MISSION 10: Reaction Tester	Time: 45-60 minutes

Overview:

In this project, students will create a game that measures the time between the display lighting up and a button being pressed. After the measurement is complete, this time will be scrolled across the display until a button is pressed to restart the game.

Cross Curricular:

- **SCIENCE:** The mission creates a program that measures reaction time. This could be made into a lab, following the scientific method. Students could keep track of their times, plot their times, compare to other students, experiment with ages, etc.
- **MATH:** Students can make a list of their times and the data can be used to calculate average or median. Students can create various charts or graphs with their data.
- **MATH:** Change the delay times in increments, plot the points and then develop the algebraic equation to reaction times (y = mx + b).
- Supports **language arts** through reflection writing.

Materials Included in the learning portal Teacher Resources:

Mission 10 Slidedeck

The slide deck is for teacher-led instructions that let you guide students through the material using the slides. It is an alternative to the students reading a lot of instructions in CodeSpace. The slides mirror the instructions, with simplified language that is chunked into smaller sections at a time. The information is shown on slides with “Objective”. The tasks to complete are on slides with “Mission Activity''.

Mission 10 Workbook

The workbook can be used instead of slides for student-led or independent work. It is an alternative to students reading a lot of instructions in CodeSpace. It mirrors the instructions (and the slide deck), with simplified language that is chunked into smaller sections at a time. Each objective is on its own page. The tasks to complete are labeled “DO THIS” and have a robot icon next to it.

Mission 10 Log

This mission log is the worksheet for students to complete as they work through the mission. It should be printed and given to each student before the mission starts. They write on the mission log during the assignment and turn it in at the completion of the mission (assignment).

Mission 10 Lesson Plan

The lesson plan comes from the original CodeX Teacher Manual and is included here for easy reference.

Mission 10 Remix Folder

Following Mission 10, students should complete a remix of their code.

Links:	Formative Assessment Ideas:
• Mission 10 Solution (Reaction Time) ○ A code solution to Mission 10 in a text file. • Mission 10 Review Kahoot	• Exit ticket • Mission log completion • Completed program • Mission 10 Review Kahoot • Student Reflection

Vocabulary:

- **Computer Clock:** Electronic clock circuits; the heartbeat of the computer. The tick of the clock moves through the code one line at a time. It is also used in the sleep function, scheduled activities within the CPU, and everything timing related on the computer.

Preparing for the lesson:

Students will use the Codex throughout the lesson. Decide if they will work in pairs or individually.

- Look through the slide deck and workbook. Decide what materials you want to use for presenting the lesson. The slide deck can be projected on a large screen. The workbook (if used) can be printed or remain digital through your LMS.
- Be familiar with the Mission Log (assignment) and the questions they will answer.
- Print the Mission Log for each student, or prepare it digitally.
- The mission program does not need to be portable. If you want students to use the CodeX without a cable, then have batteries available. This is a good mission to make portable.

Lesson Tips and Tricks:

💡 **Teaching tip:**

You can use a variety of discussion strategies to get the most engagement from your students. For example, you can have students write their answers before asking anyone for an answer. You can use one of many think-pair-share methods. You can have students write their answer and share with someone, and then have other students share answers they heard from their peers. You can randomly select students to answer.

👫 **Pre-Mission Discussion (Slide 2, page 1):**

Students can write in their log first and then share, or discuss first and then write in their log.

There is one question for the pre-mission. There isn't a "right" answer here. The purpose is to get them thinking about the need for selecting something random. Also, there are real-world applications to what they are learning.

- In this mission you will use a computer clock to measure time. What are things you use a timer for?

💻 **Mission Activities:**

Most of this lesson is on the computer, writing code to make a reaction tester.

- Each student will complete a Mission Log.
- Students could work in pairs through the lesson, or can work individually.
- Students will need the CodeX and USB cable.

💡 **Teaching tip: Objective #1** -- Slides 2-8, Pages 2-5
This objective has two parts. First the code is shown using a list to change all the pixels with one line of code.

The second part is introducing the computer clock and its use of milliseconds.

💡 **Teaching tip: Objective #2** -- Slides 9-11, Pages 6-7
The instructions for displaying a countdown are given. Students learn about display.clear() and use the display.print() command with a scale.

💡 **Teaching tip: Objective #3** -- Slides 12-17, Pages 8-10
Students learn about electronic clock circuits. They also import the entire time module, not just sleep, so they must change the way they call sleep(). Then they learn about getting the clock time using ticks_ms().

Two activities are given for students to complete. They will answer a question in the log. Then they will complete code in CodeSpace by using the computer clock.

💡 **Teaching tip: Objective #4** -- Slides 18-20, Pages 11-12
This objective discusses finding the difference in two clock times.

🗝️ **NOTE:** The digital instructions go through a lot of information about computer clocks and how they roll over like an odometer, so using regular subtraction may occasionally give an incorrect answer. The slide deck does not go over the specifics, but does introduce the ticks_diff() function without going into detail.

Two activities are given for students to complete. They will answer a question in the log. Then they will complete code in CodeSpace by finding the difference of the starting and ending clock time.

💡 **Teaching tip: Objective #5** -- Slides 21-22, Pages 13-14
This objective has students add in an infinite loop so the game can be played over and over again. Students will need to carefully indent all the code inside the while loop. They will also add another wait loop for a button press.

🗝️ **NOTE:** Students should follow the example code carefully to avoid errors.

💡 **Teaching tip: Objective #6** -- Slides 23-24, Pages 15-16
This objective reduces duplicate code by creating a function for the wait loop. The function will be called twice in the infinite loop.

🗝️ **NOTE:** The function should be created above the while loop, near the top of the code.

🗝️ **NOTE:** Remind the students to delete the code they used in the function from the infinite loop before they call the function.

💡 **Teaching tip: Quiz** -- Slide 25, Page 16

Students take a ❓ short quiz. The 3 Quiz questions are below. You can decide if you need to go over the question with your students.

💡 **Teaching tip: Objective #7** -- Slides 26-27, Page 17

This short objective just adds one line of code to the program -- a way to reset the button press.

💻 Mission Complete:

This mission ends with a completed, working program that will act as a reaction tester game. You need to decide how you will use the program for assessment. You could:

- Go to each student and check-off their code
- Have the students download their code to a text file and turn it in using your LMS
- Have students print their code (either download and then print the text file, or print a screenshot)
- Have students switch computers and run each other's code. Fill out a simple rubric and turn in to teacher
- Any other way that works for you

👫 Post-Mission Reflection:

The post-mission reflection asks students to think about real-world applications for animation, and also to reflect on their coding experience during the mission. You can change the questions if there is something else you want to emphasize with your students.

- Computers measure time in all types of applications. Name some applications where a computer will measure time:
- What is something new you learned from completing this mission?

End by collecting the Mission Log and any formative assessment you want to include.

💻 IMPORTANT Clearing the CodeX:

The students have already created a "Clear" program. Students should open and run "Clear" at the end of each class period.

SUCCESS CRITERIA:

- ❑ Give the player a 3-2-1 countdown.
- ❑ Program a random delay so the player can't "guess" the timing.
- ❑ Measure the time until a button press occurs.
- ❑ Display the reaction time.
- ❑ Wait for a button press, then restart the game.
- ❑ Use functions to reduce repetition and to organize your code.

❓ Quiz Questions