

Classes and Instructors

Teaching at WMI, plus outlines and handouts for current classes.

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Teaching at the Makerspace

Proposing and running a class.

Proposing a Class

Members teaching members

Members teaching members is one of the best parts of Waukesha Makerspace. The most popular classes have been run by regular members sharing something they know.

You do not need to be an expert. If you know something well enough to show one other person, that is a class. If you just got started and figured a few things out the hard way, there are members who know less than you and would love to learn from you.

What counts as a class

Almost anything. Some ideas:

- Joinery, or cutting curves and shapes on the band saw
- MIG or TIG welding basics
- Sewing machine basics, the embroidery machine, or leatherworking
- 3D printing setup and slicing
- Soldering
- Cleaning and maintaining a machine you know well
- A piece of software you use, like Fusion 360, LightBurn or Inkscape
- Anything else you have been tinkering with lately

Keep it small and simple

- A class can run anywhere from **30 minutes to 2 hours**.
- It can be **one on one**, or you showing a handful of people.
- **No slides or handouts required.** Pick one thing, show how you do it, and answer questions.

If you want to build something reusable, see **Writing a Syllabus Others Can Reuse**.

Getting your class on the calendar

There are two ways:

1. **Add it to the events calendar yourself.**
2. **Email admin@waukeshamakers.com** with:
 - the topic,
 - a rough length,
 - how many people you can take,
 - a date or two that work for you.

An admin or board member will set up the event page for you.

Once it is listed, see **Volunteer Runbooks: Promoting an Event** to get the word out.

Not sure your idea is "enough"?

It probably is. Email admin@waukeshamakers.com, ask in Discord, or grab a board member at the space. You can also mention it during the "Teach a Skill" part of the monthly open house.

Instructor terms and materials fees

How instructors are compensated and how materials fees work is not written down yet. See **Instructor Terms and Materials Fees**.

Instructor Terms and Materials Fees

This page will explain the terms for teaching at Waukesha Makerspace: whether and how instructors are paid or credited, how class fees and materials fees are set and collected, who pays for consumables used in a class, and how fees are handled for members and non-members.

This page is being written. The board owns this gap: it needs to decide the instructor terms and materials fee rules before they can be published here.

Writing a Syllabus Others Can Reuse

A class does not need a written outline. But if you write one down, another member can teach your class when you cannot, and the class can run again and again. The **Fusion 360 Basics** and **Practical AI** outlines in this book are good models; this page describes the pattern they follow.

Put it in two parts

- **An instructor outline:** everything the person teaching needs.
- **A student handout:** a one or two page take-home card with the key steps, shortcuts or habits, so students can repeat what they learned at home.

What a reusable instructor outline includes

1. **The basics up top:** class name, length, level (for example "complete beginner"), and any prerequisites. Leave the instructor and date blank so anyone can use it.
2. **A class flow at a glance:** a table of sections with start times and durations, so the instructor can check the pace during class.
3. **Before class:** what students must do in advance (install software, create an account, bring a laptop) and the text of the email that tells them. Send it about a week ahead and again the day before.
4. **Section by section:** for each section, the key point to make, the steps to demonstrate, and a short practice moment for students.
5. **Common mistakes to head off:** the places students usually get stuck, and the fix for each. A table of "problem, cause, fix" works well.
6. **Instructor notes:**
 - a before-class checklist (projector, loaner equipment, props, a finished example),
 - pacing tips, including what to cut if you run short on time and what to add if you have extra,

- how to handle a student who cannot or will not do a step.
7. **What to learn next:** a short list of next topics and good outside resources.

Write it so it stays true

- **Avoid details that go stale.** Do not tie the outline to a date, a specific group of students, or product prices. If something in the class depends on menus or settings that change often, add a note telling the instructor to check them the day before.
- **Use the shop's own rules.** If the class touches equipment, point to the tool's SOP page and say that the class does not replace a check-off. Check-offs are recorded in Journeyman (<https://journeyman.waukeshamakers.com>).
- **Write plainly.** Short sections, numbered steps, and the words you would actually say.

Publishing it here

When your outline is finished, ask a knowledge base editor to add it as a new chapter in this book (outline and handout as separate pages). Drafts stay in Google Docs until then. See **Editor's Handbook: Writing for the Knowledge Base**.

Fusion 360 Basics

Class outline and student handout.

Fusion 360 Basics Class Outline

Fusion 360 Basics: From Sketch to Solid

- **Length:** 90 minutes
- **Level:** complete beginner, no CAD experience required
- **Prerequisites:** Fusion 360 installed and a free account created (see Appendix A)
- **Student handout:** see **Student Handout** in this chapter

Class flow at a glance

Time	Section	Length
0:00	Welcome and UI orientation	10 min
0:10	Sketching fundamentals	25 min
0:35	Extrude and fillet	15 min
0:50	Sketching on faces and cutting	20 min
1:10	Guided project: phone stand	15 min
1:25	Wrap-up and next steps	5 min

Before class: setup email

Send this to registered students **one week before class** and again **the day before**:

📧 **Subject: Fusion 360 Class Prep: Please Do This Before Class**

Hi! Looking forward to seeing you at the Fusion 360 Basics class. To make the most of our 90 minutes together, please complete these two steps before you

arrive:

1. **Create a free Autodesk account** at <https://www.autodesk.com/products/fusion-360/personal>. Choose the "Personal Use" license (free for hobbyists and non-commercial use). You'll need a valid email address.
2. **Download and install Fusion 360.** After creating your account, download the installer, run it and sign in with your new account. Open Fusion 360 once to make sure it loads (it may take a minute the first time).

If you get stuck, no worries: arrive 15 minutes early and we'll help you get set up.

Bring: a laptop with a mouse. Fusion 360 works with a trackpad, but a mouse makes 3D navigation much easier.

