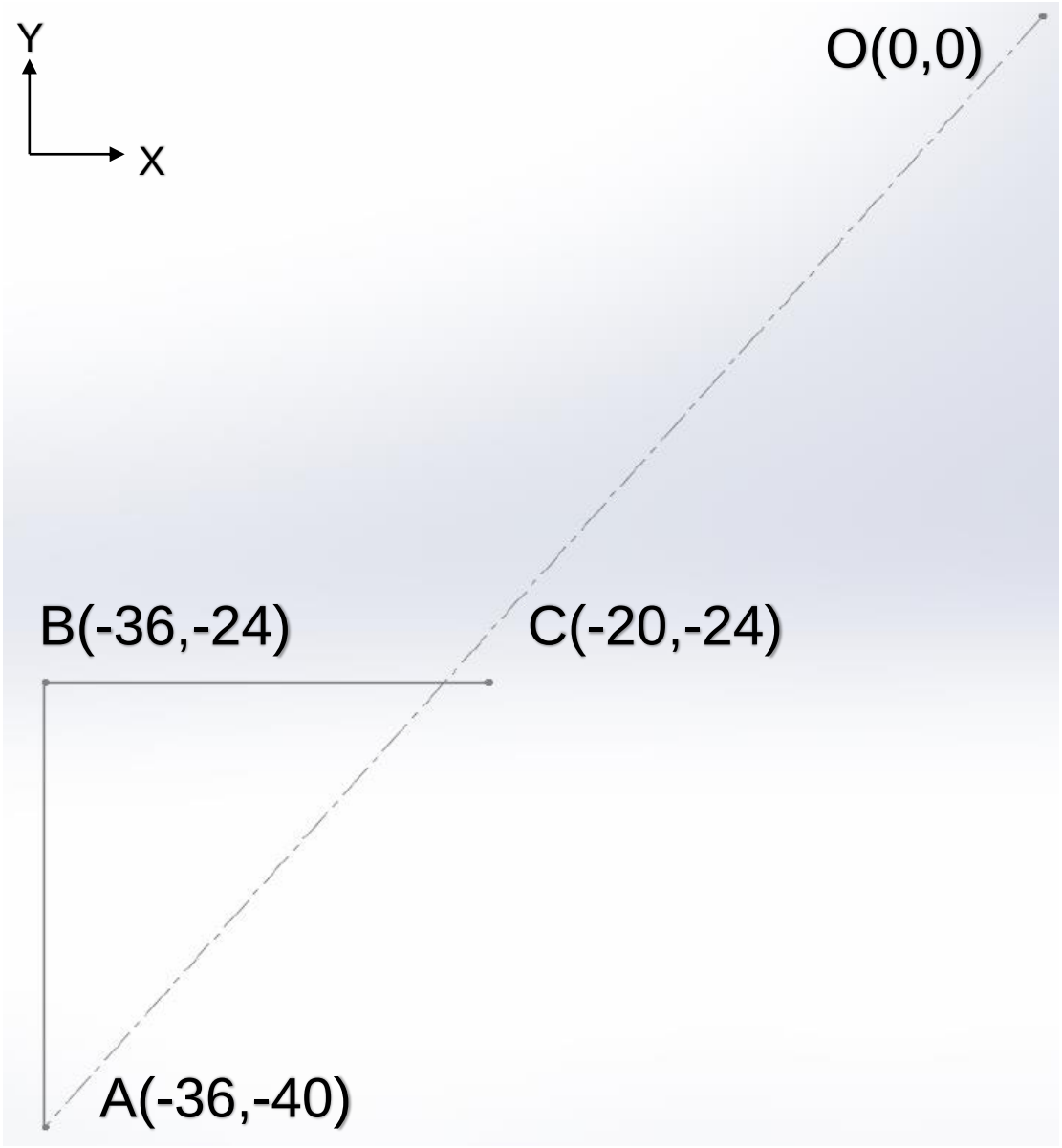


- G1 X36. Y-24.
- G1 X36. Y-40.
- G1 X0. Y-36.
- G1 X-36. Y-40.
- G4 P0
- M05 S0
- G0 X0 Y0
- M18

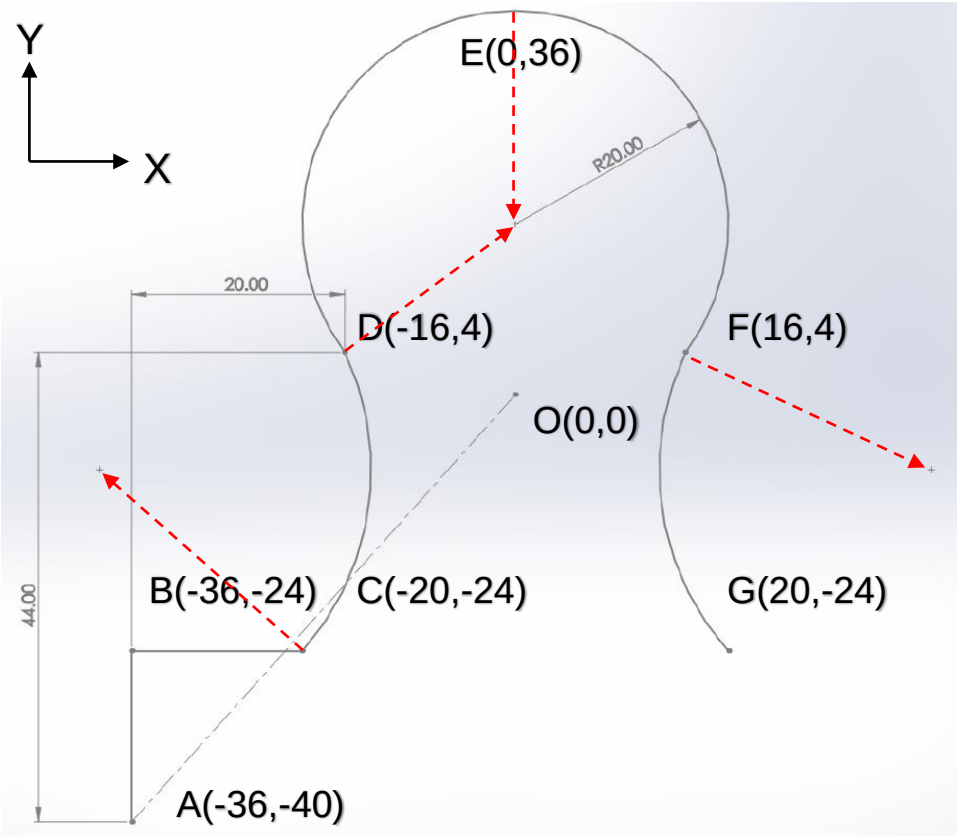


相對座標 (G91)

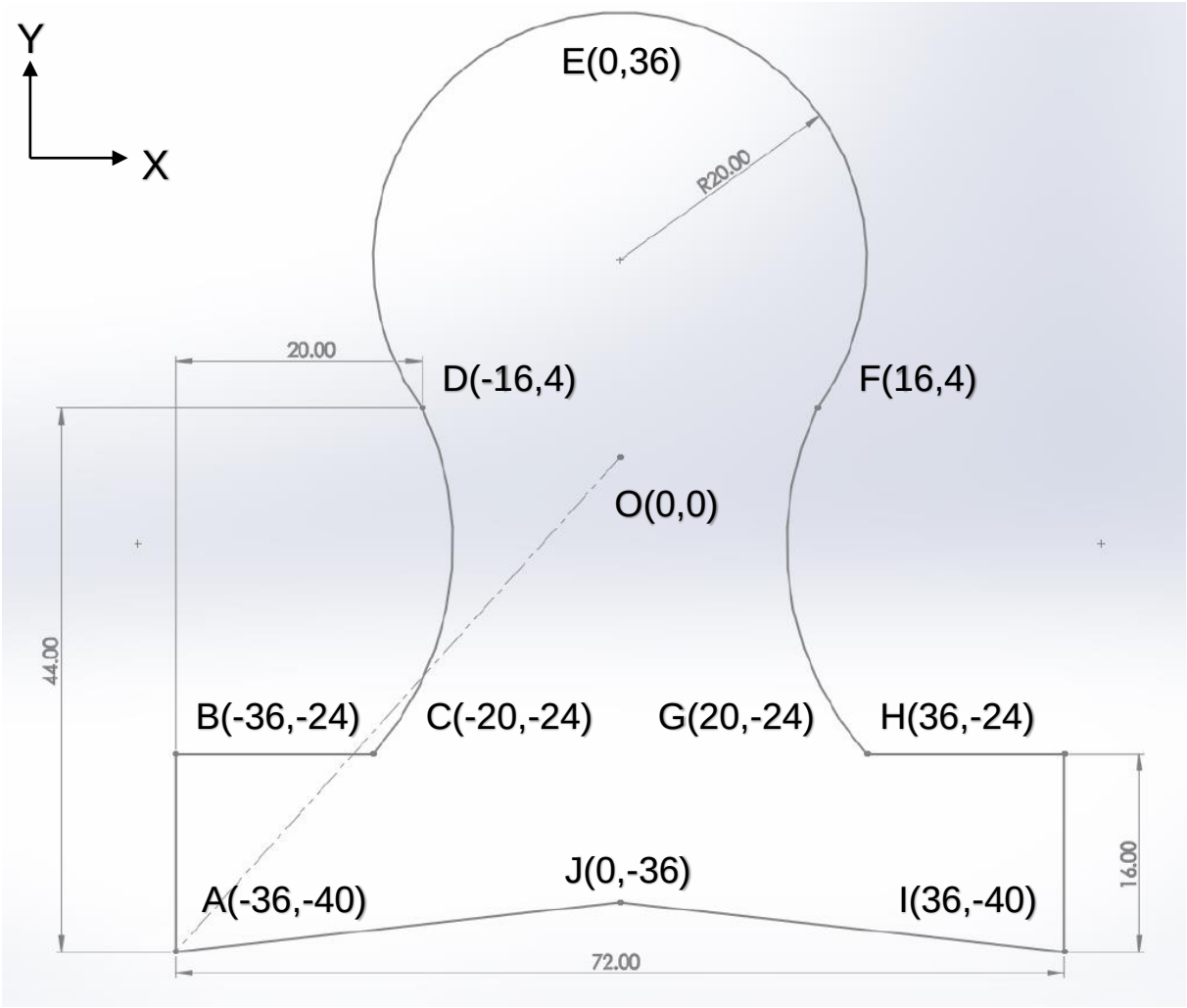
- M05 S0
- G91
- G21
- G1 F600
- G0 X-36. Y-40.
- G4 P0
- M03 S255
- G4 P0
- G1 F600
- G1 X0. Y16.
- G1 X16. Y0.



- **G3 X4. Y28. I-19. J17**
- **G2 X16. Y32. I16. J12.**
- **G2 X16. Y-32. J-20.**
- **G3 X4. Y-28. I23. J-11.**



- G1 X16. Y0.
- G1 X0. Y-16.
- G1 X-36. Y4.
- G1 X-36. Y-4.
- G4 P0
- M05 S0
- G0 X0 Y0
- M18



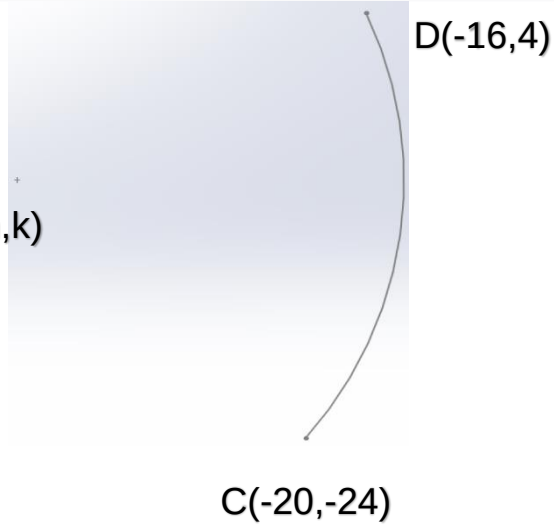
補充:圓心計算

- 計算圓弧CD圓心如下
- 另圓心=圓心Q(h,k)
- 由圓心到圓上任一點等距
- [(-16)-h]^2+(4-k)^2=[(-20)-h)]^2+[k-(-24)]^2

⇒-8h-56k=704

⇒h+7k=-88

⇒h=-7k-88 ----- (1)



- 根據題意半徑R=√650

- [(-16)-h]^2+(4-k)^2=650 ----- (2)
- 將(1)帶入(2)得:
- [-16-(-7k-88)]^2+(4-k)^2=650

⇒50k^2+1000k+4550=0

⇒k^2+20k+91=0 ----- 利用配方法得

⇒k=-7or-13 h=-39or3 (由圖形可知3不合)

⇒故圓心Q(h,k)=Q(-39,-7)

