Regional School District 1

<u>Hidden Figures</u>

By Margot Lee Shetterly

4-8th

Six Schools, One Book

During the reading of *Hidden Figures* we are challenging families to try **at least one or two** activities **per week** over the course of the project. Complete an activity together, fill out the reflection form, and be entered into a drawing for a STEM prize basket from your school!

For each completed activity, students will receive a raffle ticket! The more activities you complete, the more chances you'll have to win! Email us pictures of you reading or working on a project and we will post them on our website!

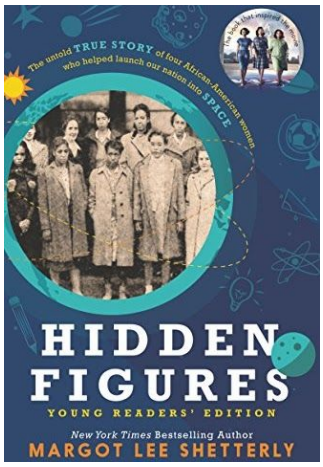
Activity Choices

Grades 4-8

*Activity Bingo- Each activity completed earns a raffle ticket.
Complete four in a row to earn extra raffle tickets*

Parent /Guardian signature in the box indicates completion

Discussion Questions Chapters 1-5 Submit responses	Discussion Questions Chapters 6-9 Submit responses	Discussion Questions Chapters 10-13 Submit responses	Discussion Questions Chapters 14-18 Submit responses
Discussion Questions Chapters 19-23 Submit responses	Mathematics Activity Submit responses	Public Library Visit Real or Virtual Submit responses	Public Library Create a Real or Virtual Scavenger Hunt Submit responses
Paper Airplane Challenge Submit Reflection Form	Women Picture Cards Submit responses	Spaghetti Tower Marshmallow Challenge Submit Reflection Form	Space Capsule Submit Reflection Form
Air Rockets Submit Reflection Form	Moon Landing Flight Plan Submit Reflection Form	Crater Catapult Submit Reflection Form	Lunar Lander Submit Reflection Form



Discussion Questions

Chapters 1-5

1. What is segregation? Describe what segregation was like in America during the 1930s and 1940s.
2. What did the word "computer" mean in the 1930s and 1940*s*? What was a computer's job?
3. How did accepting the job at Langley Field change Dorothy Vaughan's life? Why does she accept the job?
4. Why did many African Americans of the 1940s ask "What are we fighting for*?"* What was the "double V*?"*

Chapters 6-9

5. How did the West Area Computers act like a family? Why was this important? What struggles did they face?
6. What wartime work was done at Langley? How did things change at Langley after the war was over?
7. Who was Dorothy Hoover? What barriers did she overcome when she changed her job position?
8. Why was Dorothy Vaughan promoted in January 1951? Why was her promotion so important?

Chapters 10-13

9. How did America's fear of communism affect things at Langley*?*

10. Who was Mary Jackson? How was she disrespected by the East Side Computers? How did she respond?

11. What was so exceptional about Katherine Goble? Why did she get a salary increase*?*

12. How did Katherine Goble's life change in December 1956? How did she respond to this tragedy?

Chapters 14-18

13. How did the purchase of electronic computers at Langley threaten Dorothy Vaughan's job? How did she respond to this situation?

14. How did the Soviet Union's launch of *Sputnik* change the focus of work at Langley? Wh*y* were the eyes of all Americans suddenly focused on them?

15. Why was Katherine Goble not allowed to go to the editorial meetings? Why did she want to be a part of them? How does she finally get the change?

16. What was *Project Mercury*? What rolę did Katherine Goble play in it? What first did she accomplish while working on this project?

Chapters 19-23

17. What two kinds of discrimination did Mary Jackson face throughout her life? Why was her job as an engineer so special?

18. What changes took place at Langley in the early 1960s? What were NASA's major goals? How was Dorothy Vaughan's work impacted by these changes?

19. What important role did Katherine Johnson play in John Glenn's mission to orbit the Earth? Why was she the one to do this? How did she help put a man on the moon?

20. How did women like Dorothy Vaughan, Mary Jackson, and Katherin Johnson live out the American Dream and make a difference for future generations?

