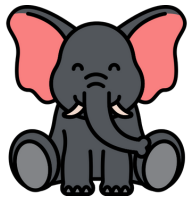
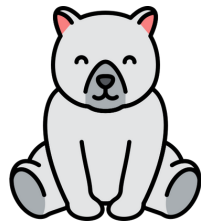
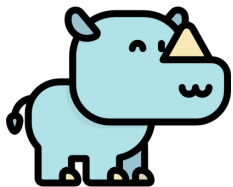
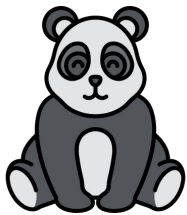




**3Dux | Design**  
The Modern Zoo Re-imagined



Congratulations you have been hired as the designer in charge of upgrading the world-famous Community Zoo in Paper Town, USA! Your job is to redesign the animal enclosures making sure that the animals are safe, healthy, and happy and that visitors can have a truly interactive and educational zoo experience.



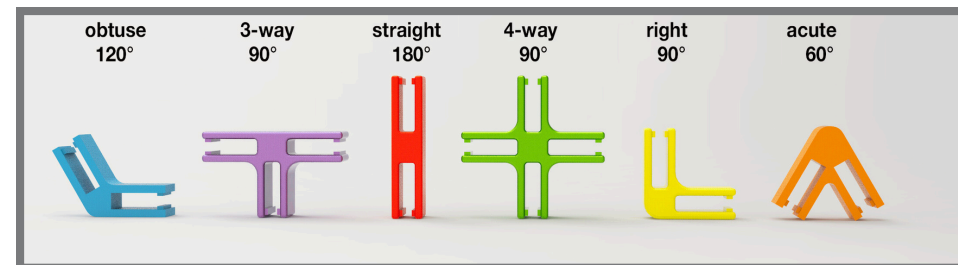
The staff would like to keep the zoo open during the construction phase. They will assign you one animal enclosure at a time to focus on. You will need to begin with research to learn about the animals in their natural habitats and use that knowledge to design each animal's enclosure.

## Things to consider:

1. The animals should be happy and healthy so be sure to include a fun activity for exercise. This will include a simple machine as described in each challenge.
2. Each animal should feel safe so consider its natural environment in your design.
3. Visitors should be able to safely see the animals; design the exhibit so visitors can watch and safely interact with the animals.
4. Be creative; unique ideas attract visitors!
5. If you finish early, add decorations, animal descriptions, more structural features, do the bonus challenge, or prepare a presentation!

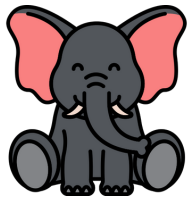
The animals are excited to see their new homes!

## Connector Guide

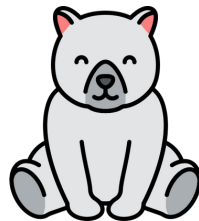
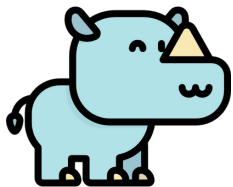
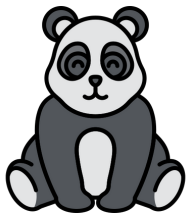




**3Dux | Design**  
The Modern Zoo Re-imagined



Congratulations you have been hired as the designer in charge of upgrading the world-famous Community Zoo in Paper Town, USA! Your job is to redesign the animal enclosures making sure that the animals are safe, healthy, and happy and that visitors can have a truly interactive and educational zoo experience.



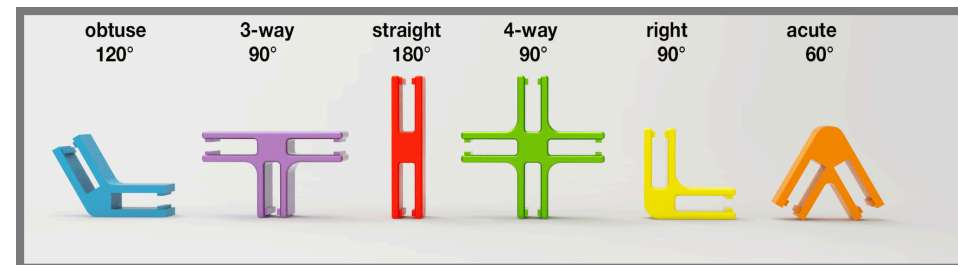
The staff would like to keep the zoo open during the construction phase. They will assign you one animal enclosure at a time to focus on. You will need to begin with research to learn about the animals in their natural habitats and use that knowledge to design each animal's enclosure.

