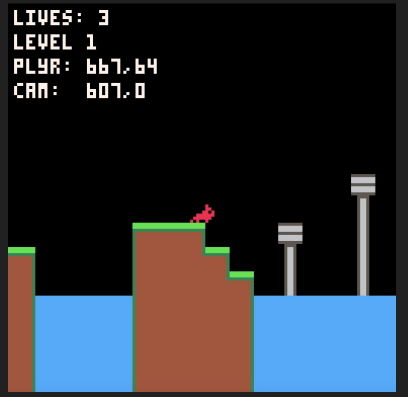
PICO-8
FANTASY CONSOLE

Making a Sidescrolling Platformer Game in PICO-8

Complete Walkthrough



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as seen in GAM-120: Intro to Game Logic

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Making a Side-Scrolling Platformer Game

Download Assets File: platformer_00_assets_only.p8

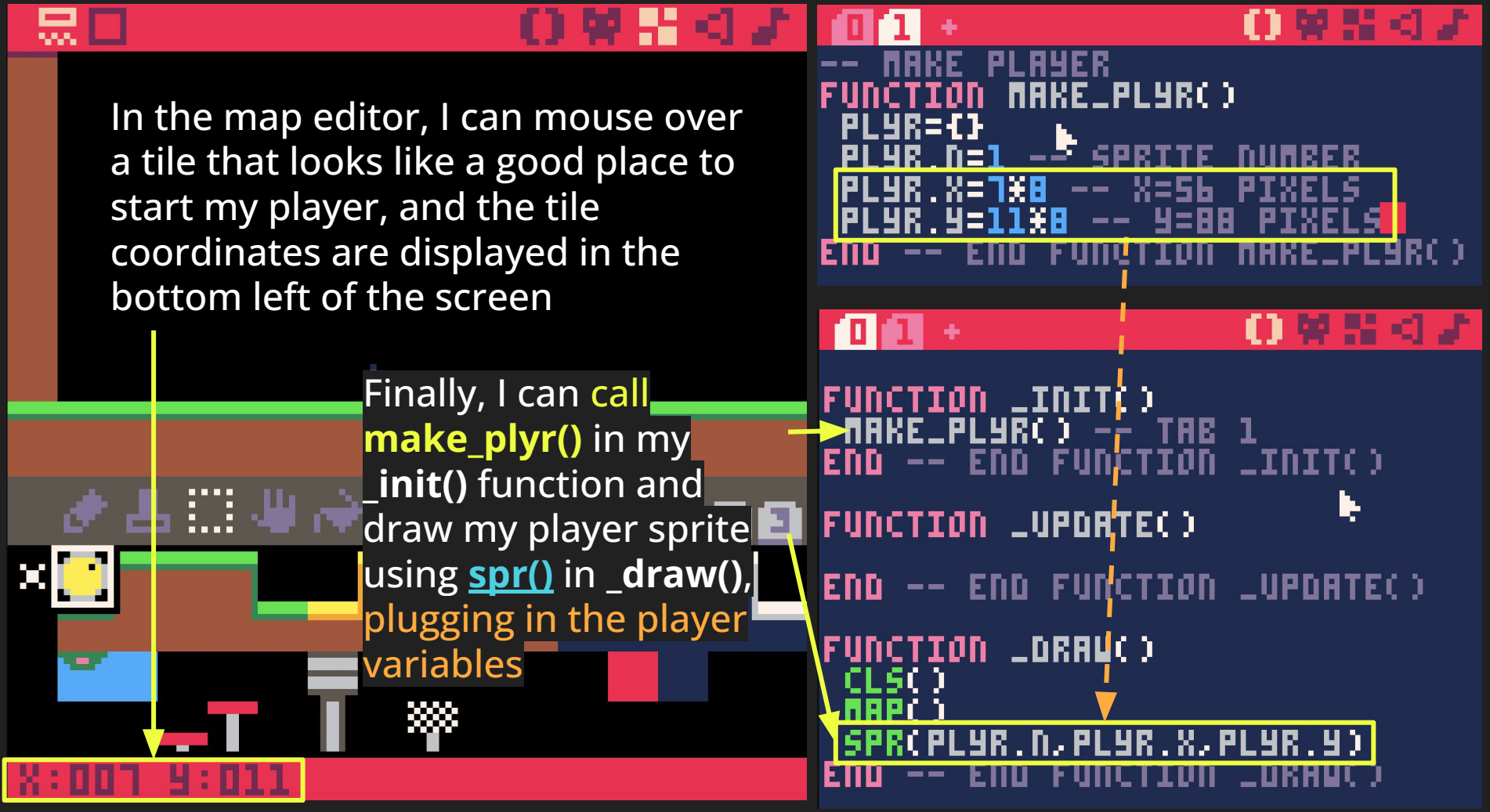
Step 01: Setting the Player Start Position

Download Example File: platformer_01_starting_position.p8


In the map editor, I can mouse over a tile that looks like a good place to start my player, and the tile coordinates are displayed in the bottom left of the screen
001
0
1
2
3
X:007 Y:011


```
-- MAKE PLAYER
FUNCTION MAKE_PLYR()
 PLYR={}
 PLYR.N=1  -- SPRITE NUMBER
 PLYR.X=7*8  -- X=56 PIXELS
 PLYR.Y=11*8  -- Y=88 PIXELS
END -- END FUNCTION MAKE_PLYR()
```

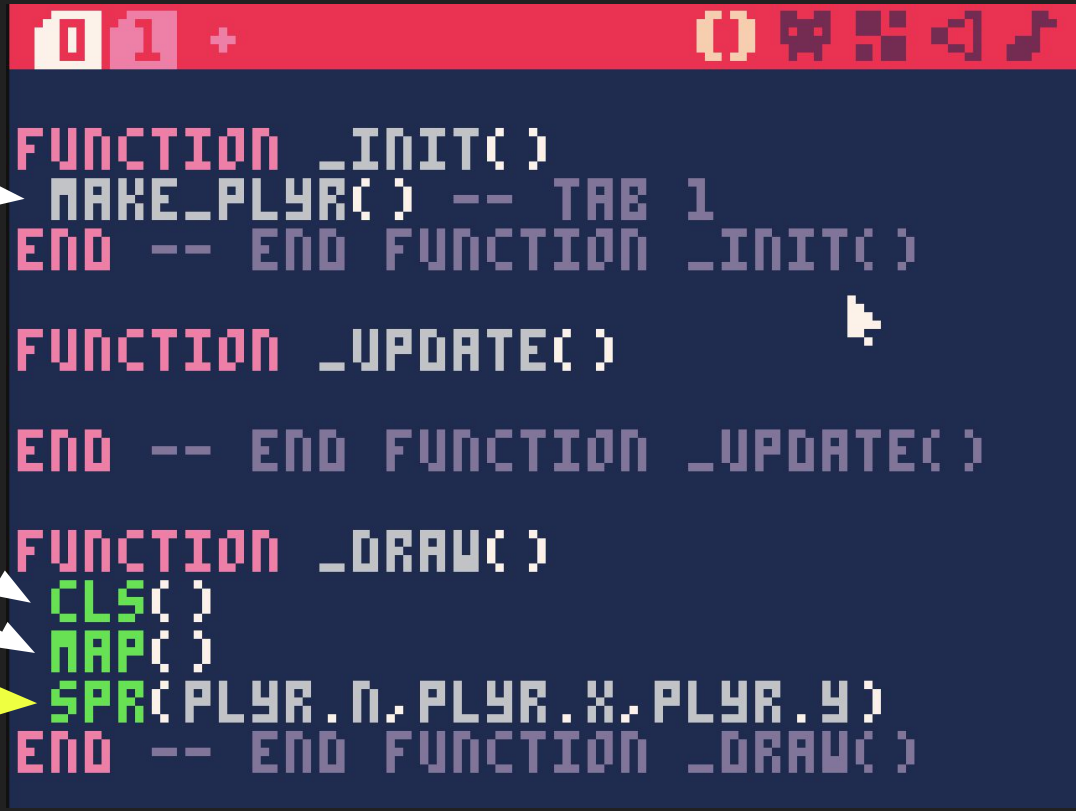
Our platformer game will most likely work best with **pixel-based movement** (*as opposed to the tile-based movement in the top-down game*), so we want to express our **player's position** in terms of **pixels**


