

## **COURSE: Exploration of 3D Development Using Tinkercad**

Designed for learners in Grades 6-8.

### **COURSE DESCRIPTION**

Students answer questions such as “What is the Engineering Design process?” and “How can I use it to design in 3D printing for a purpose?” Students will demonstrate proficiency in using Tinkercad tools from design to print out.

### **LESSON SEQUENCE AND LEARNING TARGETS**

#### **Lesson One:** **Computer-Aided** **Design Tool**

- ☐ I can navigate Tinkercad to change the workspace and use different design tools.
- ☐ I can create a 3D Tent Name Tag.

#### **Lesson Two:** **Modeling**

- ☐ I can use Tinkercad to design an object to print at full scale.
- ☐ I can use Tinkercad to create a model of a bag tag to print.

#### **Lesson Three:** **Modifying Designs**

- ☐ I can search and modify an object already found in Tinkercad.
- ☐ I can begin to ideate a design of an object that could solve a real-world problem.

#### **Lesson Four:** **Design a Stamp**

- ☐ I can create a detailed blueprint and sketch of a design solution.
- ☐ I can mirror an image.
- ☐ I can design a product solution.

#### **Lesson Five: CAD** **Applications**

- ☐ I can understand 3D printing applications.
- ☐ I can identify and define a design that solves a problem using CAD software.

#### **Lesson Six: Design** **Process**

- ☐ I can use the Engineering Design Process to solve a problem for a user.
- ☐ I can work in teams to develop a product solution.

#### **Lesson Seven:** **Slicing and** **Preparing for Print**

- ☐ I can choose the best orientation of a model for 3D printing.
- ☐ I can calculate the cost of a 3D print.
- ☐ I can prepare and modify a file in a slicing software for 3D printing.

#### **Lesson Eight:** **Printing in 3D**

- ☐ I know the difference between 2D and 3D printers.
- ☐ I know the parts of a 3D printer.
- ☐ I can troubleshoot for and print an object on a 3D printer.

## Lesson Nine: Test and Improve

- ☐ I can test a product solution.
- ☐ I can gather data from my test and suggest improvements.

## Lesson Ten: Reflect and Share

- ☐ I can reflect on my design and my development experience.
- ☐ I can share my results.

## COURSE OVERVIEW AND PACING GUIDE

Lesson	Learning Targets	Materials Needed	Pacing (60 min.)
Computer-Aided Design Tools	<ul style="list-style-type: none"> <li><input type="checkbox"/> I can navigate Tinkercad to change the workspace and use different design tools.</li> <li><input type="checkbox"/> I can create a 3D Tent Name Tag</li> </ul>	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> 2D and 3D Shapes and Tinkercad (10 min.)</p> <p><b>Explain:</b> Tinkercad Workspace (10 min.)</p> <p><b>Elaborate:</b> Design with Tinkercad (30 min.)</p> <p><b>Evaluate:</b> Learning Review (5 min.)</p>
Modeling	<ul style="list-style-type: none"> <li><input type="checkbox"/> I can use Tinkercad to design an object to print at full scale.</li> <li><input type="checkbox"/> I can use Tinkercad to create a model of a bag tag to print.</li> </ul>	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> Back to Tinkercad (10 min.)</p> <p><b>Explain:</b> Design a Bag Tag (25 min.)</p> <p><b>Elaborate:</b> Saving 3D Files (10 min.)</p> <p><b>Evaluate:</b> Learning Review (5 min.)</p>

Modifying Designs	<ul style="list-style-type: none"> <li>❑ I can search and modify an object already found in Tinkercad.</li> <li>❑ I can begin to ideate a design of an object that could solve a real-world problem.</li> </ul>	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> Back to Tinkercad (10 min.)</p> <p><b>Explain:</b> Search an Object in Tinkercad (10 min.)</p> <p><b>Elaborate:</b> Modify Objects in Tinkercad (20 min.)</p> <p><b>Evaluate:</b> Real-World Objects in Tinkercad and Learning Review (15 min.)</p>
Design a Stamp	<ul style="list-style-type: none"> <li>❑ I can create a detailed blueprint and sketch of a design solution.</li> <li>❑ I can mirror an image.</li> <li>❑ I can design a product solution.</li> </ul>	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> Engineering Design Process (5 min.)</p> <p><b>Explain:</b> Mirroring (15 min.)</p> <p><b>Elaborate:</b> Imagine and Design (30 min.)</p> <p><b>Evaluate:</b> Learning Review (5 min.)</p>
CAD Applications	<ul style="list-style-type: none"> <li>❑ I can understand 3D printing applications.</li> <li>❑ I can identify and define a design that solves a problem using CAD software.</li> </ul>	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> CAD Applications (15 min.)</p> <p><b>Explain:</b> 3D Printing in the Future (10 min.)</p> <p><b>Elaborate:</b> Solve a Problem Using CAD (25 min.)</p> <p><b>Evaluate:</b> Learning Review (5 min.)</p>