## Things to consider:

1. The animals should be happy and healthy so be sure to include a fun activity for exercise. This will include a simple machine as described in each challenge.
2. Each animal should feel safe so consider its natural environment in your design.
3. Visitors should be able to safely see the animals; design the exhibit so visitors can watch and safely interact with the animals.
4. Be creative; unique ideas attract visitors!
5. If you finish early, add decorations, animal descriptions, more structural features, do the bonus challenge, or prepare a presentation!

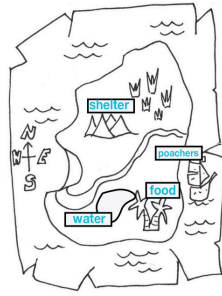
The animals are excited to see their new homes!

## Connector Guide



## Build.

Build your animal and the enclosure based on your design. Build your simple machine and refine it until satisfied. Include a zookeeper that is the correct **proportion** compared to your animal).



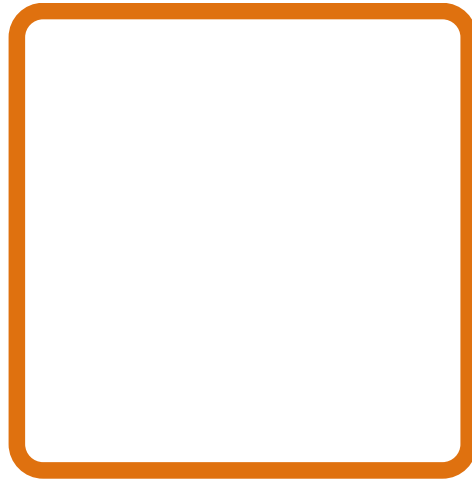
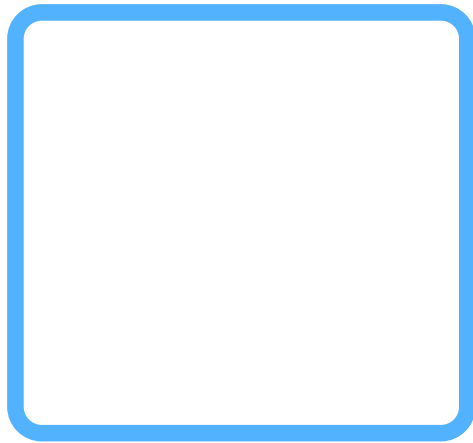
## Bonus Challenge.

After finishing your animal enclosure, draw your project from 3 different perspectives.

**Eye-level view** (like you're standing in front of the penguins)

## Bird's eye view

(from above)

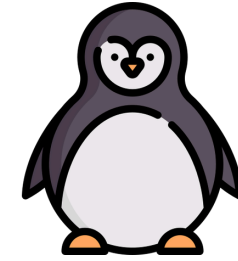


**Earthworm view** (from below, like you are a worm lying on the ground looking up at the penguins).



# 3Dux|Design

## Zoo Challenge: The Emperor Penguin



Habitats and fun facts



The challenge



Design your solution



Build it!



## Habitats and Fun Facts.



• The **Emperor Penguin** is from **Antarctica**, the coldest place on earth! They have a thick layer of fat and dense feathers to keep them warm. They also huddle together to share heat.

• The Emperor Penguin is only **4 feet tall**, that's the same as most 6-year-old children!

• Penguins love to **eat fish**.

• These penguins are **amazing swimmers** and can dive deeper than any other bird.

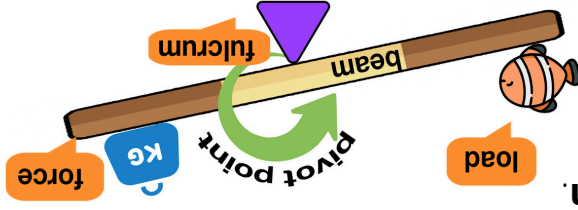
• Unlike many birds, Emperor Penguins don't build nests. Instead, the father penguin keeps the egg on his feet and covers it with a warm layer of feathered skin called a **brood pouch**.