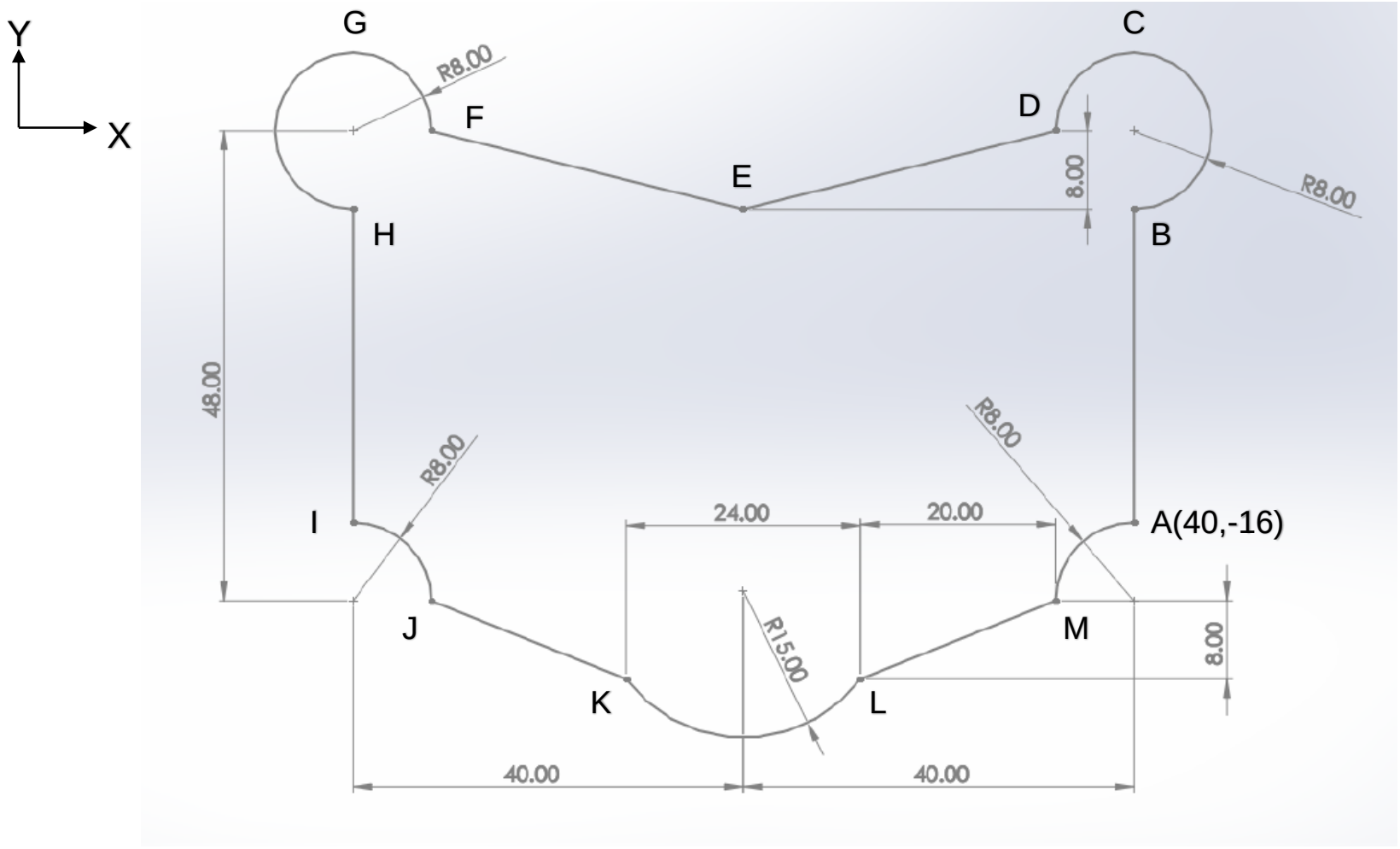
說明

- 如例題4之切削路徑，若要使用I、J法的圓弧切削，則必須知道圓弧起點與圓心的關係，且一般工程圖不會標註，需經過一番計算才可得解，使用上相當不便。

- 為了解決這種不便，後續也發明已知終點座標、圓弧半徑及圓心角是否大於180°即可切削的指令，稱為半徑法，使用上遠比I、J法方便許多，但由於Cubiio只是掌上型雕刻機，功能略不齊全，並不支援此種功能，這種方法會放在模擬雕刻機MDX-40A上進行說明。

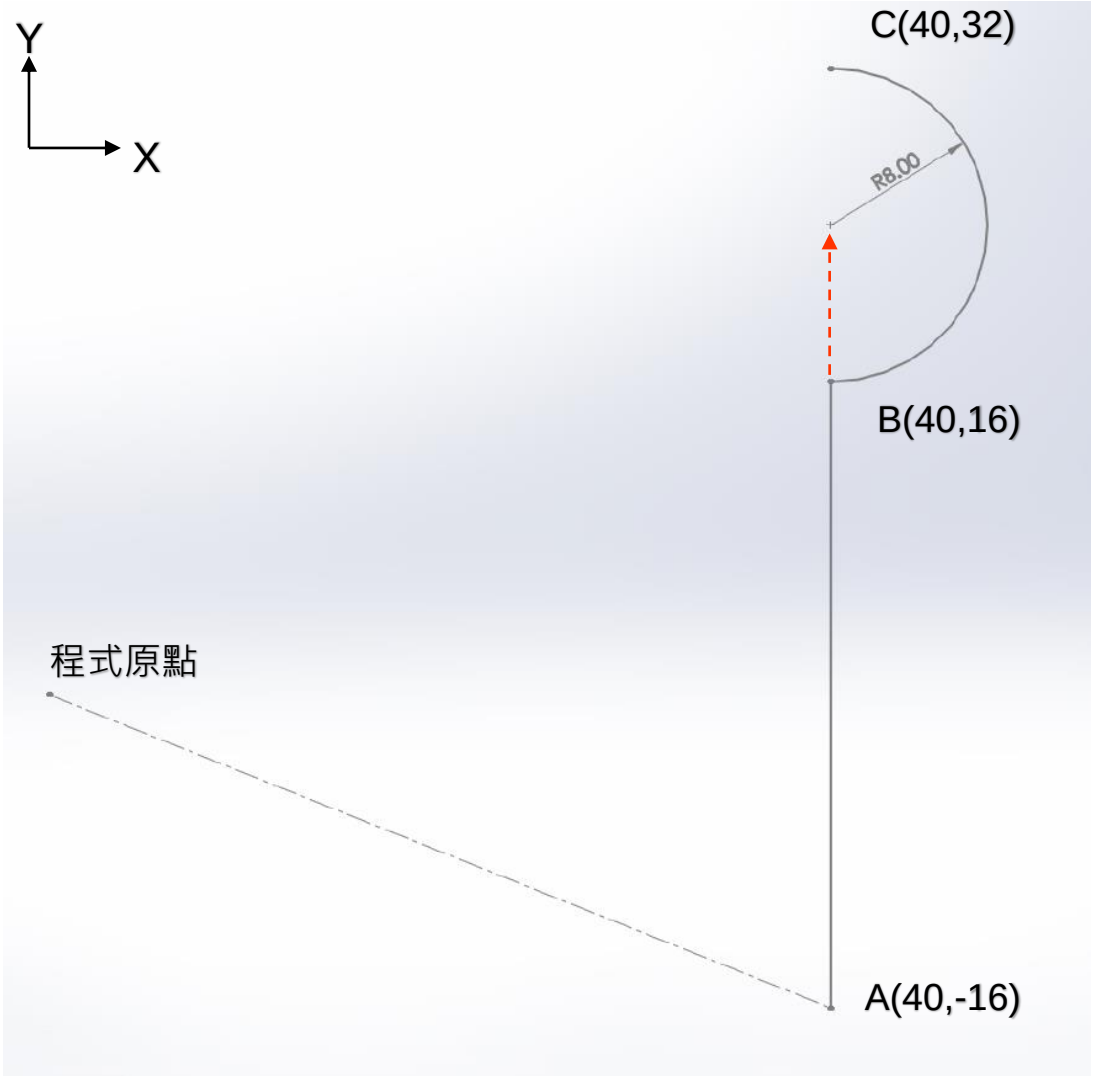
程式編輯 例題5

- 如圖所示，請用程式指令完成下方圖形輪廓，假設雷射起點在程式原點(0,0)上，分別利用絕對座標與相對座標完成圖形。

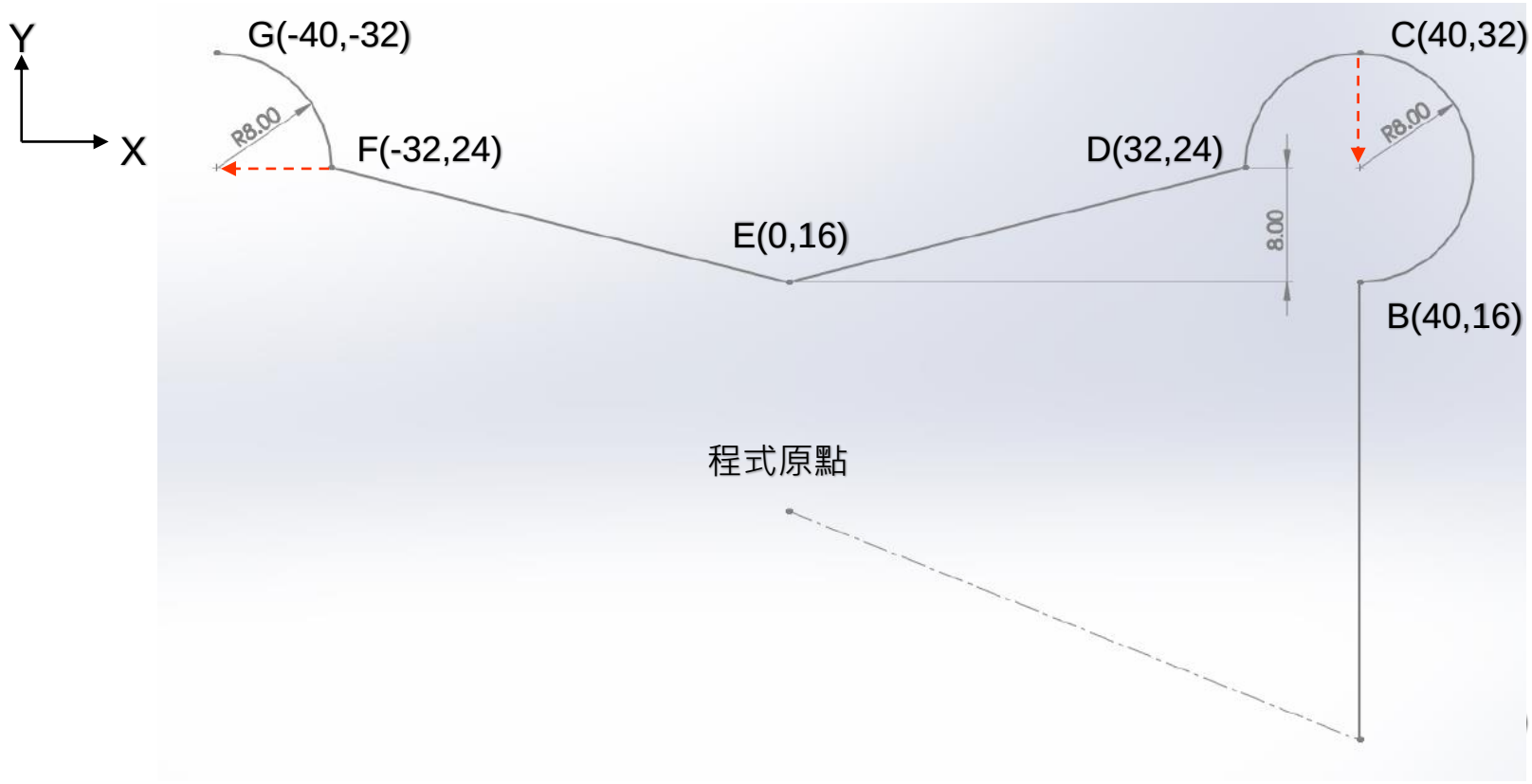


絕對座標 (G90)

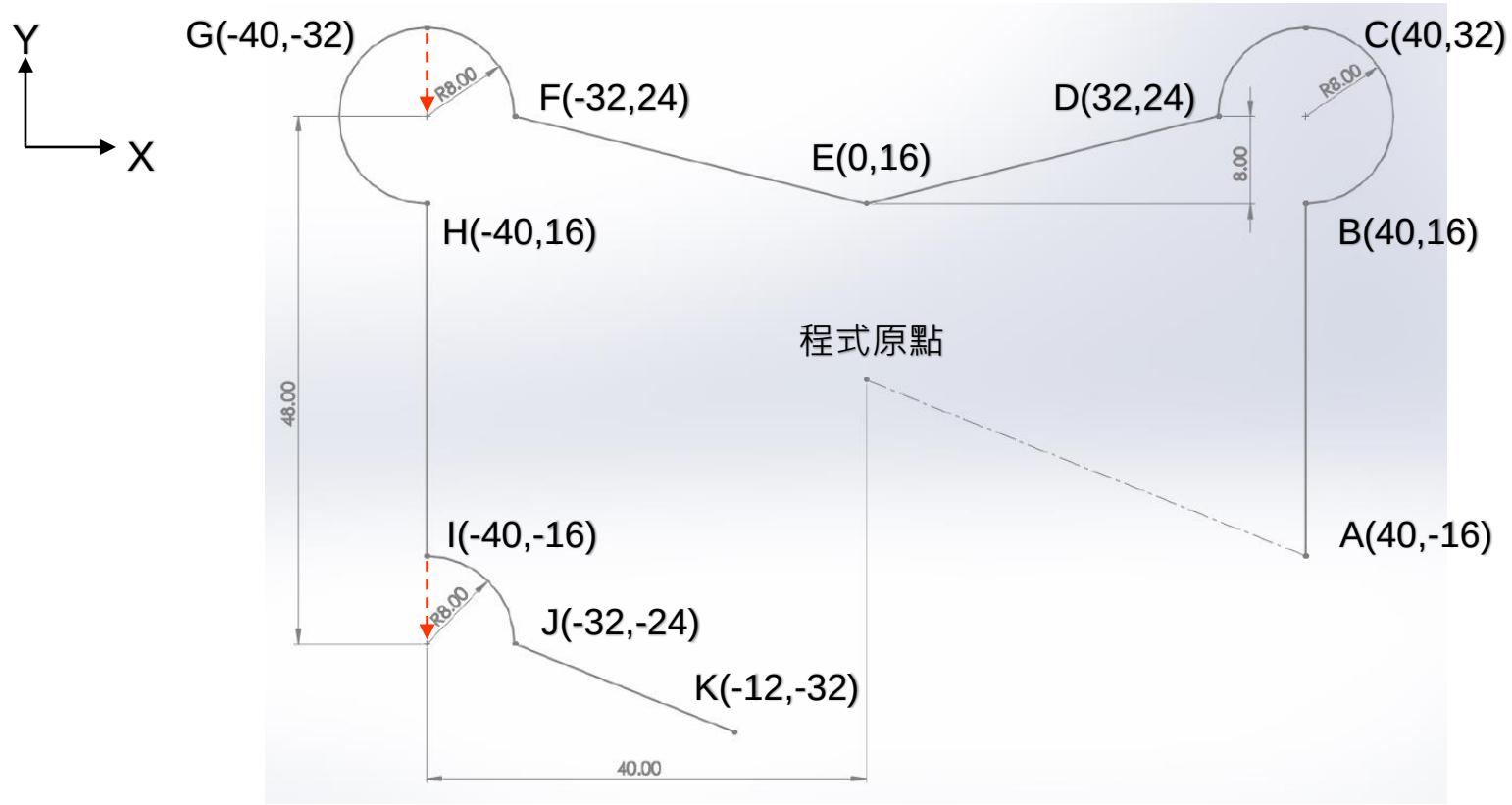
- M05 S0
- G90
- G21
- G1 F600
- G0 X40. Y-16.
- G4 P0
- M03 S255
- G4 P0
- G1 F600
- G1 X40. Y16.
- G3 X40. Y32. I0. J8.