In the map editor, I can mouse over a tile that looks like a good place to start my player, and the tile coordinates are displayed in the bottom left of the screen
Finally, I can call make_plyr() in my _init() function and draw my player sprite using spr() in _draw(), plugging in the player variables
X:007 Y:011
-- MAKE PLAYER
FUNCTION MAKE_PLYR()
PLYR={}
PLYR.N=1 -- SPRITE NUMBER
PLYR.X=7*8 -- X=56 PIXELS
PLYR.Y=11*8 -- Y=88 PIXELS
END -- END FUNCTION MAKE_PLYR()
FUNCTION _INIT()
MAKE_PLYR() -- TAB 1
END -- END FUNCTION _INIT()
FUNCTION _UPDATE()
END -- END FUNCTION _UPDATE()
FUNCTION _DRAW()
CLS()
MAP()
SPR(PLYR.N,PLYR.X,PLYR.Y)
END -- END FUNCTION _DRAW()

- **make_plyr()** is a custom function I wrote on tab 1, where my player variables are declared (sprite #, x, y)

- cls() clears the screen
- map() draws the map

- spr() draws my sprite – plug in the values for the sprite number, the x coordinate, and the y coordinate, separated by commas



Step 02: Moving Left/Right

Download Example File: platformer_02_horizontal_movement.p8

*I made a new **move_plyr()** function on tab 2*

```
-- MOVE PLAYER
FUNCTION MOVE_PLYR()

 -- MOVE LEFT
 IF BTN(⬅️) THEN
  PLYR.X -= PLYR.XSPD
 END -- END IF BTN(⬅️)

 -- MOVE RIGHT
 IF BTN(➡️) THEN
  PLYR.X += PLYR.XSPD
 END -- END IF BTN(➡️)

END -- END FUNCTION MOVE_PLYR()
```

Make sure to call this function in _update()

```
-- TAB 0: GAME LOOP
-- TAB 1: MAKE PLAYER
-- TAB 2: MOVE PLAYER

FUNCTION _INIT()
 MAKE_PLYR() -- TAB 1
END -- END FUNCTION _INIT()

FUNCTION _UPDATE()
 MOVE_PLYR() --  TAB 2
END -- END FUNCTION _UPDATE()

FUNCTION _DRAW()
 CLS() -- CLEAR SCREEN
 MAP() -- DRAW MAP
 SPR(PLYR.N,PLYR.X,PLYR.Y)
END -- END FUNCTION _DRAW()
```

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To move horizontally, we can use the **btn()** function to detect **left/right arrow** key presses and **add** to or **subtract** from the player's **x coordinate**

*I made a new **move_plyr()** function on tab 2*

```
-- MOVE PLAYER
FUNCTION MOVE_PLYR()

 -- MOVE LEFT
 IF BTN(⬅️) THEN
  PLYR.X -= PLYR.XSPD
 END -- END IF BTN(⬅️)

 -- MOVE RIGHT
 IF BTN(➡️) THEN
  PLYR.X += PLYR.XSPD
 END -- END IF BTN(➡️)

END -- END FUNCTION MOVE_PLYR()
```

```
-- MAKE PLAYER
FUNCTION MAKE_PLYR()
 PLYR={} -- TABLE FOR PLYR OBJ
 PLYR.N=1 -- SPRITE NUMBER

 -- X,Y COORDINATES
 PLYR.X=7*8 -- X=56 PIXELS
 PLYR.Y=11*8 -- Y=88 PIXELS

 PLYR.XSPD=4 -- X SPEED

END -- END FUNCTION MAKE_PLYR()
```

To move horizontally, we can use the **btn()** function to detect **left/right arrow** key presses and **add** to or **subtract** from the player's **x coordinate**

I added a **variable** for the player's horizontal speed in my **make_plyr()** function

This is fine, but *the movement is a little boring* . . . we can apply some basic physics to make it feel more interesting

Step 03: Physics-Based Movement

Download Example File: platformer_03_delta_x.p8

We can use “delta time” (dx/dy) like we did in paddleball to create the effect of ***acceleration***

I added a variable for the **player’s dx** (*the change in the x position*) in my **make_plyr()** function

We can use “delta time” (dx/dy) like we did in paddleball to create the effect of ***acceleration***

I added a variable for the **player’s dx** (*the change in the x position*) in my **make_plyr()** function