## Your Challenge:

The zoo staff would like visitors to interact with the penguins. It is your job to design a "Fish Frenzy Game" where guests can feed the penguins from a safe distance. Design and build a **lever** with a **fixed pivot** that will catapult fish into the tank.

## \* Need to Know.

A **lever** is like a seesaw that helps lift heavy things. You push down on one side (that's the **force**), and the other side goes up, lifting the object (that's the **load**). The point where the seesaw balances and turns is called the **fulcrum**.



Frenzy Game to your design.

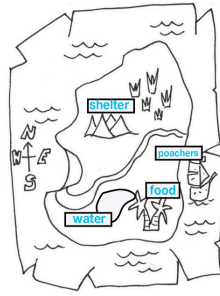
**Design your solution.** Design an enclosure with everything penguins need to survive. Add the Fish





## Build.

Build your animal and the enclosure based on your design. Build your simple machine and refine it until satisfied. Include a zookeeper that is the correct **proportion** compared to your animal).



# 3Dux|Design

## Zoo Challenge: The Bengal Tiger



## Bonus Challenge.

After building your design, test what happens to the speed of an object moving when you change the slope of your inclined plane. Which is faster? Why?



Less steep ramp



More steep ramp

Compare what happens to the speed of an object moving down a ramp when the ramp surface is rough vs. smooth. Using the same slope, cover one ramp with smooth, shiny tape (less friction) and keep the other ramp rough (more friction) cardboard. Which is faster? Why?



Rough ramp



Smooth ramp



Habitats and fun facts



The challenge



Design your solution



Build it!



## Habitats and Fun Facts.

- The **Bengal Tiger** is from **Bangladesh** (in Asia) and can live up to **25 years**.
- The Bengal tiger is the only wild cat in the world that likes to **play in water**!

- Tigers are **carnivores** which means their diet consists mostly of meat. They will eat up to 85 pounds of meat in one meal which will give them up to 3 weeks of energy.

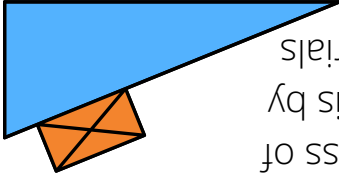
- Tigers **love to be up high** (for example in trees) so they can see all of their surroundings, ensure their own safety, and look for prey simultaneously.
- A grown male Bengal Tiger can weigh up to **420 pounds** and reach **9 feet** long!

## Your Challenge.

The zoo is upgrading the tiger exhibit! Design an enclosure that supports the animal's needs. Because tigers love to be above ground level, include a high platform feature with an inclined plane for the tiger to climb up and down. For an added challenge, try to include an **acute angle** somewhere in your design.

## \* Need to Know.

An **inclined plane** is a ramp that helps to move an object. The **force** required to move an object up an incline is less than just lifting it. The **rate** at which an object slides down a ramp depends on the steepness (or **slope**) of the incline and the roughness of the surface (**friction**). You can test this by changing the slope and surface materials of your ramp.

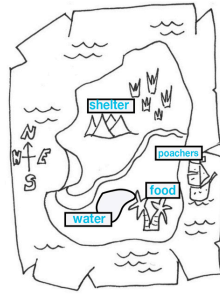


**Design your solution.** Design an enclosure with everything a tiger needs to survive. Be sure to add a platform with an inclined plane to your design.



## Build.

Build your animal and the enclosure based on your design. Build your simple machine and refine it until satisfied. Include a zookeeper that is the correct **proportion** compared to your animal).



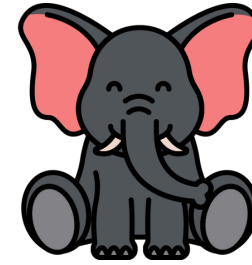
## Bonus Challenge.

Elephants like to play by moving things with their trunks. Design a playground feature with moving items. Make a list of safe but eco-friendly materials you would include.