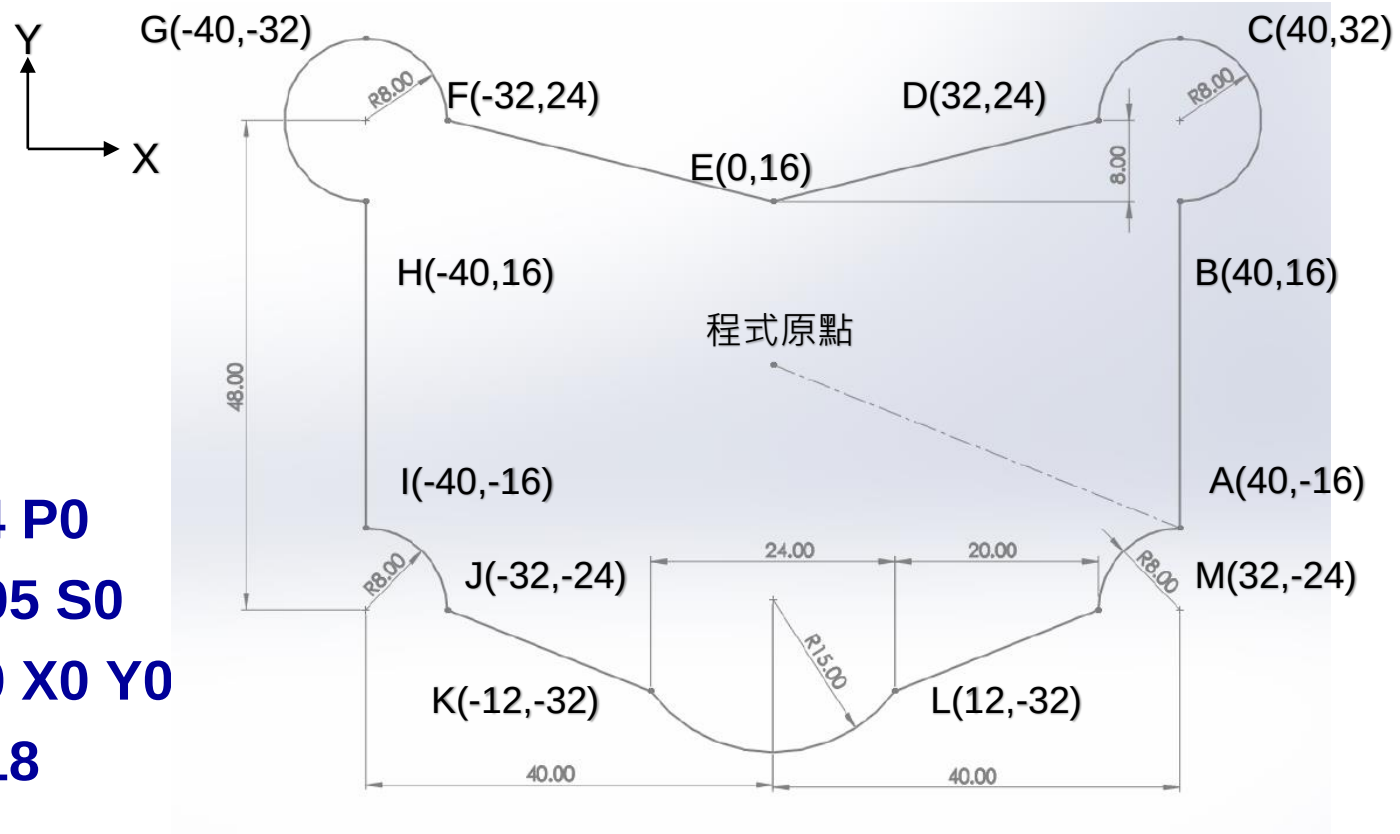
- **G3 X32. Y24. I0. J-8.**
- **G1 X0. Y16.**
- **G1 X-32. Y24.**
- **G3 X-40. Y32. I-8. J0.**



- **G3 X-40. Y16. I0. J-8.**
- **G1 X-40. Y-16.**
- **G2 X-32. Y-24. I0. J-8.**
- **G1 X-12. Y-32.**



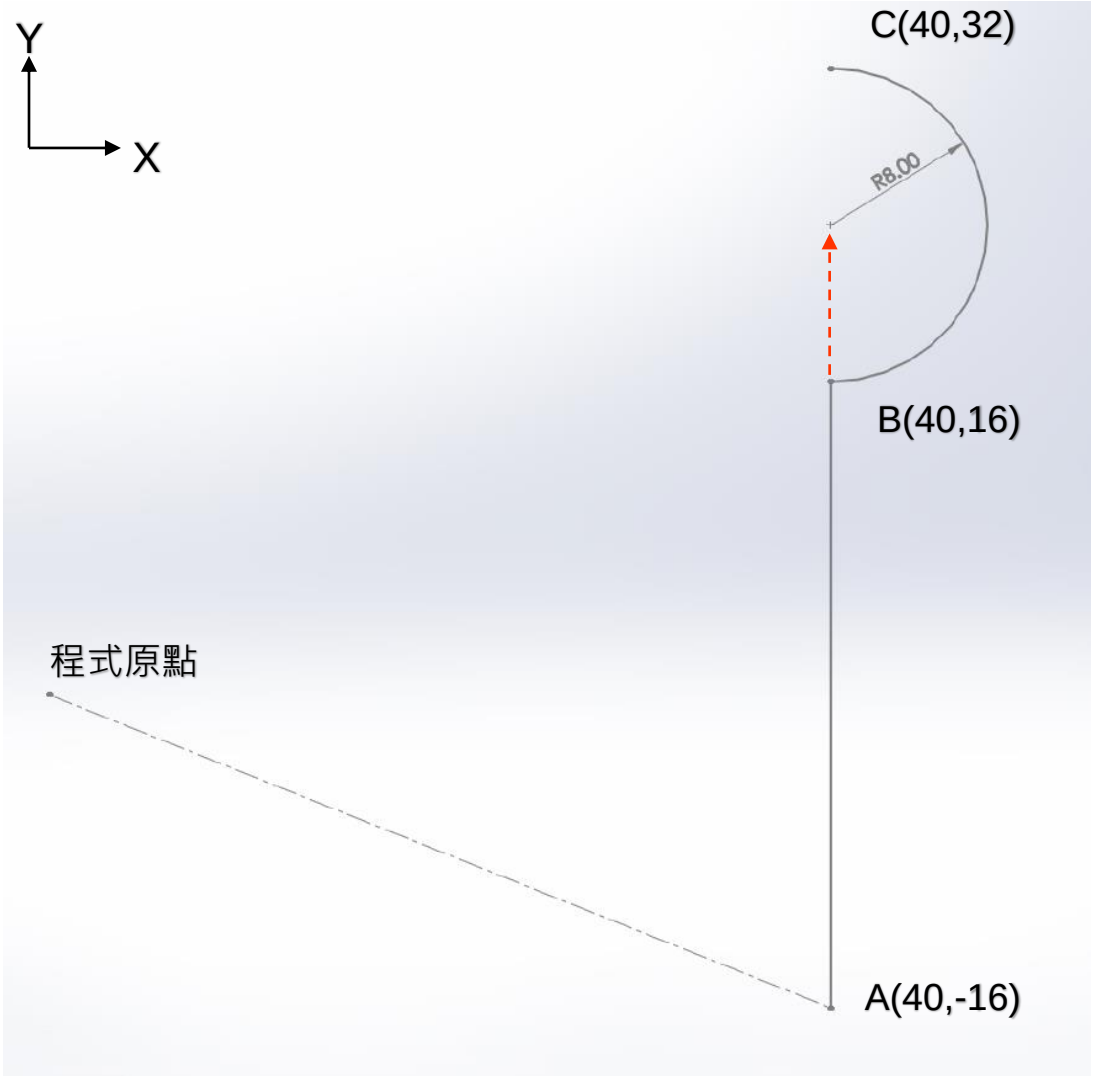
- **G3 X12. Y-32. I12. J9.**
- **G1 X32. Y-24.**
- **G2 X40. Y-16. I8. J0.**



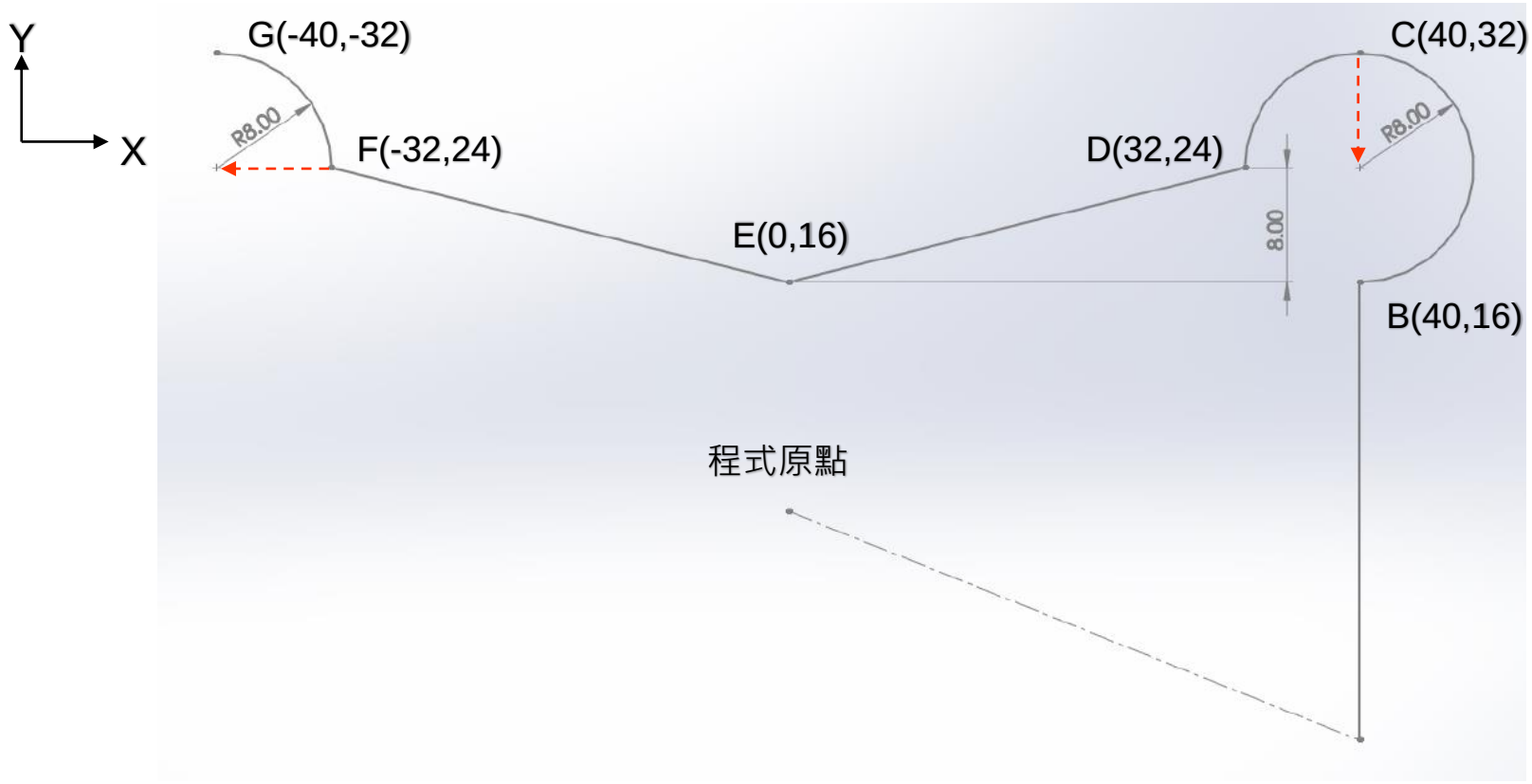
- **G4 P0**
- **M05 S0**
- **G0 X0 Y0**
- **M18**

