3D DESIGN & PRINTING

This book belongs to

....

Introduction to 3D Design & Design Thinking Program

Grade 5/6 - Student Book

MAKERS M EMPIRE

Contents

The lessons in this book are aligned to the Makers Empire International Design Curriculum. This curriculum aligns to international design & technology and engineering curricula around the world including Australian Curriculum and Next Generation Science Standards (USA).

This book has been designed as an introduction to 3D design and printing. It specifically addresses the Grade 3 & 4 curriculum, however, it is also suitable for intermediate students of all ages.
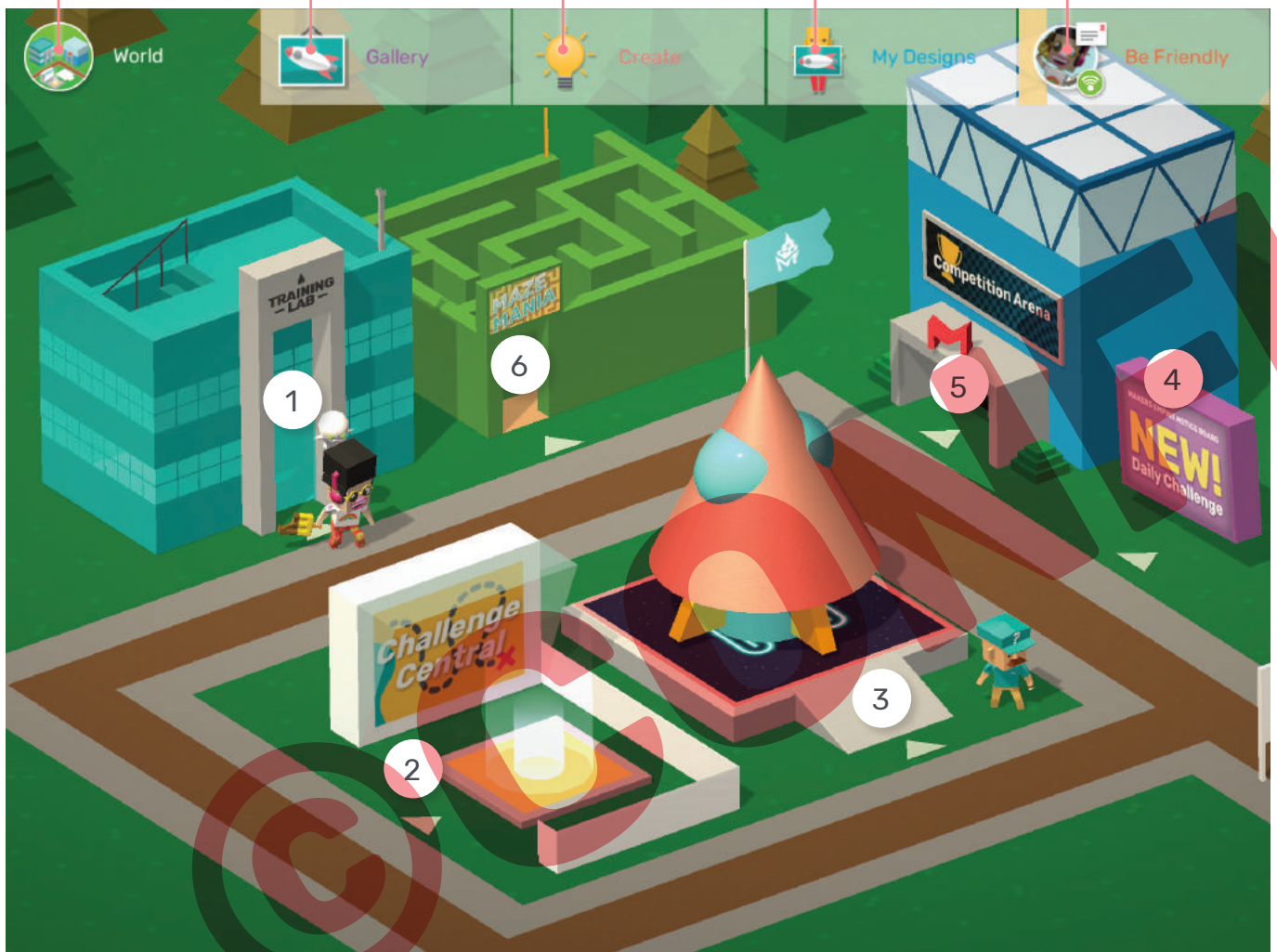
Maker World - where you can get challenges, create missions and play 3D mazes

Create - to open the free form design tools which you will use for the rest of this course

Me tab - this is where you can check your settings and edit your avatar

Gallery - this is where you can view other people's designs

My Designs - this is where you go to view and edit your own designs

1. Getting Started with Makers Empire

Description

In this lesson you will get started with your 3D learning.

You will learn how to log in to the **Makers Empire 3D** app and create your 3D avatar.

You will work through the tutorials in the **Training Lab** and learn how to use all the different tools in the app.

Welcome to Maker World

1. **Training Lab** - This is where new users go to complete some simple tutorials and quickly learn the basic design tools of Makers Empire 3D.

2. **Challenge Central** - In here you complete design challenges to test your problem solving skills. Your teacher will assess your work and you can get rewards if you do a really good job!

3. **Mission Maker** - You can create your own design missions for others to try., or try one of the thousands of missions other students have made.

4. **Daily Challenges** - You can visit the board if you need a bit of inspiration to start a design. There is a fresh challenge everyday, so there is always something new to try.

5. **Competition Arena** - This is the home of our hotly contested monthly competitions. Students from all over the world submit designs based on a new design problem every month. Winners and runners up receive a Makers Empire trophy and the glory of being crowned a Design Champion!

6. **Maze Mania** - Use your 3D design skills to create unique 3D maze games for their friends. Maze Mania uses Game Based Learning to teach the importance of testing and iteration, and also develops spatial reasoning and the ability to predict outcomes.

How to Get Started with Makers Empire

Step 1.

You will need to remember your log in details. Record them here to keep them handy.

Username: ....

Password: ....

Step 2.

Now you are going to log onto Makers Empire for the first time.

As you work your way through you will be guided step by step.

The first thing you are going to do is log in, create your avatar and then complete nine tutorials.

As you finish each tutorial you will earn tokens and move up levels.

1. Log In

Open Makers Empire 3D and click the green **Log In** button. Enter your **username** and **password**.
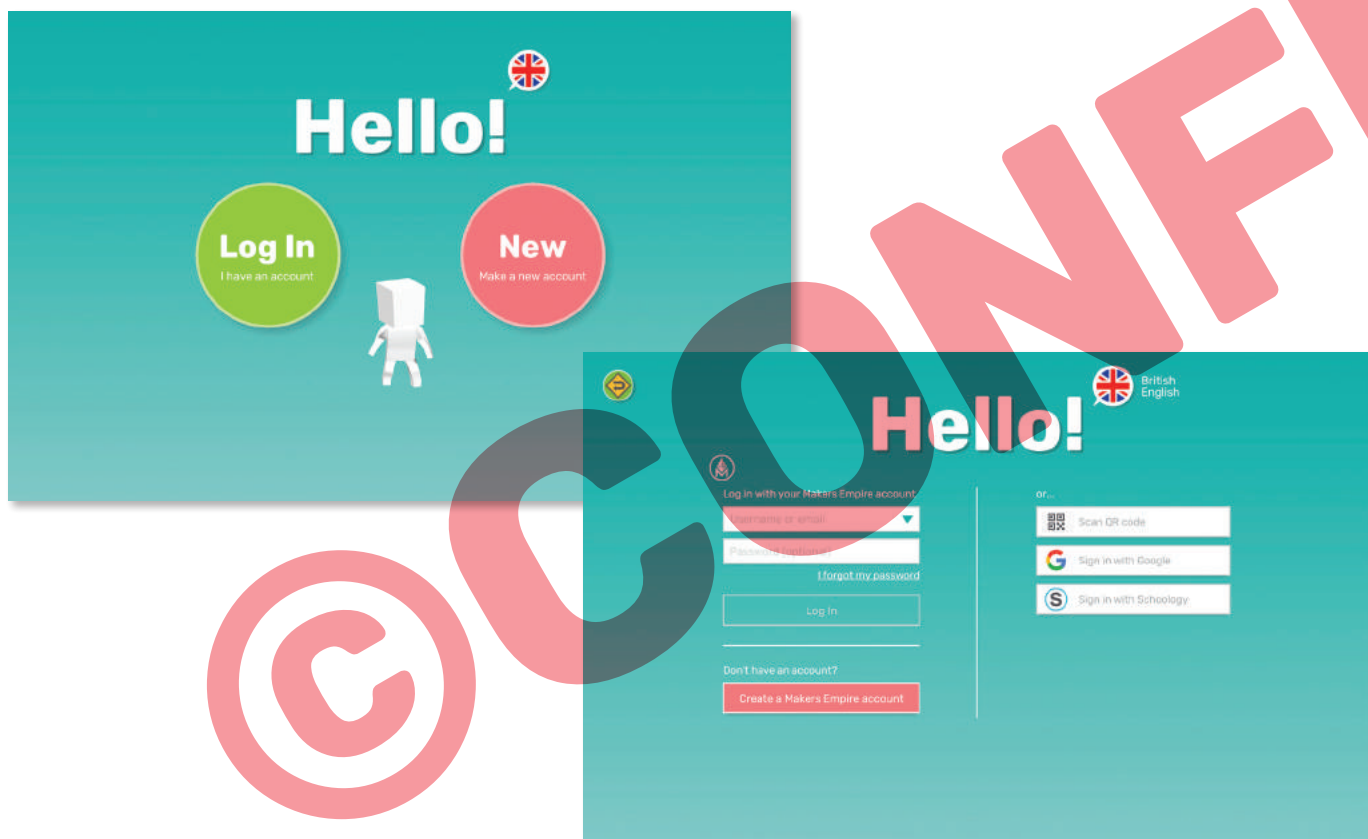
2. Enter the Training Lab and create your avatar

Click on the **Training Lab** building to enter, then click the **green flag** to begin the first tutorial.