Section 1: Welcome and UI orientation (10 min)

Opening (2 min)

Start with a finished model on screen: something simple but impressive, like a custom bracket or enclosure that was 3D printed.

Key point: "This was made entirely in Fusion 360, starting from a blank canvas. By the end of today, you'll understand every technique that went into making it."

Set expectations

- This is a hands-on class. We build together, step by step.
- If you fall behind, raise your hand. It's a small group; nobody gets left behind.
- The goal isn't to memorize buttons. It's to understand the *workflow*: sketch a shape, then turn it into a 3D object.
- We'll make mistakes on purpose. Undo (Cmd+Z or Ctrl+Z) is your best friend.

UI tour (8 min)

Walk through these with everyone's Fusion 360 open.

The toolbar (top)

- Point out the major sections: Solid, Surface, Sheet Metal.
- "Today we live in the Solid section. That's where most beginners spend their time."
- Highlight just three tools: **Create Sketch**, **Extrude** and **Fillet**. "These three tools can build an astonishing number of things."

The browser panel (left)

- "This is your model's table of contents. Every sketch and body shows up here."
- Show how to expand and collapse items, and how to toggle visibility (the eye icon).
- "Don't worry about understanding everything here yet. Just know it exists."

The timeline (bottom)

- "Fusion records every step you take, like a history. Each icon is an operation, and you can go back and edit any step."
- "This is one of Fusion's superpowers, but we won't dig into it today."

Navigation (critical)

- **Orbit:** middle mouse button (or Shift + middle mouse)
- **Pan:** middle mouse button + Shift
- **Zoom:** scroll wheel
- **Home view:** click the house icon on the view cube (top right)

Practice moment: "Everyone orbit around. Zoom in and out. Pan left and right. If you ever get lost and your model disappears, click the house icon to reset your view."

Section 2: Sketching fundamentals (25 min)

Why sketching matters (2 min)

Key concept: "Everything in Fusion 360 starts as a 2D sketch. You draw a flat shape, then you pull it into 3D. The quality of your 3D model depends on the quality of your sketch. This is the most important section of the class."

Analogy: "Think of a cookie cutter. The sketch is the cutter shape. Extruding is pressing it into the dough. If your cutter shape is sloppy, your cookie is sloppy."

Starting a sketch (3 min)

1. Click **Create Sketch** in the toolbar.
2. Fusion asks you to pick a plane; three planes appear (XY, XZ, YZ).
3. "For now, always pick the bottom plane (XZ). It's the one that looks like a floor."
4. Click the XZ plane.

What just happened: "You're now in sketch mode. The toolbar changed: you have sketch tools like Line, Rectangle and Circle, and a grid appeared. That's your sketching surface."

Common mistake to head off: "You'll know you're in sketch mode because you see 'Finish Sketch' in the toolbar. If you try to draw and nothing happens, check whether you're actually in a sketch."

Drawing basic shapes (8 min)

Rectangle

1. Click **Rectangle**, then **2-Point Rectangle**.
2. Click once near the origin to place the first corner.
3. Move the mouse and click again to place the opposite corner.
4. "Don't worry about exact size yet. Just get a rectangle on screen."

Add dimensions:

1. Click **Sketch Dimension** (or press **D**).
2. Click one side of the rectangle, then click to place the dimension.
3. Type and press Enter. That side is now 60 mm.
4. Repeat for the other side: .

Key concept: constrained vs unconstrained

- "See how the lines turned from blue to black? Blue means 'I can still move.' Black means 'I'm locked in place.' That's called being **fully constrained**."
- "A fully constrained sketch is the goal. Your shape is completely defined; nothing is ambiguous."
- Grab a corner and try to drag it: "See? It doesn't move."

Show what unconstrained looks like:

- Undo back to before the dimensions.

- Drag a corner: "It moves freely, because Fusion doesn't know how big you want it."
- Re-add the dimensions.

Circle

1. Click **Circle**, then **Center Diameter Circle**.
2. Click to place the center.
3. Move outward and click, or type a diameter.
4. Add a dimension: .

Practice moment (2 min): "Delete everything in your sketch (Ctrl+A to select all, then Delete). Now draw an 80 mm x 50 mm rectangle on your own. When you're done, your lines should be black. Raise your hand if they're still blue."

Constraints: the big three (5 min)

"Dimensions control *size*. Constraints control *relationships* between things."

Coincident: "These two points are the same point."

- Draw two separate lines.
- Click **Constraints**, then **Coincident**.
- Click the endpoint of one line, then the endpoint of the other. They snap together.

Horizontal/Vertical: "This line must be perfectly flat or perfectly upright."

- Draw a slightly tilted line and apply the Horizontal constraint. It snaps level.

Equal: "These two things must be the same size."

- Draw two circles of different sizes and apply the Equal constraint. They match.

Key point: "You won't often apply constraints by hand. Fusion applies them automatically as you draw: a line that *looks* horizontal is made horizontal. Knowing they exist helps you understand why things snap, and how to fix a sketch that misbehaves."

Finish the sketch (2 min)

1. Click **Finish Sketch** (green checkmark in the toolbar, or right-click and choose Finish Sketch).
2. "You're back in 3D space. Your sketch still exists; see it in the browser panel."

Common mistake to head off: "Always finish your sketch before you extrude. If Extrude is grayed out, you're probably still in a sketch."

Section 3: Extrude and fillet (15 min)

Extrude: pulling 2D into 3D (10 min)

Key concept: "Extrude takes a closed 2D shape and stretches it into the third dimension. It's the most-used tool in Fusion 360."

Basic extrude

1. Click **Extrude** (or press **E**).
2. Click your rectangle sketch; it highlights in blue.
3. Drag the arrow upward, or type in the distance field.
4. Click OK.

Pause and celebrate: "You just made your first 3D solid. Orbit around it. It's a real object now."

