Unit 1 Lesson 1

Intro to Problem Solving

Resources

Name(s)_____ Period _____ Date _____

Activity Guide - Aluminum Boats

Goal

Build a boat that holds the most possible pennies, using a piece of aluminum foil. You will build two boats and will try to improve your design between the first and the second.

Rules

- You may only use a single piece of foil to build your boat
- You may not touch or adjust your boat once it is in the water
- You must add pennies one at a time

Develop a Plan

- What kind of boat does your group plan to make? Write a description or draw a picture below.

- What are the strengths of this design? What possible weaknesses might this design have?

Test Your Boat

- How many pennies did your boat hold?

- Why did your boat eventually sink? What needs to be improved?

Evaluate and Improve

- What are the most common kinds of problems you see among the boats tested?

- What ideas seem to be working well?

Develop a Plan

- What kind of boat does your group plan on making? Write a description or draw a picture below.

- What are the strengths of this design? What possible weaknesses might this design have?

Test Your Boat

- How many pennies did your group's new design hold?

- Why did your boat eventually sink? What needs to be improved?

Reflect

- What was your favorite part of this activity? What was the most challenging for you? Were they the same?

- Why do you think we're doing this activity in a computer science class?

Unit 1 Lesson 2

The Problem Solving Process

Resources

Name(s)_____ Period _____ Date _____

Activity Guide - The Problem Solving Process

The Problem Solving Process

Having a strategy for approaching problems can help you develop new insights and come up with new and better solutions. This process is generally useful for solving all kinds of problems.

- **Define**
    - What problem are you trying to solve?
    - What are your constraints?
    - What does success look like?
- **Prepare**
    - Brainstorm / research possible solutions
    - Compare pros and cons
    - Make a plan
- **Try**
    - Put your plan into action
- **Reflect**
    - How do your results compare to the goals you set while defining the problem?
    - What can you learn from this or do better next time?
    - What new problems have you discovered?

What it Looks Like

You're going to list the strategies and processes you and your classmates already use for each step in this process. Fill out the tables below for each of the three problems.
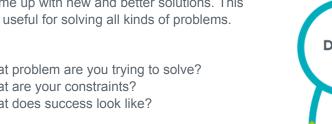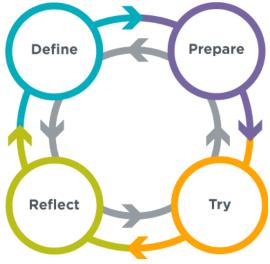
Aluminum Boats

For each step in the Problem Solving Process list the parts of this activity you believe fall within that step

- **Define**

- **Prepare**

- **Try**

- **Reflect**

What strategies did you use in solving this problem that could help you solve other problems?

A Problem You Are Good at Solving

You should have brainstormed a type of problem that you're good at solving. Write down the steps of your process that you believe fall into each step of the Problem Solving Process

Type of Problem: _____

- **Define**

- **Prepare**

- **Try**

- **Reflect**

What strategies do you use in solving this problem that could help you solve other problems?

A Problem You and a Classmate Want to Get Better at Solving

Find a classmate and talk to figure out a type of problem you both could get better at solving. Fill out the questions below with strategies or steps you would want to use to try to solve this problem using the problem solving process.

Type of Problem: _____

- **Define**

- **Prepare**

- **Try**

- **Reflect**

What strategies could you use in solving this problem that could help you solve other problems?