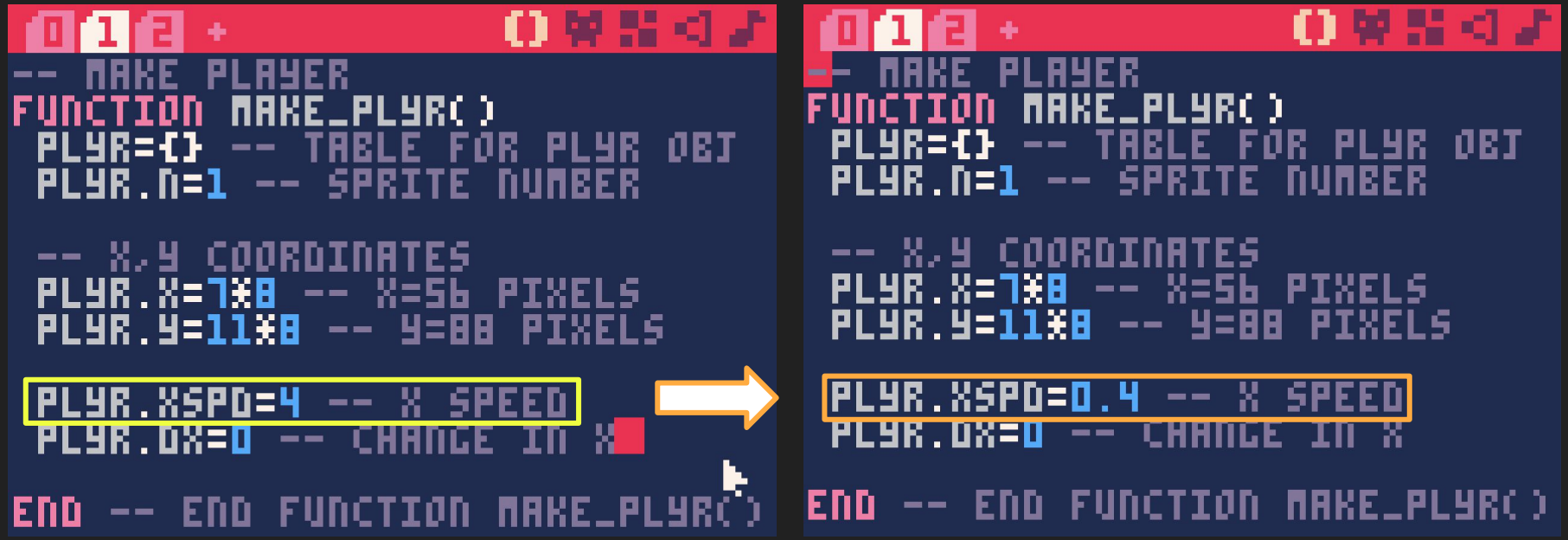
Instead of changing **x** when the L/R arrow keys are pressed, we change **dx**

Then we **add dx to x** at the end of the **move_plyr()** function

You'll notice that ***the player moves way too fast and never comes to a full stop***, even after the arrow keys are released – we'll need to ***add friction to slow and stop the player***

Step 04: Applying Friction

Download Example File: platformer_04_friction.p8



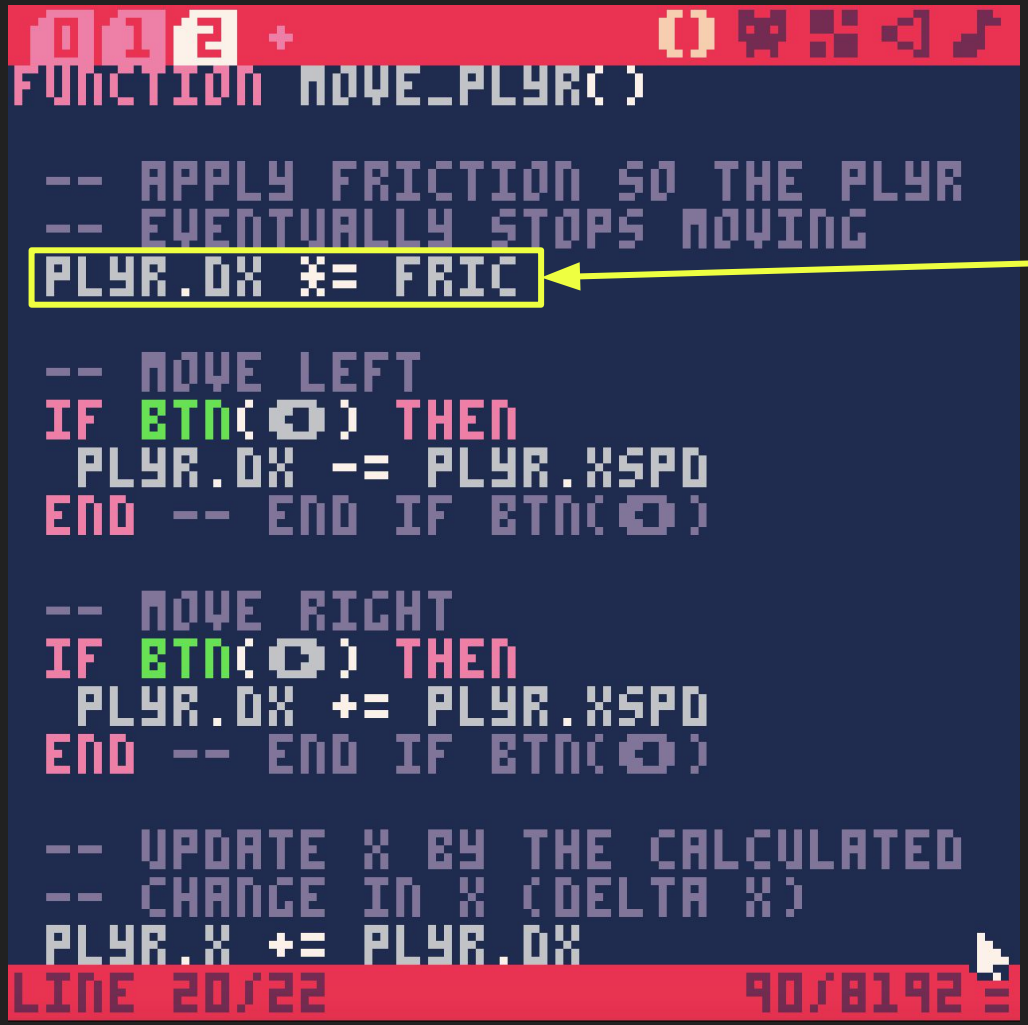
For starters, I **reduced my player's x speed by a factor of 10**

With x being increased exponentially each frame (because dx is growing larger), the value gets higher much more quickly

Note: I eventually settled on an xspd of 0.5 – feel free to fine-tune as necessary

In my **_init()** function, I added new variable for friction, called **fric**, and set it to a value of **0.85**

If we *multiply the player's dx by a value less than 1.0, it will gradually get smaller*, slowing the player to a stop once the arrow keys are released



In my **move_plyr()** function, I **multiply the player's dx by the friction value of 0.85** specified in _init()

If we *multiply the player's dx by a value less than 1.0, it will gradually get smaller*, slowing the player to a stop once the arrow keys are released