Choose body parts, clothes and something to hold in your hand.

Click **Finish** when you are ready
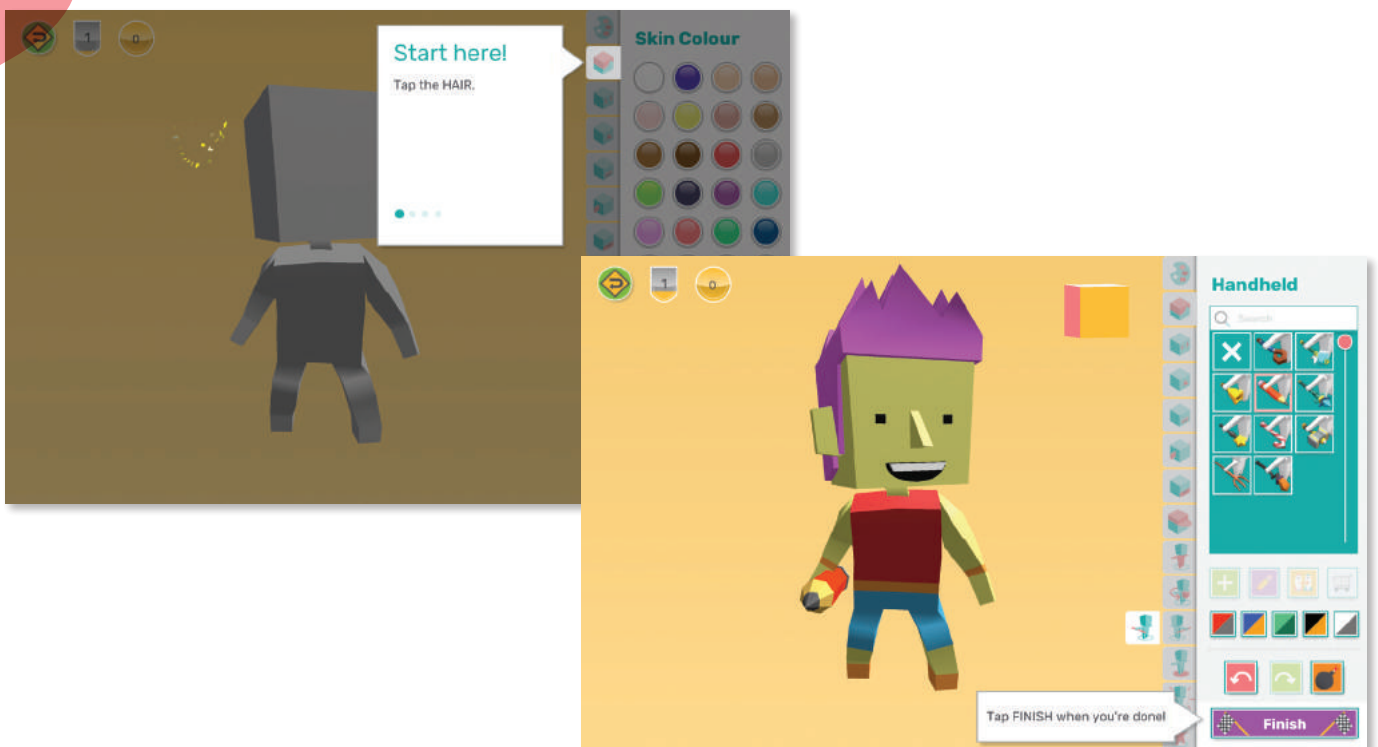
3. Make a tower

You are going to make a tower by using the **Shaper Module**.

You will learn how to add shapes, delete your whole design and undo your last action.

4. Your favorite colors

You are now going to practice using the **color palette** and paint the flower.

Take your time to learn all about colors.

5. Beard maker

In this challenge you are going to use the **Blocker Module** to add a beard to the face.

Follow the instructions and have fun creating a block beard.
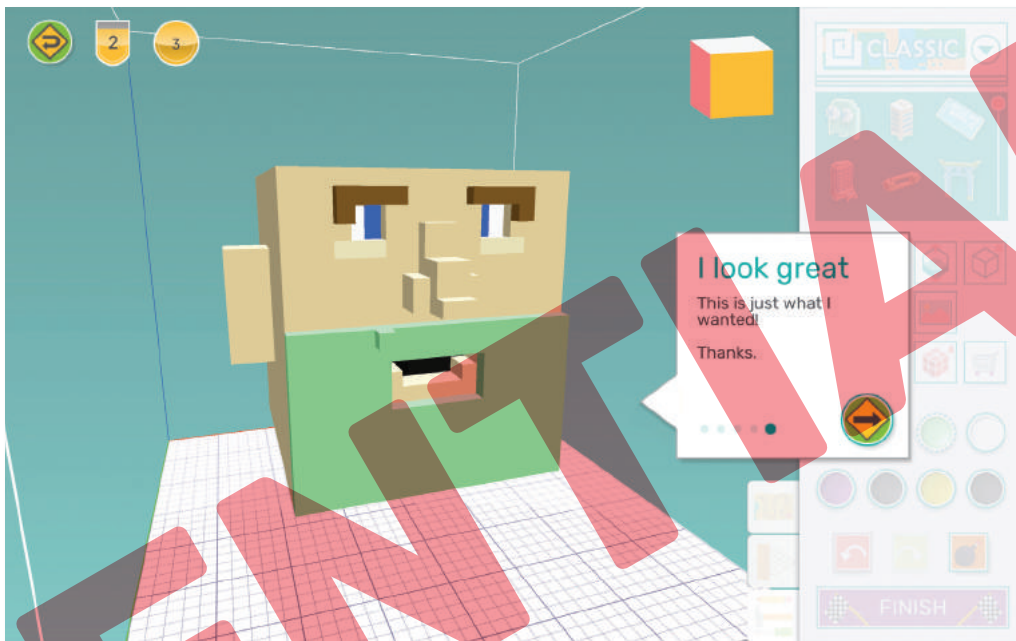
6. Open a present

In this challenge you will learn how to take blocks away to see what is hidden in the present.

Follow the instructions. What did you find?
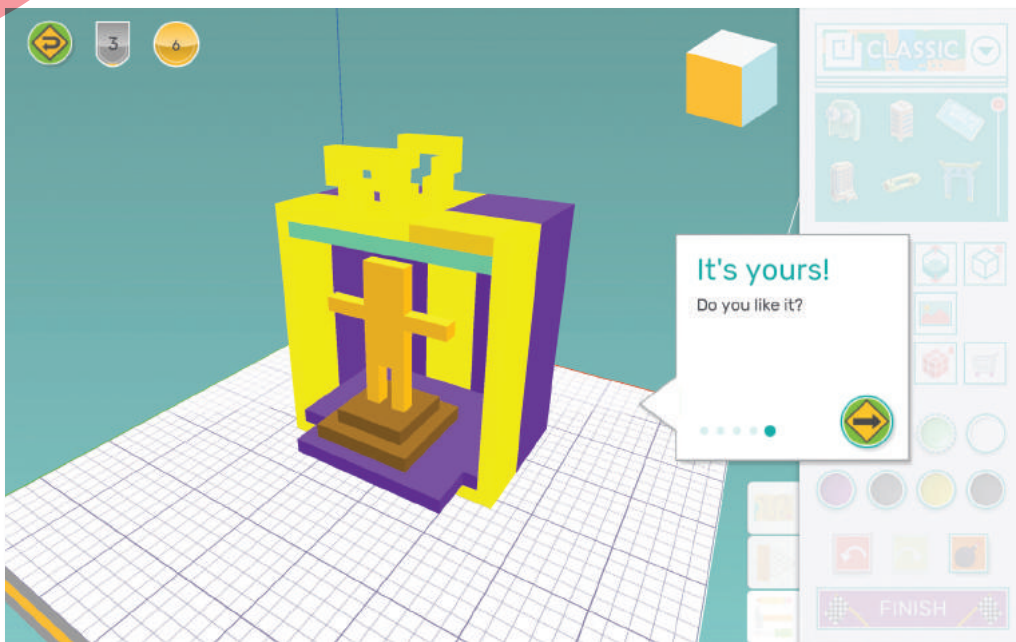
7. Spooky Painting

Now for some spooky fun, the spooky painting challenge shows you how to add and change colors in the **Blocker Module**.