Design Process	<input type="checkbox"/> I can use the Engineering Design Process to solve a problem for a user. <input type="checkbox"/> I can work in teams to develop a product solution.	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<b>Engage:</b> Pique Interest and Prior Knowledge (5 min.) <b>Explore:</b> Engineering Design Process (5 min.) <b>Explain:</b> Problem to Solve (10 min.) <b>Elaborate:</b> Designing Solutions (35 min.) <b>Evaluate:</b> Learning Review (5 min.)
Slicing and Preparing for Print	<input type="checkbox"/> I can choose the best orientation of a model for 3D printing. <input type="checkbox"/> I can calculate the cost of a 3D print. <input type="checkbox"/> I can prepare and modify a file in a slicing software for 3D printing.	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<b>Engage:</b> Pique Interest and Prior Knowledge (5 min.) <b>Explore:</b> Orientation (15 min.) <b>Explain:</b> Slicing Software (15 min.) <b>Elaborate:</b> Improve Print and Costing (20 min.) <b>Evaluate:</b> Learning Review (5 min.)
Printing in 3D	<input type="checkbox"/> I know the difference between 2D and 3D printers. <input type="checkbox"/> I know the parts of a 3D printer. <input type="checkbox"/> I can troubleshoot for and print an object on a 3D printer.	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<b>Engage:</b> Pique Interest and Prior Knowledge (5 min.) <b>Explore:</b> Printers (5 min.) <b>Explain:</b> Making the Printer Work (10 min.) <b>Elaborate:</b> Troubleshoot and Print Time (30 min.) <b>Evaluate:</b> Learning Review (5 min.)

Test and Improve	<input type="checkbox"/> I can test a product solution. <input type="checkbox"/> I can gather data from my test and suggest improvements.	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> Testing Criteria (10 min.)</p> <p><b>Explain:</b> Testing Solutions (20 min.)</p> <p><b>Elaborate:</b> Improve Design Solution (20 min.)</p> <p><b>Evaluate:</b> Learning Review (5 min.)</p>
Reflect and Share	<input type="checkbox"/> I can reflect on my design and my development experience. <input type="checkbox"/> I can share my results.	<ul style="list-style-type: none"> <li>- Tinkercad Classrooms available on teacher's laptop</li> <li>- Tinkercad Keyboard Shortcuts sheets (1 per student)</li> <li>- Classroom whiteboard and markers</li> <li>- Presentation material (poster board, printer paper, chart paper)</li> </ul>	<p><b>Engage:</b> Pique Interest and Prior Knowledge (5 min.)</p> <p><b>Explore:</b> Redesign Solution (10 min.)</p> <p><b>Explain:</b> Present Design Process (20 min.)</p> <p><b>Elaborate:</b> Share Results (20 min.)</p> <p><b>Evaluate:</b> Learning Review (5 min.)</p>

## **COURSE PREPARATION**

Students will create 3D Designs using Tinkercad. There are 2 options for having students log in to Tinkercad:

### **Option 1: Student logs in with Class Code and Nickname provided by Teacher** ***Teacher setup is required.***

#### **Teacher Setup Directions:**

1. Access Tinkercad Classrooms (<https://www.tinkercad.com/teach>), by selecting Classes under the profile navigation.
2. If you do not see this feature, please confirm you have identified as a teacher on the Teach page. If you've previously identified as something other than a teacher, you can contact Tinkercad support to have your account corrected.
3. Select "Create new class." You will be prompted to create a name for your class and to then add the grades/ages taught and the subject. Then click on the "Create class" button.
4. Click on the "Add students" button, and add each student's name (anything identifiable to you) and a Nickname that your student will use to enter Tinkercad. Tinkercad will auto-generate a suggested Nickname based on the student name you enter. (You can customize it to anything you or the student prefers.) Click "Save changes" to add the student to the class. Repeat these steps for all students. Click on the "Back to class" button to return to the roster.
5. From the Class Roster page, click on the "Class Code" button to generate a class code that the students will use to access the class.

### **Option 2: Students log in using their Google Account. - *Teacher setup is not required.***

#### **Student Login Directions**

1. Direct students to click on the "Sign in" button at the top right of the [Tinkercad site](https://www.tinkercad.com).
2. Tell students to click the "Sign in with Google" button and use their information to log in.

