



PLTW Engineering

12/Paper Airplane Design Challenge

May 7, 2020



12/EDD

Lesson: 5/7/2020

Objective/Learning Target: Students will be able to apply the design process to design and build a paper airplane and explain how flight is achieved.



Background

Engineers often create small-size models of a new product to test its design. This is especially true with airplanes. Model testing tells engineers how a design responds to different air conditions and aircraft shapes, and lets them experiment with the control surfaces that are used to steer the aircraft. Using small models guides engineers to discard prototypes that do not work, which is a smarter and more cost effective option than throwing away full-size (large and expensive to build) aircraft that do not work.



Planes and glider science

Paper airplanes are gliders. They have a main body, and generally two wings. Some are more complex, with tails, rudders and flaps. The wings compress the air below the paper airplane, creating high pressure, and thus the airplane is able to "sit" and glide on the air. Moving the rudders, ailerons, or flaps up or down can change the flight path of an airplane. For example, folding down the wing flaps can result in a nosedive and folding up the flaps can point the airplane in an upward direction.



Design challenge

For this design challenge, you will construct a few standard paper glider designs using the materials listed.

You will then test each design in terms of distance and flight time.

Finally you will wrap up the activity with some critical thinking.

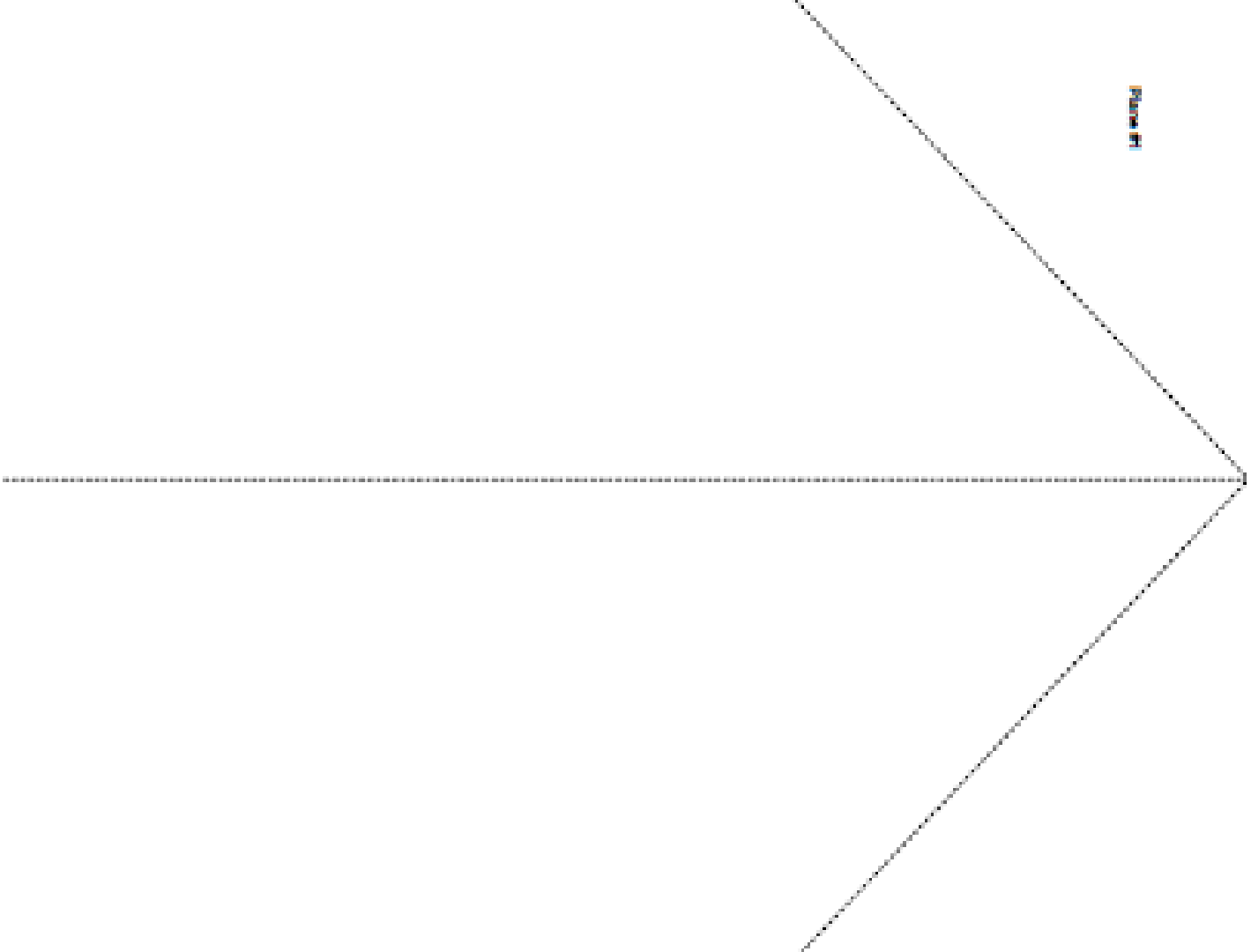


Gather materials

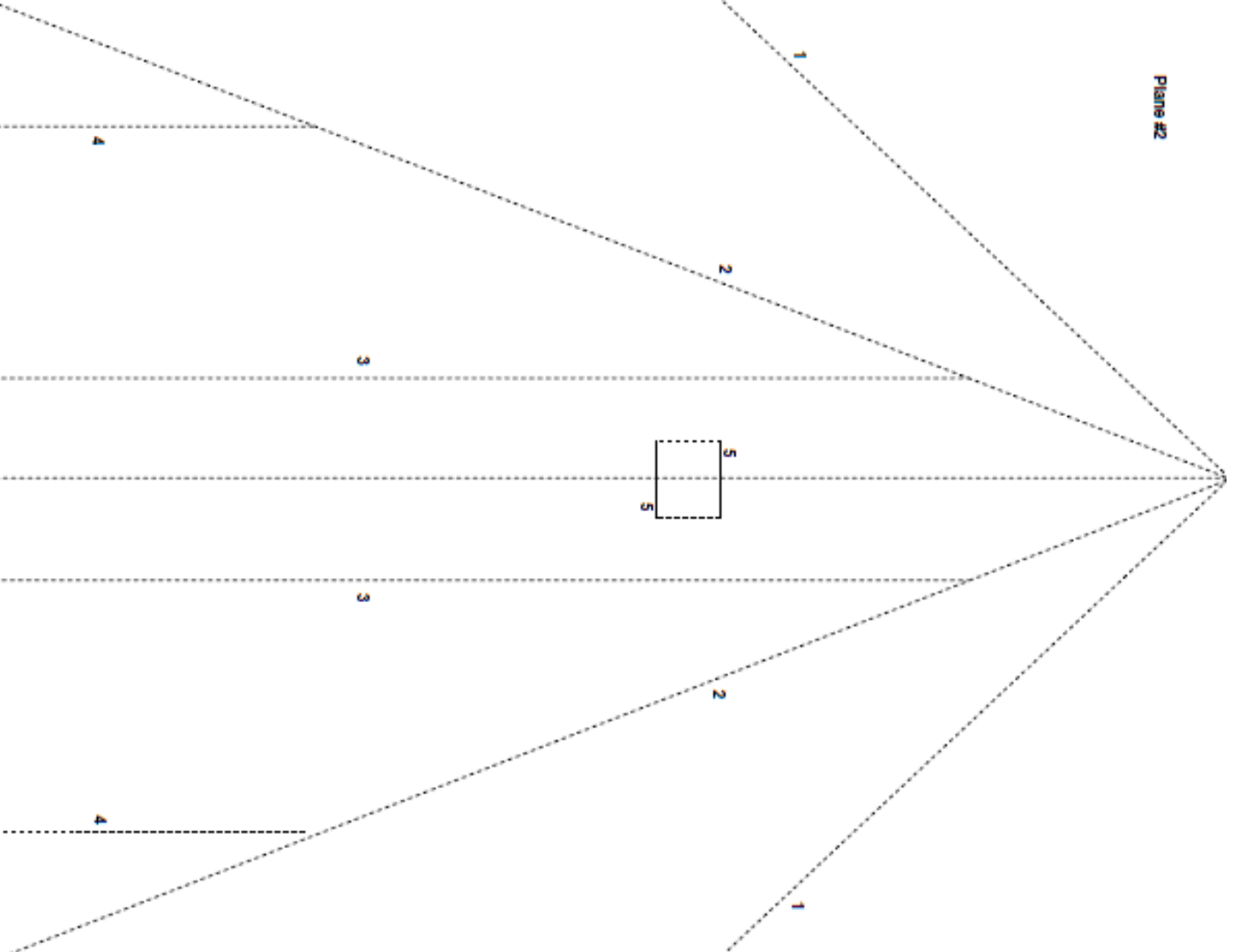
You will need the following materials for this activity:

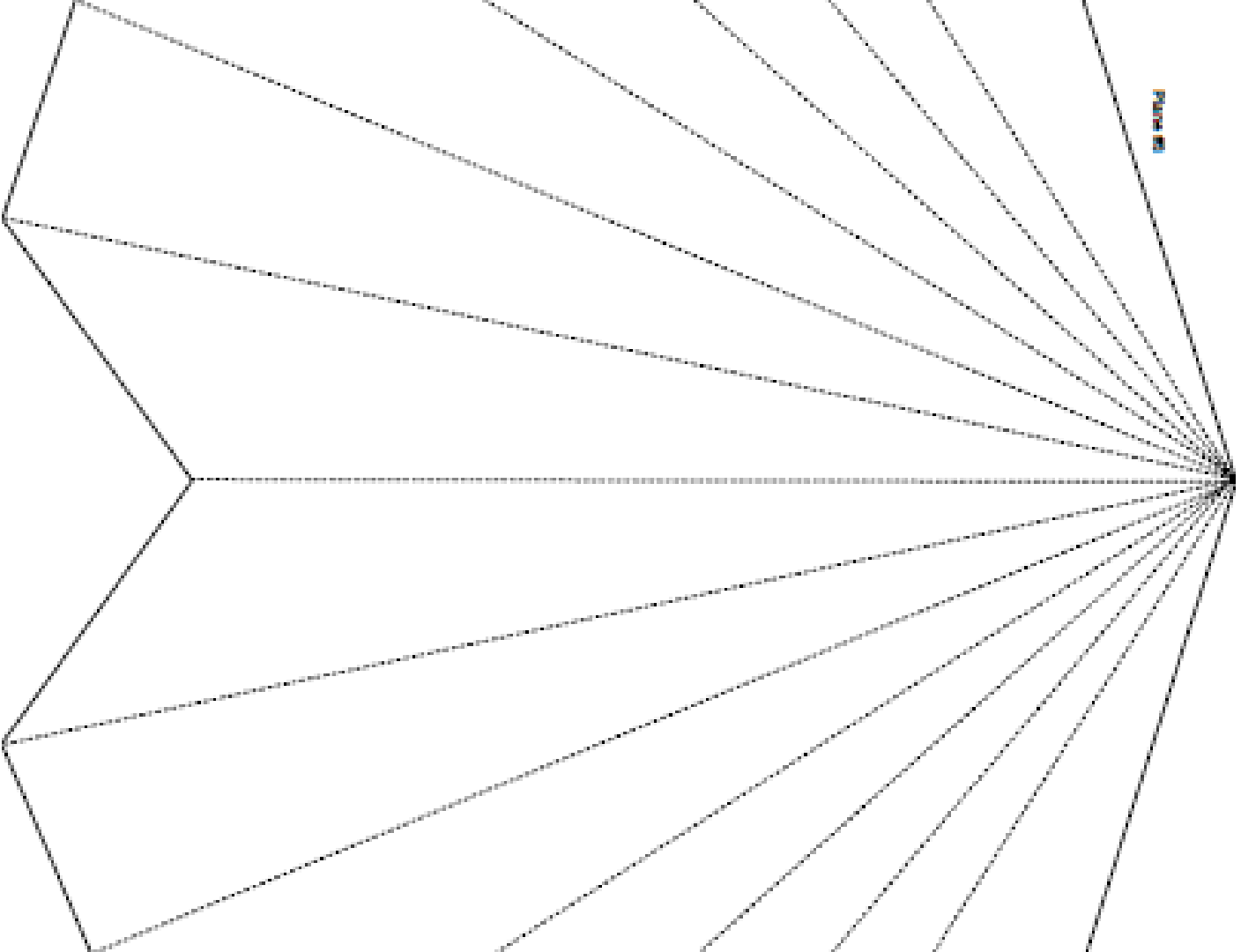
- 5-6 sheets of 8.5 x 11" paper
- paper airplane designs from the next few slides
- scissors
- tape measure and/or meter sticks, and/or use cones to mark every five feet
- stopwatch, or a watch with a second hand
- tape
- glue
- paperclips