Try experimenting with different colors
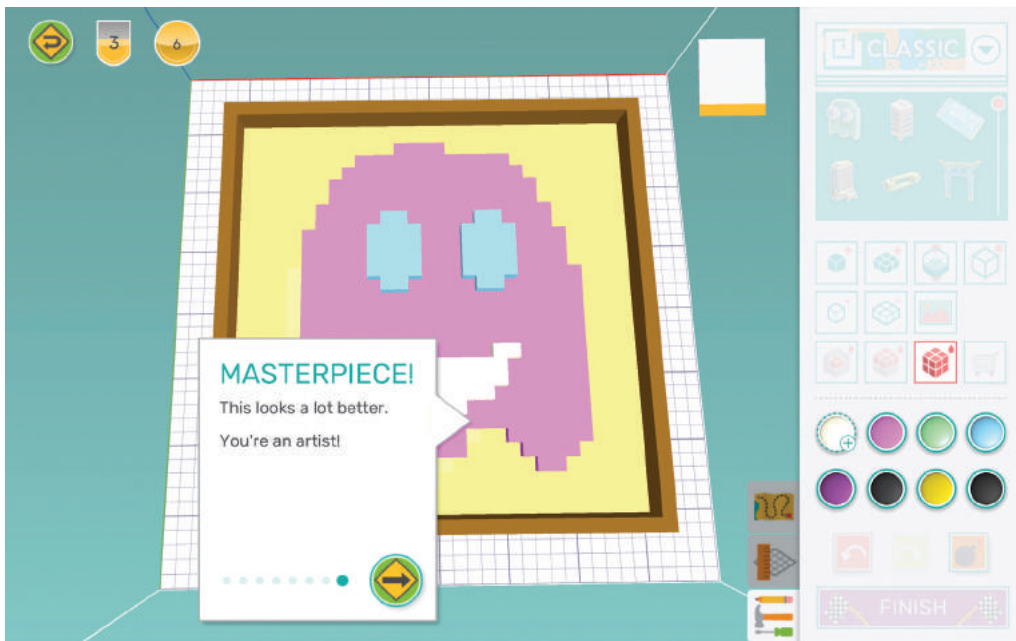
8. Fish Out-of-Water

In this challenge you have to put the fish back into the water.

Someone tipped the tank over!

Click on the fish. Then **drag** and drop it into the water.
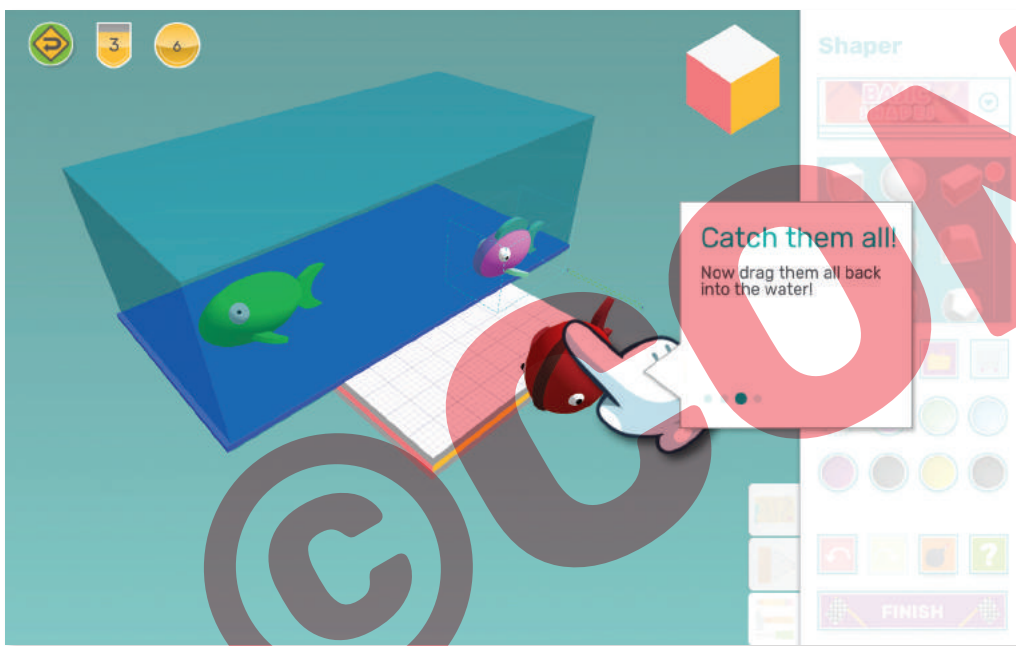
9. Grow Your Hair

In this challenge you will use the **resize buttons** to make the hair grow bigger.

Drag up and out to make bigger or down and in to make smaller.
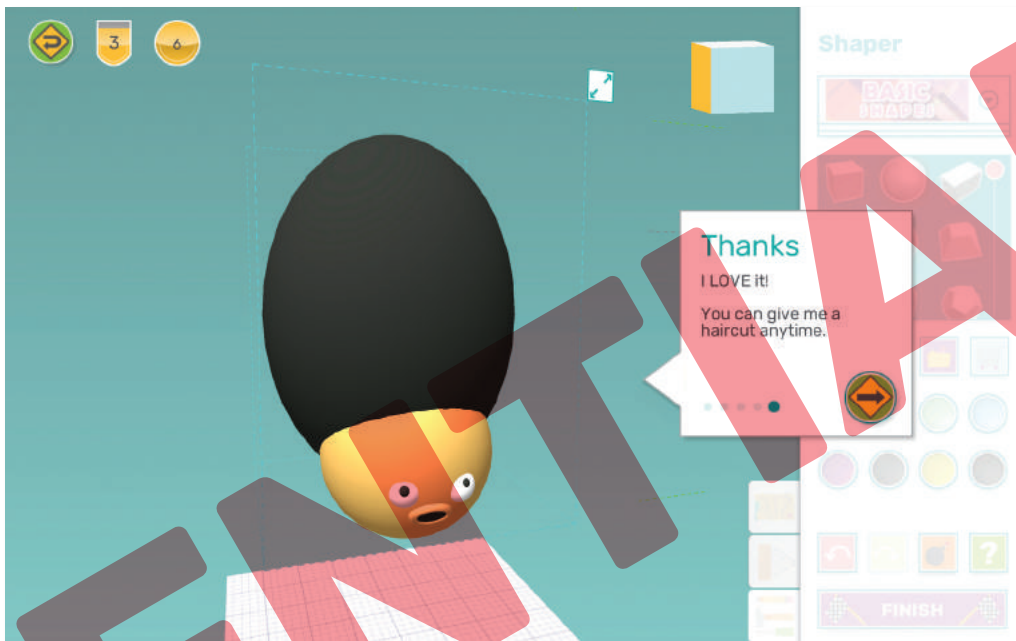
10. Bug Catcher

The poor dog is covered in fleas! Use the **zoom** tool to get a closer look, and spin around to find all the pesky fleas.

Use the **delete** tool to remove the fleas and make the dog happy again.

10. Make a hat for your avatar

Combine shapes to make an original hat design. Maybe you'd like a party hat? Or a cowboy hat? What about a helmet? Perhaps a warm wool cap is more your style?

Give your hat design a title, and set a price. Maybe someone will buy it from you!

Once you've learned how to make a hat, you can make any parts you want for your avatar.
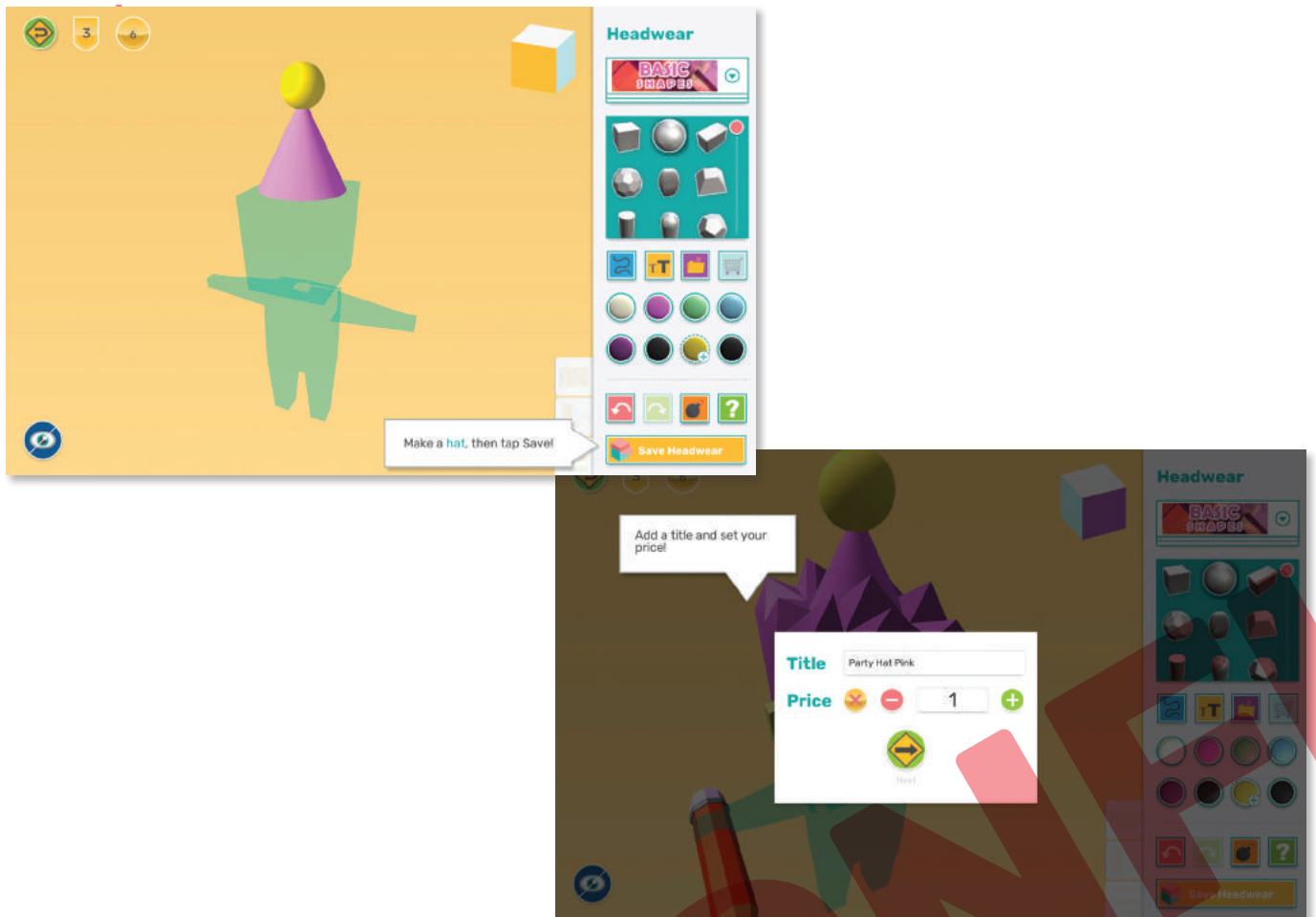
Step 3

When you have finished the Training Lab tutorials visit other areas of Maker World and discover what else you can do here.