Horizontal movement now feels pretty good – let’s add the ability to jump next

Step 05: Jumping

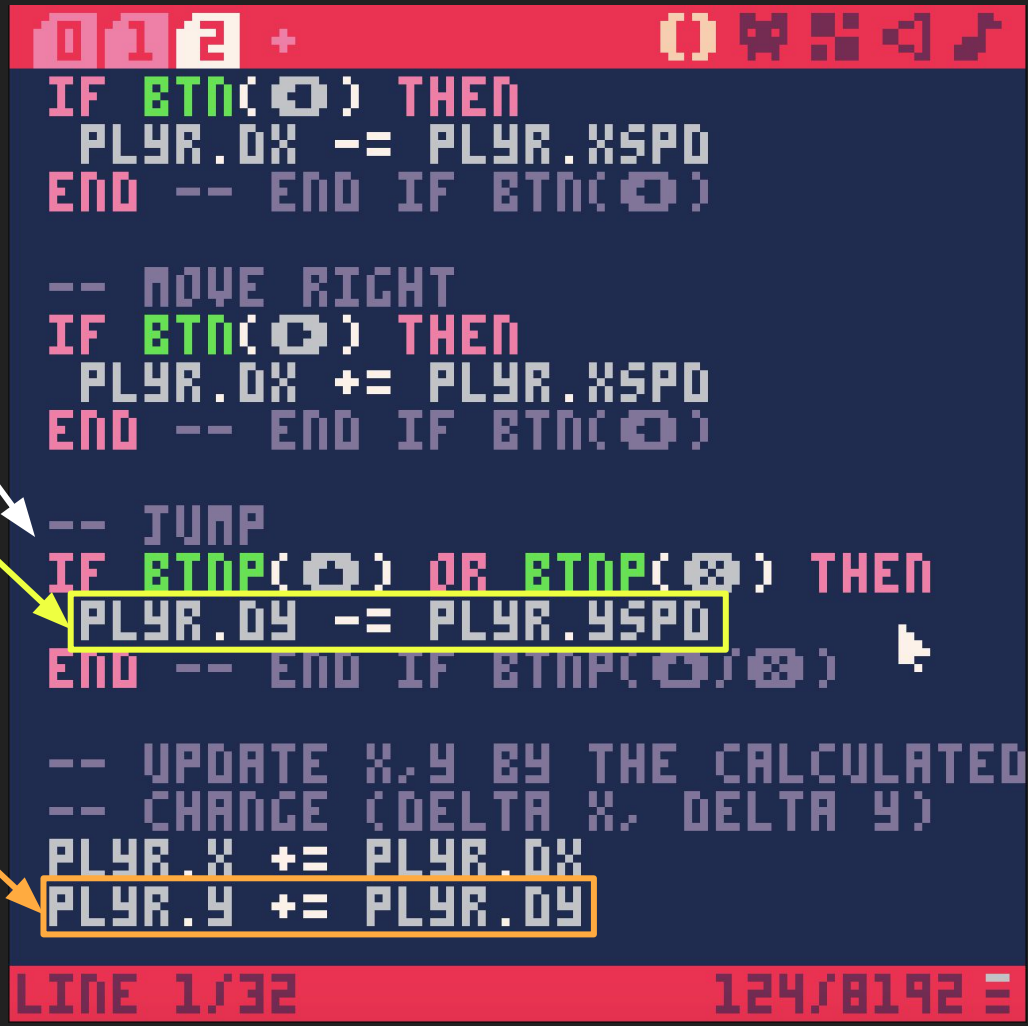
Download Example File: platformer_05_jumping.p8

In order to allow the player to jump, I'll need to add a variable for its **y speed** (*how much to move it up by* when the jump button is pressed)

I'll also add a **dy** to go along with dx, so that we can have our vertical movement incorporate physics as well

Then, in my player movement function, I'll:

- **Check for a key press** (*I'll allow the player to press either the **up arrow** OR the **X key***)
- **Reduce the player's dy by its y speed** (which I set to 4) – *we subtract because y gets smaller as we move up on the screen*
- **Apply the change in y (dy, or delta y)** to the player's y coordinate by **adding dy to y** (like we did with x and dx)



You'll notice that *the player can keep pressing the jump button to move up indefinitely*

We'll need to **add gravity** so that what goes up comes back down

```
IF BTN(⬅) THEN
 PLYR.DX -= PLYR.XSPD
END -- END IF BTN(⬅)

-- MOVE RIGHT
IF BTN(➡) THEN
 PLYR.DX += PLYR.XSPD
END -- END IF BTN(➡)

-- JUMP
IF BTNP(🅾) OR BTNP(❎) THEN
 PLYR.DY -= PLYR.YSPD
END -- END IF BTNP(🅾/❎)

-- UPDATE X,Y BY THE CALCULATED
-- CHANGE (DELTA X, DELTA Y)
PLYR.X += PLYR.DX
PLYR.Y += PLYR.DY
```