Unit 1 Lesson 3

Exploring Problem Solving

Resources

Name(s)_____   Period _____ Date _____

Activity Guide - Using the Problem Solving Process

Word Search

Overview
Working with a team find the following words in the grid. They may be horizontal, vertical, or diagonal in any direction.
DEFINE, **PREPARE**, **TRY**, **REFLECT**, **PROBLEM**, **SOLVE**, **COMPUTER**, **SCIENCE**

Objective
Find and circle all 8 words as quickly as you can!

```
E S Q H J H R C F A X M G M U E B L N I
S R K E R E T U P M O C E C M Z T Y J C
D X A P N X Q L Y V K L S X X N C E H N
J M X P K W W O J Q B B O Q M H E A H T
B I U O E Y H K M O A R L F R D L P H A
N J H T Y R A E R C F L V M S C F A J M
T I R Y Q W P P H D X Q E Q U N E R G S
H Y R I M I X D Z K B M N G O J R B K U
P U B U E U J E G D T F B D T I M V V P
H V W S K F D G K V D M S O X Y O R S F
S C I E N C E W P Q T E O R I A S Q M U
H R G D Y V N H I J D C F G V H E M Z M
U O H H N A G X O Q K K B I G M T W O L
O P E I O Q G B A R V H P N N A Z E X V
Y I S W E N R N U U W G H X H A E B O P N
L X D J X R P V Y J H U H X D Y F O I D
F U D J X V U K F C V D Q B P D Z I B D
F B R D S I W P K F K V T R D R G Y C R
Y E T Y O D M X H L L V P T J V I J C D
H E X K R O I P B W E T O Y X I B W V O
```

Once You're Done
Head to the last page of the activity guide and fill in the row there for the "Word Search" in the table.
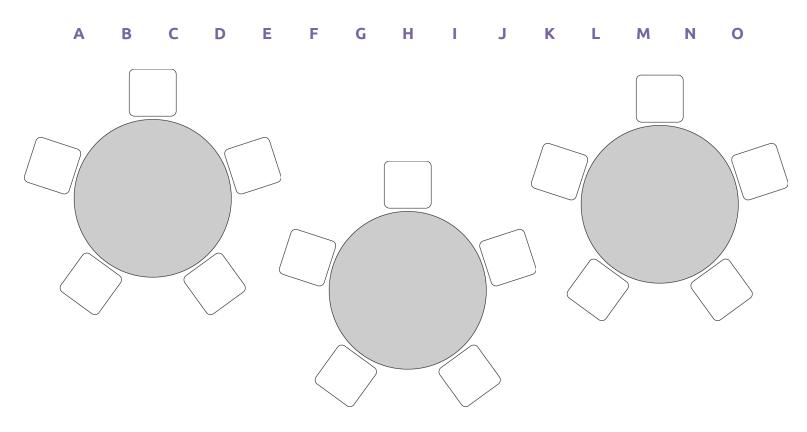
Birthday Guests

Overview

A big group of 15 guests is getting together at a restaurant for a birthday. The restaurant has 3 tables that can each seat only 5 people. Below you can find some information about the people who are attending the party.

Aysha, Ben, Carla, Damien, Eric, Fan, Genaro, Hannah, Isaias, Jessica, Kyla, Laila, Max, Nazek, Owen

Close Friends (Try to put them together)	**In a Fight** (Try to keep them apart)
Aysha and Damien	Aysha and Genaro
Max and Isaias	Ben and Hannah
Nazek and Laila	Fan and Max
Owen and Genaro	Damien and Laila
Ben and Jessica	Isaias and Owen
Genaro and Eric	Kyla and Jessica

Objective

Find the best possible arrangement of guests at the party. Draw your solution in the space below. To help you can cross out the letters of the names you've assigned in the row below.

A   B   C   D   E   F   G   H   I   J   K   L   M   N   O

Once You're Done

Head to the last page of the activity guide and fill in the row there for the "Birthday Guests" in the table.

Plan a Trip

Overview
You and your friends will be going on a trip. You've got the entire school day to travel, and you need to get back to school by the end of the trip, but otherwise how your trip goes it up to you. Plan the best trip that you can!

Explore the Tool
Head to https://www.google.com/maps and search for your school. Look at the different options for finding directions to other locations. Don't worry about making a plan yet, but make sure you understand what kinds of information are available.

Develop Goals
Talk with your group for a few minutes. What are the most important things about your trip? Do you care what you see? How you get there? How long it takes? What it costs? Write down the goals you'll use to decide what makes a good plan.