相對座標(G91)

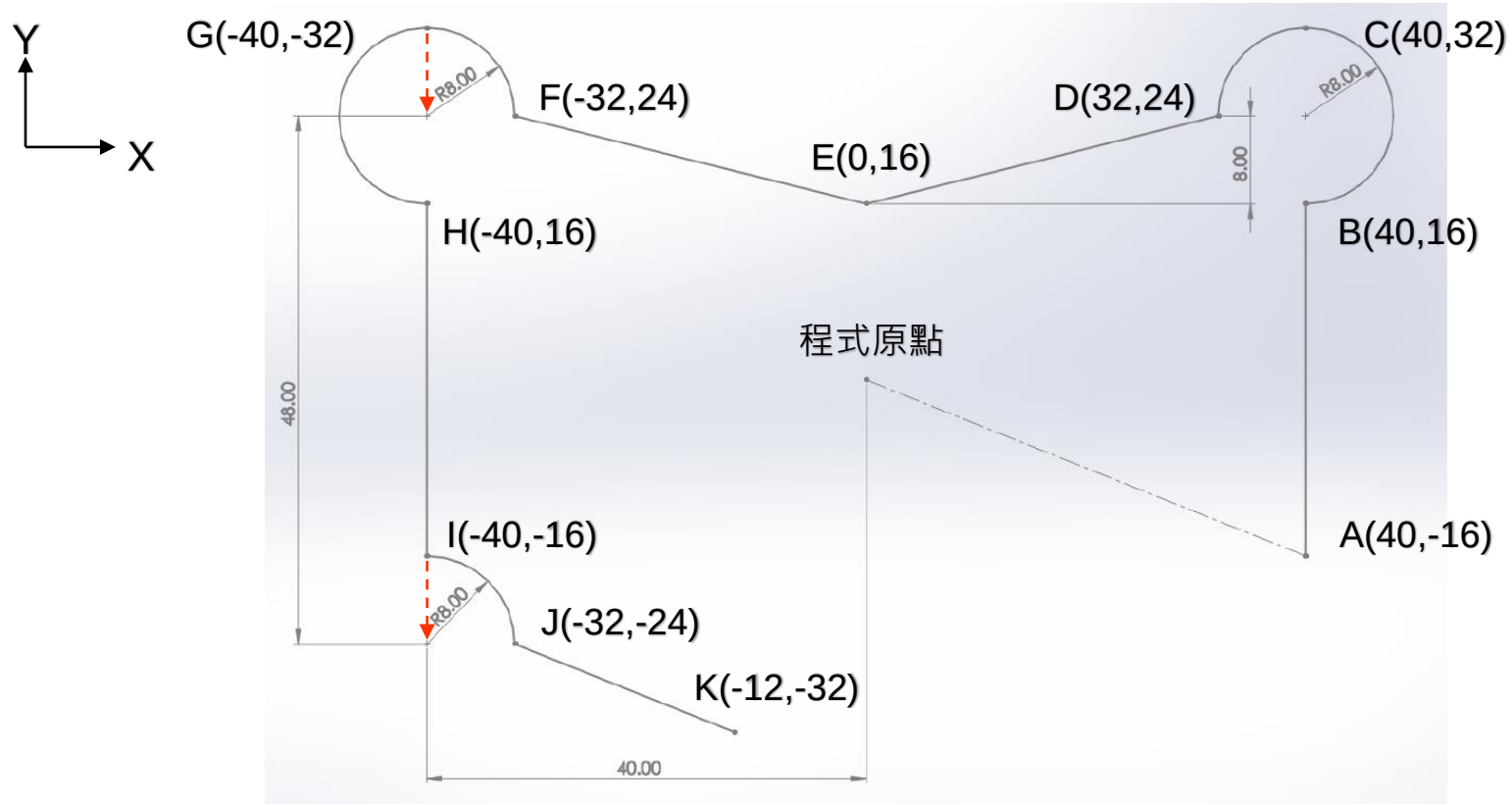
- M05 S0
- G91
- G21
- G1 F600
- G0 X40. Y-16.
- G4 P0
- M03 S255
- G4 P0
- G1 F600
- G1 X0. Y32.
- G3 X0. Y16. I0. J8.



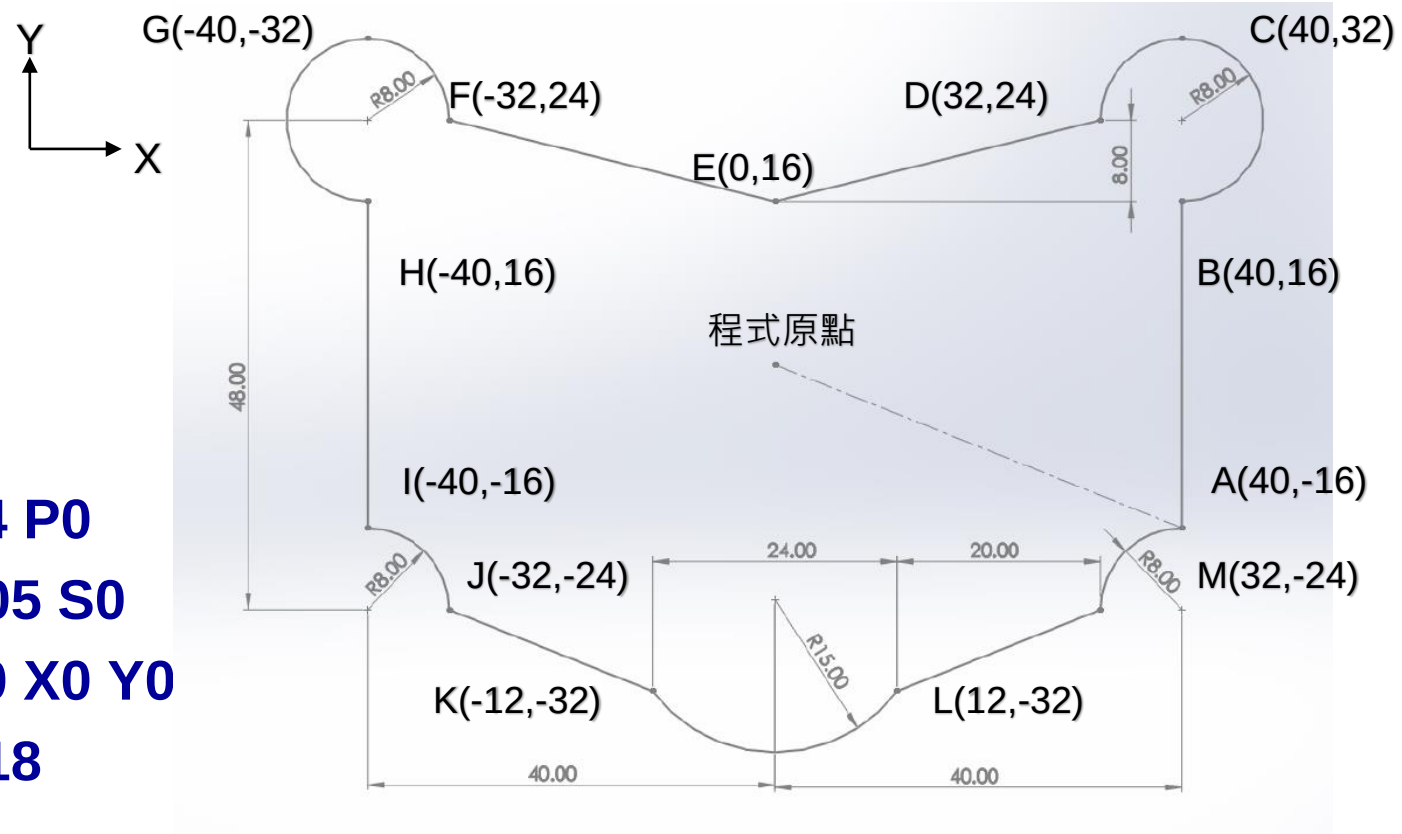
- **G3 X-8. Y-8. I0. J-8.**
- **G1 X-32. Y-8.**
- **G1 X-32. Y8.**
- **G3 X-8. Y8. I-8. J0.**



- **G3 X0. Y-16. I0. J-8.**
- **G1 X0. Y-32.**
- **G2 X8. Y-8. I0. J-8.**
- **G1 X20. Y-8.**



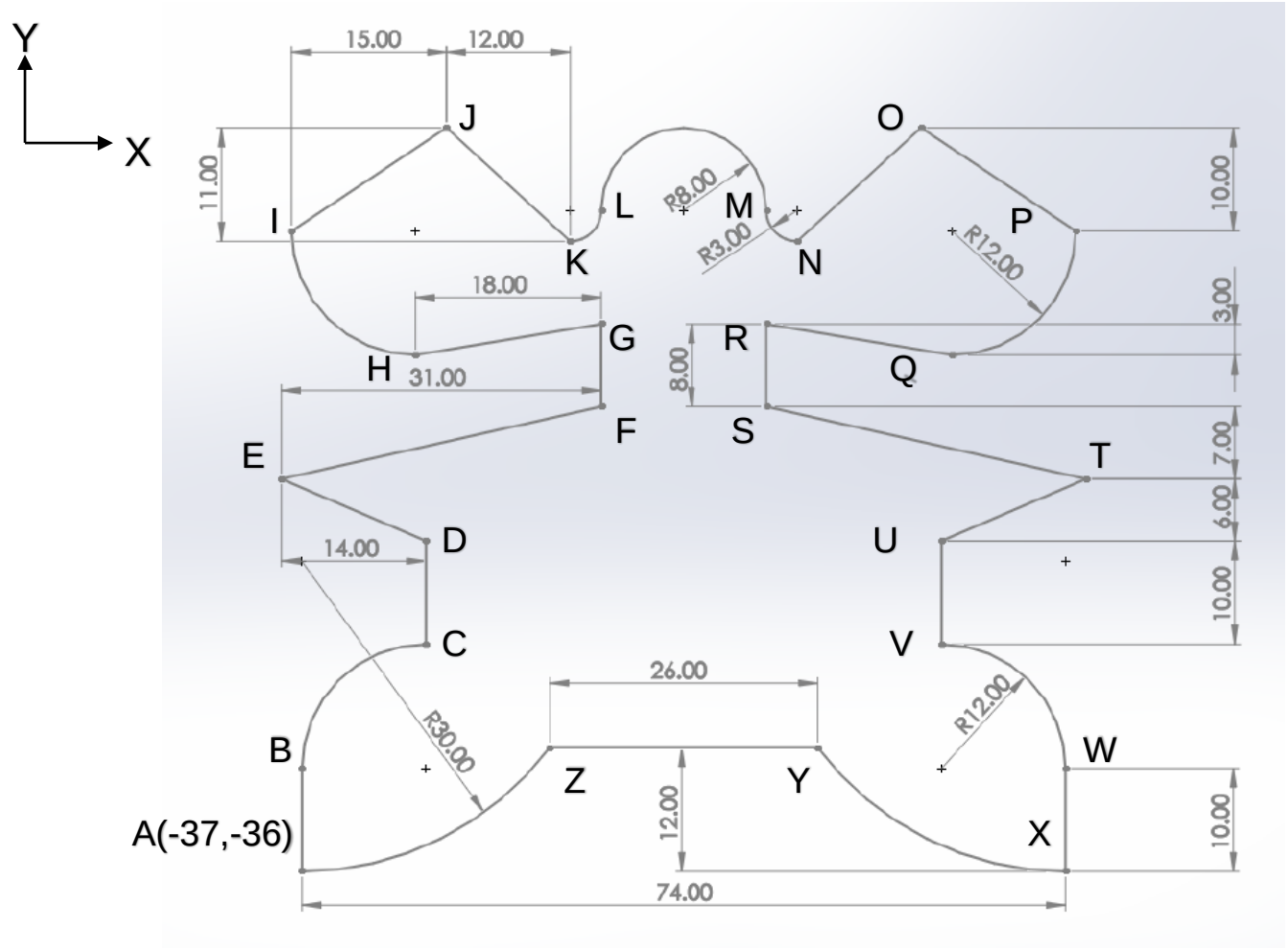
- **G3 X24. Y0. I12. J9.**
- **G1 X20. Y8.**
- **G2 X8. Y8. I8. J0.**