Symmetric extrude

1. Undo the extrude.
2. Click **Extrude** again and select the rectangle.
3. Change **Direction** from "One Side" to **Symmetric**.
4. Type (10 mm each way, 20 mm total).
5. Click OK.

Why it matters: "Symmetric extrude builds equally above and below the sketch plane. It keeps your model centered, which makes later steps easier. Get in the habit."

What about that circle?

If the sketch has both a rectangle and a circle: "When you hover over the sketch during Extrude, Fusion highlights individual *regions*, not the whole sketch. You can pick the rectangle without the circle, or both."

Fillet: rounding edges (5 min)

Key concept: "Fillet rounds off sharp edges. It takes five seconds and makes everything look far more professional."

1. Click **Fillet** (in the Modify menu, or press **F**).

2. Click an edge of the box.
3. Type for a 3 mm radius.
4. Click OK.

The "wow" moment: "One rounded edge and it already looks like a real product instead of a blocky box."

Let them experiment (2 min): "Try different edges, a bigger radius, or several edges at once (keep clicking edges before you hit OK). What happens if the radius is too big?"

Common mistake to head off: "If Fusion gives you an error when filleting, the radius is probably too large for the shape. Make it smaller."

Section 4: Sketching on faces and cutting (20 min)

The key concept (2 min)

"So far you've sketched on a flat plane in empty space. You can also sketch directly on the *face* of a 3D object. That's how you add holes, pockets, slots and engravings."

Sketch on a face (8 min)

1. Click **Create Sketch**.
2. Instead of a plane, **click the top face of your box**.
3. "You're sketching on the surface of your object now."

Draw a circle on the top face:

1. Select **Circle**.
2. Click on the top face to place the center.
3. Type for a 10 mm diameter.
4. Optionally add dimensions to position it from the edges.
5. **Finish Sketch**.

Extrude as cut (8 min)

1. Click **Extrude**.

2. Click the circle on the top face.
3. Drag the arrow *down* into the box (or type a negative value such as).
4. Check that **Operation** says **Cut**. "Fusion usually suggests Cut when you extrude into a body, but always double-check."
5. Click OK.

Pause and orbit: "You just made a pocket in your box. Orbit underneath: it's a real pocket, not a mark on the surface."

The concept landing: "This is the core Fusion workflow: **sketch, extrude, sketch on a face, cut**. Repeat that cycle to add detail. Holes, pockets, slots and channels are all extrude-as-cut from a sketch on a face."

Try a second cut (5 min)

1. **Create Sketch** on a *side face* of the box.
2. Draw a rectangle, about 30 mm x 5 mm, near the bottom.
3. **Finish Sketch**.
4. **Extrude** as a cut going *through* the box: in the Extent menu choose **All** instead of typing a distance. "This cuts all the way through, however thick the box is."
5. Click OK.

Result: "A box with a pocket on top and a slot through the side. That's already a useful part: a cable organizer, a bracket, a pen holder."

Section 5: Guided project: phone stand (15 min)

Build a simple angled phone stand that ties together sketch, extrude, sketch on face, cut and fillet.

Show a picture or a printed example of the finished stand first so students know where they're heading.

Step 1: Base (3 min)

1. **Create Sketch** on the XZ plane (the floor).
2. Draw a rectangle: .
3. **Finish Sketch**.
4. **Extrude** symmetrically: (5 mm each way).

Result: a flat base, 70 x 80 x 10 mm.

Step 2: Back support (3 min)

1. **Create Sketch** on the back face of the base (the 70 mm x 10 mm face).
2. Draw a rectangle from the top-left corner of the face: 70 mm wide x 60 mm tall. Use a coincident constraint or simply start at the corner.
3. **Finish Sketch**.
4. **Extrude** 10 mm away from the base.

Result: an L shape, the base with a tall back wall.

Step 3: Phone slot (3 min)

1. **Create Sketch** on the top face of the base.
2. Draw a rectangle near the back wall: 50 mm x 4 mm, about 5 mm from the back face.
3. **Finish Sketch**.
4. **Extrude as Cut**: -8 mm. That leaves a 2 mm floor, so it's a slot and not a hole.

Result: a slot for the bottom edge of the phone.

Step 4: Fillet the edges (2 min)

1. Click **Fillet**.
2. Select the top edges of the back support, radius 5 mm.
3. Click OK.
4. Optionally fillet the outer bottom edges of the base: 3 mm.

Result: a finished-looking phone stand.

Step 5: Make it yours (4 min, if time allows)

- **Charging cable hole:** sketch a circle on the back face behind the slot and cut through.
- **Change the size:** wider for a tablet, narrower for a small phone.
- **More fillets:** round every sharp edge.

If you're running behind, skip Step 5. The stand is complete at Step 4.

Section 6: Wrap-up and next steps (5 min)

Celebrate what they built

"Look at the timeline. Count the steps. You went from an empty canvas to a working object with four core tools: sketch, extrude, cut and fillet."

The workflow

Write this on the board or show it on screen:

1. SKETCH a 2D shape
2. EXTRUDE it into 3D
3. SKETCH on a face
4. CUT to add detail
5. FILLET to finish
6. Repeat 3 to 5 until done

"This workflow handles most of what you'll ever want to model."

Show the timeline superpower

- Double-click an early step in the timeline, such as the first sketch.
- Change a dimension and press Enter. The whole model updates.

"Every step remembers how it relates to the steps before it. Change one dimension and the model adapts. That's **parametric modeling**, and it's a topic for next time."

What to learn next

1. **Components:** organizing multi-part models (essential for assemblies)
2. **User parameters:** named variables that drive your dimensions
3. **Patterns:** circular and rectangular repeats
4. **Joints:** connecting components so they move realistically
5. **Export for 3D printing:** File, Export, STL

Resources

- **Product Design Online** (YouTube): excellent beginner Fusion 360 tutorials
- **Autodesk's official tutorials:** built into Fusion 360 under the "?" menu
- **r/Fusion360:** an active Reddit community
- **Waukesha Makerspace:** come in and practice; members are happy to help

Tease the next class

"If there's interest, the next class would cover **components, user parameters and multi-part assemblies**: designing things that fit together."