Hidden Figures: Mathematics Activity

In June 1941, during World War II, President Franklin Roosevelt looked to ensure the growth of the space program and began recruiting African-Americans with college degrees to work for NASA. While they did the same work as white workers, African-Americans were paid less and had to use separate dining halls and bathrooms. Three brilliant African-American women at NASA - Katherine Johnson, Dorothy Vaughan and Mary Jackson - served as the brains behind one of the greatest operations in history: the launch of astronaut John led Glenn into orbit, a stunning achievement that restored the nation's confidence, turned around the Space Race and shocked the world! The women worked as human computers. Before electronic computers, the term "computers" referred to people rather than machines. "Computers" would perform complex mathematical calculations by hand. The women's job was to trace, in extreme detail, a spaceflight's exact path from liftoff to splashdown. Astronauts use math in order to make precise mathematical calculations, from how the spacecraft leaves Earth's atmosphere to how the astronauts pilot the craft. Designers use math to calculate distance, speed, velocity, and their own safety when preparing for a space mission.

Task: Work as a "Human Computer" to evaluate various expressions for the next space mission. These expressions will help calculate plans and expectations for the next space exploration. Be sure to use the Order of Operations to have accurate calculations!

1. Evaluate the following expressions to help the astronauts prepare for take off. These numbers will help calculate the amount of time it will take to prepare for take off.

In this case x = 4, y = 5 and z= ½

7x - 5y= ___ minutes to secure the door.	12z + $2y^2$ = ___ minutes to complete system check.	2xy + 8z = ___ minutes to fill pantry with astronaut food.

2. Evaluate the next three expressions to help calculate the start of the spacecraft engines. This will help prepare for takeoff.

In this case, a = 10, b = 0.50 and c = 0.25.

a - 11b =	2(b+c) =	b^2 + 6c =
____ seconds for the large external tank to power on.	____ seconds for the power booster to register.	____ seconds for the fuel tank to unite.

3. Evaluate the next expression to determine how many days the space mission will take. In this case, q = 4, r = 6, and s = ⅔.

$2q^3$ + rs - 18s =

The space mission will take ____ days.

4. Evaluate the following expression to calculate the speed of the spacecraft during the flight when x = 8, y = 3, and z = 1.5.

$2(x - y)^3$ - 60z =

The speed of the spacecraft is _____ meters per minute.

PAPER AIRPLANE CHALLENGE

How much cargo can your airplane carry?

Challenge: The human computers at NASA had to calculate anything from how many rockets were needed to make a plane fly to what kind of rockets were needed to lift a spacecraft! In this challenge, can you design a paper airplane that can carry a cargo and glide more than 10 feet? Your “cargo” is money-coins; try different combinations of coins to fly the most money.