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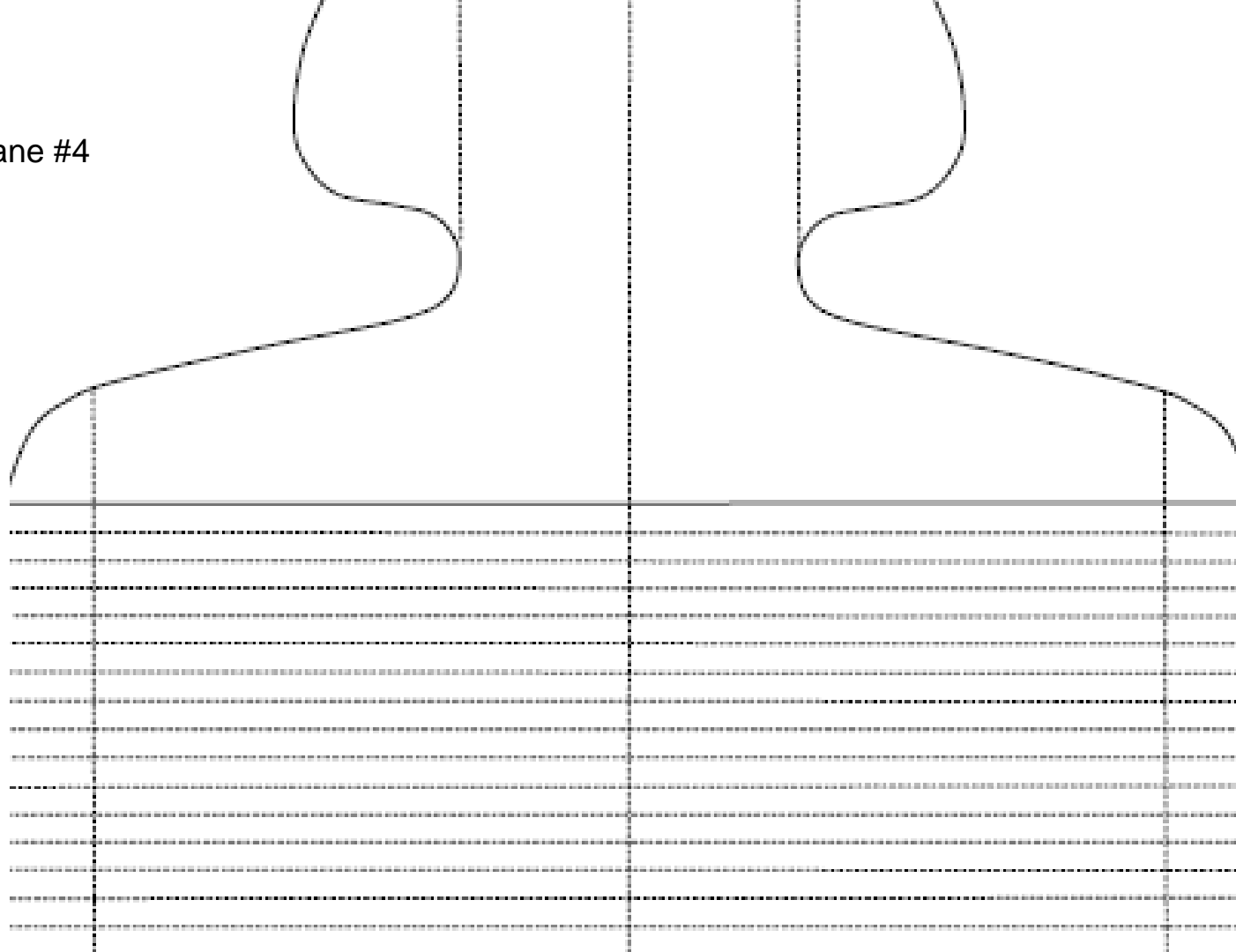