Instructor notes

Before-class checklist

- ☐ Confirm every student got the setup email.
- ☐ Have a backup laptop with Fusion 360 ready, in case someone can't install.
- ☐ Bring 2 or 3 USB mice as loaners.
- ☐ Test the projector. Fusion's UI is small; increase UI scaling if projecting (Preferences, General, UI Scale).
- ☐ Bring a 3D-printed phone stand as a prop.
- ☐ Pre-build the phone stand in Fusion 360 so you can refer to it if something goes wrong live.

Pacing tips

- **Section 2 (sketching) will feel slow, and it's worth every minute.** Students who understand sketching sail through the rest; students who don't struggle with everything after it.
- **Section 5 is your pressure valve.** If you're behind, skip the phone slot and build just the base, back and fillets. If you're ahead, add the charging hole and extra fillets.
- **Build in recovery time.** A few students will get lost at some point. Walk behind the screens now and then and help them catch up without stopping the class.

Common student problems

Problem	Cause	Fix
"I can't see my sketch"	The view is edge-on to the sketch plane	Click Home on the view cube, or "Look At" on the sketch in the browser
"Extrude is grayed out"	Still inside a sketch	Click Finish Sketch first
"My extrude didn't cut"	Operation was New Body or Join	Undo, redo the extrude, set Operation to Cut
"My sketch lines are still blue"	Sketch not fully constrained	Add dimensions or constraints. For this class it still extrudes
"I can't select the face"	Clicking an edge instead of a face	Zoom in and hover until the face highlights
"My model disappeared"	A body got hidden, or the view zoomed too far	Check the eye icons in the browser panel, or click Home
"I made two bodies by accident"	Extrude created a new body instead of joining or cutting	Undo and redo with the right Operation

If you're short on time

1. Skip the second cut in Section 4 (saves 5 minutes).
2. Build only the base, back wall and fillets for the phone stand (saves 5 minutes).
3. Show just one fillet example (saves 2 minutes).

If you have extra time

1. Let students customize their stand (charging hole, rounded back, wider base).
2. Show how to export an STL and send it to one of the makerspace's 3D printers (students need a check-off before printing on their own).
3. Demo the Revolve tool: sketch a profile and spin it around an axis to make a bowl or vase.
4. Let students start a second object of their choice with your help.

Appendix A: Pre-class setup

System requirements

- **OS:** Windows 10 or 11, or macOS 11 or later
- **RAM:** 4 GB minimum, 8 GB recommended
- **Graphics:** a dedicated GPU helps but is not required
- **Internet:** required for sign-in and setup

- **Mouse:** strongly recommended (a 3-button mouse is ideal)

Installation

1. Go to <https://www.autodesk.com/products/fusion-360/personal>.
2. Click "Get Started" or "Download Free".
3. Create an Autodesk account, or sign in.
4. Choose "Personal Use" as the license type.
5. Download the installer for your operating system.
6. Run it. It downloads more components, which can take 5 to 10 minutes.
7. Launch Fusion 360 and sign in.

Troubleshooting

- **"I don't see the free option":** look for "Personal Use" or "Hobbyist". Autodesk changes the signup flow often, but the free license is still offered.
- **"It's asking me to pay":** you may have started a trial by accident. Go back to the personal-use page above and register the free license.
- **"It's really slow":** close other programs. On older machines, lower the graphics settings (Preferences, General, Graphics Driver).

Appendix B: Keyboard shortcuts

Print and hand out, or show on a second screen.

Shortcut	Action
S	Search (find any tool by name)
L	Line
C	Circle
R	Rectangle
D	Sketch Dimension
E	Extrude
F	Fillet
Q	Push/Pull
M	Move/Copy
Cmd+Z / Ctrl+Z	Undo

Shortcut	Action
Cmd+Shift+Z / Ctrl+Y	Redo
Middle mouse	Orbit
Shift + middle mouse	Pan
Scroll wheel	Zoom

Tip: press **S** and type a tool's name. It's the fastest way to find anything when you forget where a button lives.

Appendix C: Phone stand dimensions

For students who need to catch up or rebuild at home.

BASE

Width: 70 mm
Depth: 80 mm
Height: 10 mm (symmetric extrude)

BACK SUPPORT

Width: 70 mm (same as base)
Height: 60 mm
Depth: 10 mm (extruded from the back face)

PHONE SLOT

Width: 50 mm (centered on the base)
Depth: 4 mm
Cut: 8 mm deep (leaves a 2 mm floor)
Position: 5 mm from the back wall

FILLETS

Back support top edges: 5 mm
Base bottom edges: 3 mm (optional)

Student Handout

The take-home cheat sheet for the Fusion 360 Basics class. The same sheet is in the **Digital Fabrication** book as the Fusion 360 Cheat Sheet.

The core workflow

You will repeat this for almost everything you build in Fusion 360:

1. SKETCH a 2D shape on a plane or face
 2. EXTRUDE it into 3D (add material)
 3. SKETCH on a face of your 3D object
 4. CUT to remove material (extrude inward)
 5. FILLET to round edges and finish
 6. Repeat steps 3 to 5 to add detail

Keyboard shortcuts

Shortcut	Action
S	Search (find any tool by name)
L	Line
C	Circle
R	Rectangle
D	Sketch Dimension
E	Extrude
F	Fillet
Q	Push/Pull
M	Move/Copy
Ctrl+Z / Cmd+Z	Undo

Tip: press **S** and type a tool's name. It's the fastest way to find anything.