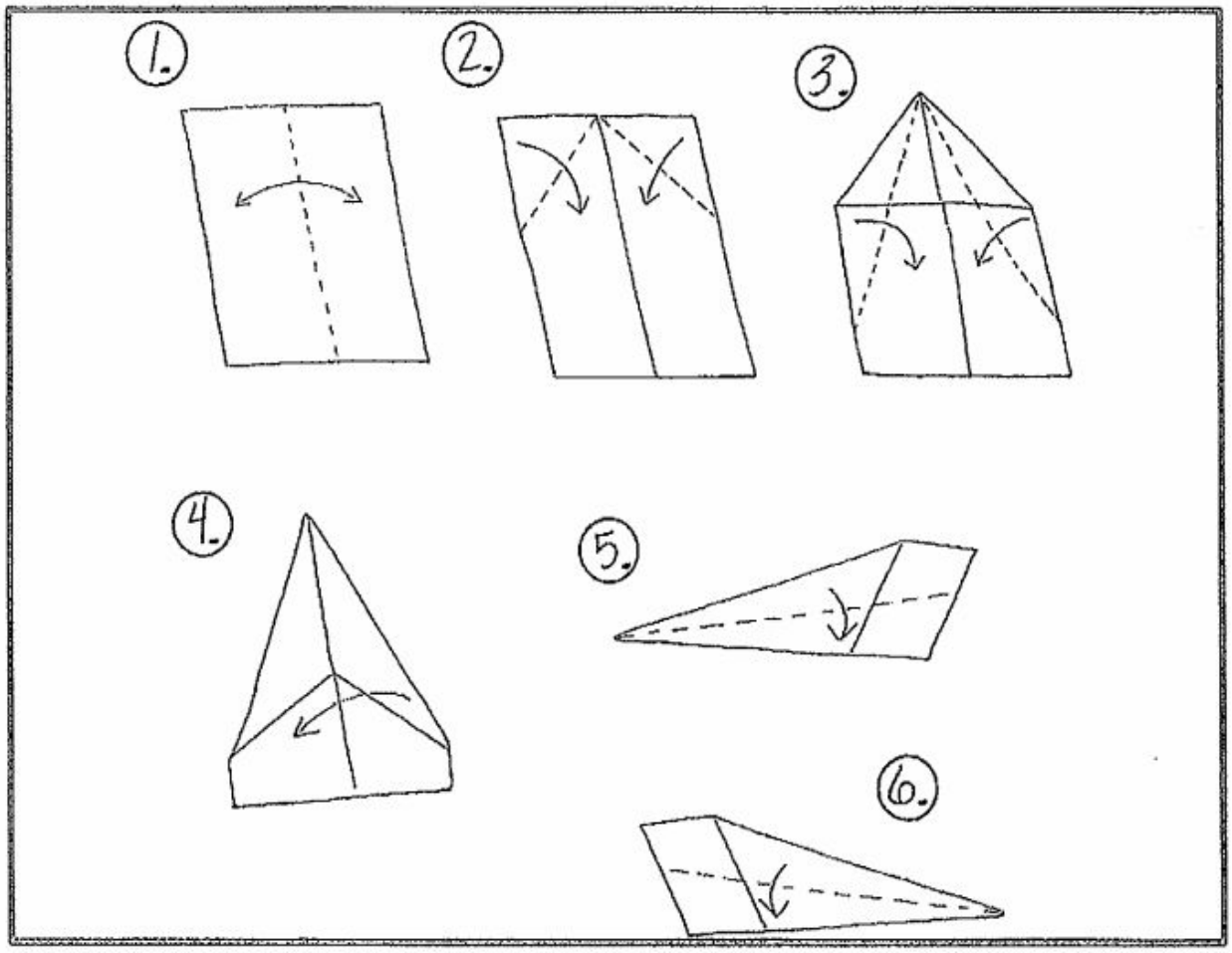
Materials:

- **Construction paper**
- **Scotch tape**
- **Handful of a variety of coins**
- **Masking tape (mark a target 10 feet from the starting position)**

Trial #	$ Carried	Distance

Directions:

- Choose how to fold your paper airplane (see example on the following page or research your own!)
- Mark a target line with masking tape approximately 10 feet away from your starting point.
- Secure a variety of coins inside the paper airplane. Record the amount of money your plane is carrying.
- Test your airplane. Toss your airplane towards the target line and measure the distance!
- Keep trying to send the most money the farthest! Keep track of all trials.


1.
2.
3.
4.
5.
6.

Dorothy Johnson Vaughan

Mary Winston Jackson

Katherine Coleman Goble Johnson

Dr. Christine Mann Darden

Women Picture Cards

Response Choices

- ❑ Explain why the woman is important.
- ❑ Write a character trait of the woman on the card.
- ❑ Draw a picture of the woman in action.
- ❑ Make a list of everything you know about the woman.
- ❑ Explain what you still want to know about the woman.
- ❑ Write a question you would ask the woman.
- ❑ Compare this woman to another and write a similarity.

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SPAGHETTI TOWER-MARSHMALLOW CHALLENGE