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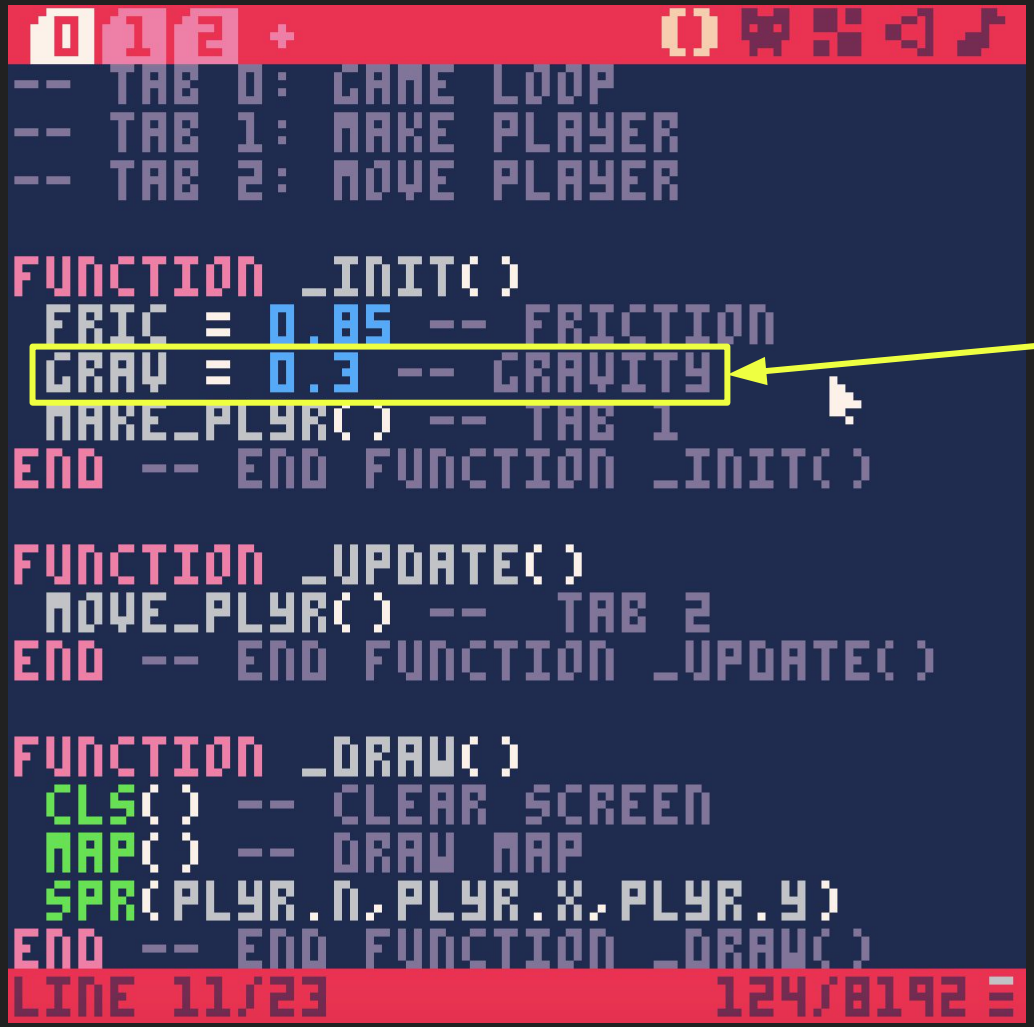
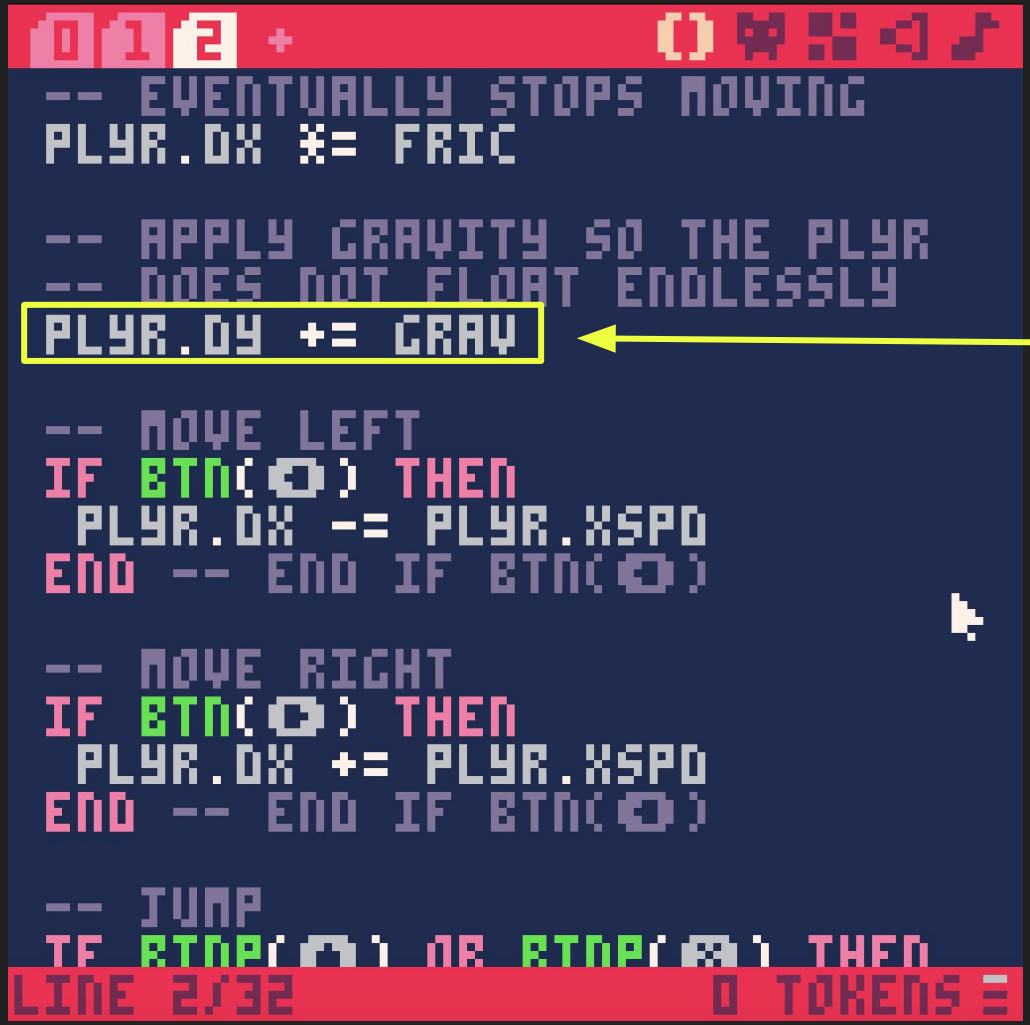
Step 06: Applying Gravity

Download Example File: platformer_06_gravity.p8

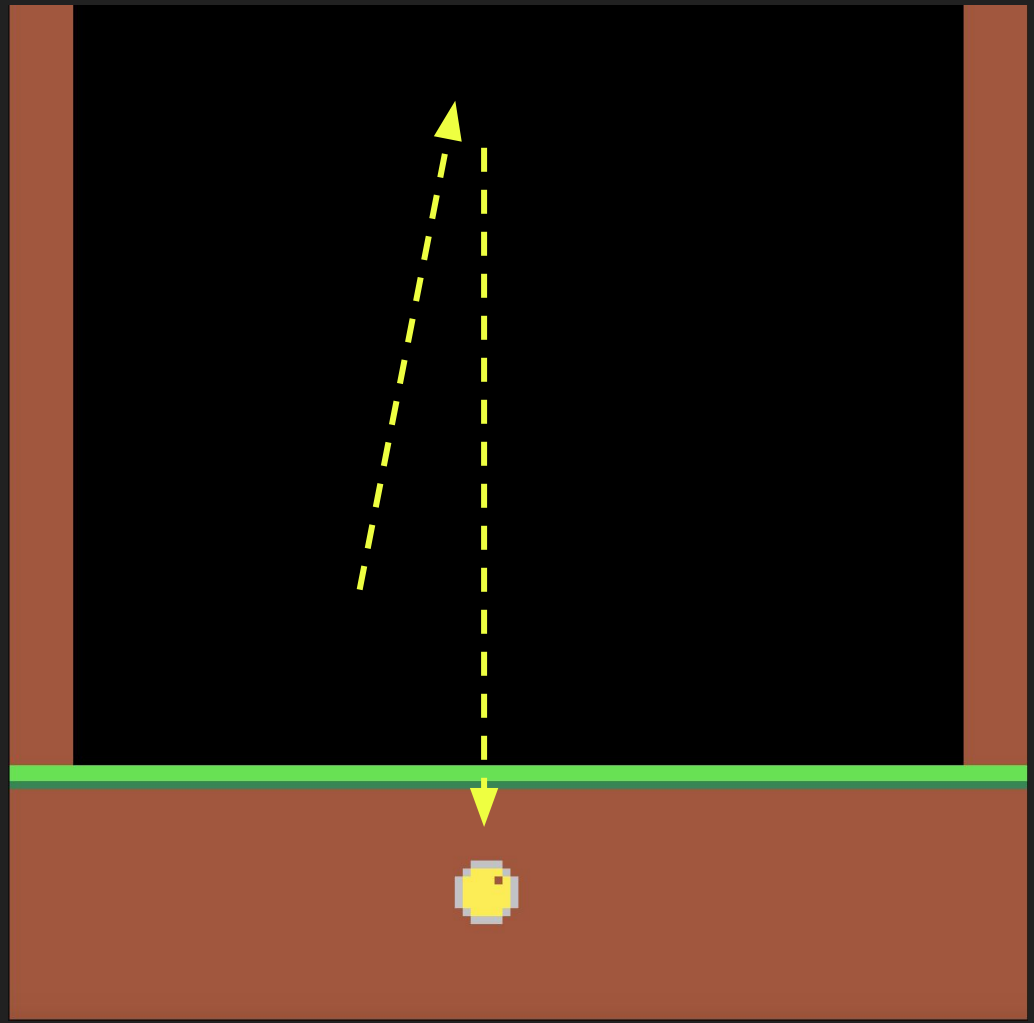


Like with friction, I'll declare a variable for **gravity** in my **_init()** function