# 3Dux|Design

## Zoo Challenge: The Elephant



Habitats and fun facts



The challenge



Design your solution



Build it!



## Habitats and Fun Facts.

- **Elephants** can be found in **Africa and Asia.**
- They can live up to **70 years.**
- Elephants are the world's largest land animal. They stand up to **10 feet tall and weigh up to 6.5 tons!**

They have about **150,000 muscles in their trunks.** which they use to drink water, as a snorkel when swimming, and to reach leaves in trees when eating.

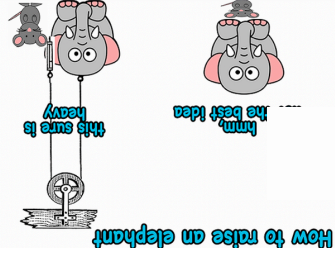
- Elephants are **herbivores**, eating up to 330 pounds of grasses, leaves, shrubs, fruits, and roots daily.
- Elephants have a better memory than humans!

## Your Challenge:

You have been asked to design and build the new elephant enclosure. Elephants are very smart and like to be challenged. Include a **pulley system** that will allow the zookeeper to lift pales of food into a tree (to **simulate** eating leaves). This way the elephants can exercise their trunks as they reach for their food and help make feeding time feel more natural. See if you can add a **right-angle** connector in this design.

## \* Need to Know.

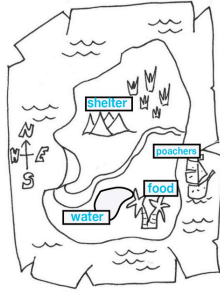
A **pulley** is a simple machine made of a wheel with a groove where a rope or belt can fit to help us lift heavy objects more easily. It is made up of a **wheel** that is fixed on an **axel**. By pulling on the rope, the pulley helps make it easier to lift an object.



**Design your solution.** Design an enclosure with everything an elephant needs to survive. Be sure to add a pulley system to your design!

## Build.

Build your animal and the enclosure based on your design. Build your simple machine and refine it until satisfied. Include a zookeeper that is the correct **proportion** compared to your animal).



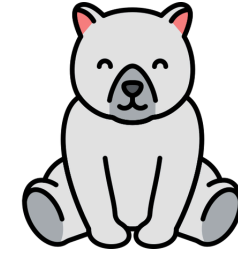
## Bonus Challenge.

Come up with a new Polar Bear den design where a ball can't get into the den structure. Draft your design below.



# 3Dux|Design

## Zoo Challenge: The Polar Bear



Habitats and fun facts



The challenge



Design your solution



Build it!





## Habitats and Fun Facts.

- The **Polar Bear** can be found in **Arctic** and can live up to **20 - 30 years**.
- The Polar Bear is only about **8 feet tall** but can weigh **up to 1,600 pounds!**

• Polar Bears are **carnivores** (which means they eat

meat - mostly seals).

• A polar bear's skin is actually black! Under their thick

layer of fur, they have jet-black skin!

• Unfortunately, with climate change (which is causing

ice in the Arctic to melt) and constant oil spills, these

animals are now on the **endangered species** list.

## Your Challenge:

The polar bear enclosure includes a bear den. Bears love to swim and play with toys but you have discovered that the bears' favorite toy ball often gets accidentally stuck under the den. Your challenge is to design a den and a **tool with a linkage system** that the zookeeper can use to lift the den and retrieve the balls when they get stuck. Try to include an **obtuse angle** in your model.

## \* Need to Know.

A **linkage** is a set of moving parts connected in a way

which help things move. For example, one type of linkage

might be two blades connected in the middle by a screw.

When the blades are opened, it becomes easier to move

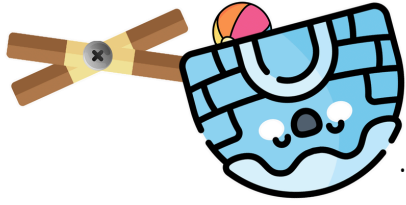
things. Your muscle moving the blades is the

**force**, the object lifted is the **load**.

The point where the blades

are connected is called

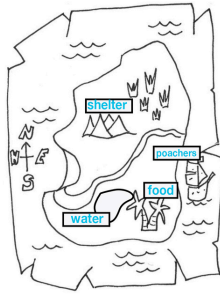
the **fulcrum** or the **pivot point**.



