**AP CSP CodeX**

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| **MISSION 11 Spirit Level** | | **Time: 45 minutes** |
| **Project Goal:** Students will use a graphical display to show the position of the CodeX, based on reading the accelerometer.  **Learning Targets**   * I can use code to read the CodeX accelerometer. * I can convert an accelerometer reading to degrees. * I can use functions from the math library. * I can use built-in functions to draw lines and circles on the display screen. | **Key Concepts**   * Meet the accelerometer. There’s one in your cell phone, and in many other devices we use. * Make sure students read the accelerometer toolbox entry! * Convert units generated by the accelerometer into degrees. * Use a bit o’ math for scaling the degrees to a range suitable for the moving “bubble”. * The CodeX screen is a graphical user interface and can display lines, circles and text. | |
| **Assessment Opportunities**   * Mission 11 Assignment * Spirit\_Level program | **Success Criteria**   * Read data from the accelerometer * Convert data to degrees * Draw lines on the display screen * Use data from the accelerometer to draw a circle * Create and call a function with a return | |
| **AP CSP Framework**  **DAT-2.A** Describe what information can be extracted from data.  **AAP-3.D** Select appropriate libraries or existing code segments to use in creating new programs.  **Computational Thinking Practice 3.A** Generalize data sources through variables.  **Computational Thinking Practice 4.C** Identify and correct errors in algorithms and programs, including error discovery through testing. | **Materials**   * Mission 11 Assignment / Answers * [Mission 11 Kahoot Review](https://create.kahoot.it/share/firia-labs-mission-11/e88d6087-ab8b-4a68-a332-6bb6177a87ff) * Solution code for two objectives, with functions, and the challenge. | |
| **Teacher Notes**   * The assignment is best completed digitally. Prepare the assignment for distributing through your LMS. * Encourage the students to do as much code on their own as they can, and use the CodeTrek to check their work, or as a hint when needed. * The assignment adds an extra step to complete after Objective 6, before turning in the program. * If you have time at the end of the lesson, use the [Mission 11 Kahoot Review](https://create.kahoot.it/share/firia-labs-mission-11/e88d6087-ab8b-4a68-a332-6bb6177a87ff). * Another suggestion for assessment is for students to keep a daily journal, or use a reflection form for students to process information they learned and reflect on questions they may still have. * Refer to the Python with CodeX Curriculum Guide or Mission 11 Lesson Prep (found in the l[earning portal](https://learn.firialabs.com/curricula/python-with-codex/teachers-resources/codex-teacher-materials)) for more information. * The teaching guide (below) gives the narration for one way to present the lesson. | | |

**Teaching Guide**

The actual coding part of this Mission is about one normal class period.

**Warm-up (5 minutes)**

🧑‍🤝‍🧑 **Discuss** – Use a discussion strategy, like journaling, working at boards, selecting random students, or a form of think-pair-share.

* **Topic:** Bring a physical level to school and show it to the students. Discuss how a mechanical spirit level works. The “spirit” is a liquid with space for a bubble, which will be in the center of the tube when it is horizontal. Today’s program will create a digital level using the CodeX and its accelerometer.

**Activity – Mission #10 (35 minutes)**

💻 Randomly group students into pairs for pair programming (or they can work individually).

For pair programming, students log in to one computer. Two computers can be used if they want to have the assignment open on one computer and CodeSpace on the other computer.

Students go to [make.firialabs.com](http://make.firialabs.com) and should be at the beginning of Mission 11.

💡 **Teaching tip – Objective 1:**

The objective introduces the accelerometer. It returns three values for 3 dimensions – x, y and z. Students will work with x (and y in the challenges). There is a bit of reading for this objective so students understand what the accelerometer is and what it does, and the values it will return. Use the activity guide for talking points and review.

💡 **Teaching tip – Objective 2:**

This objective shows the code for reading the accelerometer. Use the activity guide for talking points and review.

💡 **Teaching tip – Objective 3:**

This objective uses functions from the math library. If your students are not yet in trig., don’t worry about explaining the math. They can just copy the code.

💡 **Teaching tip – Objective 4:**

This objective introduces line and circle for the first time. Students can fill the screen with any color and then draw lines and circles on the screen. There is a bit of reading on this objective so students can understand how the simple graphics work and the orientation of the screen.

NOTE: If displaying on a screen, using a BLACK fill and WHITE lines is easier to see.

Here are all the commands students could use. These will be used in a future lesson. (<https://docs.firialabs.com/codex/canvas.html>)













💡 **Teaching tip – Objective 6:**

Students complete the Spirit Level program using CodeTrek. Code solution for this objective is available.

💡 **Teaching tip – After Objective 6:**

The students create a function with a return for converting an accelerometer into degrees. Instructions are on the assignment document. This is a good time to remind students about abstraction and how useful it can be in programming.

Two options are given. Both are fairly simple, and students should be able to code both. When creating a function for the background, students should NOT include the constant CENTER.

Code solution for functions is available.

💡 **Teaching tip – Challenge:**

If students have time, have them try the challenge. This gives them an opportunity to apply their knowledge in a new situation. A code solution for the challenge is available.

✅ Assignment is complete and ready to turn in.

**Wrap-Up (5 minutes – optional)**

You can discuss with students other applications for the CodeX accelerometer. Let them brainstorm ideas.

Use a formative assessment for the wrap-up.

✅ **IMPORTANT!!**

* Remind students to clear their CodeX.

Formative Assessment:

* Daily reflection journal
* [Mission 11 Kahoot Review](https://create.kahoot.it/share/firia-labs-mission-11/e88d6087-ab8b-4a68-a332-6bb6177a87ff)  (in class or individual)
* Exit ticket or group review on the accelerometer, tuples, or other topics used in the lesson