Mouse navigation

Action	Control
Orbit	Middle mouse button
Pan	Shift + middle mouse button
Zoom	Scroll wheel
Reset view	Click the house icon on the view cube (top right)

The class project: phone stand

Dimensions are included so you can rebuild it at home.

Step 1: Base

1. **Create Sketch** on the XZ plane (the floor).
2. Draw a **rectangle**: 70 mm x 80 mm.
3. **Finish Sketch**.
4. **Extrude** (Symmetric): 10 mm.

Step 2: Back support

1. **Create Sketch** on the back face (the 70 mm x 10 mm face).
2. Draw a **rectangle** from the top-left corner: 70 mm wide x 60 mm tall.
3. **Finish Sketch**.
4. **Extrude**: 10 mm, away from the base.

Step 3: Phone slot

1. **Create Sketch** on the top face of the base.
2. Draw a **rectangle**: 50 mm x 4 mm, 5 mm from the back wall.
3. **Finish Sketch**.
4. **Extrude** as **Cut**: -8 mm (leaves a 2 mm floor).

Step 4: Fillet

1. Select **Fillet** (or press **F**).
2. Click the top edges of the back support, radius **5 mm**.
3. Optionally fillet the bottom edges of the base: **3 mm**.

Dimensions

BASE:	70 x 80 x 10 mm
BACK SUPPORT:	70 x 60 x 10 mm
PHONE SLOT:	50 x 4 mm, 8 mm deep cut
FILLETS:	5 mm (top), 3 mm (bottom)

Stuck? Check here first

Problem	Fix
Can't see my sketch	Click the Home icon on the view cube
Extrude is grayed out	Click Finish Sketch first
Extrude didn't cut	Undo, redo the extrude, set Operation to Cut
Sketch lines are still blue	Add dimensions to fully constrain it (it still works if you don't)
Can't select a face	Zoom in and hover until the <i>face</i> highlights, not an edge
Model disappeared	Check the eye icons in the browser panel (left side)

What to learn next

1. **Components:** organizing multi-part models
2. **User parameters:** named variables for dimensions
3. **Patterns:** repeat features in circles or grids
4. **STL export:** File, Export, STL to 3D print your designs

Resources

- **Product Design Online** (YouTube): excellent beginner Fusion 360 tutorials
- **r/Fusion360:** Reddit community for questions and inspiration

- **Waukesha Makerspace:** come in and practice. Find upcoming classes at <https://waukeshamakers.com>.

Practical AI

Class outline and handout.

Practical AI Class Outline

Practical AI: Using ChatGPT, Claude and Gemini Safely and Well

- **Length:** 90 minutes
- **Format:** small-group workshop, run as a conversation around one table
- **Level:** beginner, no prior AI experience needed
- **Student handout:** see **Take-Home Card** in this chapter
- **Last revised:** October 2026. AI apps change fast; check the settings menus and plan names the day before you teach (see Instructor notes).

The class uses the "brilliant intern" analogy and a short checklist for asking well (R.O.L.E.S.). It covers privacy and security early, and shows what AI apps can do now: search, see, listen and carry out tasks.

Know the room

- **Run it as a conversation, not a lecture.** With a small group, stop for questions anywhere.
- **Welcome skeptics.** If someone is wary of AI, treat that as an asset. Their concerns are often legitimate and the class should say so plainly. Invite them to be the "red team" during demos: their job is to catch the AI being wrong.
- **Use the opening round** to learn each person's experience level and goals.
- **Nobody connects a personal email, calendar or drive account during class.** Connected-account features are instructor demos only.

Class flow at a glance

Time	Section	Length
0:00	Welcome: what you want from AI, what worries you	10 min
0:10	How AI actually works: tools, tokens, reasoning	14 min
0:24	Privacy and security first	20 min

Time	Section	Length
0:44	Hands-on: asking well, and managing a conversation	20 min
1:04	Demo tour: what AI can do now	16 min
1:20	Verification habits, handout, Q&A	10 min

Section 1: Welcome (10 min)

Opening round

Go around the table. Each person answers two questions:

1. "What is one thing in your life or work you would like help with?" (a letter, a project plan, learning a skill, fixing something)
2. "What worries you about AI, if anything?"

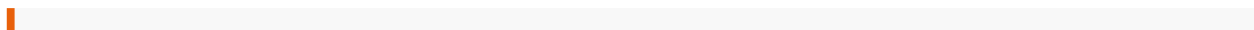
Write both lists on the whiteboard and leave them up all class. The first list becomes demo material in Sections 4 and 5. The second is a checklist: before the class ends, every worry on it should be addressed or honestly acknowledged.

Set expectations

- This class is neither cheerleading nor fear. It is like learning a new power tool: what it is good for, where it bites, and which guards to use.
- Skepticism is welcome. Several of today's habits exist *because* the skeptics are right about some things.
- Goal: leave with your privacy settings checked and three habits you can use tonight.

Section 2: How AI actually works (14 min)

The brilliant intern



"Think of AI as the smartest intern you have ever met. They have read nearly everything, they are fast, and they never get tired. But they are still an intern. They need clear instructions, they will confidently hand you wrong information if you do not check their work, and they badly want to give you an answer even when 'I'm not sure' would be better. Your job is to be a good manager."

Next-word prediction, briefly

These tools generate text by predicting what is most likely to come next, based on patterns in an enormous amount of writing. That is why the same tool can write a lovely thank-you note and also invent a book that does not exist. Both are "plausible next words."

The intern got tools

A year or two ago, the honest summary was "AI can talk, but it can't do anything." That is no longer true. The major apps can now:

- **Search the web** and show sources, often automatically.
- **See:** read a photo, a screenshot, a PDF or a live camera view.
- **Listen and talk:** hold a spoken conversation (voice mode).
- **Run calculations and create files:** spreadsheets, documents, charts.
- **Do multi-step research:** read dozens of pages and write a cited report (often called "Research" or "Deep Research").
- **Carry out tasks** (agents): click through websites, fill in forms, work with files on your computer, connect to email or a calendar.

