

Problem 2.5 Animal Rescue

Introduction

Animals in both the wild and in zoos can fall into ravines or other deep pits. Rescuers need to be very careful when helping trapped animals like horses, lions, and elephants. These animals can be very large and require the use of machines to provide enough force to lift and rescue them. The largest animal on land is the male African elephant, which can grow up to 10.5 feet tall at the shoulder and can weigh up to 15,000 pounds!

You have learned about effort and resistance forces in simple and compound machines. You also investigated magnets and how they interact with objects they are not touching. The design problem you now face is to design an animal rescue device to lift a tiger out of a moat. You will design and test a **model** of an animal rescue device. A model is often smaller than what is used in real-life situations. Models are used to test designs.

Equipment

- iPad® tablet
- VEX IQ® equipment
- One tiger model per group
- String

Procedure

1. Work with your team to design, sketch, and build a model of an animal rescue device that can rescue a trapped zoo animal. Your group will decide how to rescue the animal by lifting and moving it to a safe area. Follow these criteria and constraints for your design:

Criteria	Constraints
<p>Criteria are guidelines or rules for your design.</p> <ul style="list-style-type: none"> • The group will design, build, and test a device to rescue a trapped zoo animal. • The device must safely lift the animal at least 4 inches and set it down in a safe area away from where the animal was trapped. • You must include a magnet in your design. • Your design must include a 	<p>Constraints are the limitations or restrictions on your design.</p> <ul style="list-style-type: none"> • Your teacher will determine the amount of time you have to design, sketch, and build your model. • You are limited to the following materials: <ul style="list-style-type: none"> ○ VEX IQ® Kit ○ String

<p>compound machine consisting of at least two simple machines.</p> <ul style="list-style-type: none">• A harness for the animal must be created that safely supports the animal and does not pull on the animal's tail, legs, or head.	
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2. Ask

- a. Respond to the following questions in your Launch Log:
 - What is the need or want that we are trying to fulfill?
 - What will make the design solution successful?
- b. List the criteria and constraints for the design problem in the Ask section of the Launch Log.
- c. Follow your teacher's directions to complete the self-assessment at the end of the Ask section.

3. Explore

- a. Write or sketch in the Explore section of your Launch Log how others have tried to solve a similar problem.
- b. You may use the skills and knowledge your team gained from the activities and project in this module as well as any outside information you have to help your group design the best solution.
- c. Brainstorm several ideas that may solve the problem. Create sketches of your ideas in the Explore section.
- d. Talk to your team and share ideas. Add any additional ideas by writing or sketching in your Launch Log. Add labels to your sketch.
- e. Follow your teacher's directions to complete the self-assessment at the end of the Explore section.

4. Model

- a. In this step you will compare the solutions that your team generated during the Explore step.
- b. Work collaboratively to choose the best idea for your model using the Animal Rescue Design Matrix.
- c. Follow your teacher's directions to build a model of your design.
- d. Document your model by sketching the final design or by taking photographs with your tablet before you begin testing.
- e. Follow your teacher's directions to complete the self-assessment at the end of the Model section.

5. Evaluate

- a. Follow your teacher's directions to conduct a fair test to determine how well your model solves the design problem.
 - Conduct three trials.
 - Use the tablet camera to videotape the trials.
 - Record the results of your test in your Launch Log.
 - Discuss the results of the trials with your team. Was your model able to successfully complete the task?
 - Follow your teacher's directions to complete the self-assessment at the end of the Evaluate section.

6. Explain

- a. Present your design, evaluation, and suggestions for improvement for your rescue device model. You may use tablet applications in your presentation.
- b. Complete the Explain section of your Launch Log by evaluating how the animal rescue device solved (or didn't solve) the problem. Include the data you collected to support your conclusions.
- c. Follow your teacher's directions to complete the self-assessment at the end of the Explain section.

Conclusion Questions

Record your answer to the questions below in your Launch Log.

1. Was your animal rescue model able to successfully move the animal to a safe area? Support your answer with the evidence you recorded in your Launch Log.
2. List two changes you would make to improve the design. Why do you think these changes would improve your animal rescue model?
3. In this problem you designed an animal rescue device to lift an animal to safety. What forces and interactions occurred during the rescue? Sketch or use the tablet to take an image of the device. Label the forces and interactions. Include opposing forces such as effort and resistance force.