CODE to LEARN | PROGRAMMER pour APPRENDRE

CREATE A GRAVITY SIMULATION!

with

LYNX™

lynxcoding.club

DESCRIPTION
Coding a Gravity Simulation

Students (grades 3-8) will create a gravity simulation.

This activity will allow the students to demonstrate how an object is affected by gravity and rolls down an inclined plane or hill.

For this simulation and animation the students will use a ball to show what this might look like.

Students will code using Lynx at **lynxcoding.club**.

Students will code the computer to:

- Locate objects using coordinates
- Create backgrounds
- Direct actions based on compass headings
- Write procedures
- Use buttons to trigger actions
- Animate an object to simulate movement
- Add a slider to create variables
- Include advanced options:
  - Using more complex inclined plane
  - Finding their own clipart

Success Criteria
Co-construct success criteria with your students.
- could include demonstrating an understanding of simple machines, inertia, velocity or gravity.

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Prerequisites

What you should know ahead of time.

*We will be using these commands without much explanation here. You can learn these from other card sets such as **Geometric Fun** and **Create an Interactive Greeting Card**...or you can figure them out in this set as you go! :-)*

Know these commands:	
fd bk lt rt	*setshape*
pd pu	*setsize*
setheading	*repeat [ ]*
cg	*wait*
	stamp

Know how to write procedures.

GETTING STARTED

Get a LYNX Account and Understand the Layout

Get a Lynx Account

Details at lynxcoding.club

Help ▾
- FAQ
- User Guides
- Contact Us
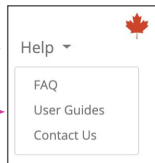
We suggest:
- teacher gets a **School Administrator Account**
- students get **permanent Individual Accounts**
- teacher creates a **'club'** and invites all students

NO Account
You can try Lynx for free without an account, by clicking on **Create a Lynx Project** on the home page at **lynxcoding.club**

FREE TRIAL Account
For full access, register (click **Login/Register** located at the top, right side of the Lynx web page).

INDIVIDUAL Account
Convert your trial account to a permanent individual account before end of trial period.
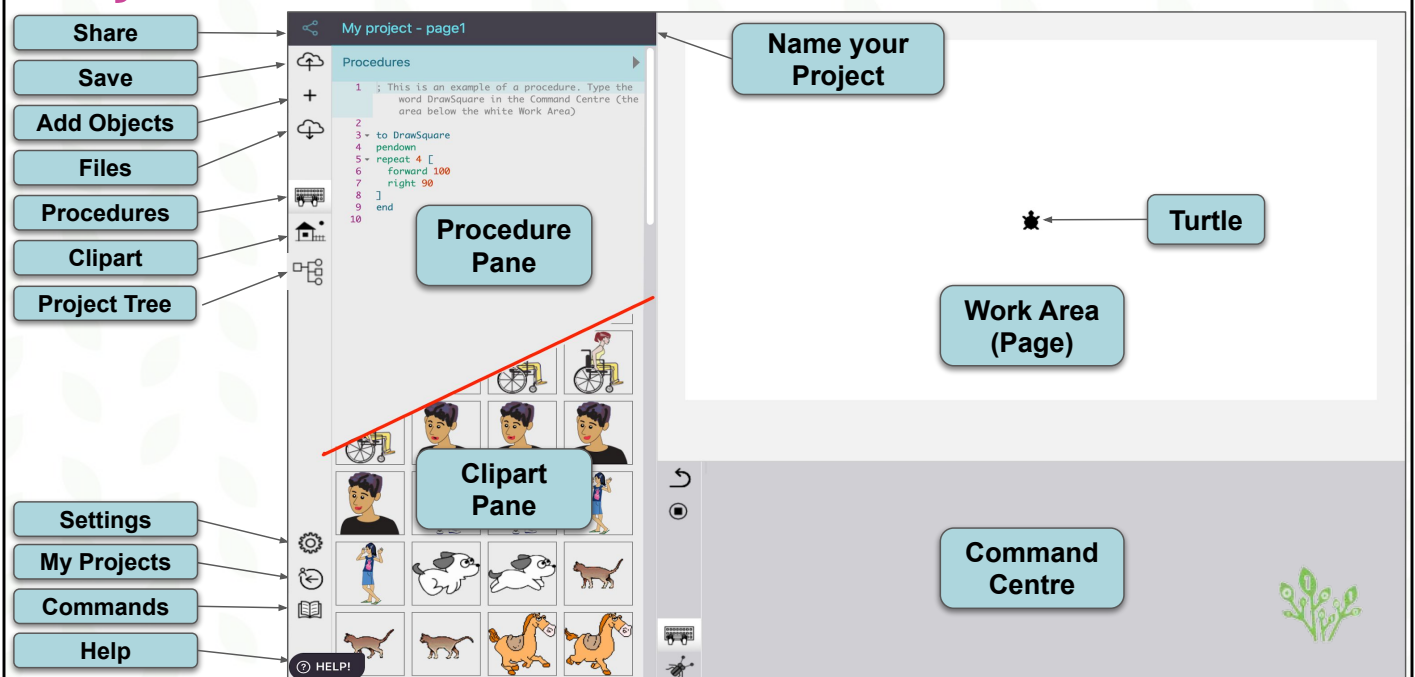
SCHOOL ADMINISTRATOR Account
Convert your trial account to a School Administrator account before end of trial period.