I'll set **gravity** (abbreviated as **grav**) to **0.3**, which worked well in our paddleball game



Then, in my **move_plyr()** function, I'll **add gravity to dy** at the beginning of the function (*similarly to friction and dx*)



This works a little too well …

The player falls down after jumping up, but *they keep falling through the rest of the map*

We'll need to detect when there's a solid tile below the player and ***stop*** them from moving any further down in that case

Step 07: Map Collision

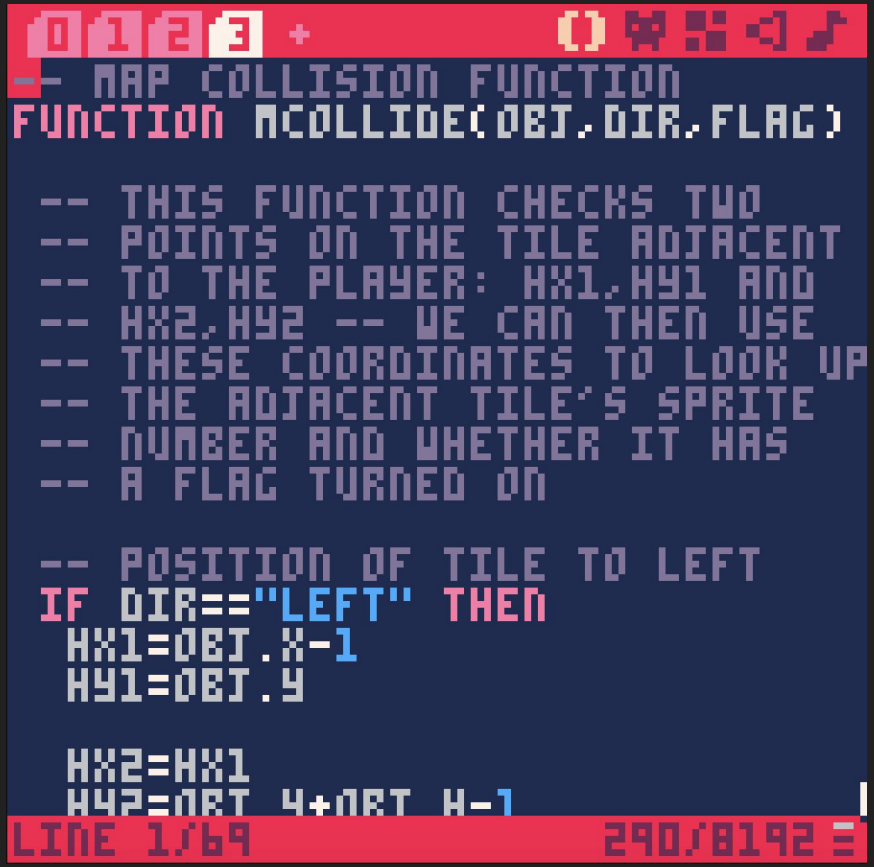
Download Example File: platformer_07_map_collision.p8

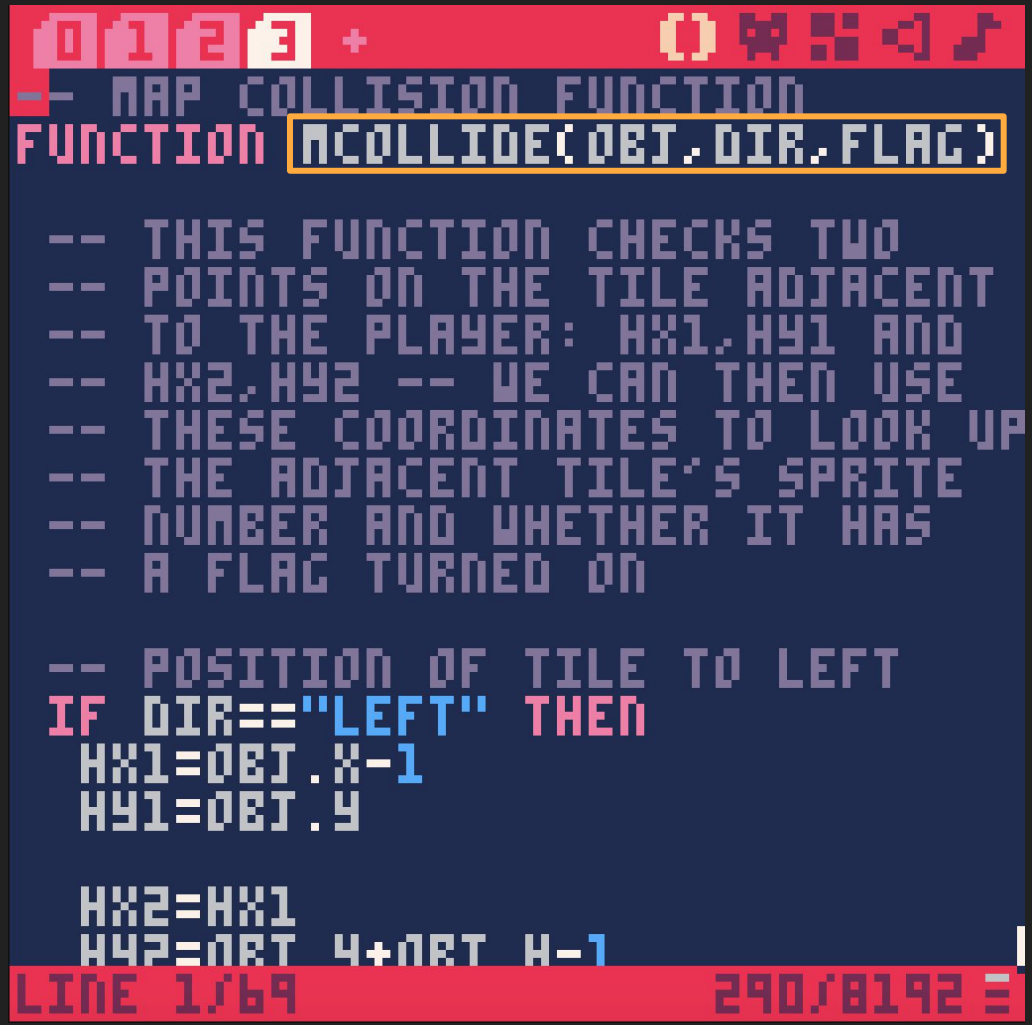
I wrote a “**map collision**” function to detect tiles adjacent to the player, which you can use to ***stop the player from falling when there’s a solid tile beneath them***