List 3 new things you found in Maker World:

1. ....

2. ....

3. ....

Step 4

Draw your avatar. Label the parts you added to your avatar and the 3D shapes you used. You could also draw some other ideas for your avatar here. You can go back and edit your avatar whenever you like.
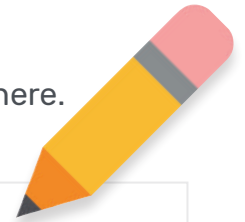
2. Your first 3D printing project

Description

In this lesson you will become a 3D designer and make your first 3D printed creation.

You will learn how to use Shaper to make a tag for your pet or another pet that you know.

You will need to think about the information to include on your pet tag.

You will also need to make sure that the tag can be attached securely to the pet's collar and be comfortable for them to wear.

How to make a pet tag

Step 1.

You are now going to create your very first 3D printed design. This will be a name tag for your own pet or another pet that you know.

The name of the pet I will make a tag for is

....

Step 2.

Draw a line to join the shapes to their name:

Rectangle

Square

Circle

Triangle

Semi-Circle

Ring

Pentagon

Hexagon
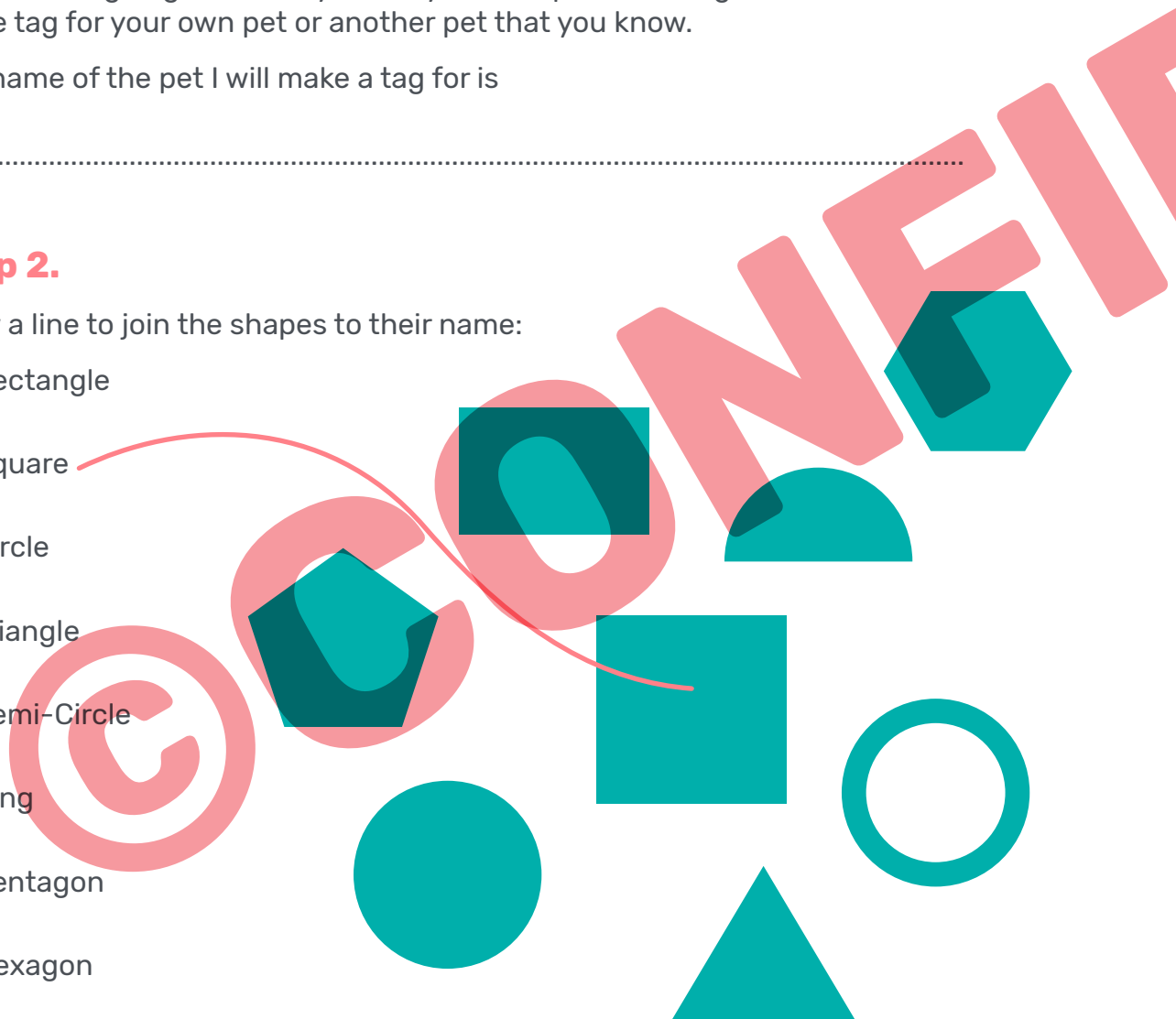
Step 3.

Draw the pet you are going to design a name tag for. Don't forget to write the pet's name on your drawing.

Things to think about:

1. How big is the pet? You will need to design a tag that is a suitable size. Imagine a tiny kitten wearing a tag the size of a dinner plate!

2. What kind of collar does the pet wear? Your tag will need to attach to the pet's collar.

3. Your tag will need to have the pet's name on it. What other information will you include on the tag? What might be helpful if the pet gets lost?

I AM MADE UP OF 2D SHAPES.
HOW MANY 2D SHAPES DO YOU KNOW?
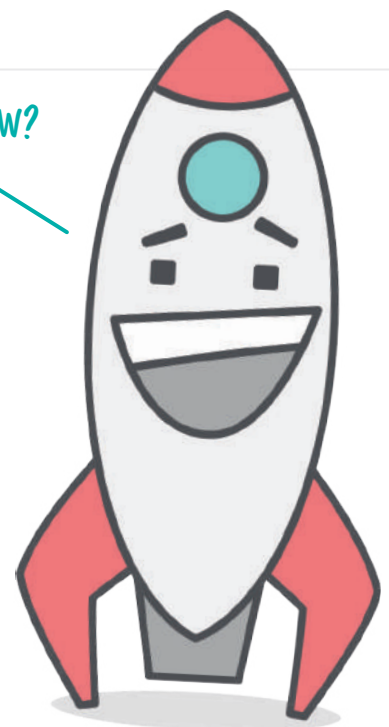
Step 4.