Plane #2



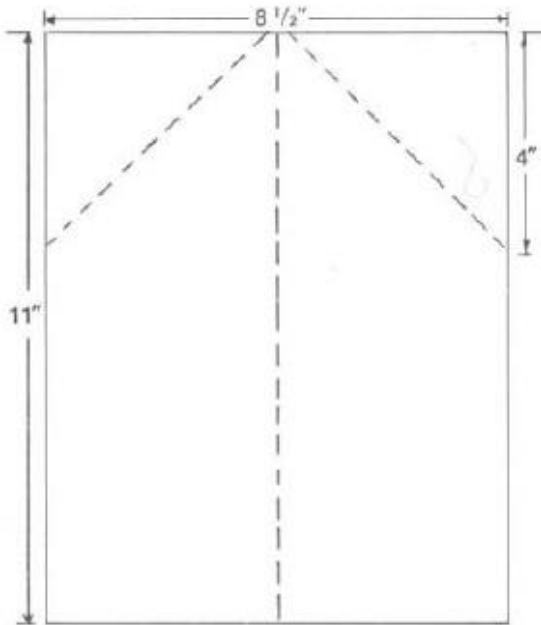


Plane #4

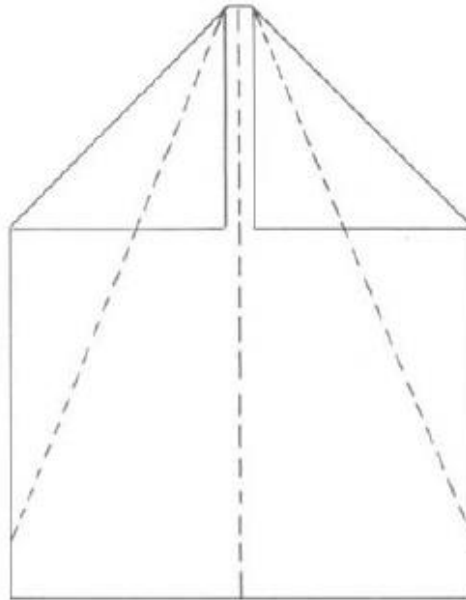


Folding instructions

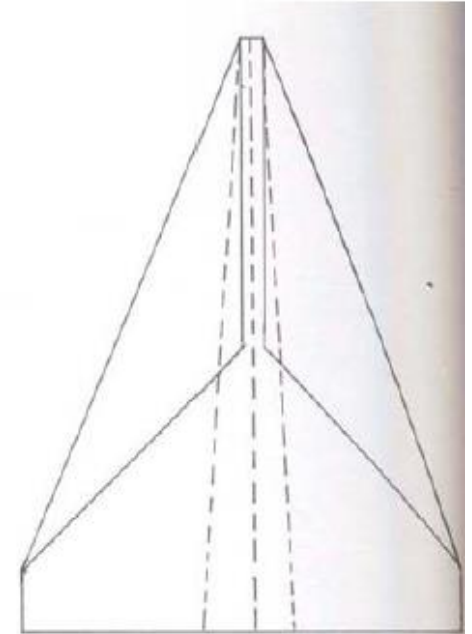
Plane #1



1. Crease on center line.
Fold corners in as shown



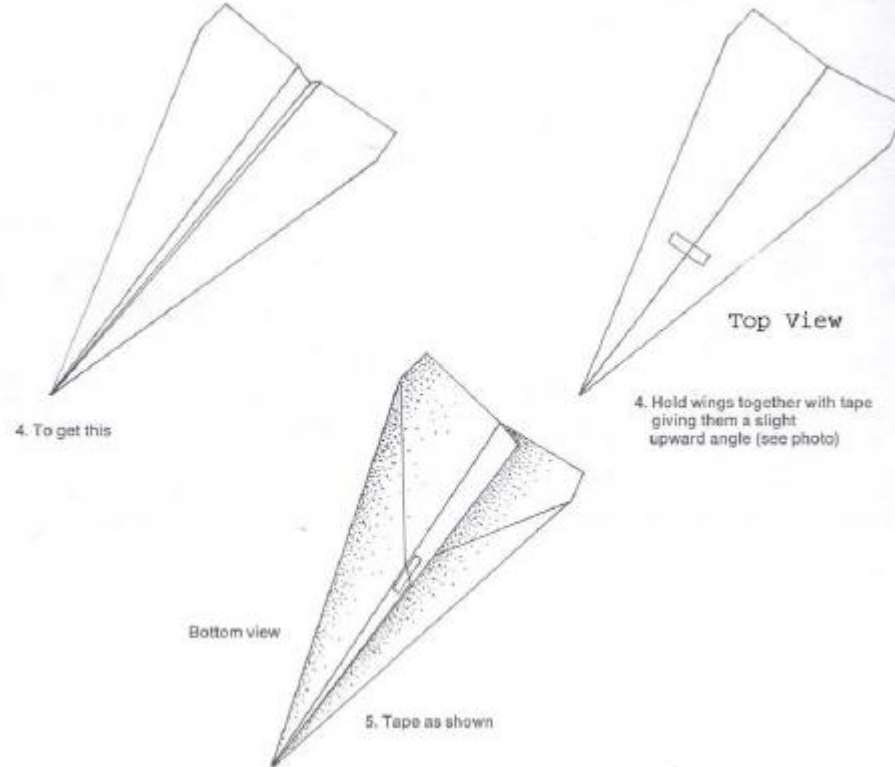
2. Fold again on dotted line



3. Fold away from you
on center line.
Make opposite folds
on dotted lines

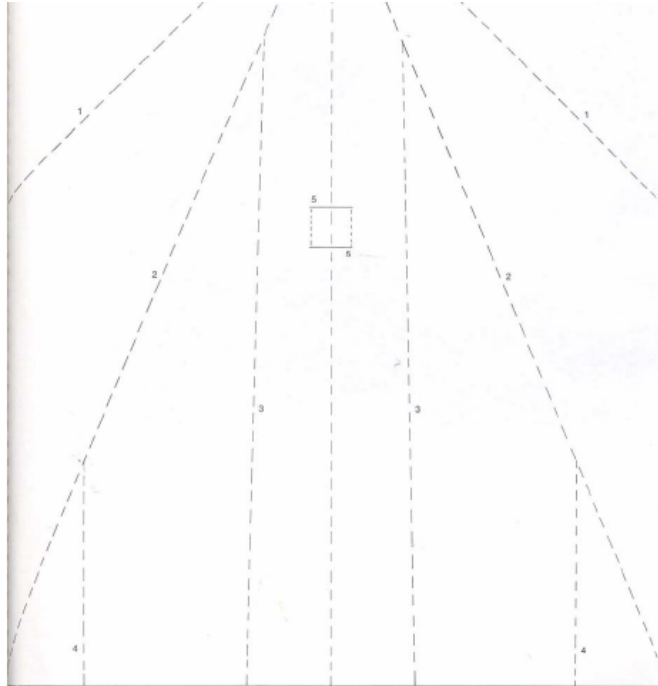