- **G4 P0**
- **M05 S0**
- **G0 X0 Y0**
- **M18**

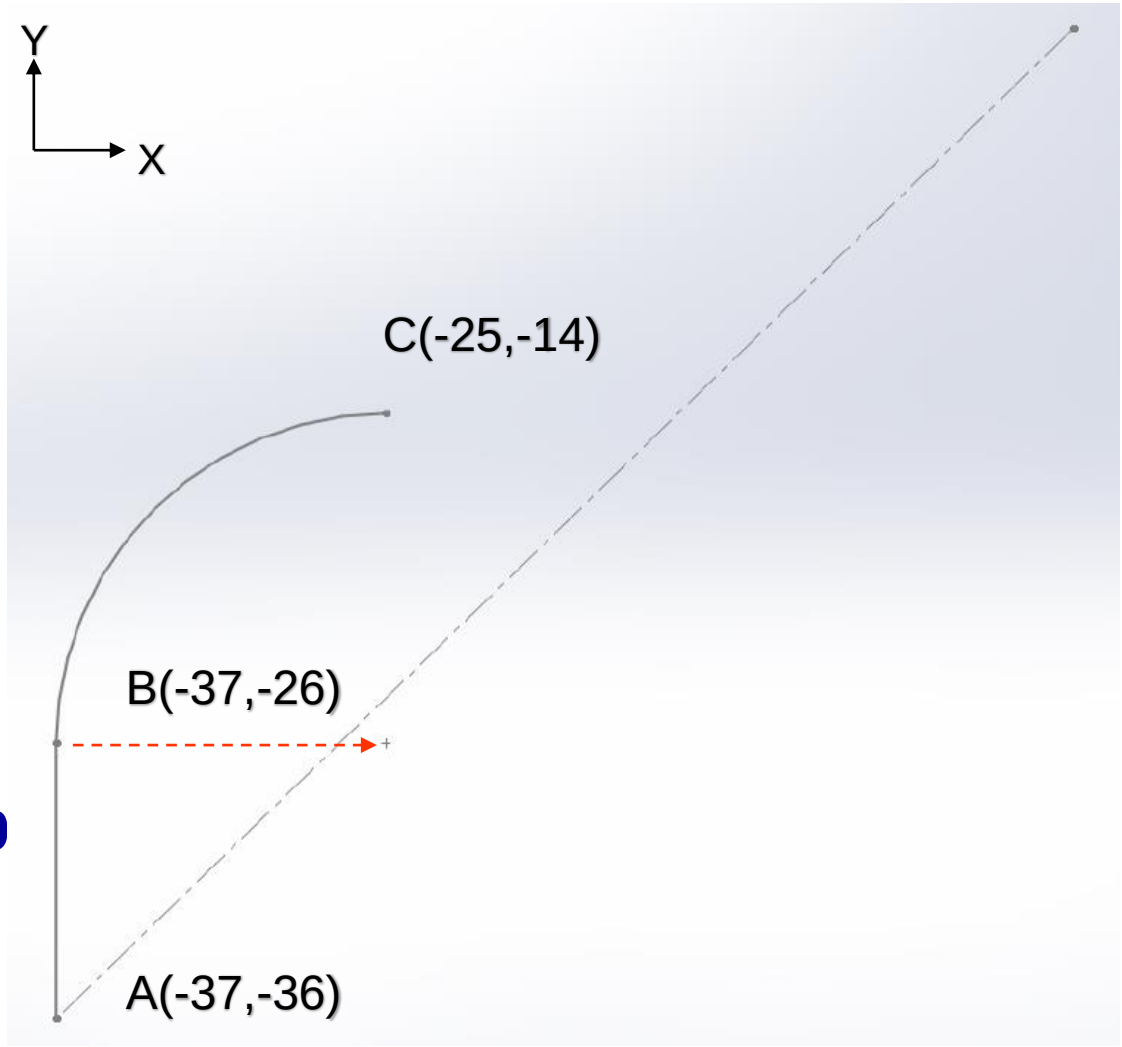
程式編輯 例題6

- 如圖所示，請用程式指令完成下方圖形輪廓，假設雷射起點在程式原點(0,0)上，分別利用絕對座標與相對座標完成圖形。

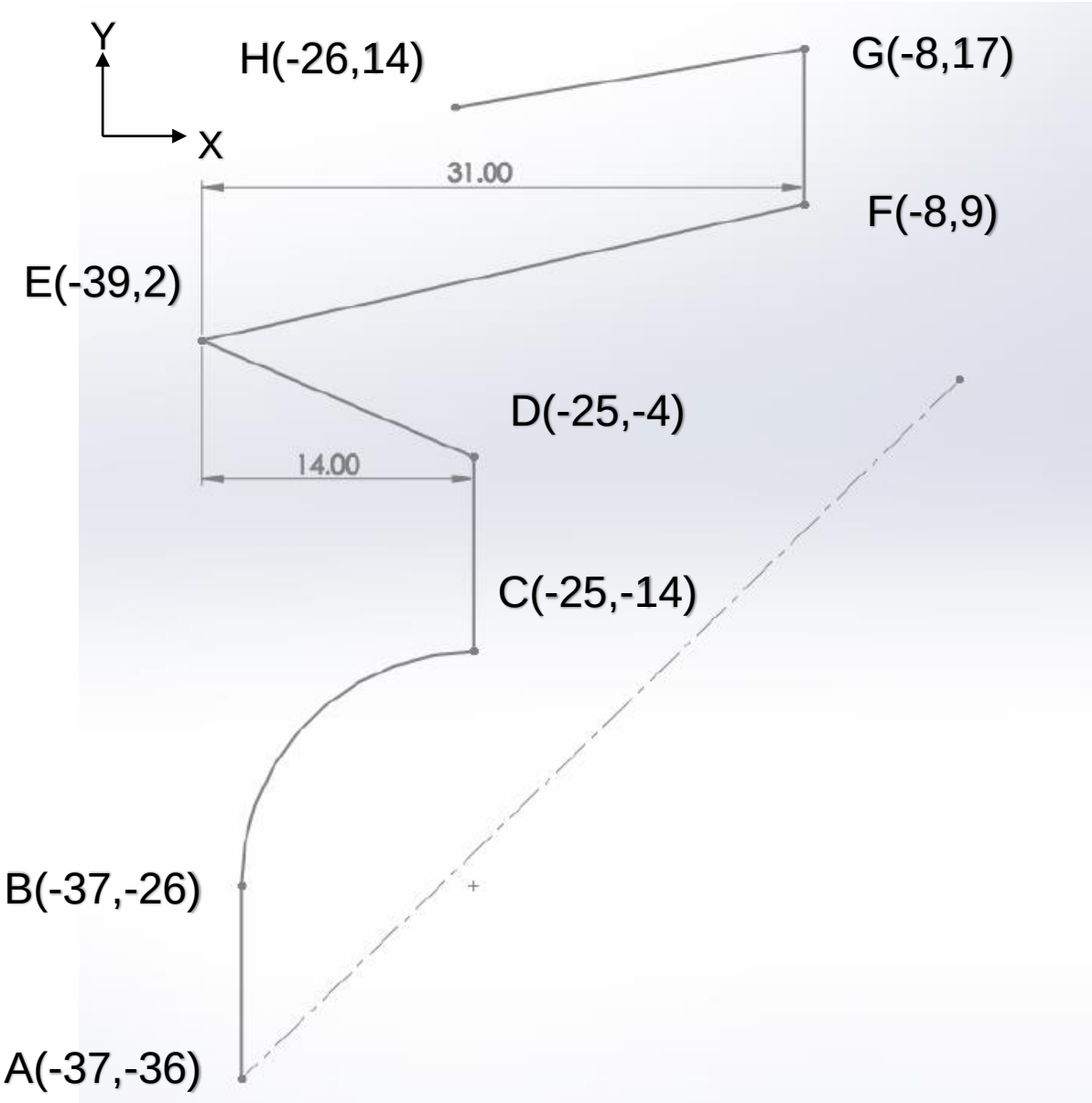


絕對座標 (G90)

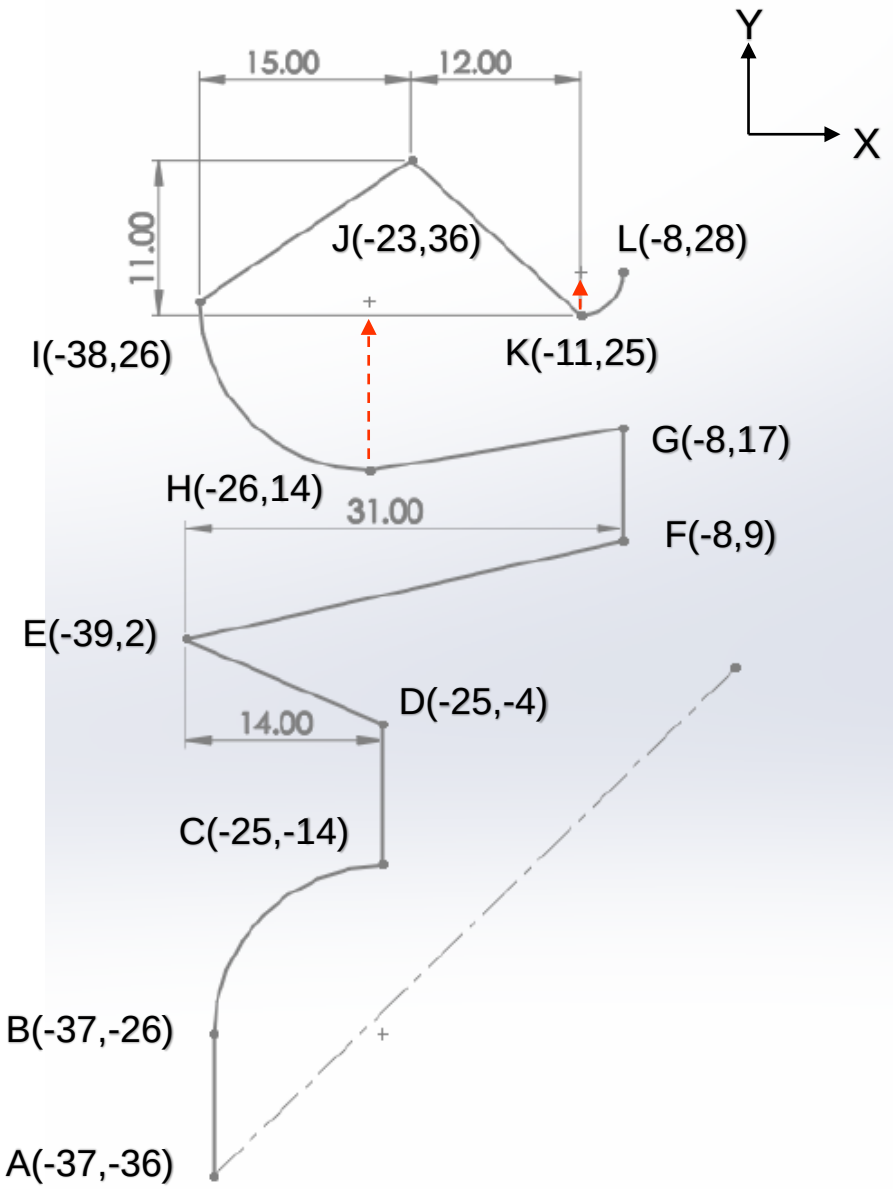
- M05 S0
- G90
- G21
- G1 F600
- G0 X-37. Y-36.
- G4 P0
- M03 S255
- G4 P0
- G1 F600
- G1 X-37. Y-26.
- G2 X-25. Y-14. I12. J0



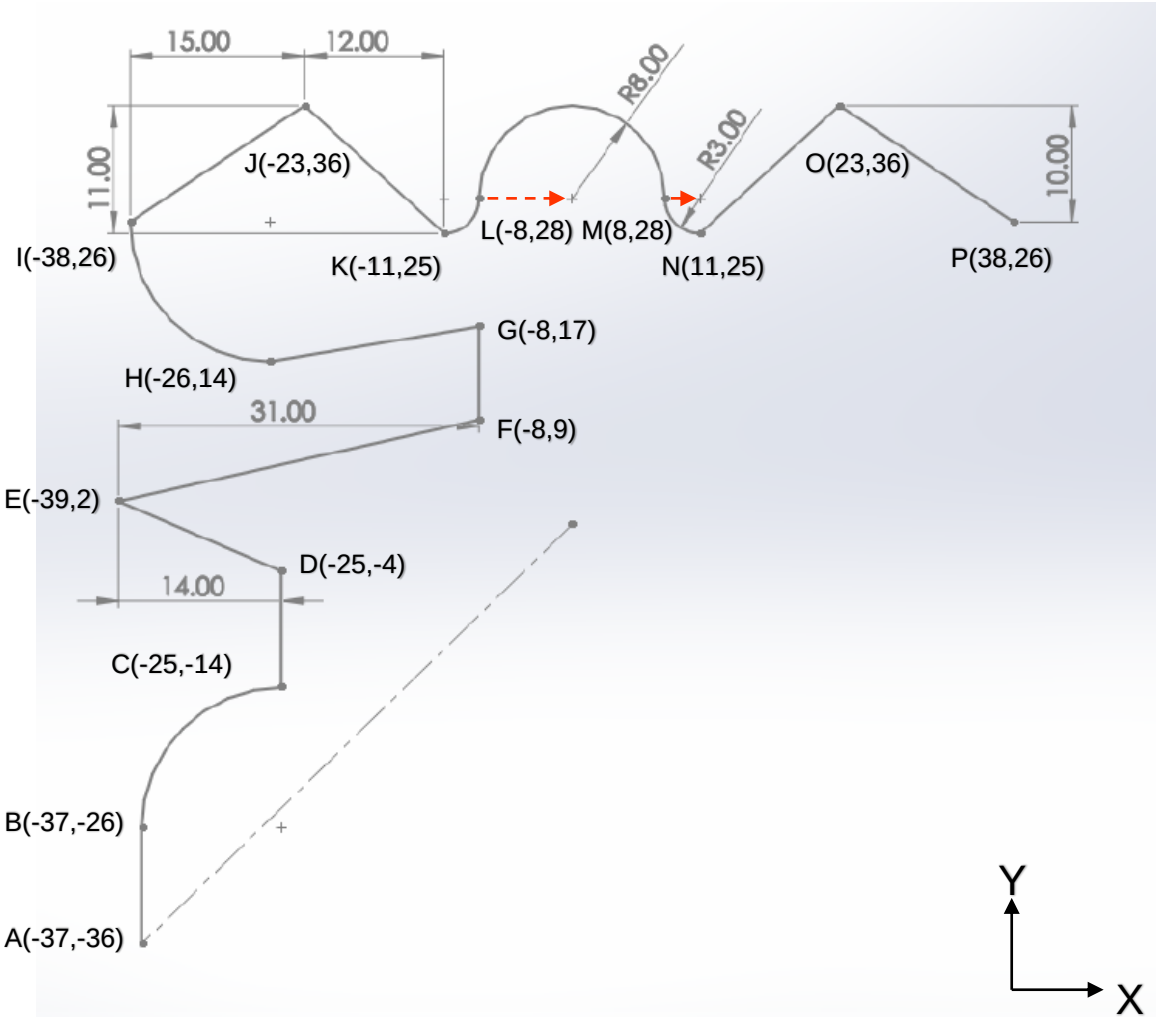
- **G1 X-25. Y-4.**
- **G1 X-39. Y2.**
- **G1 X-8. Y9.**
- **G1 X-8. Y17.**
- **G1 X-26. Y14.**