Accounts are free for Canadians thanks to a subsidy by the Government of Canada.

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Layout

- Share
- Save
- Add Objects
- Files
- Procedures
- Clipart
- Project Tree
- Settings
- My Projects
- Commands
- Help

My project - page1

Procedures

```
1   ; This is an example of a procedure. Type the
        word DrawSquare in the Command Centre (the
        area below the white Work Area)
2
3 ▸ to DrawSquare
4   pendown
5 ▸ repeat 4 [
6     forward 100
7     right 90
8   ]
9   end
10
```

Procedure Pane

Clipart Pane

? HELP!

Name your Project

Turtle

Work Area (Page)

Command Centre

START IN THE RIGHT PLACE!

Open the Templates Folder

1. **Login** to your Lynx account.

2. Go to **All Projects** and open the **Templates Folder**.

Templates

3. Open the **Gravity Template** project. Click **Edit.**

4. **Name** it something meaningful or personal e.g., Gravity Simulation

https://lynxcoding.club/Projects/Edit

My project

Procedures

5. Then click on the **Save** icon. Keep doing this as you work. There is no autosave.

Note: If you open the Clipart Pane, you can see that we have provided images for you to use. You can always add your own to any project.
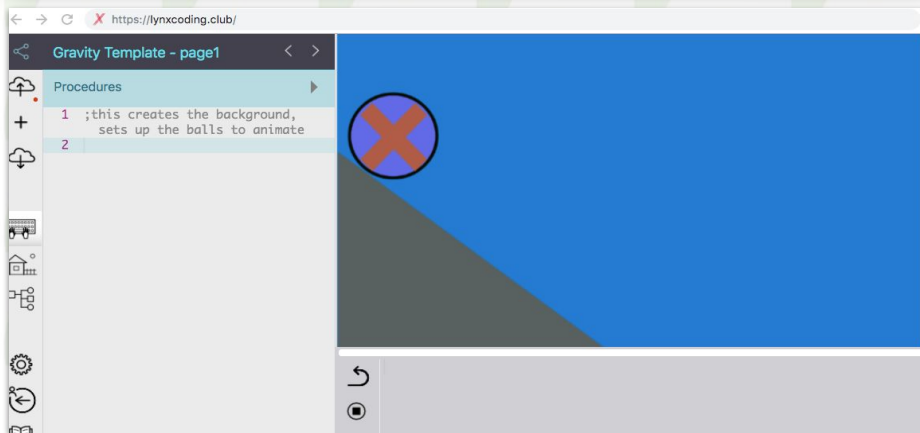

READY TO BUILD

Building a gravity simulation

BUILDING THE FIRST SIMULATION!
Get the pieces in place!

