HAAS AUTOMATION, INC.
LATHE SERIES
PROGRAMMING
WORKBOOK
ANSWERS

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GEOMETRY EXERCISE (PAGE 9)

	X (Diameter not Radius)	Z
Point 1	1.0000	0
Point 2	1.5000	-0.2500
Point 3	1.5000	-3.0000
Point 4	1.8000	-3.0000
Point 5	2.0000	-3.1000

GEOMETRY EXERCISE (PAGE 10)

	X (Diameter not Radius)	Z
Point 1	0.0000	0.0000
Point 2	1.7500	0.0000
Point 3	2.0000	-0.125
Point 4	2.0000	-1.1250
Point 5	3.5000	-1.8750
Point 6	3.7500	-2.0000
Point 7	3.7500	-2.5750
Point 8	3.3500	-2.5750
Point 9	3.3500	-2.8250
Point 10	3.7500	-2.8250
Point 11	3.7500	-3.575
Point 12	5.0000	-3.875

LINEAR INTERPOLATION EXERCISE (PAGE 33)

ABSOLUTE PROGRAMMING

O00010
...
N... G00 X0.25 Z0.1
N11 **G01** Z0. F0.006
N12 **X0.75**
N13 **X1.25 Z-0.25**
N14 **Z-1.0**
N15 **X1.75 Z-1.25**
N16 **X2.4**
N17 **X3.0 Z-1.55**
N18 **Z-2.375**
N19 X3.01 Z0.1
...

INCREMENTAL AND ABSOLUTE PROGRAMMING

O00010
...
N... G00 X0.25 Z0.1
N21 **G01** Z0. F0.006
N22 **X0.75**
N23 **U0.5 W-0.25**
N24 **W-.75**
N25 **U0.5 W-0.25**
N26 **U0.65**
N27 **U0.6 W-0.3**
N28 **W-0.825**
N29 U0.01 Z0.1
...

CIRCULAR INTERPOLATION EXERCISE (PAGE 38)

O00020
...
N11 **G01 Z-2.0** F0.01
N12 **G02 X3.5 Z-3.0 I1. K0.** **(You could use** R1.0 **instead of** I1. K0.**)**
N13 **G01 X4.5**
...
...
N21 **G01** Z0. F0.01
N22 **X3.5**
N23 **G02 X2.0 Z-.75 I0. K-.75** **(Or** R.75 **instead of** I **and** K**)**
N24 **G01 Z-5.0**
...

CIRCULAR INTERPOLATION EXERCISE (PAGE 39)

O00030
...
N31 **G01 X2.0** F0.01
N32 **G03 X4.0 Z3.5 I0. K-1.0** (Or R1.0 instead of I and K)
N33 **G01 Z0.**
...
...
N41 G01 **Z0.** F0.01
N42 **X1.25**
N43 **X4.836 Z-1.793**
N44 **G03 X5.422 Z-2.5 I-.707 K-.707** (Or R1.0 instead of I and K)
N45 **G01 Z-5.0**
...
...

CIRCULAR INTERPOLATION EXERCISE (PAGE 40)

Program example
for G02 and G03 using "I" and "K"
O00040
...
...
G00 X1. Z0.1
N11 G01 Z0. F0.005
N12 X1.01
N13 G03 X1.25 Z-0.12 **I0. K-0.12**
N14 G01 Z-0.89
N15 G02 X1.73 Z-1.13 **I0.24 K0.**
N16 G01 X2.28
N17 G03 X3. Z-1.49 **I0. K-0.360**
N18 G01 Z-2.375
...
...

Program example
for G02 and G03 using "R"
O00040
...
...
G00 X1. Z0.1
N21 G01 Z0. F0.005
N22 X1.01
N23 G03 X1.25 Z-0.12 **R0.12**
N24 G01 Z-0.89
N25 G02 X1.73 Z-1.13 **R0.24**
N26 G01 X2.28
N27 G03 X3. Z-1.49 **R0.36**
N28 G01 Z-2.375
...
...

CIRCULAR INTERPOLATION EXERCISE (PAGE 45)

Interpolation with G01 using I, K, R & A
O00050
N31 G53 G00 X0. Z0. T0
N32 T101 (O.D. TOOL x .03 TNR)
N33 G50 S2600
N34 G97 S2057 M03
N35 G54 G00 X0.65 Z0.1
N36 G96 S350
N37 **G01** G42 Z0. F0.006
N38 G01 X1.25 **K-0.25**
N39 G01 **Z-1.25 I0.25**
N40 G01 **X2.75**
N41 G01 **X3.0 A160.**
N42 G01 **Z-2.0 R0.125**
N43 G01 **X3.5 R-0.1**
N44 G01 **Z-2.375**
N45 G40 G00 U0.01 Z0.1 M09
N46 G53 G00 X0. Z0. T0

G71/G70 TYPE I EXERCISE
WITH TOOL NOSE COMPENSATION (PAGE 86-87)

O00060
N1 (G71 TYPE I O.D. ROUGHING)
G53 G00 X0. Z0. T0
T101 (O.D. TOOL . x .031 TNR)
G50 S3200
G97 S500 M03
G54 **G00 X3.2 Z0.1** M08
G96 S420
Z0.005
G01 X-0.063 F.008
G00 X3.2 Z0.1
G71 P10 Q20 U0.01 W0.005 D0.12 F0.01
N10 G00 G42 X1.4
G01 Z0. F0.006
X1.5
G03 X1.75 Z-0.125 R0.125
G01 Z-2.5
G02 X2.25 Z-2.75 R0.25
G01 X2.5
G03 X3.0 Z-3.0 R0.25
G01 Z-4.125 F.004
N20 G40 X3.2 F.02
G97 S500 M09
G53 G00 X0. Z0. T0
M01