Goals	How My Plan Helps Reach this Goal
Trip should only take one school day	
We want to go to _____	
The time we spend getting there should be less than _____	

Make a Route
Every member of your group should separately start planning your trip. You should select what places you want to go and what activities you want to do along the way. For each goal your group chose, list how your trip helps to reach it in the right column. In the space below record all the stops along your trip.

Stops on My Trip

Things We'll See

Share Your Route and Get Feedback

Share the route you developed with your teammates and explain why you think it is the best possible route given the goals you chose. Afterwards, record their feedback and reactions to your route in the space below. Is there anything that needs to change? How could your route improve?

Improve and Finalize

Using the feedback from your teammates update your route. In the space below write down the new trip that you and your group agreed on.

Stops on Our Trip

Things We'll See

Once You're Done

Head to the last page of the activity guide and fill in the row there for the "Plan a Trip" in the table.

Problem Solving Process Notes

Reflecting on Using the Process

How did you use each step of the problem solving process to solve this problem? Give examples of what each step looked like as you were solving that problem.

	Define	Prepare	Try	Reflect
Word Search				
Birthday Guests				
Plan a Trip				

The Purpose of Each Step

For each step in the problem solving process write one sentence explaining its purpose. Why is it included in the problem solving process?

Define:_____

_____

Prepare: _____

_____

Try:_____

_____

Reflect:_____
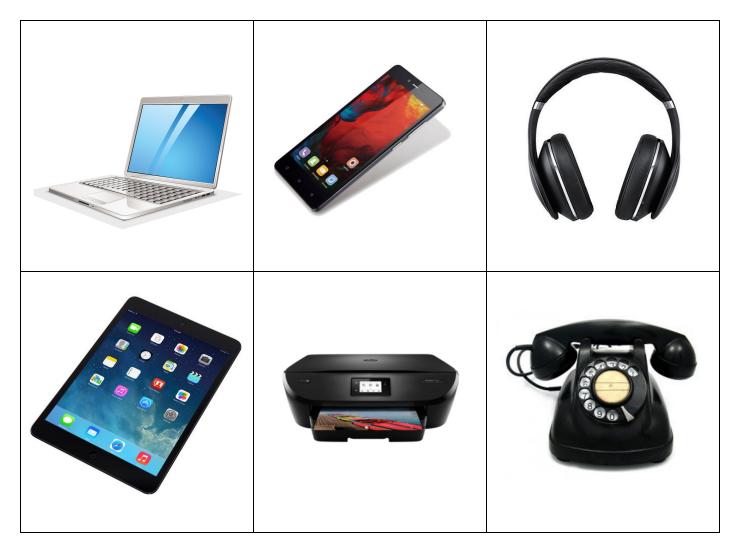
_____

Defining Problems with Questions

Before starting to solve a problem it's important that you have defined it well. What questions or strategies can you use to better define or understand a problem? Record them in the space below.

Unit 1 Lesson 4

What is a Computer?

Resources

Name(s)_____ Period _____ Date _____

Activity Guide - What Is A Computer? [Set B]

Cut out the following pictures and attach them to your poster

Name(s)_____ Period _____ Date _____

Activity Guide - What Is A Computer? [Set 1]