First, you will set up the workspace with a hill background and a turtle with a ball costume at the top of the hill.
You can add turtles by using the plus button. Or you can add them with a **newturtle** command. That's what we will do!

In this project, we will do most of our work in the Procedure Pane.

We will write procedures to make things happen.

WRITING A 'SETUP' PROCEDURE
'newturtle', 'rename', 'setsh' in a procedure

Write a new procedure called 'setup':

Hint: use a semicolon (;) to annotate your code! How professional you are!

to setup

newturtle 'hill'   ;*creates a turtle named 'hill'*

hill, setsh 7   ;*gives the turtle the 'hill' shape*

setsize 80   ;*makes the 'hill' turtle bigger*

stamp   ;*stamps the background with the 'hill' shape*

setsh [4 5 6]   ;*changes the 'hill' turtle to the 'ball' shapes*

rename 'hill' 'ball1' ;*renames the turtle*

setsize 40   ;*resizes the turtle to its default size*

end

Type setup in the Command Centre!

```
Procedures                          ▶
 1 ;all clipart uploaded for
     project
 2 to setup
 3 newturtle 'hill'  ;creates a
     turtle named "hill
 4 hill, setsh 7   ;gives the
     turtle the 'hill' shape
 5 setsize 80   ;makes the
     'hill' turtle bigger
 6 stamp      ;stamps the
     background with the 'hill'
     shape
 7 setsh [4 5 6]  ;changes the
     'hill' turtle to the
     'ball' shapes
 8 rename 'hill' 'ball1'
     ;renames the turtle
 9 setsize 40   ;resizes the
     turtle to its default size
10 end
11
```

Note: in Lynx, make sure you use straight quotes as you type or as you copy and paste instructions.

STRENGTHENING THE 'SETUP' PROCEDURE
Add 'wait' and 'cg' and 'remove'

It's great to automate things more fully rather than having to right click to delete, typing **cg**, and all!

Add these to your **setup** procedure.

• **Type as the first two lines of setup;**

cg ;clears the graphics

remove 'ball1' ;removes (deletes) the turtle

SLOW IT DOWN!

Things go so quickly!

• **Type wait 5 between the steps (as in the diagram).**

```
Procedures                                          ▶
 1  ;all clipart uploaded for project
 2▾ to setup
 3  cg ;clears the graphics
 4  remove 'ball1' ;removes (deletes) the
       turtle
 5  newturtle 'hill'  ;creates a turtle named
       "hill
 6  wait 5
 7  hill, setsh 7   ;gives the turtle the
       'hill' shape
 8  wait 5
 9  setsize 80     ;makes the 'hill' turtle
       bigger
10  wait 5
11  stamp      ;stamps the background with the
       'hill' shape
12  wait 5
13  setsh [4 5 6]   ;changes the 'hill' turtl
       to the 'ball' shapes
14  wait 5
15  rename 'hill' 'ball1' ;renames the turtle
16  wait 5
17  setsize 40    ;resizes the turtle to its
       default size
18  wait 5
19  end
20  |
```

NOTE! If you have NO turtles on your page, you need to remove *remove 'ball1'* from your procedure!

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DEBUGGING
Try it out!

SAVE!

• **Type setup in the Command Centre.**

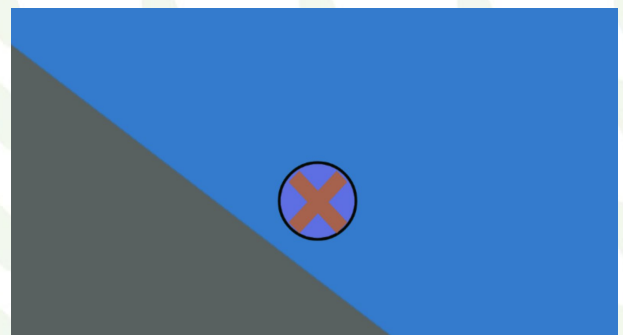You should get something like this picture!