N2 (G70 FINISH O.D)
G53 G00 X0. Z0. T0
T202 (O.D. TOOL .031 TNR)
G50 S2800
G97 S890 M03
G54 G00 X1.8 Z0.1 M08
G96 S420
Z0.
G01 X-0.062 F0.005
G00 X3.2 Z0.1
G70 P10 Q20
G97 S500 M09
G53 G00 X0. Z0. T0
M30

Note: Either G28 or G53 G00 X0. Z0. T0 can be used to send turret home.

G71/G70 TYPE II ROUGHING EXERCISE (PAGE 92-93)

O00070
N1 (G71 TYPE II O.D. ROUGHING)
G53 G00 X0. Z0. T0
T101 (O.D. TOOL . x .031 TNR)
G50 S2800
G97 S500 M03
G54 G00 X3.2 Z0.1 M08
G96 S420
Z0.005
G01 X-0.063 F.008
G00 X3.2 Z0.1
G71 P10 Q20 U0.01 W0.005 D0.12 F0.01
N10 G00 G42 X1.4 **Z0.1**
G01 Z0. F0.006
X1.5
G03 X1.75 Z-0.125 R0.125
G01 Z-0.5
X1.25 Z-1. F0.01
Z-1.5
X1.75 Z-2.
G01 Z-2.5 F0.006
G02 X2.25 Z-2.75 R0.25
G01 X2.5
G03 X3. Z-3. R0.25
G01 Z-4.125 F.004
N20 G40 X3.2 F.02
G97 S500 M09
G53 G00 X0. Z0. T0
M01

N2 (G70 FINISH O.D)
G53 G00 X0. Z0. T0
T202 (O.D. TOOL .031 TNR)
G50 S2800
G97 S890 M03
G54 G00 X1.8 Z0.1 M08
G96 S420
Z0.
G01 X-0.062 F0.005
G00 X3.2 Z0.1
G70 P10 Q20
G97 S500 M09
G53 G00 X0. Z0. T0
M30
Note: Either G28 or G53 G00 X0. Z0. T0 can be used to send turret home.

G72/G70 TYPE I EXERCISE (PAGE 98-99)

O00080
N1 (G72 ROUGH FACE)
G53 G00 X0. Z0. T0
T101 (O.D. TOOL .031 TNR)
G50 S2800
G97 S500 M03
G54 **G00 X3.2 Z0.1** M08
G96 S420
Z0.1
G72 P10 Q20 U 0.01 W0.01 D0.1 F0.012
N10 **G00 G41 Z-0.55**
G01 X3.0 F.006
X2.4 Z-0.25
X1.75
X1.25 Z0.
X-0.063
N20 **G40 G00 Z0.1**
G97 S500 M09
G53 G00 X0. Z0. T0
M01

N2 (G70 FINISH FACE)
G53 G00 X0. Z0. T0
T202 (O.D. FINISH TOOL .031 TNR)
G50 S2800
G97 S500 M03
G54 G00 X3.2 Z1. M08
G96 S420
Z0.1
G70 P10 Q20
G97 S500 M09
G53 G00 X0. Z0. T0
M30

Note: Either G28 or G53 G00 X0. Z0. T0 can be used to send turret home.

G73/G70 EXERCISE with TOOL COMP. (PAGE 102-103)

O00090
N1 (G73 O.D. ROUGHING)
G53 G00 X0. Z0. T0
T101 (O.D. TOOL . x .031 TNR)
G50 S2800
G97 S500 M03
G54 G00 X3.2 Z0.1 M08
G96 S420
Z0.005
G01 X-0.063 F.008
G00 X3.2 Z0.1
G73 P10 Q20 U0.01 W0.005 I0.15 K0.16 D 5 F0.012
N10 G00 G42 X1.4
G01 Z0. F0.006
X1.
G03 X1.75 Z-0.5 R0.5
G01 Z-2.5
G02 X2.25 Z-2.75 R0.25
G01 X2.5
G03 X3.0 Z-3.0 R0.25
G01 Z-4.125 F.004
N20 G40 X3.2 F.02
G97 S500 M09
G53 G00 X0. Z0. T0
M01

N2 (G70 FINISH O.D)
G53 G00 X0. Z0. T0
T202 (O.D. TOOL .031 TNR)
G50 S2800
G97 S890 M03
G54 G00 X1.8 Z0.1 M08
G96 S420
Z0.
G01 X-0.062 F0.005
G00 X3.2 Z0.1
G70 P10 Q20
G97 S500 M09
G53 G00 X0. Z0. T0
M30

Note: Either G28 or G53 G00 X0. Z0. T0 can be used to send turret home.

G76 O.D. THREADING EXERCISE (PAGE 117)

O00100
N1 G28
N2 T101 (O.D. THREADING TOOL)
N3 G97 S590 M03
N4 G54 G00 **X2.85 Z0.1** M08
N5 **Z0-.25 M24**
N6 **G76 X2.6478 Z-1. K0.0511 D0.0162 F0.08333**
N7 **M09**
N8 G28
N9 **M30**

Note: Either G28 or G53 G00 X0. Z0. T0 can be used to send turret home.