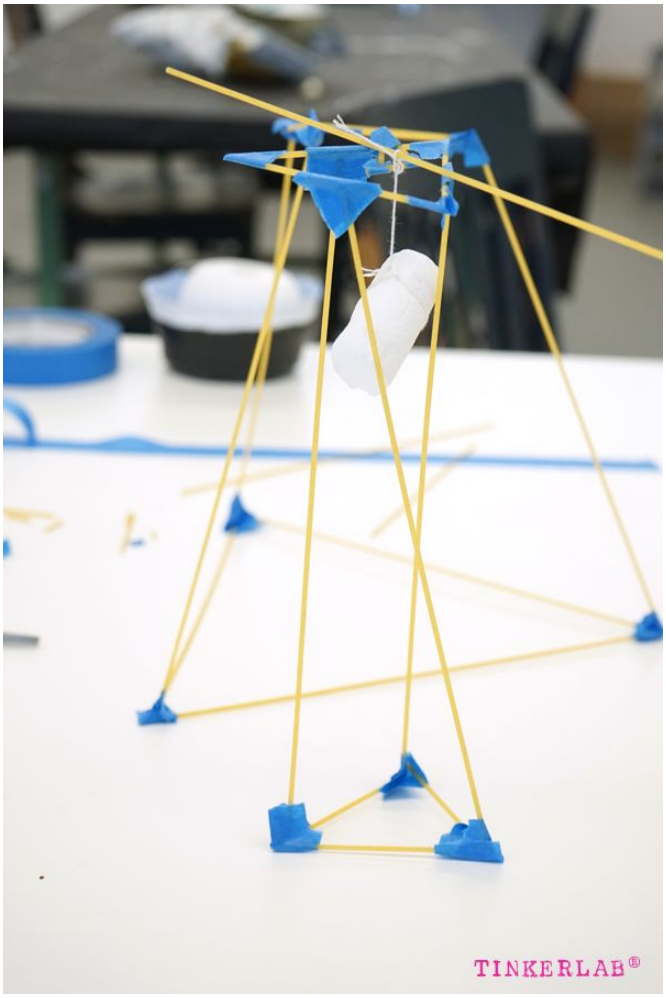
Challenge: Build the tallest spaghetti tower, in 15 minutes, that can support a marshmallow.

Materials:

- 20 sticks of spaghetti
- One yard of string
- One yard of masking tape
- One jumbo marshmallow
- Scissors

Directions:

- Set up supplies.
- Set the timer.
- Build!



SPACE CAPSULE

Materials:

- Aluminum foil
- Tape
- String
- Scissors
- Coffee filters or plastic shopping bag
- Timer
- Bucket of water

Directions:

- **Watch YouTube videos:**
  - Black Pioneers: Katherine Johnson https://www.youtube.com/watch?v=_aR8WhKCC8w
  - Apollo 13 Re-entry and Splashdown (9:58 minutes) **watch from 5 to the end https://www.youtube.com/watch?v=kmGP4o272ac

- **Ask-** What is the problem you are trying to solve? (You are helping prepare for the safe return of Apollo 13.)
- **Imagine-** What is the best way to solve the problem? (Design a space capsule that the astronauts can return to earth in.)
- **Plan-** Sketch out your plan to solve the problem. (You must design it to slow down quickly; traveling too fast will cause it to crash into the Earth's surface and be destroyed.)
- **Create-** Build your space capsule. (Must be similar in shape to a cone without the point on top.)
- **Experiment-** Record how long it took for your space capsule to land during each of your trials. (Stand on a chair holding the time capsule above your head and time how long it takes to fall to the ground. Next, you can drop the capsule into a bucket of water.)
- **Improve-** What could you do to improve? (test multiple times, make improvements, try to increase the amount of time it takes to land)
- **Record-** Write the data on the attached sheets and graph the results.

Name: _____

SPACE CAPSULE RECORDING

Directions: Record how many seconds it took your space capsule to land during each of your trials.

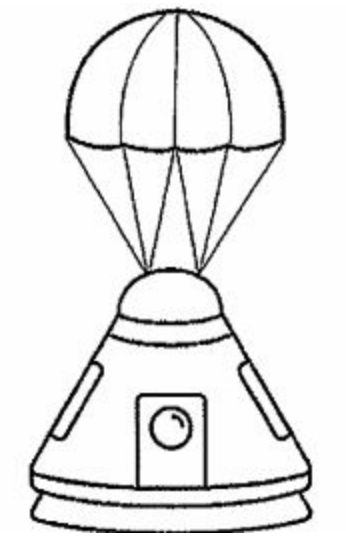
Trial #1: _____ seconds

Trial #2: _____ seconds

Trial #3: _____ seconds

Trial #4: _____ seconds

Trial #5: _____ seconds



During which trial did your space capsule take the longest to land? What factors do you think contributed to the space capsule slowing down?