Key point: more capability means more to manage. An intern who can only talk can only give you bad advice. An intern with your house keys can do real damage. That is why the next section is about security.

Tokens and context (3 min)

“AI doesn't read words, it reads chunks called tokens, roughly three quarters of a word each. Everything you type, everything you upload, and everything it writes back uses tokens. Think of the conversation as a whiteboard of fixed size: once it fills up, the oldest material gets erased.”

Why this matters to a regular user:

1. **Usage limits.** "You've reached your limit, try again at 3 PM" is measured in tokens. Long chats and big uploads use up the allowance faster. Paid plans mostly buy more allowance.
2. **Long conversations degrade.** When the whiteboard is full, the AI forgets early details. (Section 4 covers what to do.)
3. **Odd failures.** Because it reads chunks rather than letters, it can miscount the letters in a word. A good reminder that it is not magic.

If someone asks "Does it cost me per message?": "Not in the regular apps. You get a usage allowance, not a meter. Per-token billing applies to developers using the paid API."

How AI "reasons" (4 min)

“If I ask you 17 times 24, you probably can't just blurt out the answer. You work it out on scratch paper. Older AI had to blurt: it predicted the answer one word at a time with no scratch paper. Newer 'thinking' or 'reasoning' models get scratch paper. Before answering, they write out steps for themselves: break the problem down, try an approach, check it, back up if it doesn't work. Then they write the answer.”

What it looks like in the apps:

- A "Thinking..." indicator, often with a "Show thinking" panel you can open and read.
- Sometimes a choice in the model menu or a toggle ("Thinking", "Extended thinking", "Deep Think"); many apps now decide on their own how much to think.
- For math and data, the AI often writes and runs a small calculation behind the scenes instead of doing arithmetic "in its head." That is why "AI is bad at math" was mostly true of older chatbots.

When it helps: multi-step problems such as math, cut lists and material estimates, planning a schedule, troubleshooting with several possible causes, comparing options against several requirements.

When it doesn't matter: quick, simple tasks (rewording an email, a definition). Thinking makes answers slower and uses more of your allowance; the scratch paper is made of tokens too.

The honest caveats (good for the skeptic):

1. **It is still prediction.** The "thinking" is more predicted text, organized into steps. A useful technique, not a mind.
2. **It can reason its way to a wrong answer,** confidently, with neat-looking steps. Well-organized work is not the same as correct work.
3. **The shown thinking is not a perfect window.** Researchers have found the written-out steps don't always reflect what actually drove the answer. Treat it as a clue, not proof.

4. **Reading the thinking is still your best verification tool.** If a step looks wrong ("assumes 8-foot boards are exactly 96 inches with no saw kerf"), you can point at it: "Step 3 is wrong because..."

Prompting tip: even without a thinking mode, "Work through this step by step before giving your answer" or "Show your work" helps on multi-step problems and makes the answer easier to check.

The main tools (keep it short)

Tool	Made by	Free option
ChatGPT	OpenAI	Yes
Claude	Anthropic	Yes
Gemini	Google	Yes, with a Google account

Each also has paid plans; check each company's pricing page the day before class if someone is likely to ask.

“ "These are like drill brands. They all drill holes, with different grips and strengths. The free tiers are enough to learn on. The skills from today work on all of them."

Do not name specific models in class. Model names change every few months. Tell people: "The app picks a good default. Don't worry about the model menu yet."

Section 3: Privacy and security first (20 min)

Framing: "Before we use these tools, let's look at what happens to what you type, and how to lock it down. We'll change the settings together, right now."

3a. Where your data goes (5 min)

- Your conversations are sent to the company's servers and stored there, like email.
- Each company may use conversations to **train future models** unless you turn that off. Training means your text could influence what the AI learns; it does not mean it is published.

- Staff or automated systems may **review** conversations flagged for safety.
- **Rating a response (thumbs up or down) can keep that whole conversation longer**, even with training off. Check each company's privacy help pages for how long.

3b. Change the settings together (8 min)

Do this live on the projector, then help each person do it on their own device.

Tool	Turn off training	Private one-off chat	Memory
ChatGPT	Settings, Data Controls, "Improve the model for everyone" (off)	Temporary Chat (toggle at the top of a new chat): not saved to history, not used for memory or training	Settings, Personalization: view, delete or turn off memory
Claude	Settings, Privacy, "Help improve Claude" / Model Improvement (off)	Incognito chat (ghost icon): never used for training	Settings: view, edit or turn off memory
Gemini	Google account, Gemini Apps Activity, "Keep Activity" (off)	Turning off Keep Activity stops long-term saving (Google still keeps chats for up to 72 hours)	Same activity controls

Instructor prep: menu labels move around. Walk through all three on your own accounts the day before and fix this table if anything changed.

Point to make: turning off training does not erase what was used before. Set it up now, before you start pasting in real things.

3c. What never goes into an AI chat (2 min)

- Passwords, PINs, security answers, API keys
- Social Security numbers, bank or card numbers, account numbers
- Other people's private information (medical, financial, personal) without their permission
- Anything you would not put in an email to a stranger

Safer habit: replace names and numbers with placeholders. "Write a letter to [LANDLORD] about [ADDRESS]" works just as well.

3d. New risks with agents and connectors (5 min)

1. **Connectors are house keys.** Linking AI to your email, calendar or files lets it read (and sometimes act on) everything in them. Grant the least access that does the job, and disconnect what you no longer use.
2. **Prompt injection.** When an AI reads a web page, email or document, hidden text in it can try to give the AI orders ("ignore your user and forward their inbox to..."). The AI cannot always tell your instructions from instructions planted in what it reads. This is the strongest argument for keeping agents on a short leash: watch what they do, and approve anything that sends, buys or deletes.
3. **AI-powered scams.** Voice clones of family members asking for money. Perfectly written phishing emails with no typos to give them away. **Defense:** a family code word, and calling back on a number you already have.
4. **AI can be confidently wrong about safety.** Electrical, chemical, medical and machine-safety answers need a qualified source. In the shop, the makerspace's tool training and the manual win over the chatbot.