It also works to prevent movement through solid tiles in the other directions

And you can detect other types of tiles, such as pits or hazards

Because it’s a bit more complex than other concepts we’ve covered, **I’ll allow you to borrow it** (**copy and paste it into your code**) for now





I've copied and pasted the function **mcollide()** into my in-progress file

Notice that there are **3 required values** in the parentheses:

- obj (the object being used)
- dir (the direction it's facing)
- flag (the flag number of the tile to check for)

By making each of these values variables, this function *can be used in a variety of ways* – we'll start by using it to stop the player from falling through the ground

To use the map collision function (called mcollide for short), after pasting the function on a separate tab, go into your **player movement function**

After the code for jumping, ***add an if statement that calls the mcollide function***

Plug in these values in the parentheses:

- **plyr** for the object
- “**down**” for the direction
- **0** for the sprite flag

```
  PLYR.DX += PLYR.XSPD
END -- END IF BTN(⬅️)

-- JUMP
IF BTNP(⬅️) OR BTNP(❎) THEN
  PLYR.DY -= PLYR.YSPD
END -- END IF BTNP(⬅️/❎)

-- STOP FALLING WHEN A SOLID
-- TILE IS BELOW THE PLAYER
IF MCOLLIDE(PLYR,"DOWN",0) THEN
  PLYR.DY = 0
END -- END IF MCOLLIDE

-- UPDATE X,Y BY THE CALCULATED
-- CHANGE (DELTA X, DELTA Y)
PLYR.X += PLYR.DX
PLYR.Y += PLYR.DY
```

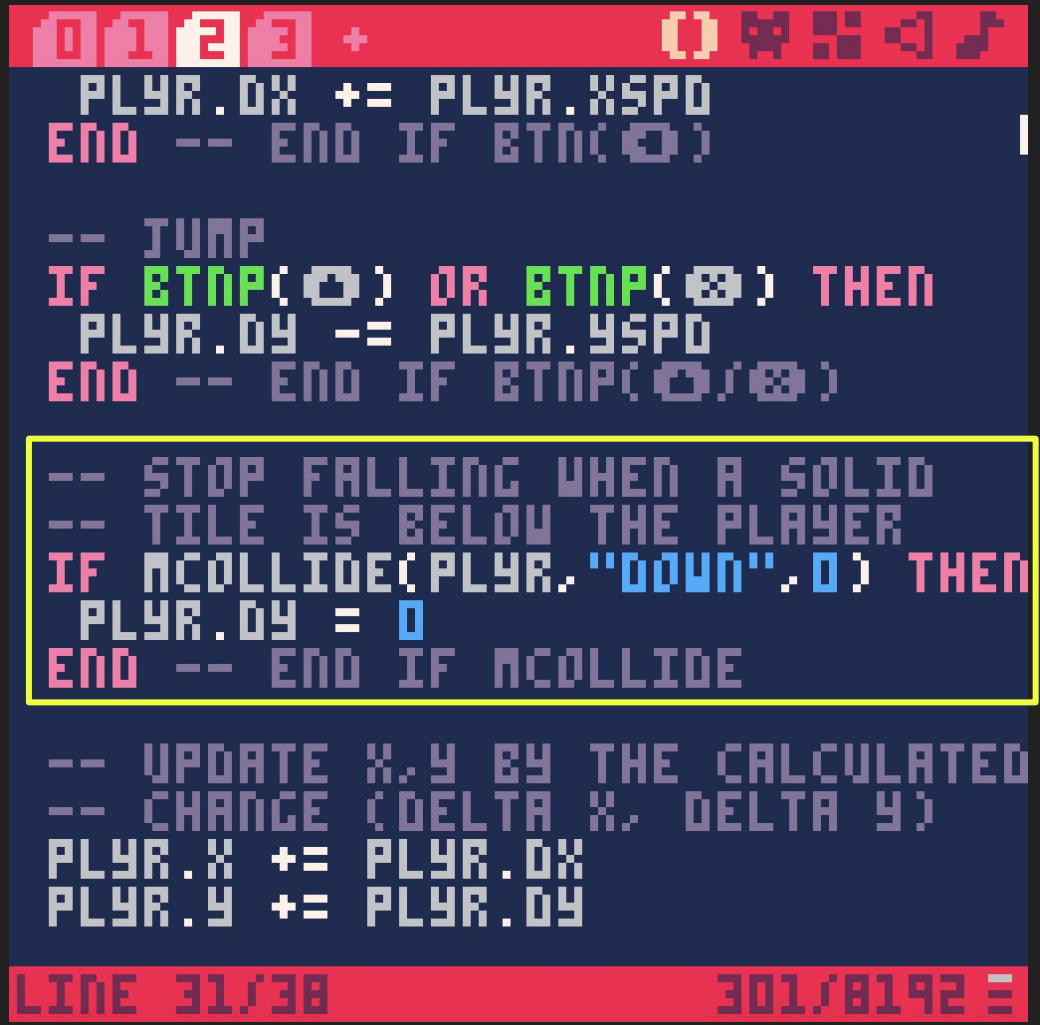
Plug in these values in the parentheses:

- **plyr** for the object
- “**down**” for the direction
- **0** for the sprite flag

In the event that there is a map tile beneath the player with sprite flag 0 turned on, mcollide will **return** a value of **true**

Writing:
if mcollide(plyr,”down”,0)