_____

_____

_____

_____

_____

Name:_____

SPACE CAPSULE GRAPHING

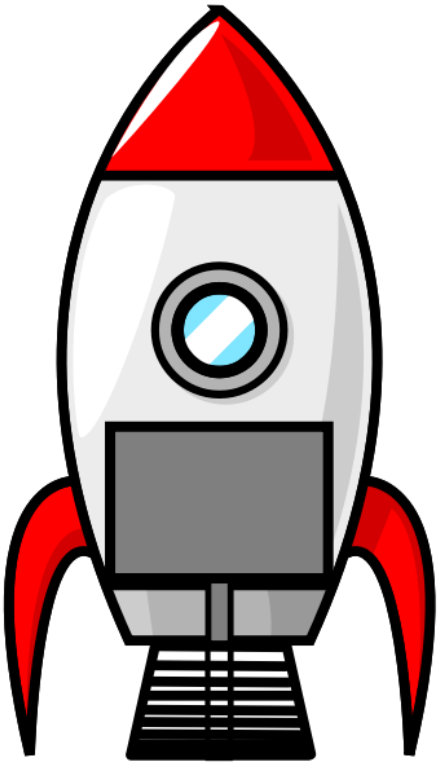
Directions: Create a bar graph of your data showing how many seconds it took your space capsule to land during each trial.

12					
11					
10					
9					
8					
7					
6					
5					
4					
3					
2					
1					
# of seconds	Trial 1	Trial 2	Trial 3	Trial 4	Trail 5

AIR ROCKETS

How far can you launch your rocket?

Challenge: Design an air rocket powered by your own air! Using a straw and your rocket design, launch your rocket and measure the distance it travels.Try three different launch trials: adjust the “launch” angle and measure each time. Record your best trial. Cut out the rocket on this sheet or design your own!

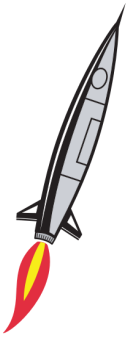


Materials:

- Disposable bendable drinking straw
- Rocket
- Toothpick
- Hot glue

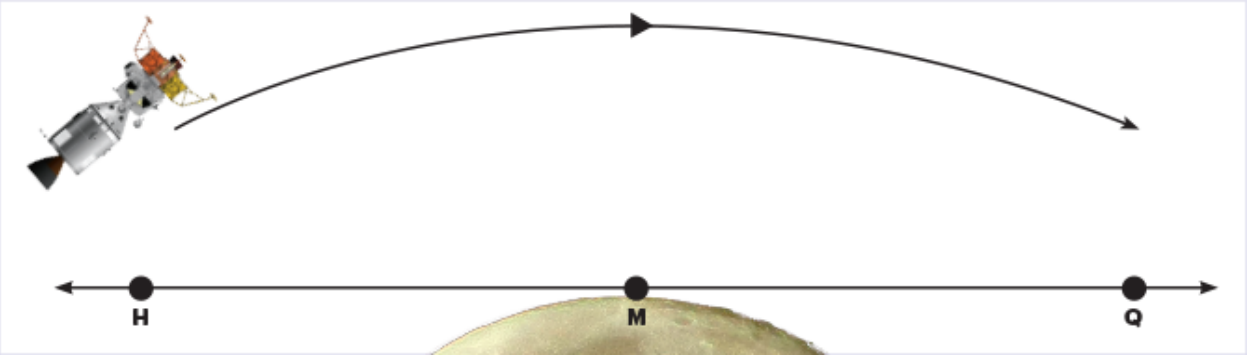
Directions:

- Cut out your rocket picture.
- Place a small bed of hot glue running up the center. Place the toothpick in the glue so half of it extends out the bottom of your rocket.
- Grab a straw and insert the toothpick into one end. Blow through the other end to launch your rocket.



MOON LANDING FLIGHT PLAN

Challenge: Complete the diagram of the moon lander's flight plan by drawing the angles that Johnson calculated. Line HMQ marks the horizon, or the line where the moon and sky appear to meet. Use point M (the moon's surface) as the vertex for all angles.



Directions:

1. The moon lander travelled from left to right. When it was 35° above the moon's horizon line, it began its landing. Draw a ray with a point of B to create this angle. Name this angle.
2. Forty seconds later, the spacecraft began tilting toward the moon and had moved an additional 16° above the horizon. Draw a ray with point C to create a 16° angle above the angle you drew in No. 1. What is the name of this new angle?
3. Another 75 seconds later, the spacecraft was in position to detach the lander at 94° from the angle you drew in No. 2. Draw a ray with point D to make the angle and name it.
4. What is the measurement of ∠DMQ that you created? Explain how you determined this.