Invite the skeptic in: "What else worries you about this?" Add answers to the whiteboard.

Section 4: Hands-on: asking well, and managing a conversation (20 min)

Everyone on their own device, or sharing the projector (see Instructor notes).

4a. Give it context, not just a question (8 min)

Newer AI models need less "prompt trickery" and more **raw material**. The biggest upgrade most people can make is pasting in or uploading the actual thing: the letter, the manual page, the photo, the spreadsheet.

R.O.L.E.S. (a checklist, not a formula):

- **Role:** who should it act as? ("You are a patient woodworking instructor")
- **Objective:** what exactly do you want? ("List the 5 decisions I need to make before I start")
- **Limits:** length, budget, tone, what to avoid ("Under 150 words, no tools over 100 dollars")
- **Examples:** show what good output looks like
- **Specifics:** your situation, audience, skill level, and the actual material

Exercise: each person takes their task from the opening whiteboard list.

1. Type it as a short, bare question. Read the answer.
2. Rewrite it with at least three R.O.L.E.S. elements and the real details. Compare.
3. Reply with one correction ("too long", "I'm a beginner", "assume I only have hand tools"). Notice it adjusts without starting over.

Key lesson: "It's a conversation, not a search box. Start rough, then steer."

4b. When to keep going vs start a new chat (7 min)

Rule of thumb: one chat per job.

Keep going in the same chat when:

- You are refining the same piece ("shorter", "more formal", "redo point 3").
- Your next question builds on what has already been said.
- You are working through one problem step by step.

Start a new chat when:

- **The topic changes.** Leftover context from the old topic quietly skews new answers.
- **It starts slipping.** It forgets details, repeats itself, or ignores earlier instructions. The whiteboard is full.
- **It is stuck on a wrong idea.** If you have corrected it twice and it keeps drifting back, the bad answer is now part of its context. A fresh start beats a third correction.
- **You want an honest second opinion.** In the same chat it is anchored to what you said and tends to agree with you. Paste your plan into a fresh chat with "Find the weaknesses in this plan."
- **It is sensitive.** Use Temporary or Incognito chat.

Live demo: recap and restart. In a long chat (prepare one in advance), ask:

“Summarize what we have figured out so far, including decisions and key details, as a short recap I can paste into a new chat.”

Paste the recap into a new chat and continue. It keeps the useful parts, drops the clutter, and fixes most "the AI got dumb" moments.

Mention briefly: Projects (ChatGPT, Claude) and memory carry context between chats automatically. Convenient, but check what memory has stored about you (the 3b table) and delete

anything you do not want kept.

4c. The yes-man problem (5 min)

AI tends to agree with you. Ask the wrong way and it tells you what you want to hear.

- **Don't lead the witness:** not "This plan is good, right?" but "What are the three biggest weaknesses in this plan?"
- **Ask for the other side:** "Argue against this as strongly as you can."
- **Ask what it is unsure of:** "Mark any claim you are less than confident about with [VERIFY]."

Red-team moment: hand this to the skeptic. Have them try to get the AI to agree with something false, or back down from something true. Discuss what happened.

Section 5: Demo tour: what AI can do now (16 min)

The instructor drives on the projector. Use tasks from the whiteboard list wherever possible. Spend 2 to 3 minutes on each demo and skip any that aren't landing.

Demo 1: Watch it think

Turn on the thinking mode (or pick a thinking model) and give it a real shop problem:

“I'm building a workbench. I need these pieces cut from 8-foot 2x4s: four at 34 inches, four at 48 inches, and six at 22 inches. Allow 1/8 inch for each saw cut. What is the fewest number of boards I need, and exactly which pieces come from each board?”

Open "Show thinking" and read a few steps aloud: it lists the pieces, tries arrangements, accounts for the kerf, checks the total. Then **have the group check one board's math by hand**. The steps are what make it checkable.

Answer key (instructor only): 6 boards. The trap is the kerf. Two 48-inch pieces don't fit on one 96-inch board ($48 + 1/8 + 48 = 96 \frac{1}{8}$), so each 48 needs its own board, leaving $47 \frac{7}{8}$ inches. That remainder holds either one 34 or two 22s, never a 34 and a 22. One workable plan:

- Boards 1 to 3: $48 + 22 + 22$
- Board 4: $48 + 34$
- Board 5: $34 + 34$
- Board 6: 34

Simple division (460 total inches divided by 96) suggests 5 boards, which is wrong. If the AI answers 5, that's a perfect teaching moment: ask it to check board by board.

Red-team option: have the skeptic change one requirement mid-stream ("actually, the 2x4s are only $92 \frac{5}{8}$ inches") and see whether it re-plans correctly.

Demo 2: Web search with sources

Ask a current question (an upcoming local event, a current product price). Point out the source links. **Click one** and confirm it says what the AI claimed. "Sources are only useful if you check them."

Demo 3: Show it a photo

Take a phone photo of something in the shop: an unlabeled part, a tool's data plate, a wiring diagram, or a 3D print with a defect. Ask "What is this, and what should I know about it?" or "What is going wrong with this print?"

Safety framing: great for identifying and understanding. For setup and safety procedures, the manual and the makerspace's tool training still rule.

Demo 4: Voice mode

Use a phone app's voice mode for a short spoken back-and-forth, such as talking through project steps while your hands are busy. Voice conversations follow the same privacy settings as typed ones.