Cut out the following pictures and attach them to your poster

Unit 1 Lesson 5

Input and Output

Resources

Name(s)_____ Period _____ Date _____
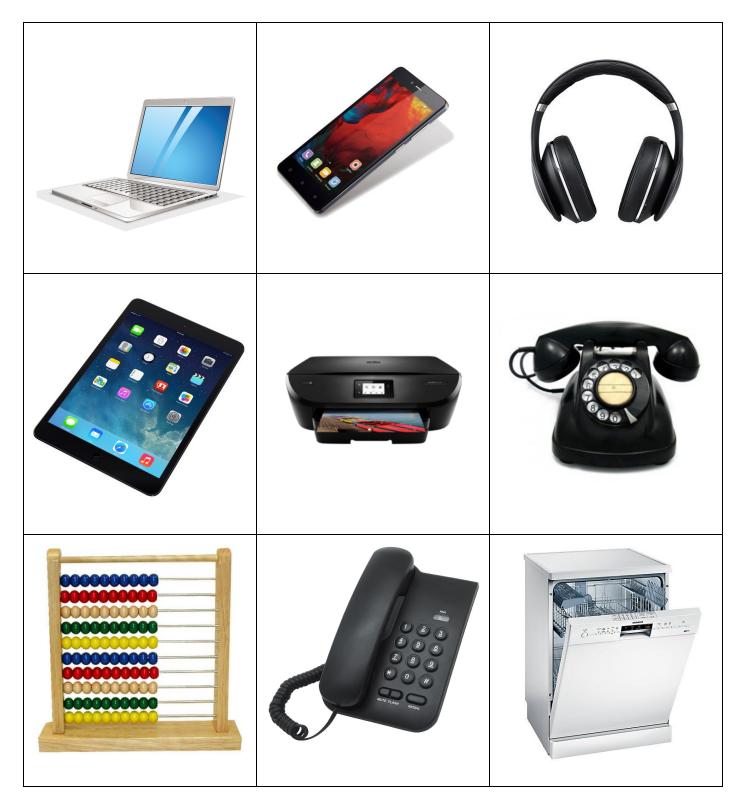
Activity Guide - Inputs and Outputs [Set D]

Vocabulary
- **Input:** A device or component that allows information to be given to a computer
- **Output:** Any device or component that receives information from a computer

Inputs and Outputs
For each category of computer brainstorm as many inputs and outputs as you can.

Computer	Inputs	Outputs
Desktop		
Tablet		
Game System		

Name(s)_____ Period _____ Date _____

Activity Guide - Inputs and Outputs [Set C]

C
D

Vocabulary
- **Input:** A device or component that allows information to be given to a computer
- **Output:** Any device or component that receives information from a computer

Inputs and Outputs
For each category of computer brainstorm as many inputs and outputs as you can.

Computer	Inputs	Outputs
Desktop		
Tablet		
Digital Assistant		

Name(s)_____ Period _____ Date _____

Activity Guide - Inputs and Outputs [Set B]

Vocabulary
- **Input:** A device or component that allows information to be given to a computer
- **Output:** Any device or component that receives information from a computer

Inputs and Outputs
For each category of computer brainstorm as many inputs and outputs as you can.

Computer	Inputs	Outputs
Desktop		
Tablet		
Fitness Tracker		

Name(s)_____ Period _____ Date _____

Activity Guide - Inputs and Outputs [Set A]

Vocabulary
- **Input:** A device or component that allows information to be given to a computer
- **Output:** Any device or component that receives information from a computer

Inputs and Outputs
For each category of computer brainstorm as many inputs and outputs as you can.

Computer	Inputs	Outputs
Desktop		
Tablet		
Smartphone		

Unit 1 Lesson 6

Processing

Resources

Name(s)_____ Period _____ Date _____

Activity Guide - Card Sorting

Objective
Develop steps to sort a row of cards, using the rules below

.

Tips
- Start with only 3 or 4 cards and work up to 8.
- Switch roles frequently.
- Practice with the cards face up first
- Test your work and even try to "break" your solution.
- Stick with it! There are many possible solutions. The point is to find yours!

Rules

Sorter
1. Can pick up, put down, and swap cards in any order they wish.
2. Shows cards to pointer without looking at them.
3. Only one card in each hand at a time.
4. Cards go back into empty spots on the table.

Pointer
1. When shown two cards can point to the bigger one.
2. For a tie point to either.
3. No other communication is allowed

Your Steps
Once you've developed your steps for processing cards, write the steps of your way of processing the cards in the space below. Feel free to draw pictures, number steps, or do anything else you think would be helpful.