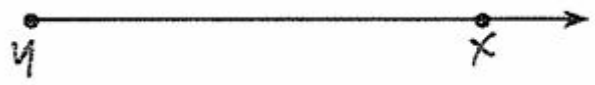
See the example on the following page to help draw your angles? Submit your final plan (like the one at the top of this page).

MOON LANDING FLIGHT PLAN

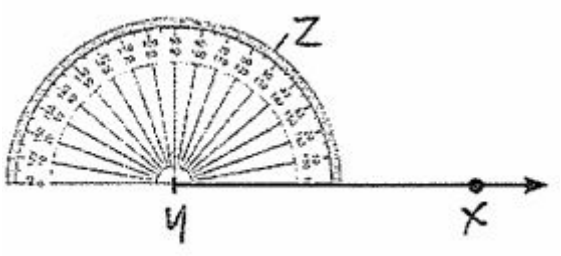
Example: Draw an angle of 52°.

.....

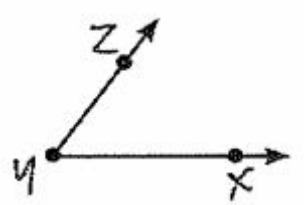
Step 1: Draw a ray and label the endpoint Y
and add another point to the ray labeled X.



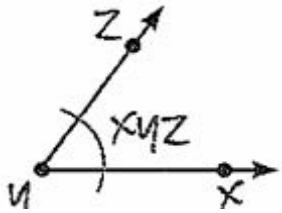
Step 2: Align the baseline of your protractor with the ray.
Point Y should be at your protractor's origin. Make a point
along the scale of the protractor at 52° and label it Z.



Step 3: Draw a ray to connect point Y to point Z to complete the angle.



Step 4: Name your angle using the points in the angle,
with the vertex in the middle. This angle is XYZ.



CRATER CATAPULT

Can you successfully launch “research equipment” to explore the craters on the moon?

Challenge: Design a simple catapult to launch “research equipment” (cotton balls or pom poms) to craters (paper plates) on the moon.

Materials:

- Popsicle sticks (10)
- Rubber bands (3)
- Plastic Spoon
- Pom pom balls/ cotton balls
- Paper plate (crater target)
- Ruler, pencil, and paper

Directions:

- Make a stack of popsicle sticks by placing one on top of the other. Start with 5 sticks.
- Wrap a rubber band around each end of the stack to hold the stack together.
- Take two popsicle sticks and stack them together. Wrap one rubber band around one end of these two sticks to hold them together.
- Pull the two popsicle sticks slightly apart and place the larger stack of sticks in between the two.
- Attach the larger stack to the stick on the top using a rubber band.
- Set the spoon on the top popsicle stick and use a rubber band to lash it down. The spoon should be facing cup side (scoop side) outwards.
- Set a paper plate 3 feet away.
- Set a pom pom on the spoon. Hold the catapult with one hand and use your other hand to pull down on the spoon. Release the spoon to see the pom pom launch! Did you reach your target? How far did it go?
- Record your observations. Measure the distance the pom pom traveled. Did it make it to the “crater”? Why or why not? Readjust the “crater” and try again. Record trials until you reach your “crater”. What changes did you make and why?

Lunar Lander

Can you design a landing device to safely send two astronauts to the surface of the moon?

Challenge: Design a Lunar Lander using the materials below to safely get your two astronauts (marshmallows) to the moon (the floor). Include a place to put your astronauts and four shock absorbers. Drop your Lunar Lander from 4 feet above the ground; if it doesn't land flat, or your "astronauts" fall out of the lander, evaluate, redesign, and test again.

Materials:

- Paper cups
- Masking tape
- Rubber bands
- Paper clips
- Tin foil
- Cardstock
- Copy paper
- Plastic straws
- Marshmallows

Sketch your design here:

STEM ACTIVITY REFLECTION

Directions:
Share any pictures during the process!

Title of activity: _____

Describe the outcome of the challenge:

_____

_____

_____

_____

_____

What advice would you give to a classmate if they completed this challenge next? Think about what you would change or do differently…

_____

_____

_____

_____

_____

_____