**Design your solution.** Design an enclosure with everything a polar bear needs to survive. Be sure to include a wheel and axle in your design.

## Build.

Build your animal and the enclosure based on your design. Build your simple machine and refine it until satisfied. Include a zookeeper that is the correct **proportion** compared to your animal).



## Bonus Challenge.

Scale is a way to compare the size of a real life object to the size of a model. It's like figuring out how many mini-you's (or the zookeeper) would fit into the real you!

1. Measure yourself in duxits
2. Measure your model zookeeper in duxits
3. Calculate the scale of your model:

Formula - miniature model in duxits/yourself in duxits

I am \_\_\_\_\_ duxits tall!

The model zookeeper is \_\_\_\_\_ duxits tall!

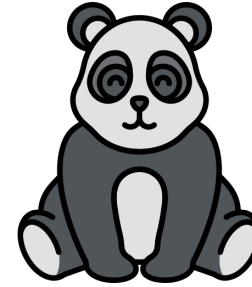
\*\*\*Formula: model size / your size = Scale

The scale of my model is: \_\_\_\_\_

Double Bonus: How many "mini-you's" would equal one real you? \_\_\_\_\_

# 3Dux|Design

## Zoo Challenge: The Giant Panda



### Habitats and fun facts



### The challenge



### Design your solution



### Build it!



## Habitats and Fun Facts.

- The **Giant Panda** can be found in **China** and can live up to **20 years**.
- The Giant Panda is the only bear that **does not hibernate** (they do not sleep through the winter).
- Giant Pandas have an extended wrist bone that they use like a thumb to help them grip their food.
- Pandas main diet consists of bamboo. They spend **10-**

## 16 hours a day eating!

- Pandas have excellent **camouflage** for their habitat. Their black and white coat can be used to blend into both snowy and shady conditions.

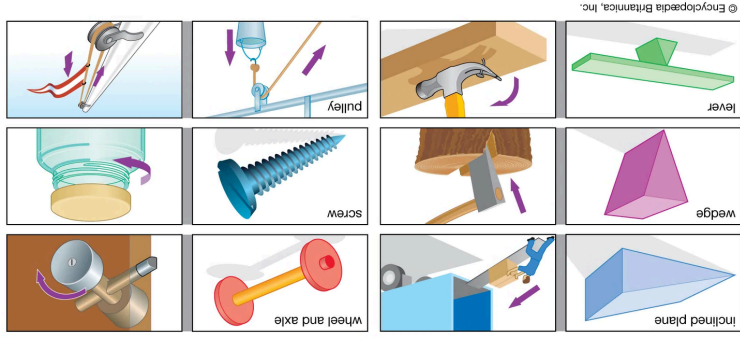
## Your Challenge.

The staff would like the pandas to get exercise (they can be a bit lazy). Design a playground with an obstacle course for the pandas. Use at least **two different simple machines** in this design.

## \* Need to Know.

There are six different simple machines. Choose at least two of the following to add into your design:

1. Inclined plane
2. Wheel and axle
3. Wedge
4. Lever
5. Pulley
6. Screw



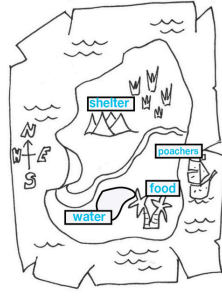
© Encyclopædia Britannica, Inc.



**Design your solution.** Design an enclosure with everything a panda needs to survive. Be sure to include at least two simple machines to your design.

## Build.

Build your animal and the enclosure based on your design. Build your simple machine and refine it until satisfied. Include a zookeeper that is the correct **proportion** compared to your animal).



## Bonus Challenge.

The best way to attract customers is to add an element of mystery and excitement! Make a one -minute commercial or flyer to advertise the new animal to attract customers. describe the animal without naming it. Take notes below.