Making a pet tag

1. **Log in to Makers Empire 3D and open Shaper**
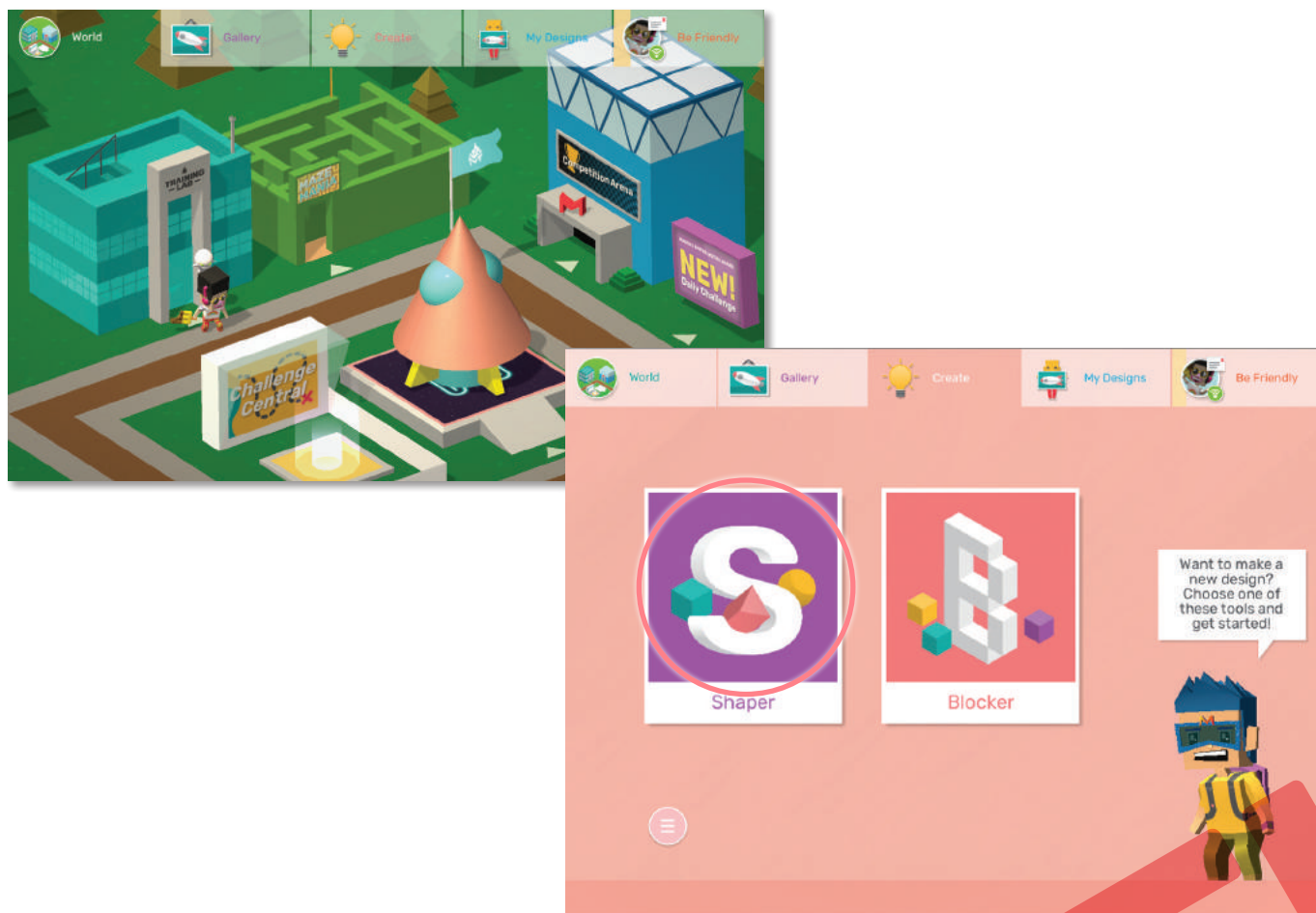
2. **Select your base shape**
   You can use any shape, but **flat shapes** work best.
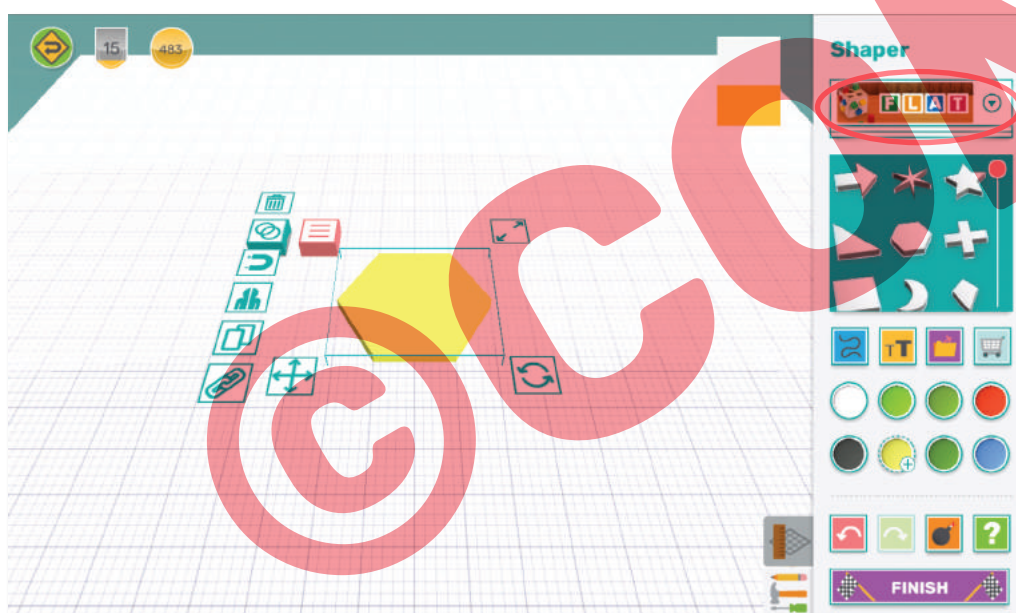
- **Resize base shape**
  Think about the size of the pet. Drag the **Size** button to adjust your tag to suit that animal.
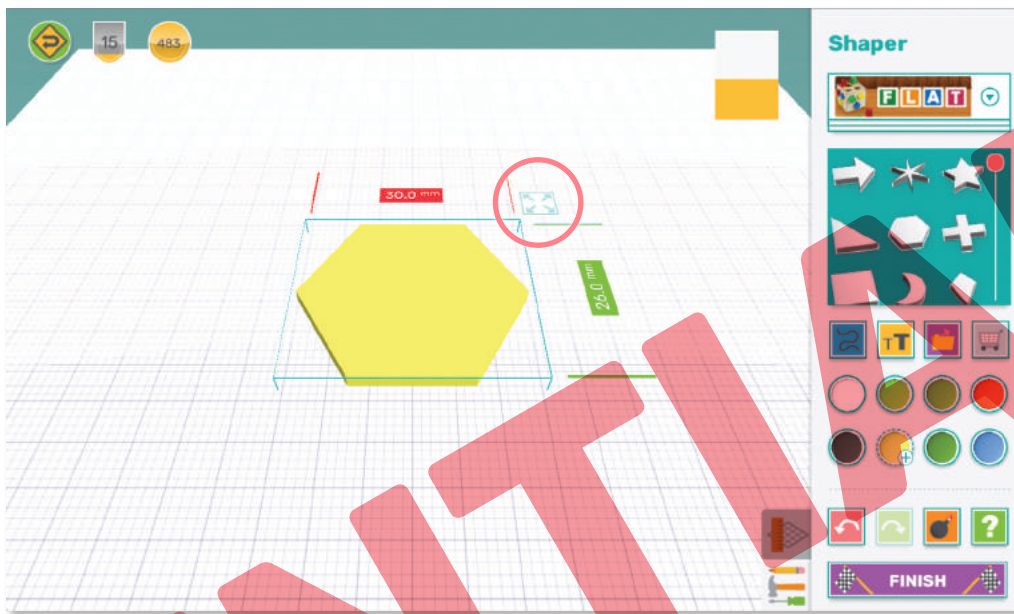
PRO TIP!

- You can click the **Size** button to open **Precision Mode** and accurately control the size of your shape.