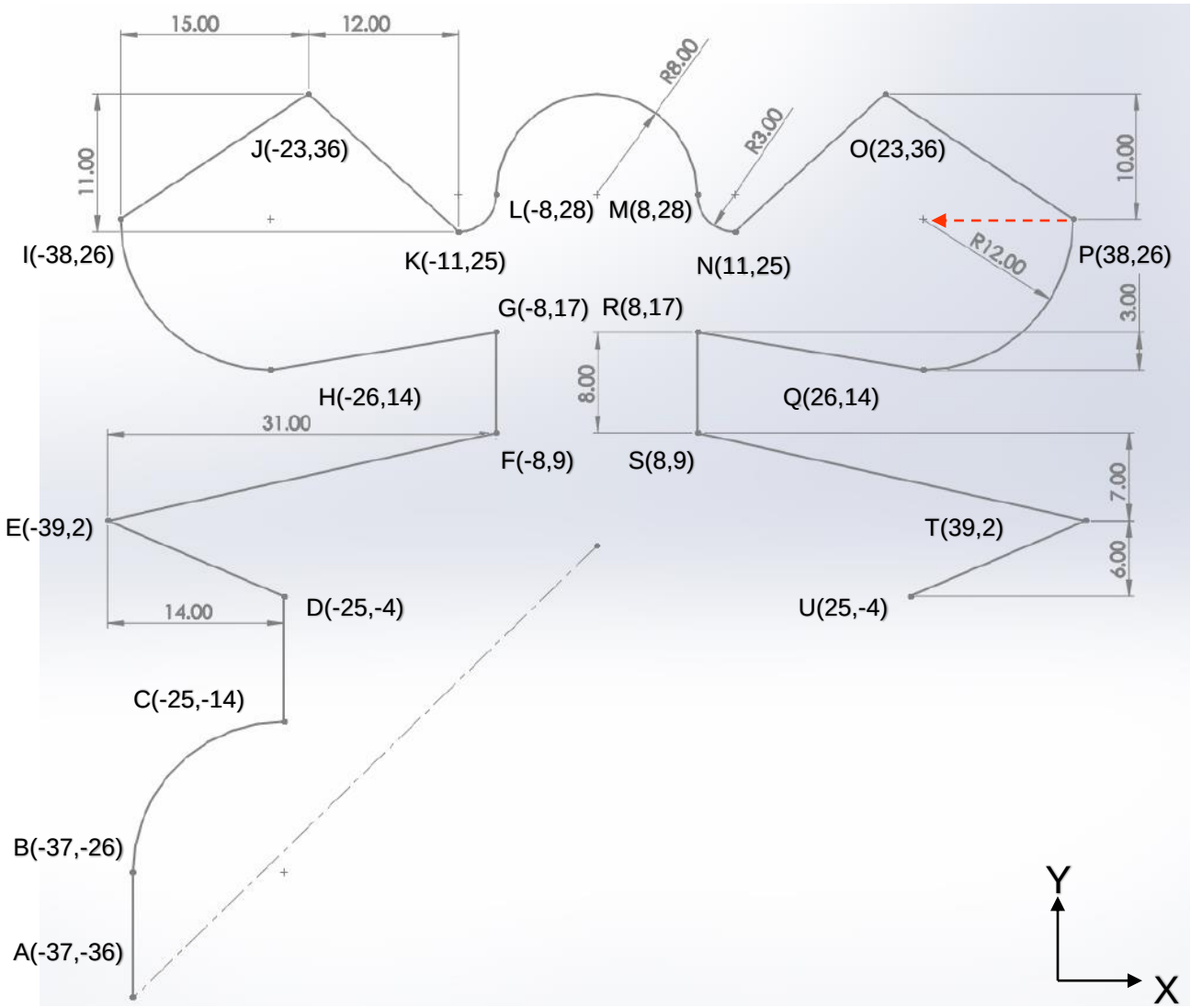
- **G2 X-38. Y26. I0. J12.**
- **G1 X-23. Y36.**
- **G1 X-11. Y25.**
- **G3 X-8. Y28. I0. J3.**



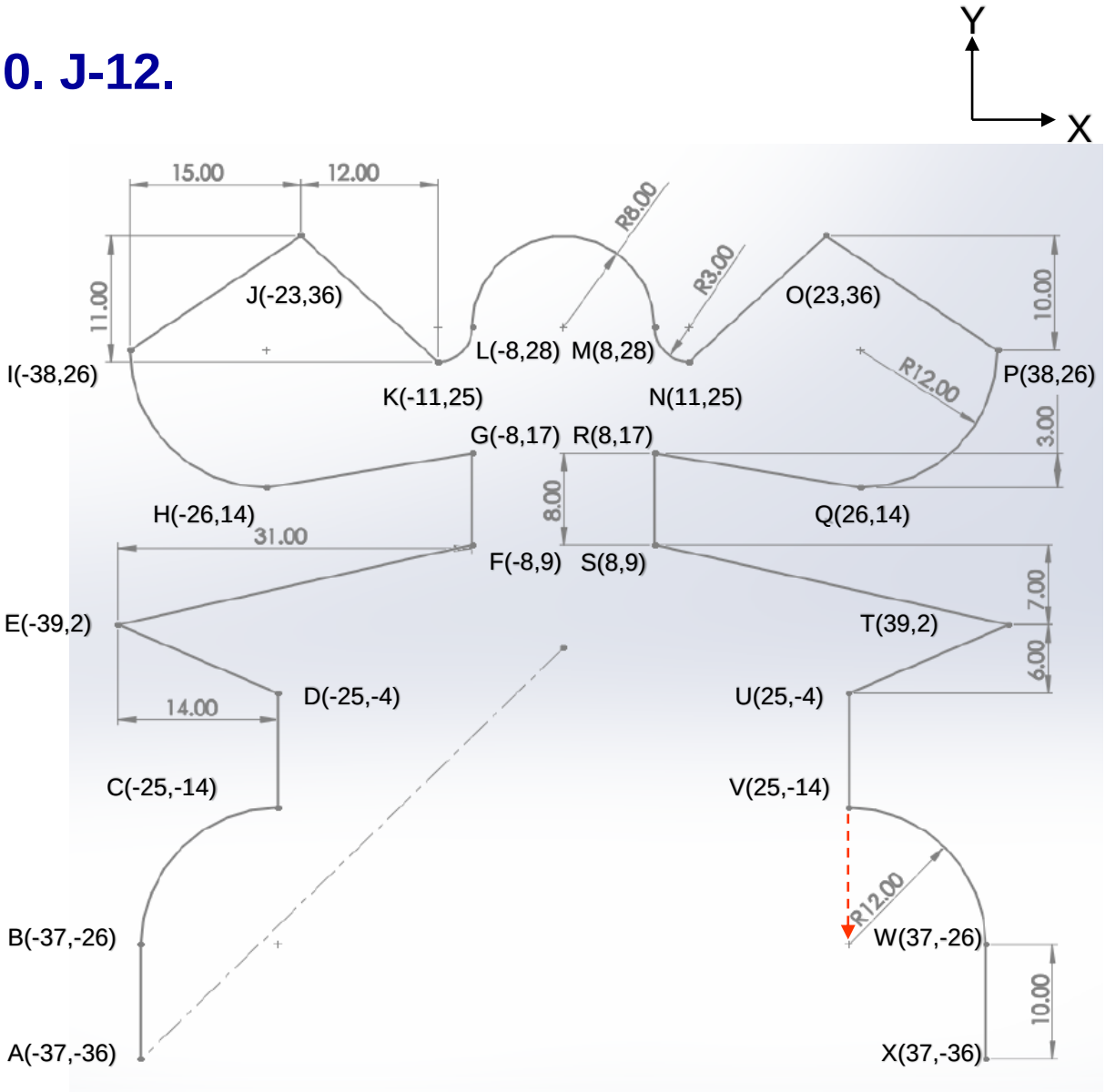
- **G2 X8. Y28. I8. J0.**
- **G3 X11. Y25. I3. J0.**
- **G1 X23. Y36.**
- **G1 X38. Y26.**



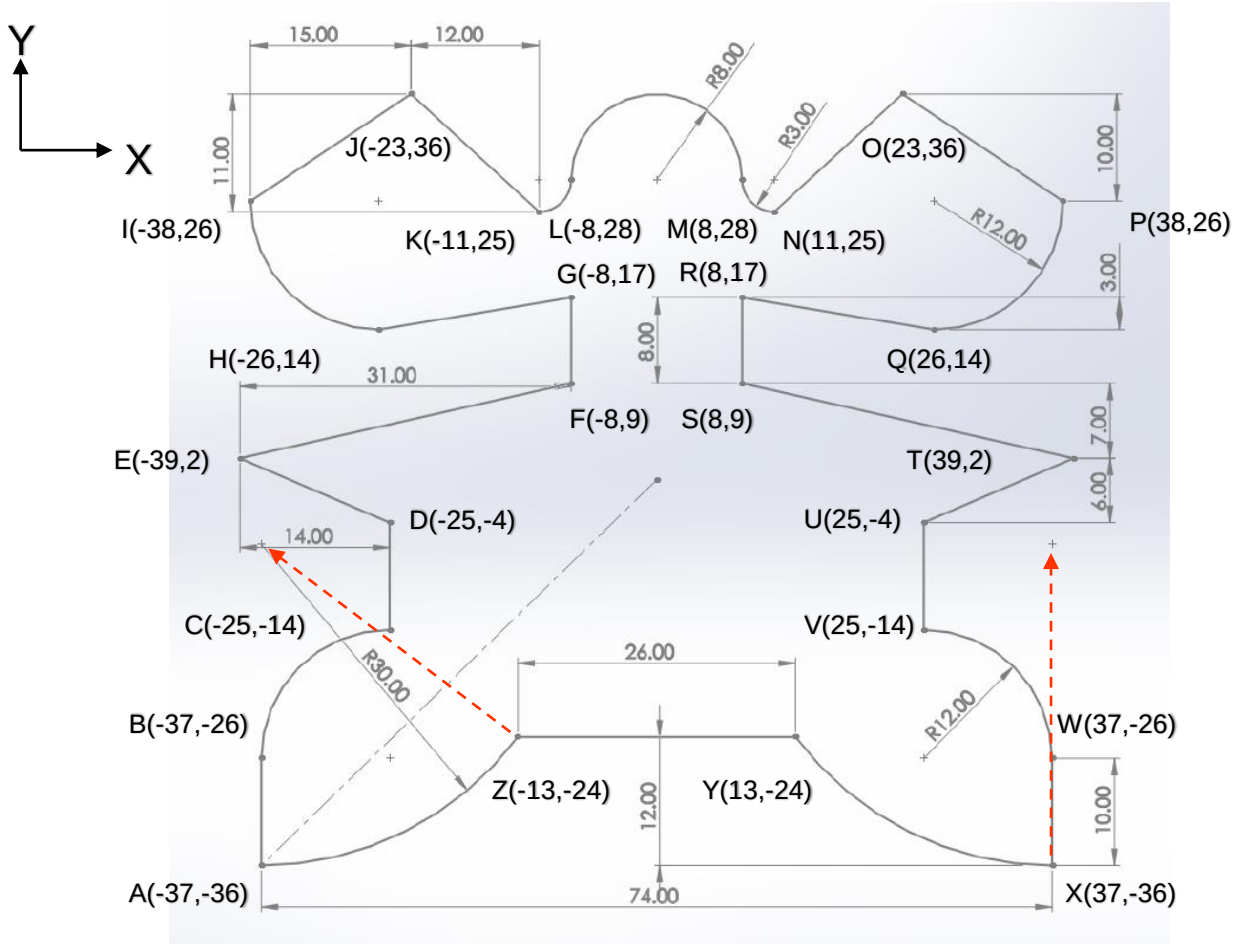
- **G2 X26. Y14. I-12. J0.**
- **G1 X8. Y17.**
- **G1 X8. Y9.**
- **G1 X39. Y2.**
- **G1 X25. Y-4.**