Share and Test
Present your steps to another group. Make sure both groups get a chance to share and test their ideas. Here's some tests to consider.
- Use different numbers of cards
- Cards are in reverse order
- Cards are already in order
- Cards are nearly in order

Iterate

Based on your tests or ideas from another group, update your steps.

```
```

Processing Uses Algorithms

Processing is anything a computer does to turn input information into output information. Humans can process information, but usually they're making lots of assumptions or mental leaps to do it. When computers process information, they use **algorithms**, or sets of instructions, that will always turn an input into a desired output. The steps you just created are an algorithm to sort cards.

Reflection

1. What step of the problem-solving process did you think was most important in this activity? _____

2. Why?

_____

_____

3. Why would someone create an algorithm if they already know how to solve a problem by hand?

_____

_____

_____

_____

Processing - Number Cards

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Unit 1 Lesson 7

Apps and Storage

Resources

Name(s)_____ Period _____ Date _____

Activity Guide - App Exploration

In this activity, you'll decide how a computer (in this case, a smartphone) can use different types of information to solve a problem. You'll need to figure out which inputs the computer should use to get the necessary information, and whether or not the information should be stored for later.

Next, you'll decide how the information should be processed, using sorting, matching, or counting, and use that method to find what the computer should output. Once you've figured out how the app should work, you'll have a chance to think of some improvements.

Ring Silencer App

Define
This app solves the problem of the user's phone ringing in class. It figures out when the phone is at a school and turns off the ringer. It turns the ringer back on when the user leaves school.

What type of output should the app produce? _____

Prepare
Fill out the following table with information that the app needs and whether you will find the information from a **phone sensor** or **the Internet**. Decide whether you want to store the information for later.

Information	Where will you find the information?	Store for later?
	Phone Sensor (GPS)	No

Choose the type of processing you will use, and explain how it will help you get your output.

Sorting / Matching / Counting

Try
Use the method you created above to process the information.

What is the output? _____ .

Reflect
This app turns off the ringer even when the user is not in class. An advanced version would only turn off the ringer at school when the user is quiet and not moving. If the user is moving around or making a lot of noise, it would assume that it is not class time and keep the ringer on.

How would you change your app to solve this new problem?

_____

_____

_____

Where would it find the new information that it needed?

_____

_____

_____

Activity Guide - App I/O

Movie Recommendation Challenge

Define
This app addresses the problem of not knowing what movies to watch. Look through the information available to you, and decide what will help to choose a movie for the user.

What type of output should the app produce? _____

Prepare
Fill out the following table with information that the app needs and whether you will find the information from a **phone sensor**, **the Internet**, or **user input**. Decide whether you want to store the information for later.

Information	Where will you find the information?	Store for later?

Movie Reviews:
        Since Then: 4/5 "Hilarious!"
        Mills: 5/5 "Even better than the book!"
        The Wait: 2/5 "Boring and predictable."
        Cargo: 3/5 "Exciting, but not much more."
        The Watch 2: 3/5 "If you loved the first one, you'll want to see this."
	Internet	Yes

User's Favorite Movies:
        The Watch (Action)
        Further (Mystery)
        The Last Night (Drama)		

User's Favorite Books:
        Whistler (Mystery)
        Mills (Drama)		

Movie Showings:
    Central Cinemas:
        ● *Since Then* (PG - Comedy)
        ● *Mills* (R - Drama)
        ● *The Wait* (PG - Mystery)
        ● *Cargo* (Action)
    Midtown 15:
        ● *The Watch 2* (PG - Action)
        ● *Since Then* (PG - Comedy)
        ● *Mills* (R - Drama)		

Choose the type(s) of processing you will use, and explain how it will help you get your output.

Sorting / Matching / Counting

Try
Use the method you created above to process the information.

What is the output? _____

Reflect
Compare your method, and the inputs it needed, to another group's method.

What is one advantage of the other group's method?