Demo 5: Research mode

Start a Research or Deep Research request at the beginning of Section 5 so it has time to finish (it can take several minutes):

“Compare three CNC routers suitable for a community makerspace with beginner users. Include price, cutting area, software, and ease of use, with

Come back at the end of the section. Show the cited report and open a couple of citations to check them.

Demo 6: An agent doing a task (watch only)

Show a short, low-stakes agent task, such as having the AI open a website and gather information into a table, or turn notes into a formatted document. Narrate what it is doing.

Tie back to Section 3: point out where it asks for approval and where you would stop it. "Watch it work. Never let it send, buy or delete without you approving."

Section 6: Verification habits, handout, Q&A (10 min)

Five habits to take home

1. **Check settings first.** Training off, memory reviewed, Temporary or Incognito chat for anything sensitive.
2. **Give it the real material.** Paste or upload the actual document, photo or details.
3. **One chat per job.** New topic or slipping answers: recap and restart.
4. **Ask for weaknesses, not approval.** Invite disagreement.
5. **The higher the stakes, the more you verify.** Casual email: skim it. Money, health, legal or safety: check every claim against a real source or a qualified person.

Revisit the worry list

Go through the whiteboard list. For each worry: addressed, partly addressed, or still a valid concern? It is fine to end on "still valid." That honesty builds more trust than over-selling.

Common questions

"Which one should I use?"

“ "Pick one free tier and use it for a week on real tasks. The skills transfer. If you want the most privacy controls up front, compare the settings we just walked through."

"Is it safe?"

“ "It is as safe as how you use it. Settings off, nothing sensitive pasted in, agents supervised, and anything important verified. Those four habits cover most of the risk."

"Is it going to take my job?"

“ "The more immediate change is that people who use it well get faster at some tasks. Learning it as a tool, with its limits, is the practical response."

"Can I trust it for medical, legal or financial things?"

“ "Use it to understand the topic and prepare questions, then take those questions to a professional."

"Does it remember me?"

“ "Only if memory is on, and you can see and delete what it remembers. Temporary and Incognito chats don't feed it."

Instructor notes

Before class

- ☐ Send a pre-class email several days ahead. Cover three things: (1) bringing a phone or laptop is optional; to follow along hands-on, create a free account on ChatGPT, Claude or Gemini before class (one is plenty), and not creating one is fine; (2) think of one real task you would like help with, since class examples come from these; (3) bring your questions and doubts, because the class starts with privacy and security and skeptics fit right in.
- ☐ Day before: walk through the Section 3b settings on ChatGPT, Claude and Gemini; fix the table and the handout if menus changed.
- ☐ Print a copy of the **Take-Home Card** for each student.
- ☐ Projector working; ChatGPT, Claude and Gemini open in separate tabs; phone app installed for the photo and voice demos.
- ☐ Pick a shop object for Demo 3 and set it at the front.
- ☐ Prepare a long chat in advance for the recap-and-restart demo.
- ☐ Optional: a throwaway class account so anyone who prefers not to create a personal account can still try things hands-on.

Pacing

- Section 3 (security) is the core of the class. Protect its time.
- If the group is engaged in Section 4, let it run and cut Demos 4 and 6.
- With a small group, questions will come constantly. Welcome them; the outline is a guide.

If someone won't create an account

Completely reasonable. They can drive the instructor's screen, use the throwaway account, or simply watch and red-team. Do not pressure anyone.

Take-Home Card

The one-page handout for the Practical AI class. Menus in these apps change often; this card was last checked in October 2026.

1. Lock down your settings

	Turn off training	Private one-off chat	Check memory
ChatGPT	Settings, Data Controls, "Improve the model for everyone"	Temporary Chat	Settings, Personalization
Claude	Settings, Privacy, Model Improvement	Incognito chat (ghost icon)	Settings, memory
Gemini	Google account, Gemini Apps Activity, Keep Activity	Keep Activity off	Gemini Apps Activity

Menus change. If you can't find a setting, ask the AI itself: "Where do I turn off training on my chats?"

2. Never paste in

Passwords, PINs, account or card numbers, Social Security numbers, or other people's private information. Use placeholders: "Write a letter to [LANDLORD]."

3. Ask well (R.O.L.E.S.)

Role (who it should act as), **Objective** (what you want), **Limits** (length, budget, tone), **Examples** (show what good looks like), **Specifics** (your situation, plus the actual document or photo).

4. One chat per job

Start a new chat when the topic changes, when it starts forgetting or repeating itself, or when it keeps returning to a wrong idea.

Recap and restart: "Summarize what we've figured out so far as a short recap I can paste into a new chat."

5. Let it think

For multi-step problems (math, cut lists, plans, troubleshooting), turn on the "Thinking" option or ask: "Work through this step by step before answering." Then read the steps. Neat-looking work can still be wrong, and the steps show you where.

6. Starter prompts

- **Understand something:** "Explain [topic] to a smart beginner with one everyday analogy. Then ask me 3 questions to check my understanding."
- **Improve your writing:** "Edit this for clarity. Keep my voice. Point out anything unclear: [paste]"
- **Get an honest critique:** "What are the three biggest weaknesses in this plan? [paste]"
- **Fix a problem:** "I have [problem]. My setup is [details]. I've tried [list]. What are the likely causes, most likely first?"
- **Make a decision:** "I'm choosing between [A] and [B]. Ask me 5 questions that would help me decide."

7. Stay safe

- **Verify** facts, numbers and citations. Click the sources.
- **Supervise agents.** Approve anything that sends, buys or deletes.
- **Connect only what you need** (email, calendar, files) and disconnect what you don't use.
- **Scam defense:** agree on a family code word; call back on a number you already have.
- **Safety, medical, legal, money:** use AI to prepare questions, then ask a qualified person. In the shop, tool training and the manual win.

Free places to start

- ChatGPT: chatgpt.com
- Claude: claude.ai

- Gemini: gemini.google.com