- **G1 X25. Y-14.**
- **G2 X37. Y-26. I0. J-12.**
- **G1 X37. Y-36.**

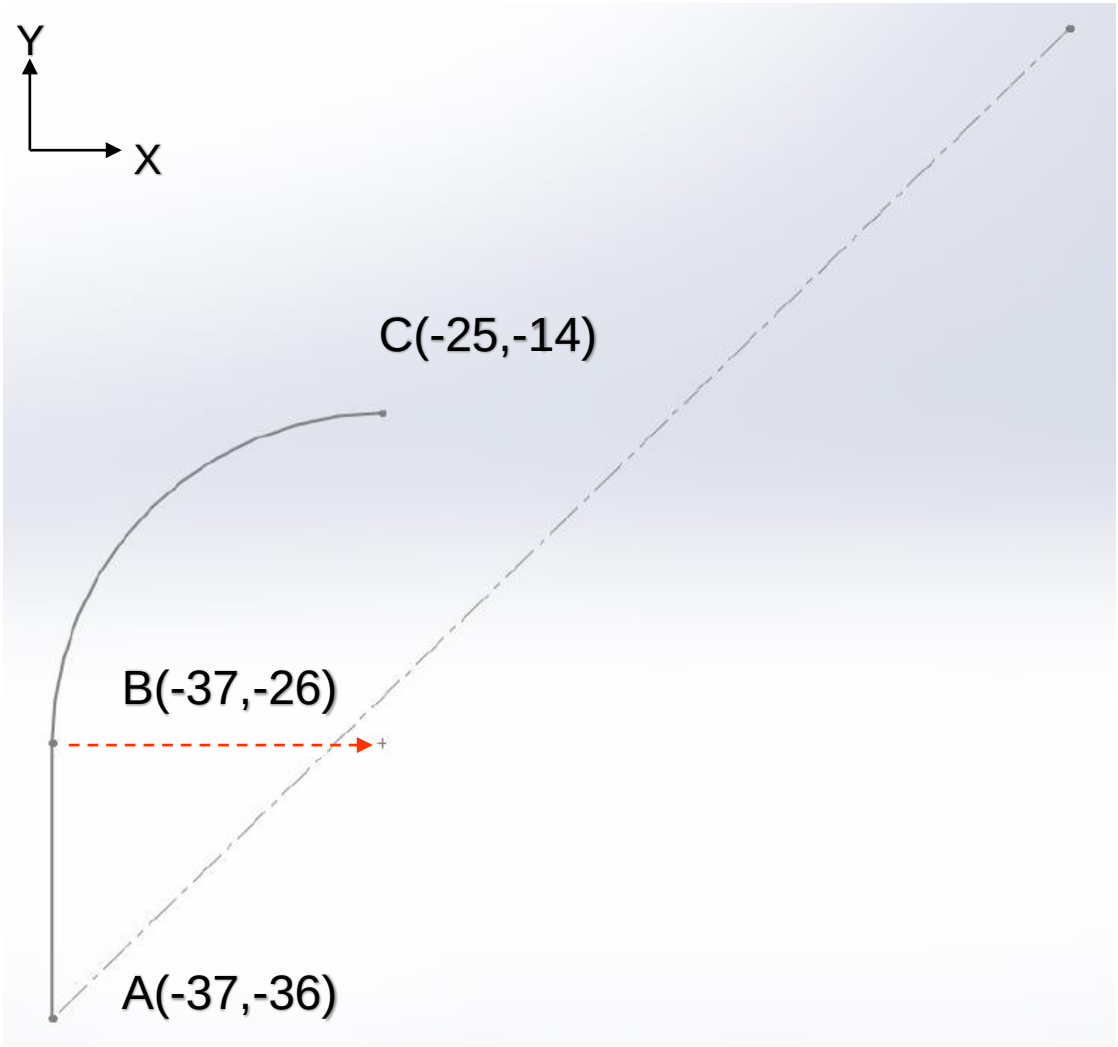


- G2 X13. Y-24. I0. J30.
- G1 X-13. Y-24.
- G2 X-37. Y-36. I-24. J18.
- G4 P0
- M05 S0
- G0 X0 Y0
- M18

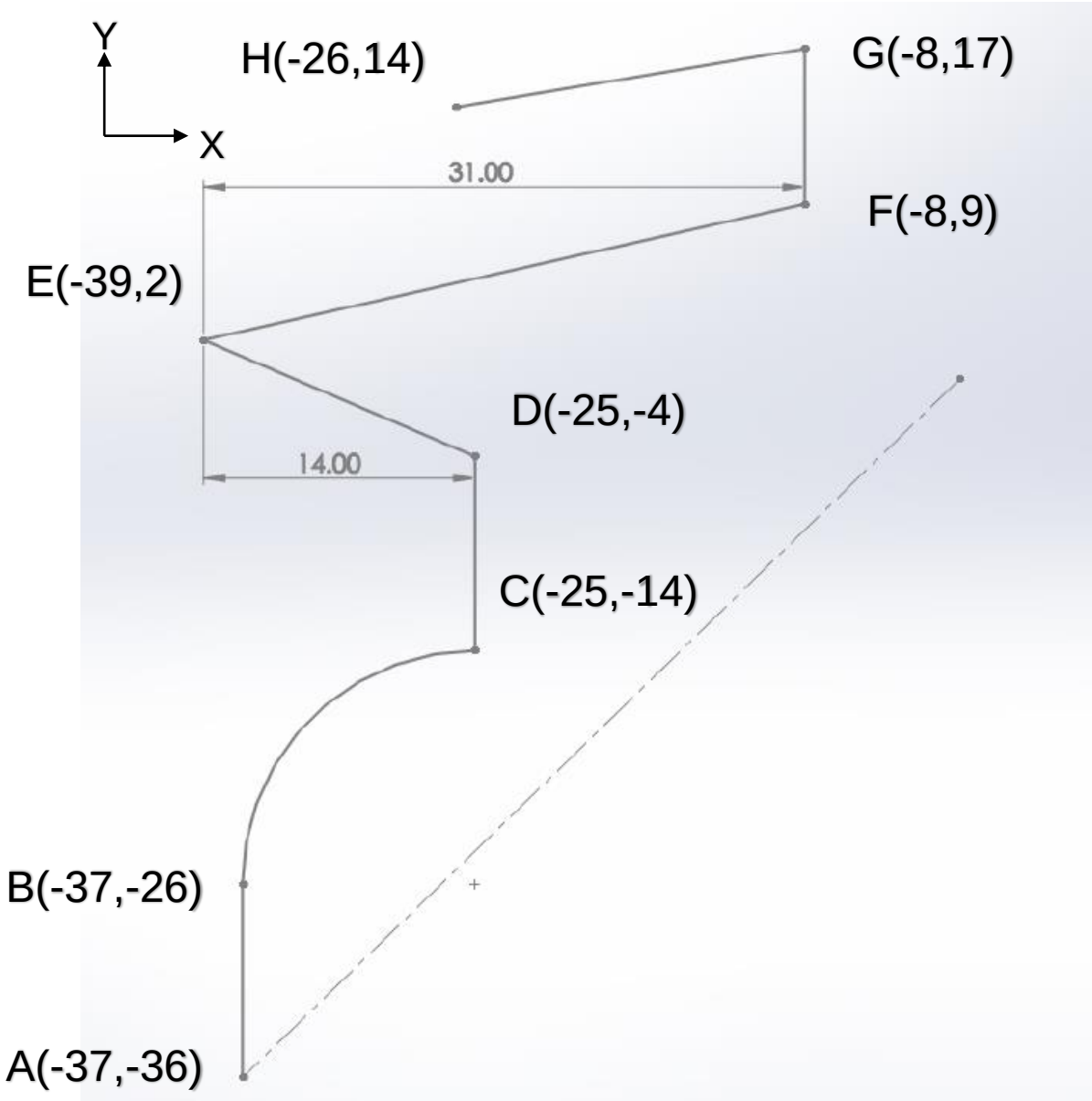


相對座標 (G91)

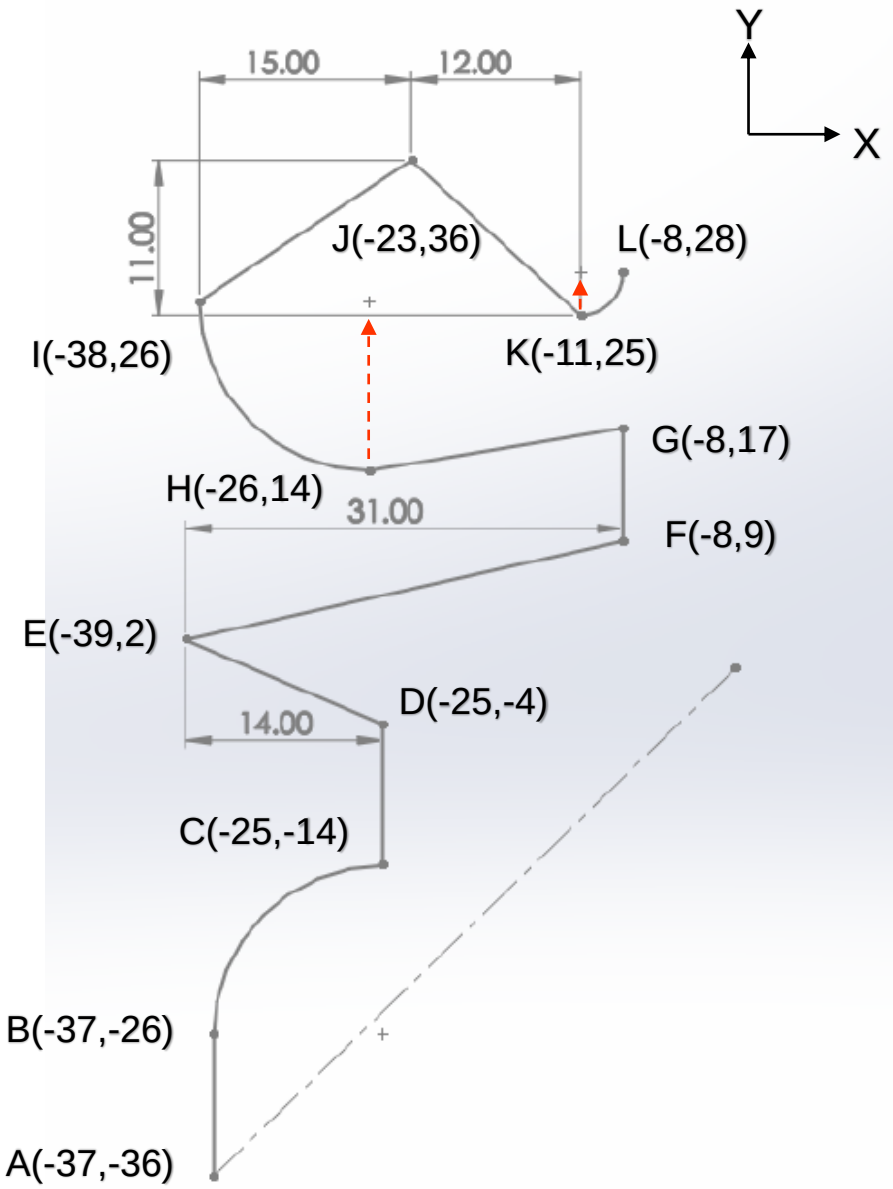
- M05 S0
- G91
- G21
- G1 F600
- G0 X-37. Y-36.
- G4 P0
- M03 S255
- G4 P0
- G1 F600
- G1 X0. Y10.
- G2 X12. Y12. I12. J0.



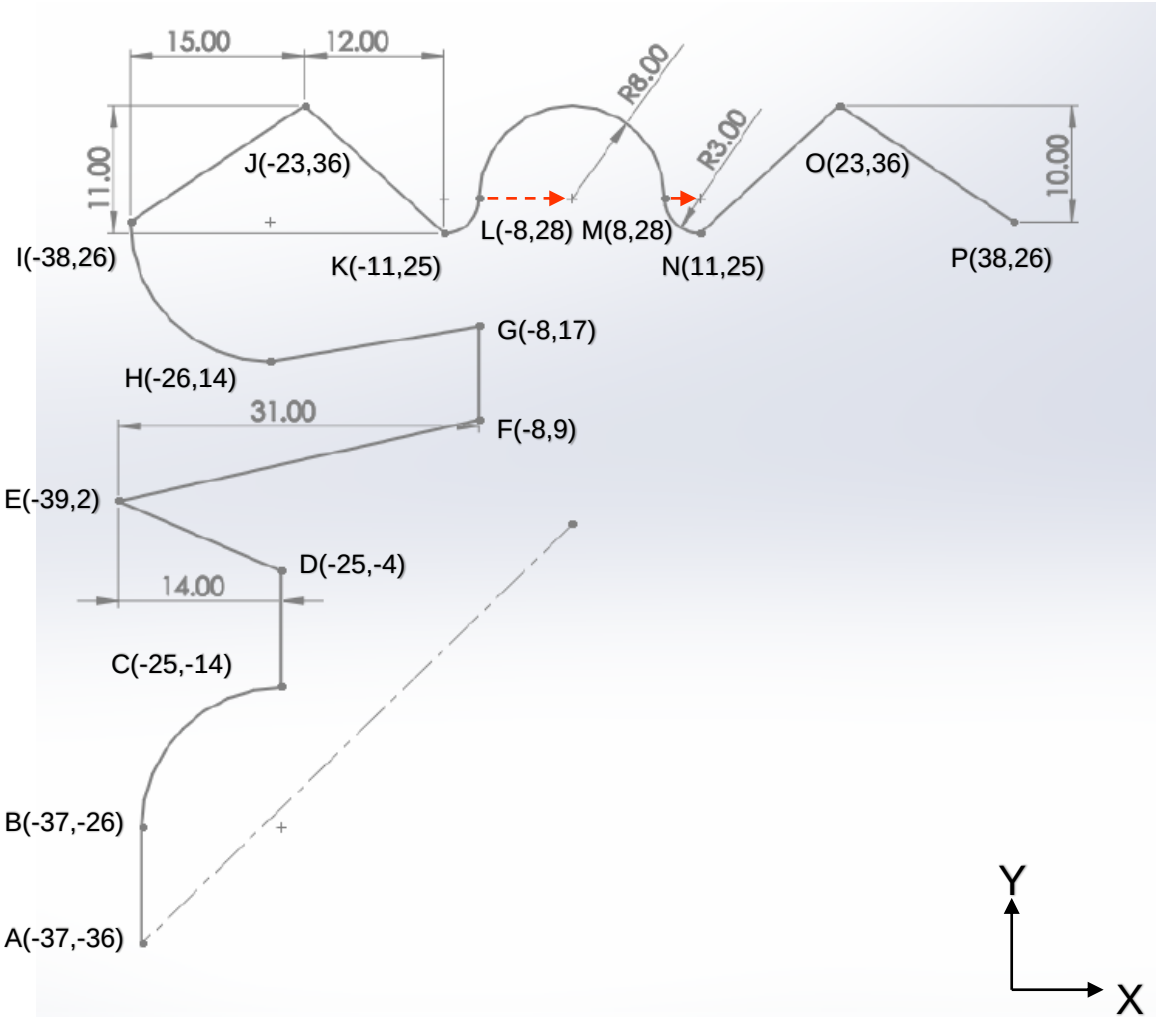
- **G1 X0. Y10.**
- **G1 X-14. Y6.**
- **G1 X31. Y7.**
- **G1 X0. Y8.**
- **G1 X-18. Y-3.**