_____

_____

How might you combine your ideas to make a better app?

_____

_____

_____

Unit 1 Lesson 8

Project - Propose an App

Resources

Name(s)_____ Period _____ Date _____

Project Guide - Apps and Problem Solving

CODE

Overview

Computer science is an extremely powerful tool for solving real world problems. For this project you will combine what you've learned about the problem solving process and the way computers work in order to propose an app that could help solve a real world problem of your choosing.

You will...
- Work with a partner
- Define a real world problem
- Brainstorm ways an app could be used to help solve that problem
- Identify the inputs / outputs / storage / processing used by your app
- Share your ideas with another group for peer feedback
- Incorporate feedback to create a final version of the app
- Create a poster of your app to share with the class

You will submit...
- This completed Project Guide
- Completed Peer Review
- A poster of your app

Project Steps

Step 1: Find Your Partner
This project will be completed in pairs. List your partner's name here: _____

Step 2: Brainstorm Problems
Brainstorm interesting and personally relevant problems. Nothing is off limits, and don't worry yet about how computer science can help solve the problem. You might think about

- Things you'd like to improve in your school, neighborhood, or community
- A task in your everyday life that you wish could be completed more easily
- A cause that you feel strongly about
- Something that is currently inconvenient or annoying to do

Record your brainstorm of problems in the space below.

Step 3: Choose Your Problem

Work with your partner to decide on which problem you would like to work on. As you discuss, make sure you consider the following criteria.

- **Interesting:** Both group members are interested in the problem
- **Well-Defined:** You can specify who specifically the problem affects, what needs to change, and how you'll be able to tell that the problem had been solved
- **CS is Relevant:** Some aspect of the problem could be addressed by computer science

Step 4: Define Your Problem

Large, complex, and poorly-defined problems are much harder to solve. Make sure you have defined your problem clearly by recording responses to the questions below.

1. **What is the problem?** Be as specific as possible. What needs to change or improve? Why does the problem exist? You may need to narrow your problem's focus. Making big changes begins with small steps!

   _____

   _____

   _____

   _____

2. **Who does the problem affect?** Be as specific as possible. Think about the age, location, life conditions, interests, background, etc. of your audience.

   _____

   _____

   _____

   _____

3. **How will you be able to tell that a solution to this problem has worked?** Be as specific as possible. What would you need to measure or observe to know the problem was solved?

   _____

   _____

   _____

   _____

Step 5: Your App

From a high level think about how an app could be used to solve a part of the problem you identified. What features would it need to have? How would someone use it? If you need to update your problem definition above then do so.

Name Your App: _____

What does your app do? Write a short description of your app as though you were describing it to someone you'd want to use it. What does it do? Why would someone want to use it? How does it help solve the problem?

_____

_____

_____

Step 6: Input, Output, Store, Process

You will sketch a version of your app and indicate what all the different outputs are. A classmate should be able to tell how the app works based on the sketch and labels.

App Sketch: Sketch what a screen of your app will look like based on your description above.

Output Information: Label the different outputs generated by your app by writing what they are and drawing an arrow to where they are located on the screen. (E.g. "List of nearby parks" or "Days until friends' birthdays")

Inputs: What kind of information does your app need as input to work? Will this input come from the user, phone sensors, or an external source (e.g. a database online)? List every piece of information your app will need to work. Your app may have more or less than 6 inputs. Feel free to add extra sheets of paper if you need them.

Type of Information *Example: User age*	Source *User / Sensor / External*	Example *Example: 13 years old*

Process: When computers process information they may do it differently from a human, but everything a computer can do, a human could do as well (just usually much slower!) If you were provided the inputs you've listed, how would YOU need to process it in order to create the outputs of your app.

Store: What information will your app store permanently? Think about information that will not change across multiple uses of the app, or information that it would be useful to have recorded and use again later.

Step 7: Peer Review

Your teacher will provide you with a Peer Review sheet. Trade projects with another group and complete the peer review. As part of this process you should develop new ideas for how you can improve your app.