- You can choose **Free Resize** to stretch your shape in any direction, or use **Fixed Resize** to change the size but keep the same shape.
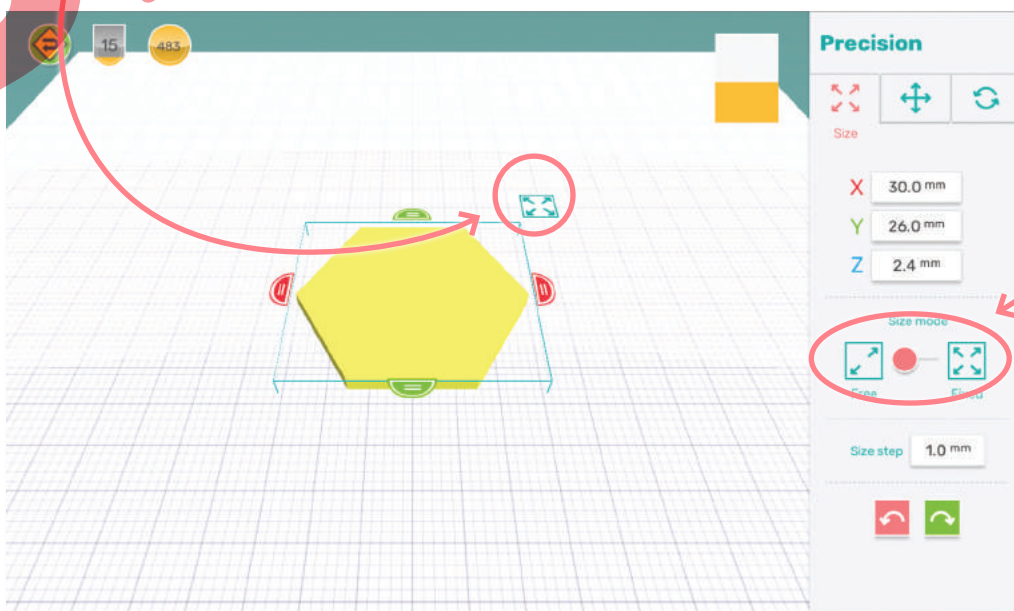
3. **Add text**
   Type your pet's name in the top box. You can choose different fonts (text styles) in the second box.
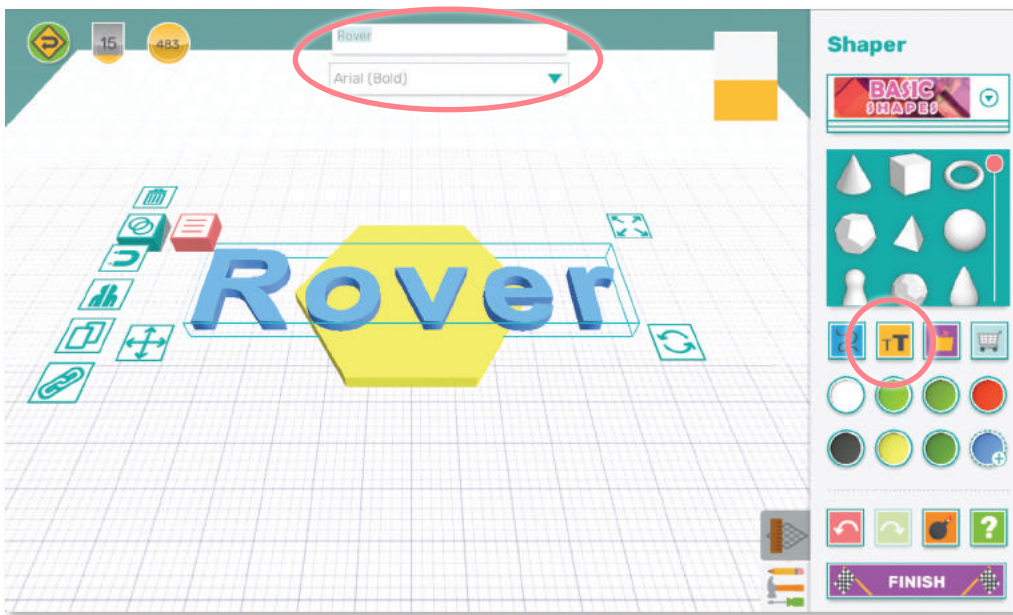
4. **Resize your text**
   Make sure your text fits on your tag and is touching your base shape
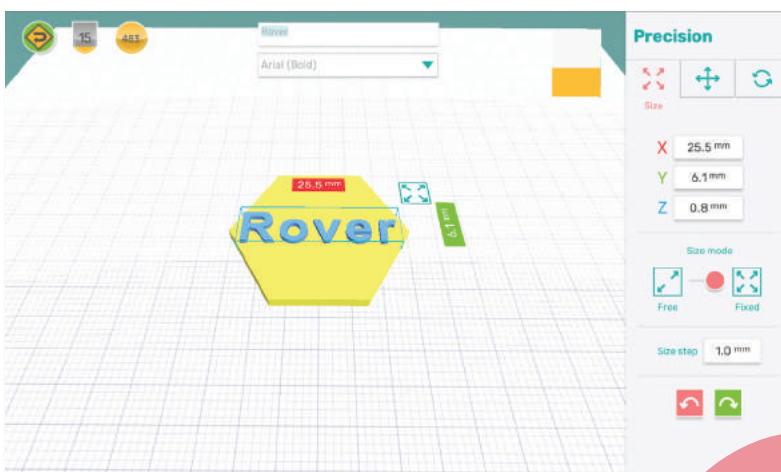
5. **Add a ring**
You can use a donut shape or a letter like "O" or "D". Use the Rotate tool to make sure the ring is facing the right way.
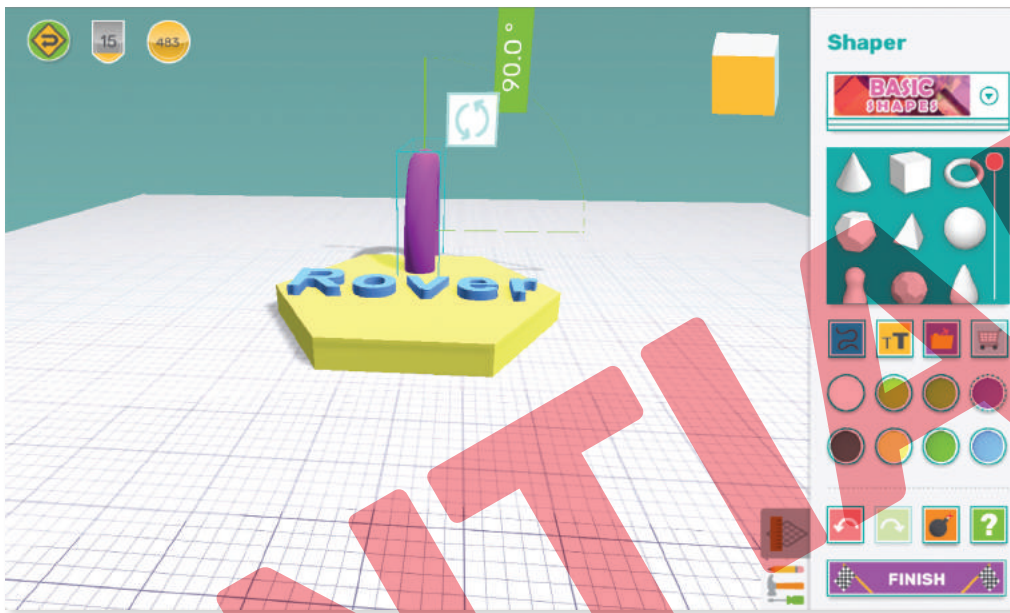
6. **Group all your shapes**
Click the **Link (Chain)** button. Click all the shapes, then click the **Tick** button.
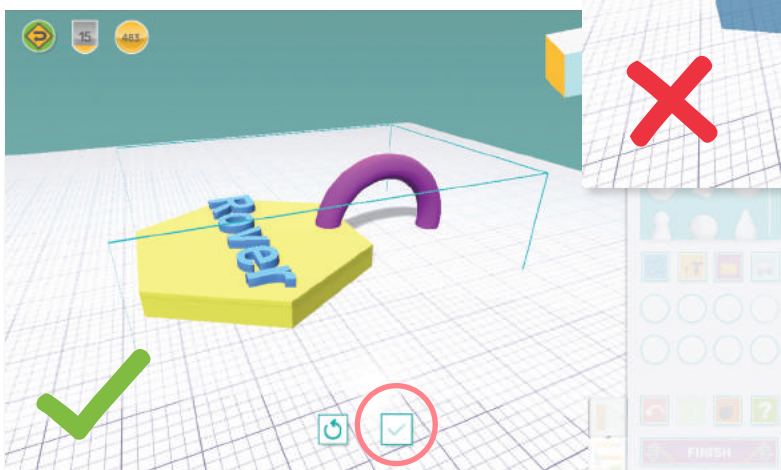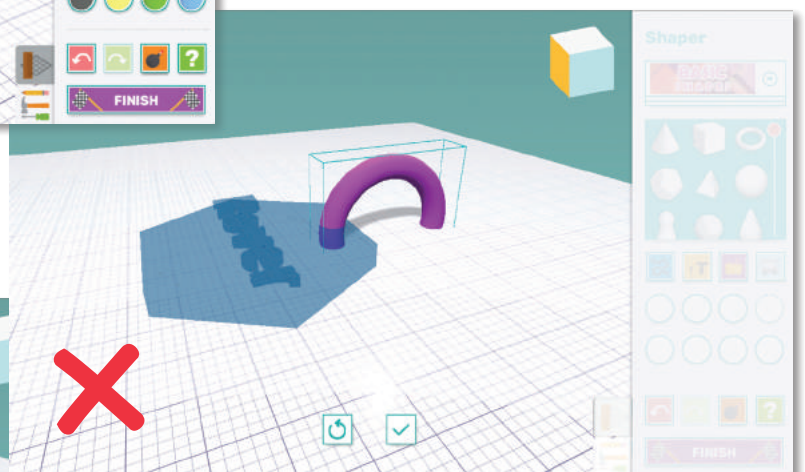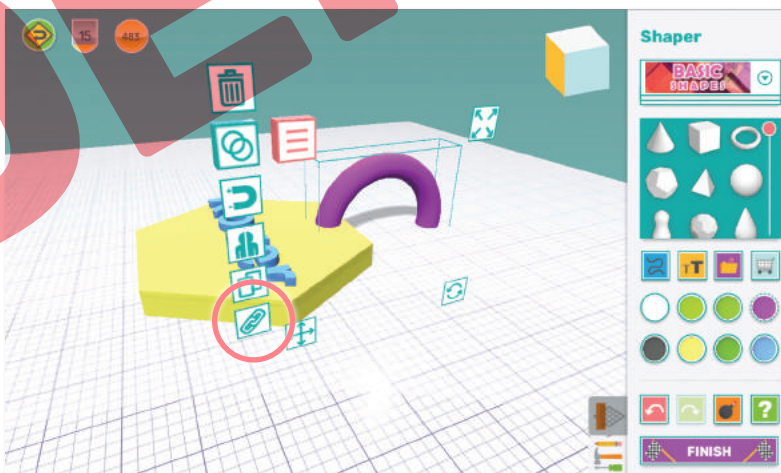
7. **Make sure your tag is not cut off by the work platform (the white rectangle)**
If your shapes are cut off by the platform they won't print! Use the **Move** tool to make your tag sit above the platform.
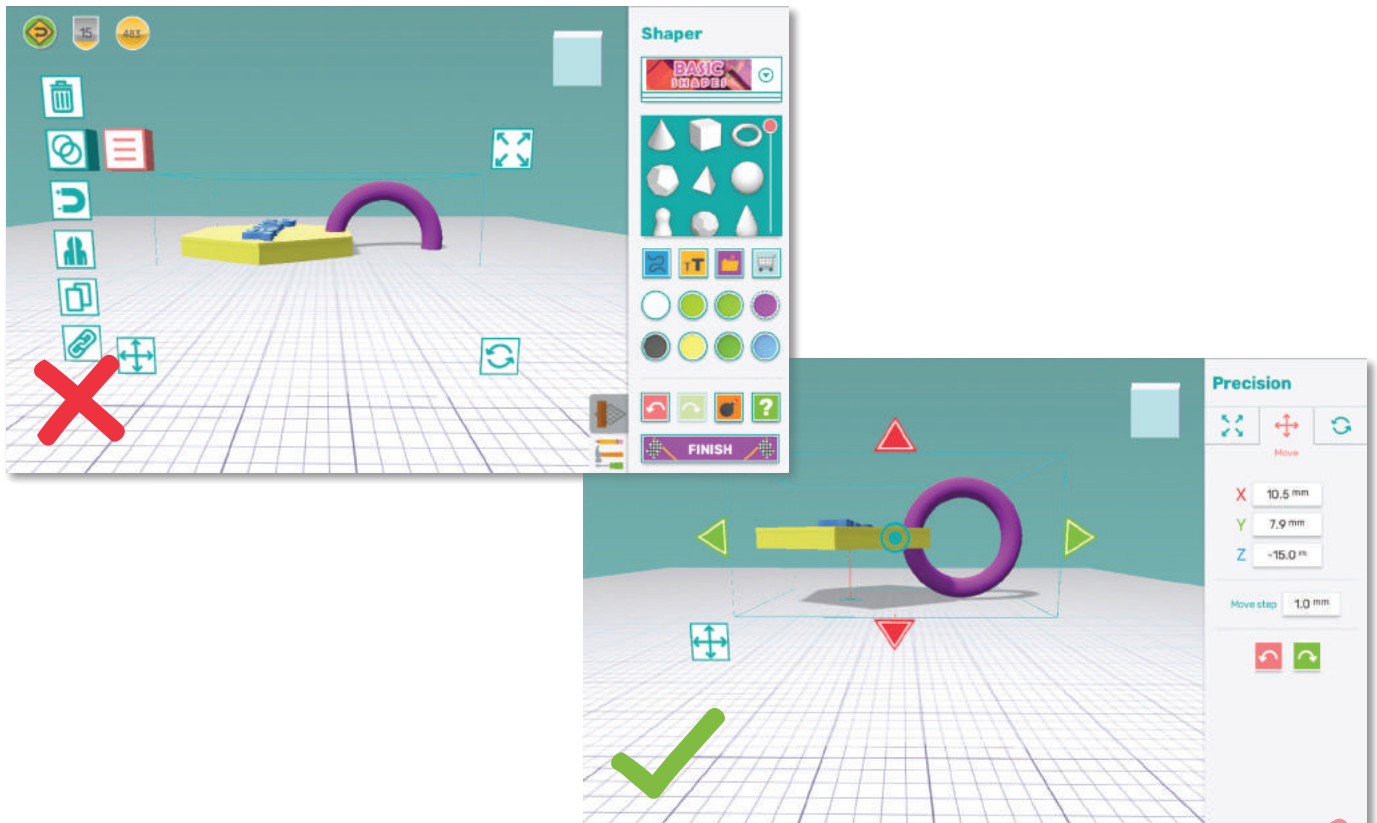
8. **When you have finished your pet tag, click "Finish" and give it a title**