If you don't, go back and 'debug' — see if you can find an error. Perhaps you typed something different.

Bugs are normal!

HOWEVER! If you have NO turtles on your page, you need to delete *remove 'ball1'* from your procedure!

But, you should have a turtle in the shape of a ball!

Top of the hill please!

Of course, you now want that ball to be at the top of the hill!

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GETTING THE BALL TO THE TOP OF THE HILL
Use Xcor and Ycor

1. Drag the ball1 to the top of the hill.

2. Right-Click on the turtle.

3. Take note of the Xcor and Ycor

These are the **x** and **y** coordinates.

4. Now write a startposition procedure by adding:

to startposition

setpos [-290 187] ;this sets the starting position

end

5. Type setup

6. Type startposition

Name	Ball1		
Xcor	-290	Ycor	187
On click	-		
On touch	-		
On message	-		
On colour	-		

☑ Visible ☐ Frozen

Apply   Cancel

MOVING THE BALL
Let's try to get that ball down the hill!

SAVE!

Now that the background is in place and the ball is ready, we need to make the ball roll down the hill.

• **Type in the Command Centre:**
   glide 100 1

Well, the ball moved...but, the wrong way!

• **Type: startposition**

GETTING THE BALL DOWN!
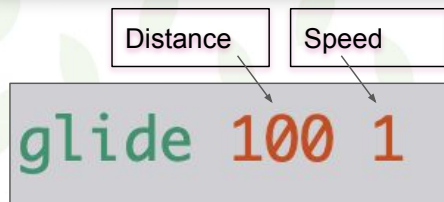## Find the distance and animate

Ok. Let's try to get that ball rolling the right direction!

1. In the command centre type:
setheading (and a compass heading you think will work)

2. Type: glide 100 1

Does it go the right direction?

Does it go the right distance at the right speed?

3. Adjust the distance or speed value of glide to make the animation look right.

4. Type startposition as required.

Distance | Speed

glide 100 1

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ADDING BUTTONS
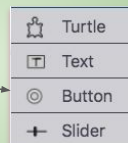## Use a button to execute a procedure

With the values you have for **setheading** and **glide** we can write a new procedure.
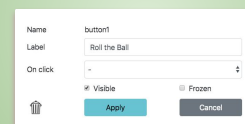
1. In the procedure pane type:

```
22  to rolldown
23  ;to make the ball roll down the
    hill
24  setheading 127
25  glide 579 .5
26  end
```

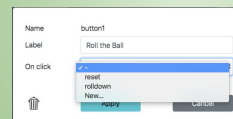**2. To activate this procedure add a button.**

Click + **and select button.**

| Turtle |
| Text |
| Button |
| Slider |

3. On the screen, right click the button and edit the label to say: Roll the Ball.

Name   button1
Label   Roll the Ball
On click   -
            ☑ Visible   ☐ Frozen
🗑   Apply   Cancel

4. Now select rolldown from On click and press Apply.

Name   button1
Label   Roll the Ball
On click
            reset
            rolldown
            New...
🗑   Apply   Cancel

5. TRY IT!

Press the button!

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FINISH THE ROLL!
Add a final procedure

SAVE!

The ball only rolls to the bottom of the hill. The momentum should take it further.

1. In the command centre type:

setheading 90 glide 20 0.5

Continue adjusting the **glide** values until the ball reaches the edge of the screen.