Step 8: Finalize App and Make Poster

Based on the results of your peer feedback make any additions or changes you need to make to how you defined your problem or how you describe your app. Then make a poster that presents the final version of your app. Your poster needs to include the following information.

- The name of your app
- The target audience
- The problem the app is designed to solve
- The input information the app uses
- A drawing of the output the app produces
- A description of how the app processes and stores information

To create your poster you can and should use your work from this project guide.

Step 9: Present Your App

The last step of this process is to present your app to your classmates. This may be done as a gallery walk or a full-class presentation. As you present your app make sure you're ready to talk to your classmates the following points.

- How you defined the problem your app is designed to solve and why you decided on this specific set of people, problems, and ways of measuring success.
- How your app is designed to work and how it aims to solve the problem.
- An overview of the information your app uses as input and output.
- An overview of how information would need to be stored or processed by your app.
- One change you made to your project based on the feedback you received

Unit 1 Project Rubric

Key Concept	Extensive Evidence	Convincing Evidence	Limited Evidence	No Evidence
Understanding Computing Devices	The outputs of the app are clearly described and could be used to address the problem.	Outputs of that app that could address the problem are listed.	Outputs are listed, but it is not clear that they could be used to fully address the problem.	Outputs are not listed.
Understanding Computing Devices	Stored information is listed and is appropriate for the functionality. Information that would change from use to use is not listed.	Stored information is listed and is mostly appropriate for the functionality of the app.	Stored information is relevant to the app, but some important information is missing.	Stored information is not listed or does not relate to the app.
The Problem Solving Process	The problem is well-defined, including a target audience, details of the problem, and how to tell it has been solved.	The problem is defined, including how to tell whether it has been solved.	The problem is defined, but it is not clear how to know when it has been solved.	The problem is not defined in enough detail to understand what it is.
The Problem Solving Process	The app is clearly described in detail,including what it does and how someone would use it.	The app is described, including what it does and how someone would use it.	The app is described in vague terms, but it is not clear exactly how it is to be used.	The app is not described well enough to understand what it does.
Computing and Algorithms	The way that the inputs are processed to produce the output is clearly described in terms of tasks appropriate for computing (e.g. sorting, counting)	The way that the inputs are processed to produce the output is clearly described.	Processing is described, but without enough detail to understand how the output could be produced from the given input.	Processing is not mentioned.
Collaboration	The peer review provides useful and constructive feedback, and peer review feedback has clearly been incorporated into the final version of the project.	Peer review provides constructive feedback, and peer review feedback has been responded to.	Some peer feedback was completed.	Peer review was not completed.

Peer Review - Apps and Problem Solving Project

Pre-Review
Creator's Name: _____

One thing I want feedback on is…_____

_____

Reviewer Section
Reviewer's Name: _____

Evidence I Found	Types of Evidence	Ideas for More
	The outputs of the app are clearly described and could be used to help the user with the problem.	
	Stored information is listed and makes sense for the what the app does. Information that would change over time is not listed.	
	The problem is well-defined, including a who the app will help, details of the problem, and how to tell it has been solved.	
	The app is clearly described in detail, including what it does and how someone would use it.	
	The way that the inputs are processed to make the output is clearly described in terms of tasks that make sense for computing (e.g. sorting, counting)	

Free Response Feedback

I like… _____

_____

I wish… _____

_____

What if… _____

_____

Creator's Reflection

1. What piece of feedback was most helpful to you? Why?

   _____

   _____

   _____

   _____

2. What piece of feedback surprised you the most? Why?

   _____

   _____

   _____

   _____

3. Based on feedback, what changes will you make to your app proposal?

   _____

   _____

   _____

   _____

Name(s)_____ Period _____ Date _____

Practices Reflection

How I've grown	Practice	How I want to grow
	Problem Solving	
	Persistence	
	Creativity	
	Collaboration	
	Communication	