Folding instructions

Plane #1



Folding instructions

Plane #2

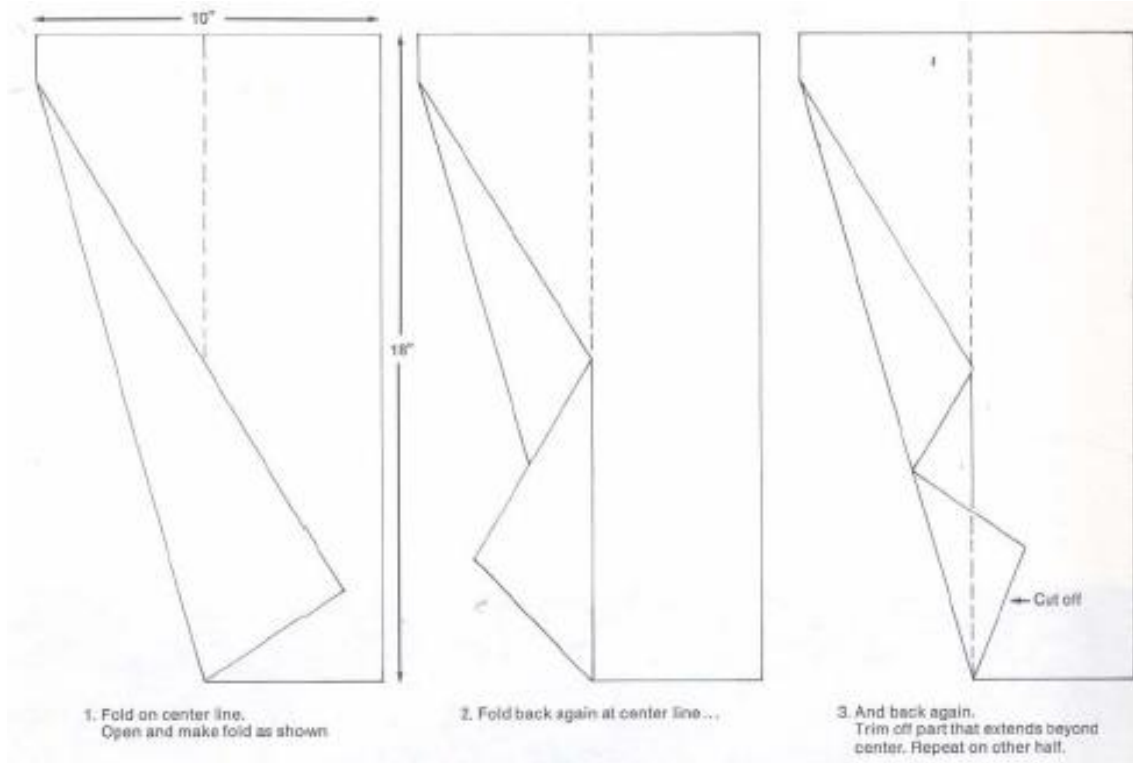


Instructions for Plane 2

Fold at the center line. Unfold and fold at 1. Hold down and fold at 2. Fold at center and then fold away from center at 3 to form wing. Form up at 4 to form stabilizer. After folding is completed, cut along solid lines 5. Double up on dotted line to lock body together.