Now take the commands you just used and turn them into a procedure.
2. In the procedure pane type:

```
21   ;to make the ball roll across
        the ground
22 ▾ to rollacross
23   setheading 90 glide 150 .5
24   end
```

The procedures for rolling can be put together into a super-procedure.
3. In the procedure pane type:

```
33 ▾ to travel
34   ;this puts all the elements
        together to simulate gravity on
        the ball
35   startposition
36   rolldown
37   rollacross
38   end
```

4. Right click the "Roll the Ball" button and change the On click to travel

On click	travel	⇕

5. Click Apply to save.

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CONTROLLING SPEED!
Add a slider to finish the simulation

A slider can be added to allow you to adjust the speed of the ball.

1. To add press the `+` **and select Slider.**

```
🏠  Turtle
T   Text
◎   Button
+   Slider
```

2. Right click on the slider and change the Name to Speed and Min to 1.

Name	Speed
Min	1
Max	100
Value	61

☑ Show name
☑ Visible   ☐ Frozen

🗑   Apply   Cancel

For the **Speed** slider to provide the numbers we need, a small equation has to be added. The slider only gives whole numbers. To get decimals we will divide by 20.

3. Type in the Command Centre:

glide 150 Speed / 20

Adjust the slider and try the command several times to see how this works.

4. Edit the rolldown and rollacross procedures to have Speed / 20 as the second glide number.

```
21   ;to make the ball roll across the
        ground
22 ▾ to rollacross
23   setheading 90 glide 150 Speed /
        20
24   end
```

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CONTROLLING ON THE ROLL!
Move the slider as it's rolling!

You may want to control the speed as the ball is moving!
That requires the following changes!

NOW TRY IT!!

1. Change glide 579 speed/20 in rolldown to:

repeat 579 [glide 1 speed/20]

2. Change glide 150 speed/20 in rollacross to:

repeat 150 [glide 1 speed/20]

Your gravity simulation is finished!

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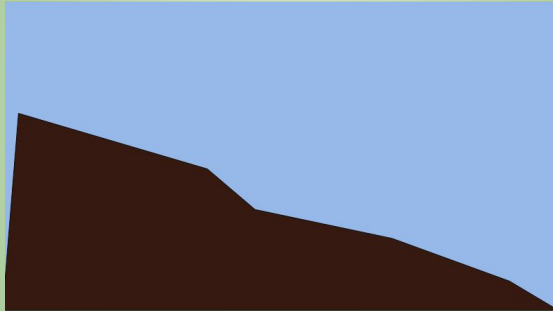# EXTRA CHALLENGES

Develop your skills further

NEXT CHALLENGE (optional)
A simple slope is easy

SAVE!

You have completed the gravity simulation on a simple slope.

1. Go back and open the Gravity template again and save a new file.

2. This time when you pick the turtle to use for the background choose setshape 8.

This gravity simulation will be more complicated as this hill has 6 sections with different distances and headings.

• **Try to include at least a button and a slider.**
• **Consider adding your own clipart.**

There is a sample called "Gravity with Slider" for you to look at if you need ideas.

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CLIPART (optional)

Adding Clipart

For royalty free clipart go to Pixabay.com and download an image. You can also use your own drawings or photos.

TWO WAYS

1. Copy the clipart (photo). Press Command-C on a Mac, or Ctrl-C on other computers.

2. Click on the House icon to open the Clipart Pane.

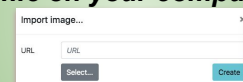*3. Click on an empty box to reveal a + sign.*

4. Paste your image into the box. Press Command-V on a Mac, or Ctrl-V on other computers.

1. Click on the House icon to open the Clipart Pane.

2. Click on an empty box and click the + sign.

3. Use the dialog box to locate a clipart file on your computer.

Import image...

URL   *URL*
       Select...   Create

4. Click the Create button.

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Can CODE to LEARN.ca

Credits

Principal Writer........... *Ray Mercer*
Secondary Writer......... *Peter Skillen*

Partners

LCSI   fair chance learning *what every student deserves*   CISCO   C21   Deloitte.