# 3Dux|Design

## Zoo Challenge: The Mystery Mammal (or Marsupial)



Habitats and fun facts



The challenge



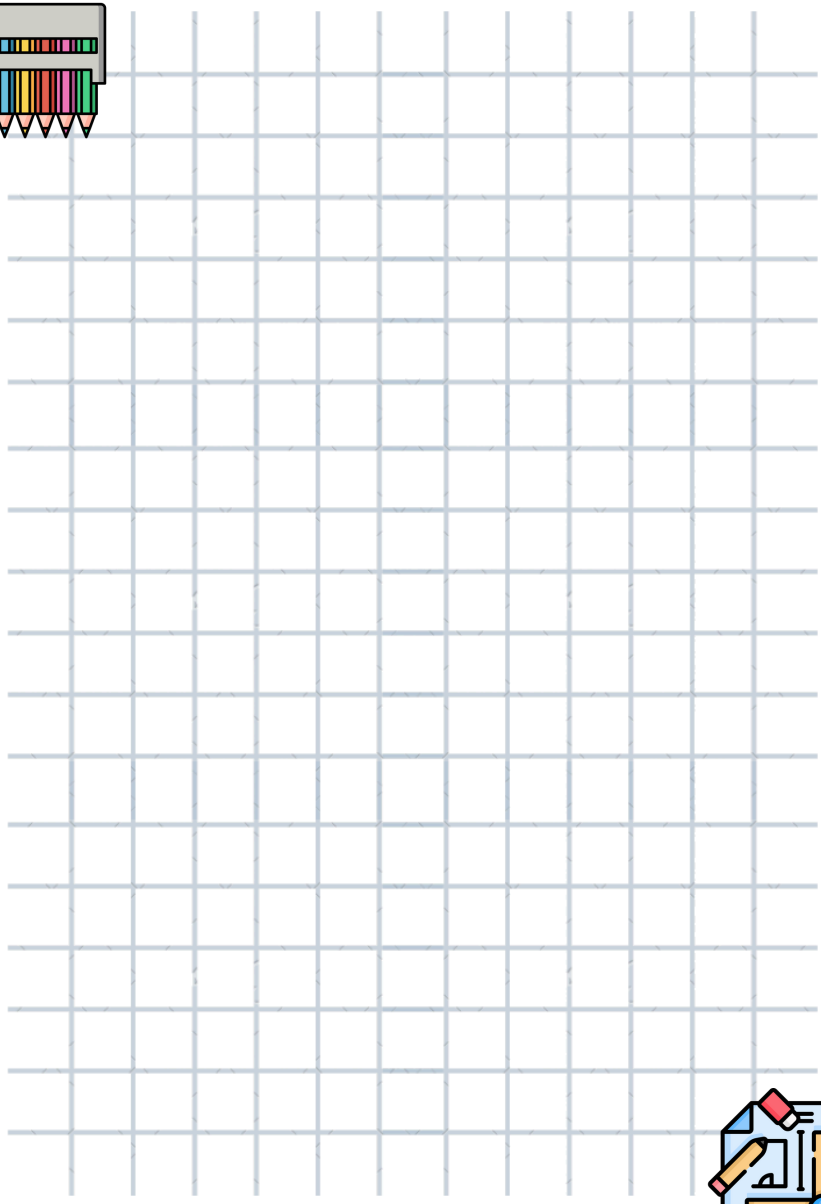
Design your solution



Build it!

**Your Challenge.** Pick a new **mammal** or **marsupial** for the zoo. Research your animal and design an enclosure that will keep the animal happy and healthy. Include a special feature in this exhibit that will allow visitors to interact safely with the animal. It should include a **wheel and axle**.

**Design your solution.** Design an enclosure with everything your mammal/marsupial needs to survive and the special feature.



### Your Challenge.

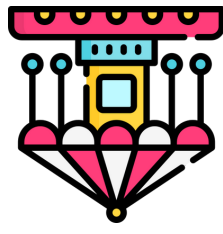
Pick a new **mammal** or **marsupial** for the zoo. Research your animal and design an enclosure that will keep the animal happy and healthy. Include a special feature in this exhibit that will allow visitors to interact safely with the animal. It should include a **wheel and axle**.

### Habitats and Fun Facts:

- 
- 
- 
- 
- 

### \* Need to Know.

Define a wheel and axle:



---

---

---

---

---

---

---

---