3. All about 3D printing

Description

In this lesson, you will learn all about 3D printers.

You will find out what a 3D printer is and how they work.

You will discover what 3D printers are being used for in different ways around the world.
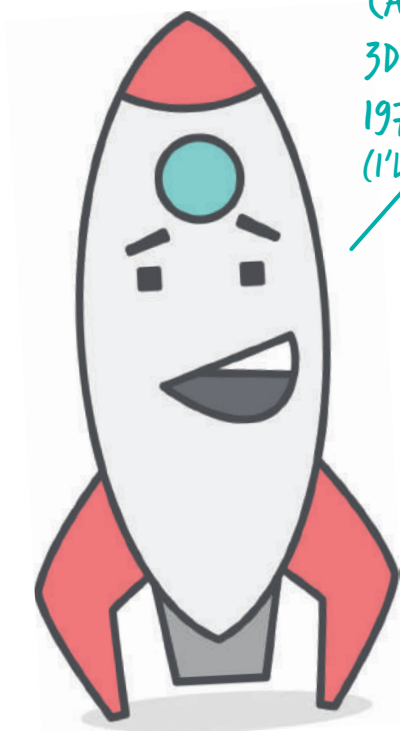
CAN YOU GUESS WHEN THE FIRST 3D PRINTER WAS INVENTED: 1973, 1983, 1993 OR 2003? (I'LL TELL YOU THE ANSWER LATER...)

Getting to know 3D printers

Step 1.

In this lesson, your teacher is going to start printing the pet tags from Lesson 2.

You will see the 3D printer in action.

Draw a picture of the 3D printer in the box below.

Make sure you label :

- The heated nozzle
- The filament
- The build platform

Can you label any other parts of your drawing?

Step 2.

Look at the pictures below. Draw a circle around the things that could be made using a 3D printer:

Step 3.

Your teacher will demonstrate how the 3D printer works. Write a sentence to explain how the 3D printer makes objects.

....

....

....

....

Step 4.

Now that your pet tag has been 3D printed compare it to your design in the Makers Empire 3D app.

What has changed?

....

....

What looks the same?

....

....

Step 5.

Draw a picture of your pet, or the pet you know, wearing the name tag you made.

4. Shaper project: Design a plant marker

Description

In this lesson you will learn how to put shapes together to make a plant marker in Shaper.

Your design can be 3D printed and used to start growing a class plant garden.

You will need to decide which herb you are going to plant.

Your plant marker needs to clearly show the name of the plant and will also need to have a spike to hold it up in the soil.

Once your plant marker is 3D printed you can plant your seeds and keep track of your plants as they grow.

How to make a plant marker

Step 1.

Do some research about plants and decide which plant you are going to grow.

Complete the information about the plant you have chosen:

- Name of plant:

  ....

- Growing conditions:

  ....

  ....

- Common uses:

  ....

  Is it flowering or non-flowering?

  ....

  Draw a picture of the plant.
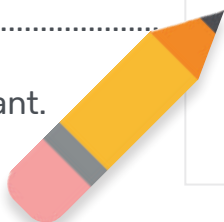
Step 2.

Draw your design idea for a plant marker here.

MANY PLANTS ARE GROWN FOR FOOD.
HOW MANY CAN YOU THINK OF?
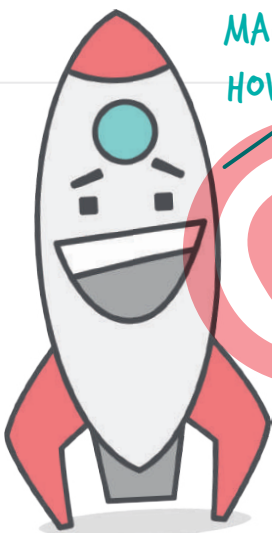
Step 3.

Follow the steps to design your plant marker in Makers Empire 3D.

The design criteria for your plant marker are:

1. Must have a spike to hold the marker in soil.

2. Must clearly show the name of the plant.

Making a plant marker

1. **Log in to Makers Empire 3D and open Shaper**

2. **Select your base shape**
    You can use any shape, but flat shapes work best. Resize your shape to match your drawn design.

3. **Add a spike**
    A flat triangle is a good shape to use.
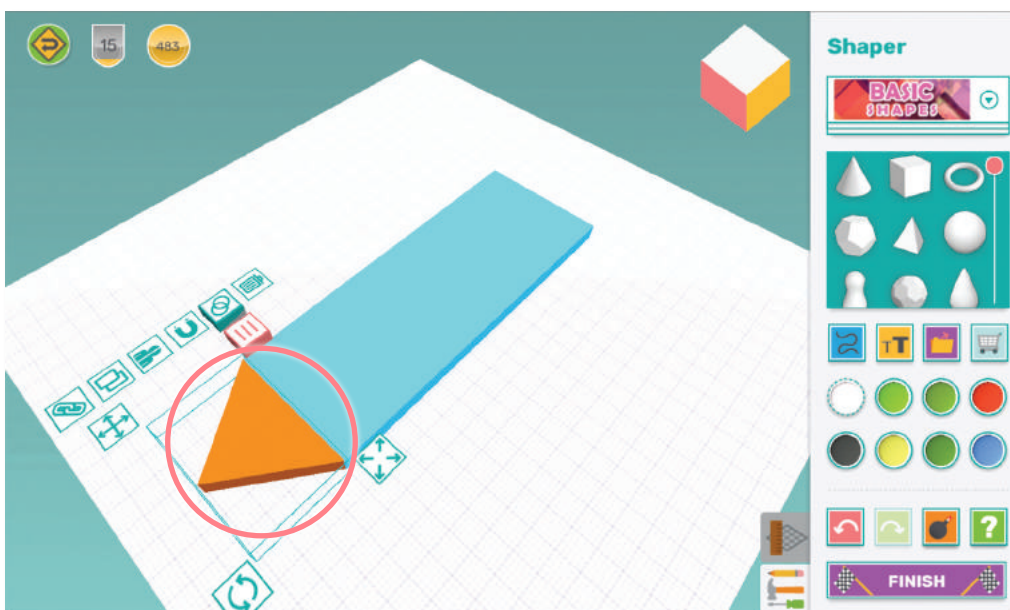
PRO TIP!

