TEACHER PAGE | LESSON PLAN

Junior Machinist: how parts are made

A free browser game from Max Machining. Students pick a cutting tool, steer it and machine parts in seven short chapters.

Grades	Time	Devices	Cost and sign-up
3 to 8 (ages 8 to 14)	One 45-minute period, or two for all seven chapters	Chromebook, laptop or tablet with a web browser	Free. No accounts. Nothing is collected from students.

Students will be able to

- Describe how a milling machine cuts a part from a solid block with a spinning tool.
- Use the X, Y and Z axes and read a tool position in decimal inches.
- Explain why machinists choose different tools, feed rates and depths of cut.
- Explain why a hole is spotted with a center drill before it is drilled.

Get ready

- Open **maxmachining.com/learn** on each device, or post the flyer so students can scan the QR code.
- Try chapter 1 yourself first. It takes about three minutes.
- Copy the student worksheet, one per student. Pairs work well: one steers, one reads the mission.

45-minute plan

5 min	**Open.** Ask: what in this room started as a solid block of metal? Explain that machinists cut parts to shape with spinning tools, and that the parts go into aircraft, cars, robots and medical devices.
30 min	**Play chapters 1 to 4.** Meet the machine, Choosing a tool, Making a pocket, Speeds and feeds. Each chapter opens with a three-step mission. Students who finish early replay a chapter for three stars.
10 min	**Close.** Discuss the questions below, then start the worksheet. Chapters 5 to 7 (Going deeper, Drilling holes, Your own part) and the certificate make a second day.

Discussion questions

- Which tool cleared metal fastest? Why not use it for everything?
- What happened when the feed rate was too high for the small tool?
- What is a gouge, and why does it matter on a real part?
- What kind of person would be good at this job? What would they need to learn?

Good to know

- Controls: arrow keys or on-screen arrows to move, Space to lower or lift the tool. On a touch screen, press and hold on the block to steer.
- Stars: one for finishing the part, one for no mistakes, one for beating the target time. Progress is saved only in that browser on that device.
- The certificate after chapter 7 shows a first name typed by the student. The name is not saved or sent anywhere.
- Real machines are run only by trained adults wearing safety glasses.

Free to copy for classroom use

STUDENT WORKSHEET

Junior Machinist

Name: _____ Date: _____

Part 1. Match each word to its meaning. Write the letter on the line.

____ 1. **Endmill**	**A.** A mark where the tool cut somewhere it should not.
____ 2. **Chip**	**B.** Movement left and right.
____ 3. **X axis**	**C.** The spinning cutting tool on a milling machine.
____ 4. **Z axis**	**D.** One trip of the tool at one depth.
____ 5. **Feed rate**	**E.** A small curl of metal shaved off by the tool.
____ 6. **Pocket**	**F.** A short, stiff tool that makes a starter dimple for a drill.
____ 7. **Island**	**G.** Movement up and down.
____ 8. **Gouge**	**H.** A hollow cut into a part.
____ 9. **Center drill**	**I.** How fast the tool moves through the metal.
____ 10. **Pass**	**J.** Material left standing in the middle of a pocket.

Part 2. Answer in a sentence.

1. Why do machinists pick the biggest tool that fits?

2. What should you do before you change tools?

3. What can happen if a small tool is fed too fast?

4. Why is a hole spotted with a center drill before it is drilled?

Part 3. Shop math.

5. A pocket is 0.3 inch deep. Each pass cuts 0.1 inch deep. How many passes does it take? _____

6. The readout shows X 1.250. You move the tool 0.500 inch to the right. What does X read now? _____

My stars. Color in the stars you earned in each chapter.

Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7
☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆

Free to copy for classroom use

TEACHER PAGE | ANSWER KEY

Worksheet answers

Part 1

1. Endmill: **C**	2. Chip: **E**	3. X axis: **B**	4. Z axis: **G**	5. Feed rate: **I**
6. Pocket: **H**	7. Island: **J**	8. Gouge: **A**	9. Center drill: **F**	10. Pass: **D**

Part 2 (sample answers)

- **1.** A bigger tool clears more metal on every pass, so the job is finished sooner.
- **2.** Lift the tool out of the metal. On a real machine the spindle goes up before the tool changer swaps tools.
- **3.** Each chip gets too thick, the tool is pushed too hard, and it can chatter or snap.
- **4.** A drill tip can skate sideways on a flat surface, so the hole ends up off location. The dimple from the short, stiff center drill keeps the drill tip in place.

Part 3

- **5.** 3 passes (0.3 divided by 0.1).
- **6.** X 1.750 (1.250 plus 0.500).

Going further

- **Measure it.** The block in the game is 3.75 inches wide and 2.5 inches tall. Have students draw it full size on grid paper and sketch a pocket with dimensions.
- **Plan it.** Before chapter 3, have pairs write the order of tools they will use and why. Compare plans after playing.
- **Careers.** Machinists, CNC programmers, inspectors and manufacturing engineers all work with these ideas. Ask students which part of the game they liked most and match it to a job.

Questions or feedback: Info@MaxMachining.com. We would like to hear how the lesson went.

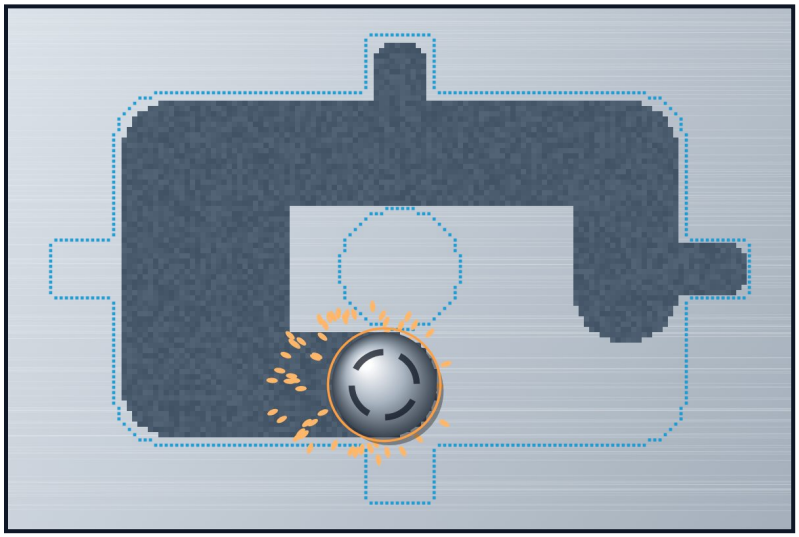
Free to copy for classroom use

MAX MACHINING

Junior Machinist

Run the mill. Make the part.

A free game that teaches how real parts are machined.



Scan to play

maxmachining.com/learn

- Pick an endmill, steer it with the arrow keys and cut your first parts.
- Seven chapters: milling, tool choice, pockets, speeds and feeds, drilling.
- Make a nameplate with your own initial and print your certificate.
- Works on Chromebooks, laptops and tablets. Ages 8 to 14.

Free. No sign-up. Nothing is collected from students.