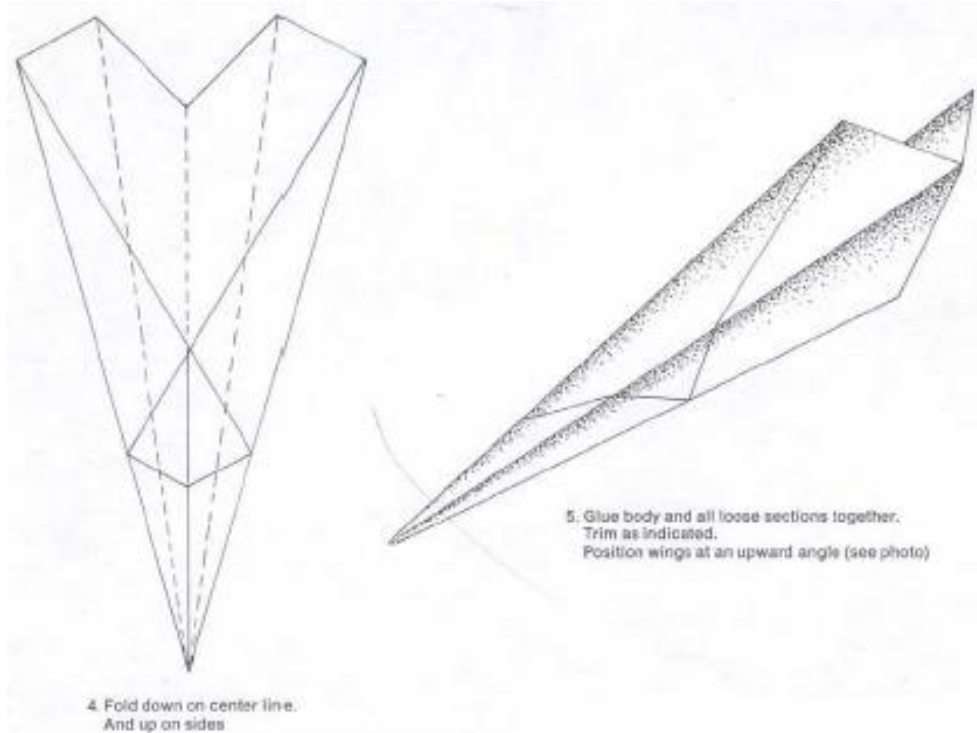
Folding instructions

Plane #2



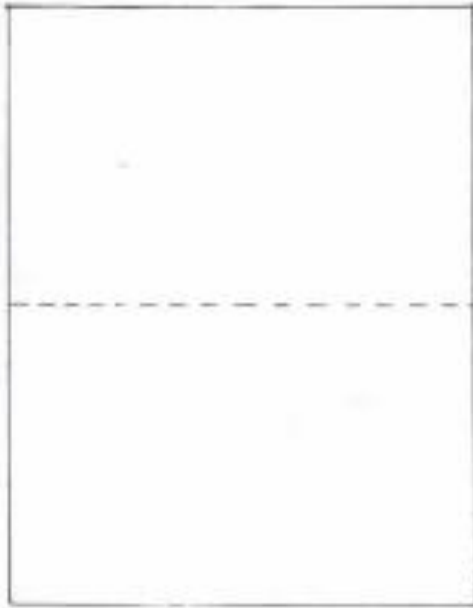
Folding instructions

Plane #2



Folding instructions

Plane #4



1. Crease 8 1/2" x 11" sheet down center



2. Start with a fold of about 1/4"



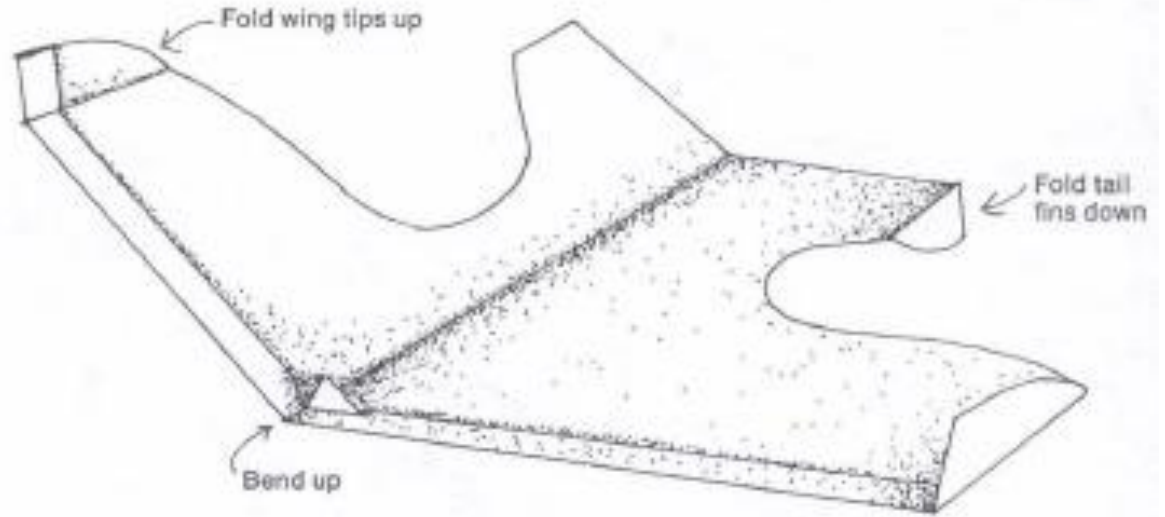
3. Continued folding until about 4 1/2" are left

Folding instructions

Plane #4



4. Fold in half
and cut as shown





Testing plan

Once you have your planes are constructed and ready to test, fly your airplanes three times each, and record the distance of each flight to the nearest foot as well as the amount of time it stayed in the air.

Take your three measurements, add them together, and divide by three to get your average flight length.

The following slide shows a table you can use for recording.



Testing plan

Plane #1

Flight #	Length in feet	Time in seconds
1		
2		
3		
Average		

Plane #2

Flight #	Length in feet	Time in seconds
1		
2		
3		
Average		

Plane #3

Flight #	Length in feet	Time in seconds
1		
2		
3		
Average		



Critical thinking questions

What plane design was easiest to make? Most difficult? Why?

Which plane went farther than five feet? Farther than 10 feet? The farthest of all?

Did certain designs go farther than others? Why?

What were your flight times? What was the longest flight time?



Critical thinking questions

Did certain designs stay aloft longer than others? Why?

Did you notice a relationship between average distance and average time?