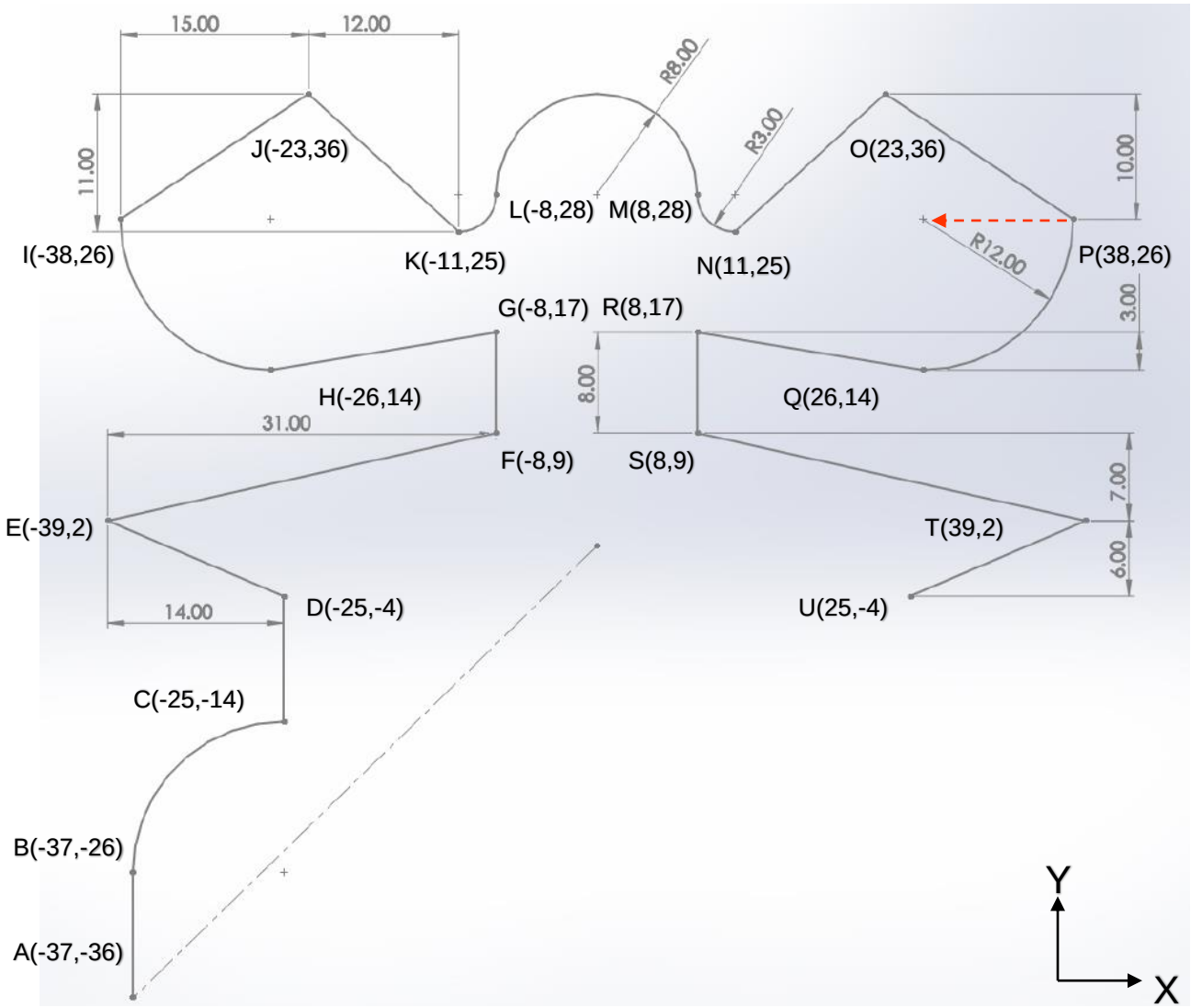
- **G2 X-12. Y12. I0. J12.**
- **G1 X15. Y10.**
- **G1 X12. Y-11.**
- **G3 X3. Y3. I0. J3.**



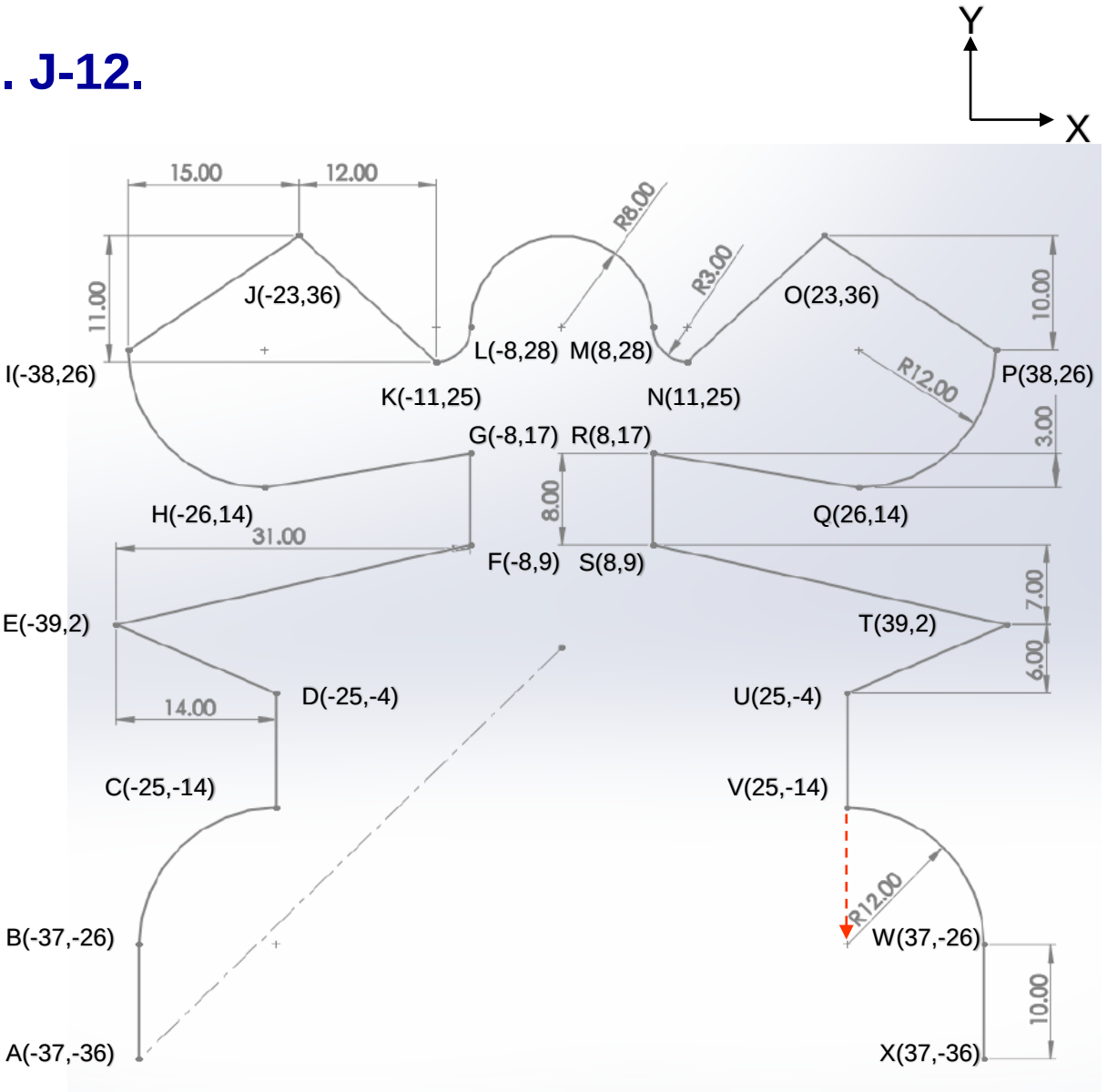
- **G2 X16. Y0. I8. J0.**
- **G3 X3. Y-3. I3. J0.**
- **G1 X12. Y11.**
- **G1 X15. Y-10.**



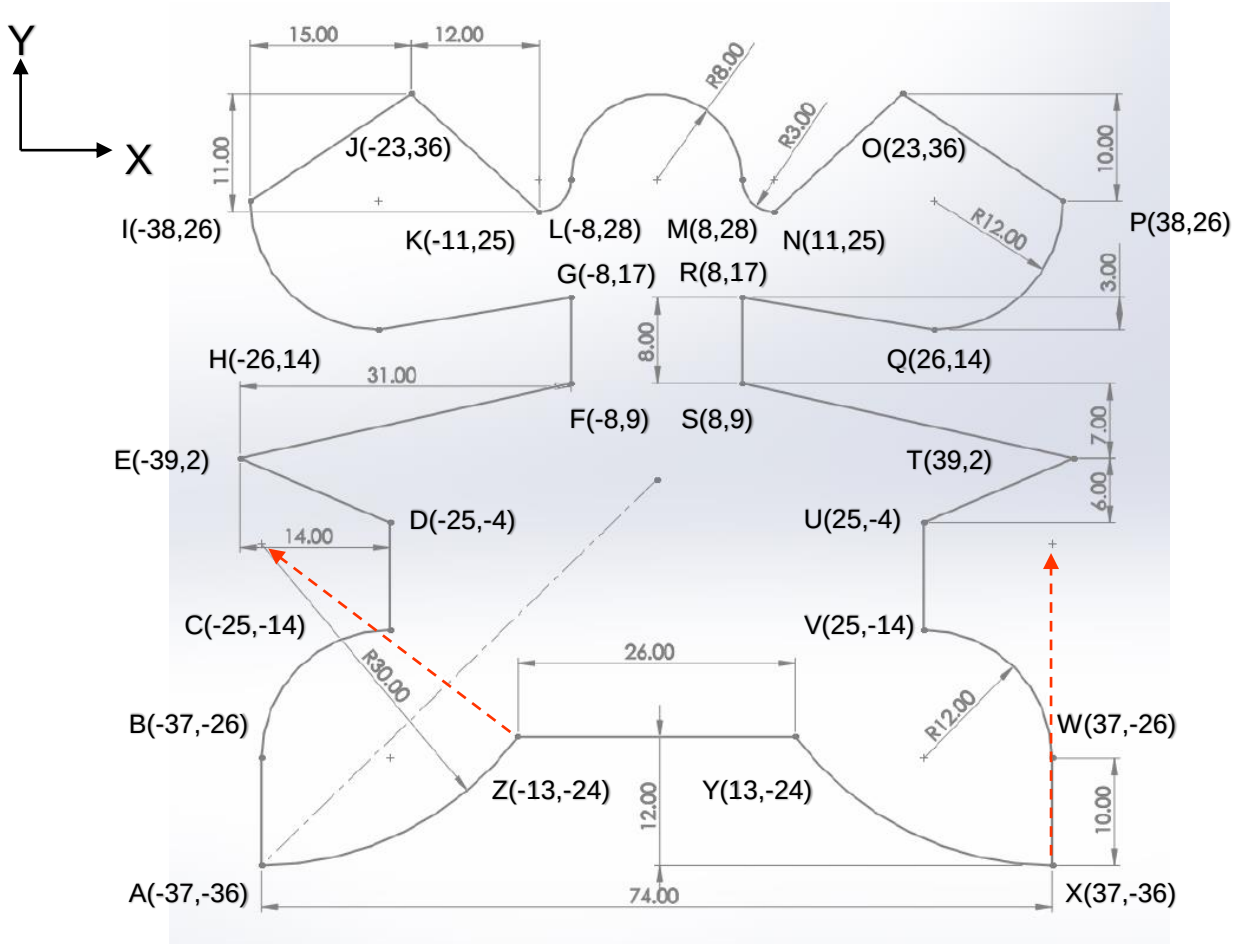
- G2 X-12. Y-12. I-12. J0.
- G1 X-18. Y3.
- G1 X0. Y-8.
- G1 X31. Y-7.
- G1 X-14. Y-6.



- **G1 X0. Y-10.**
- **G2 X12. Y-12. I0. J-12.**
- **G1 X0. Y-10.**



- G2 X-24. Y12. I0. J30.
- G1 X-26. Y0.
- G2 X-24 Y-12. I-24. J18.
- G4 P0
- M05 S0
- G0 X0 Y0
- M18



END