Use the **Group** tool to make sure your shapes stay together when you move and resize them. Click the Group button, choose the shapes you want to keep together, then click the **tick** button.
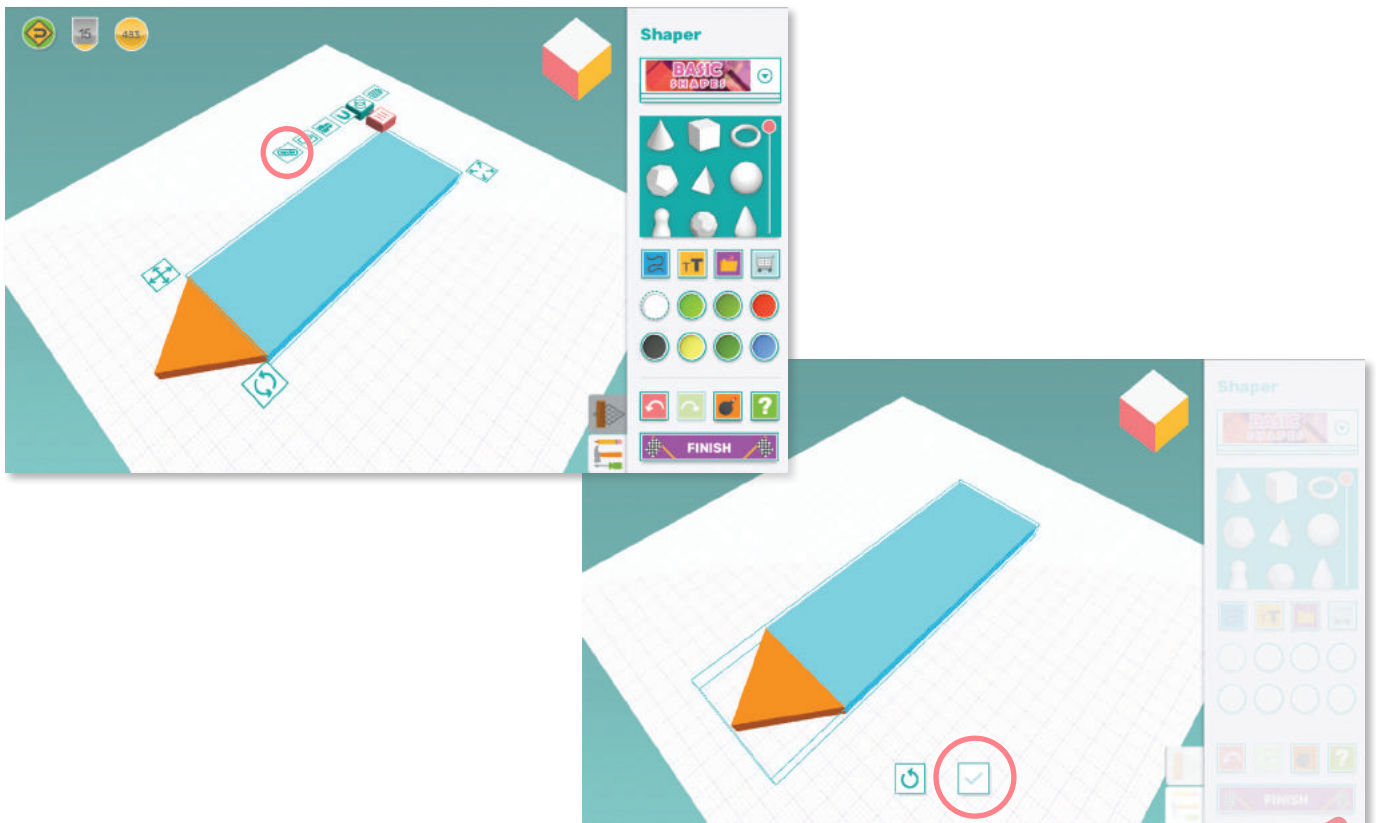
4. **Add the name of your plant**
   Use the **Text** tool to write the name of your plant, then use the **Resize, Rotate** and **Move** tools to position the name.

5. **Add extra decorations if you want to**

Step 4.

List the steps you followed to create your plant marker.

1. ....

2. ....

3. ....

4. ....

5. ....

Step 5.

Compare your 3D plant marker with the drawing of your original idea. What changes did you make and why?

....

....

....

....

....

....

QUICK GUIDE

Get started designing in Makers Empire 3D with this quick visual guide to the most used tools and navigation buttons.

MAKERS EMPIRE

PROFILE

My Profile	Edit Hero	Settings	Help-bot	Dashboard (teachers only)	Log Out

Level	Likes	Tokens	Comments	Awards	Mentions	Views	Downloads	Followers

MY DESIGNS /GALLERY

Hot Designs	New Designs	Top Designs	All the World	My School	My Class	Search		View (Gallery)	Edit (My Designs)

Set Price / Buy Design	Showing / Hidden (My Designs)	Photo	Video	Download	Like	Copy	Delete (My Designs)	Report (Gallery)	Comment

HERO

Skin Colour	Hair	Eyes	Noses	Mouths	Ears	Facial Hair	Headwear

Outfits	Back Items	Handheld Items	Bases	Auras	Poses	Buy Hero Parts

SHAPER

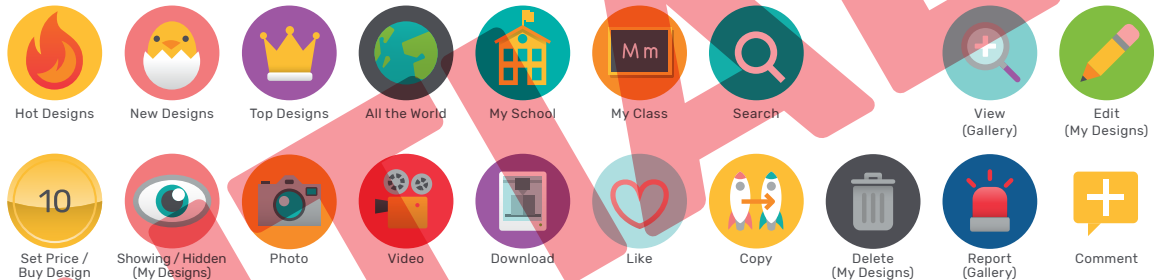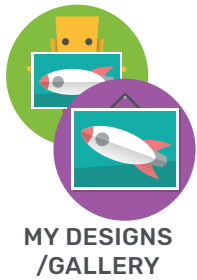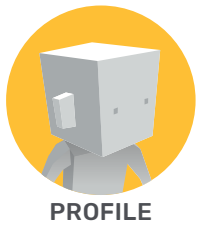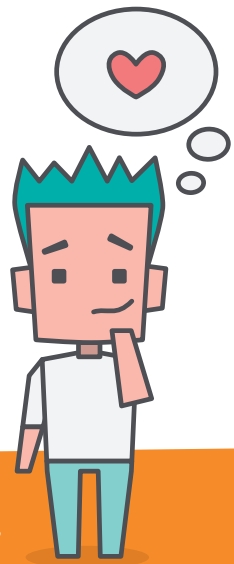| Draw Shape	Add Text	Open STL File	Buy Shapes	Platform Size	View / Hide Measurements	View / Hide Platform	Reflective-ness	Smoothness	Bumpiness

Menu	Rotate	Fixed Resize	Free Resize	Skew	Delete	Intersect Shapes	Subtract Shapes	Magnet	Mirror

Copy	Group

BLOCKER

Block Size	Add Block	Add Area	Push / Pull	Magic Box	Delete Block	Delete Area	Colour Block	Colour Area	Colour Volume
5 4 3 2 1									

	Blockify Picture	Buy Blocks	Platform Size	View / Hide Measurements	View / Hide Platform				

Menu	Rotate	Delete	Free Resize	Mirror	Copy	Save Selected Blocks

COMMON

Challenge Panel	Workspace Panel	Toolbar Panel	Background Colour	Change / Edit Colour	Eyedropper / Match Colour	Undo	Redo	Clear All	Finish

Better Learning by DESIGN

Design Thinking for Schools

No problem is too big when you think like a designer!
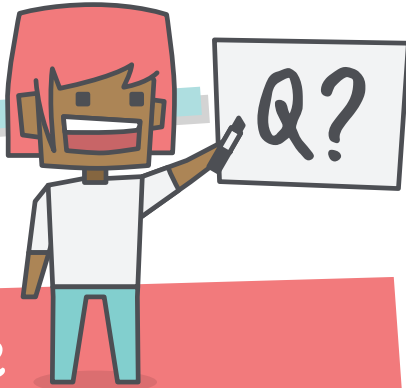
Q?

Empathise
Learn about your audience – that's the people you want to help.

Define
Decide how you can best help your audience. Where can you make the biggest difference?
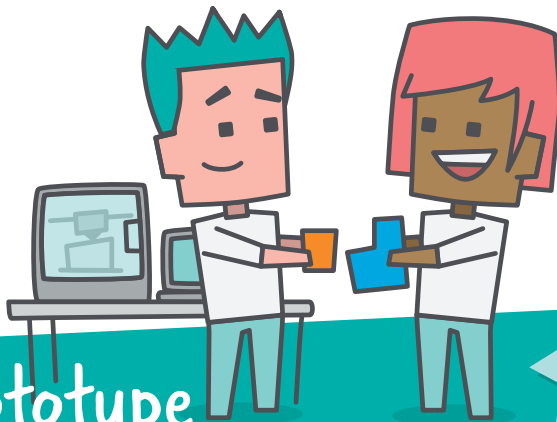
Ideate
Be creative and think of as many solutions as you can. 'Crazy' ideas are welcome!

Prototype
Make something that explains your best ideas to other people. Rough is okay!

Repeat?
Your first idea probably won't be perfect. That's okay – keep trying!

Test
Show your prototypes to your audience to see if they work, or if you can make them better!

Better Learning by DESIGN

MAKERS EMPIRE

www.makersempire.com