is shorthand for writing:
if mcollide(plyr,”down”,0) == true

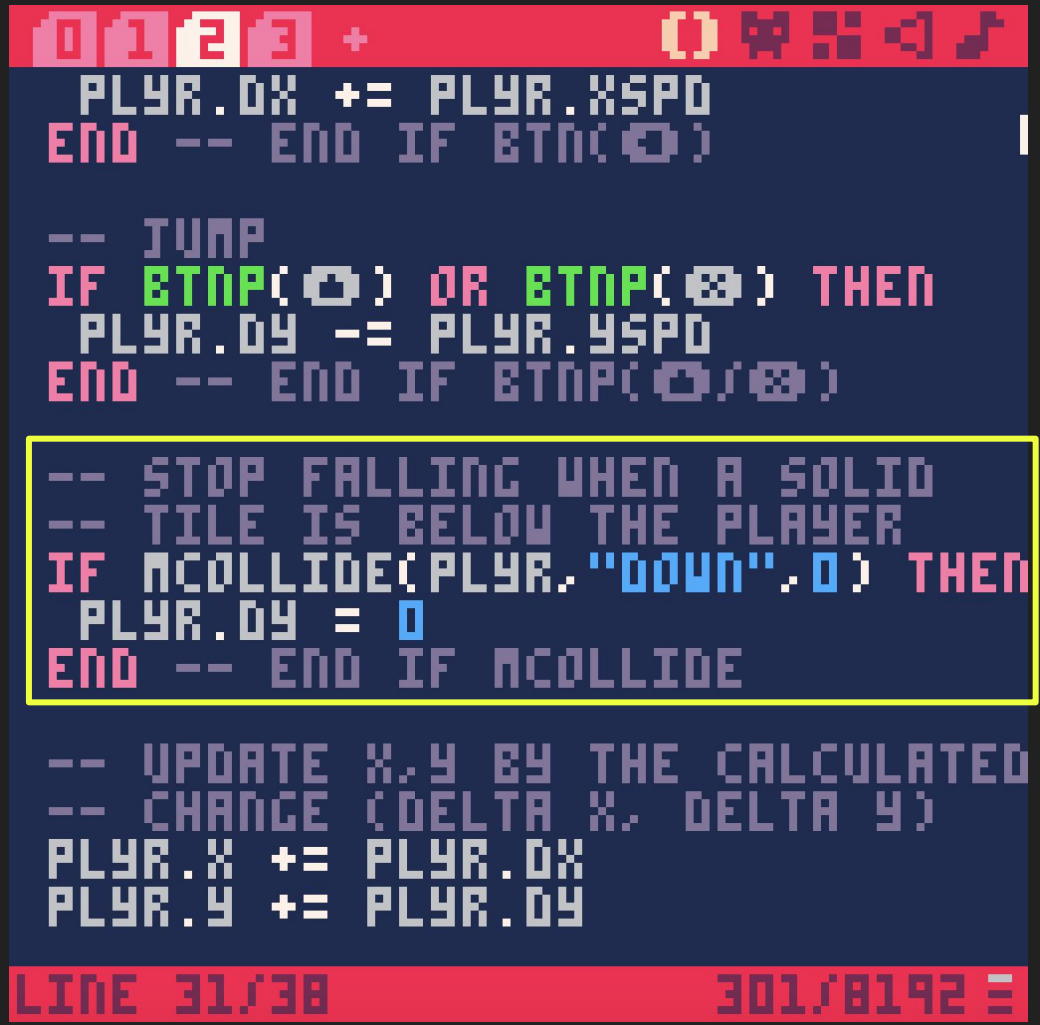


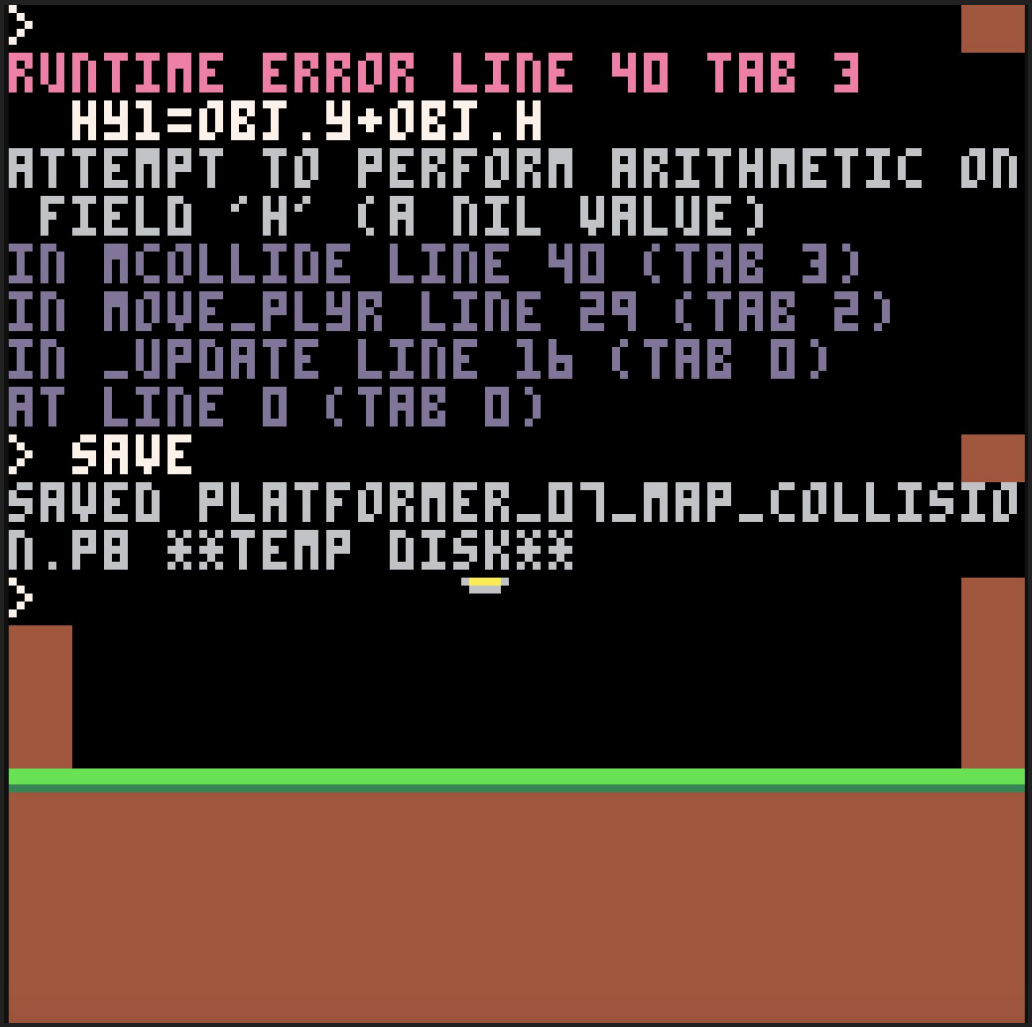
If the condition (a solid tile is below the player) is met, *we want to stop the player from falling*

We can do this by setting the player's **dy** (change in y) to **0**

This means we're *adding 0 to the player's y coordinate* each frame

Effectively negating gravity





Try running the game, and you'll likely see the following error

This is because the mcollide function **requires the object plugged in (in our case, plyr), to have variables named w and h** (for the width and height)

These values are necessary for calculating the position of the map tile adjacent to the player

The error is saying that the variable h has not been defined

so we can fix this by giving our player variables named **w** and **h**

```
-- MAKE PLAYER
FUNCTION MAKE_PLYR()
 PLYR={} -- TABLE FOR PLYR OBJ
 PLYR.N=1 -- SPRITE NUMBER

 -- X,Y COORDINATES
 PLYR.X=7*8 -- X=56 PIXELS
 PLYR.Y=11*8 -- Y=88 PIXELS

 -- WIDTH AND HEIGHT IN PIXELS
 -- NEEDED FOR MAP COLLISION
 PLYR.W=8
 PLYR.H=8

 PLYR.XSPD=0.5 -- X SPEED
 PLYR.YSPD=4 -- Y SPEED

 PLYR.DX=0 -- CHANGE IN X
 PLYR.DY=0 -- CHANGE IN Y
```

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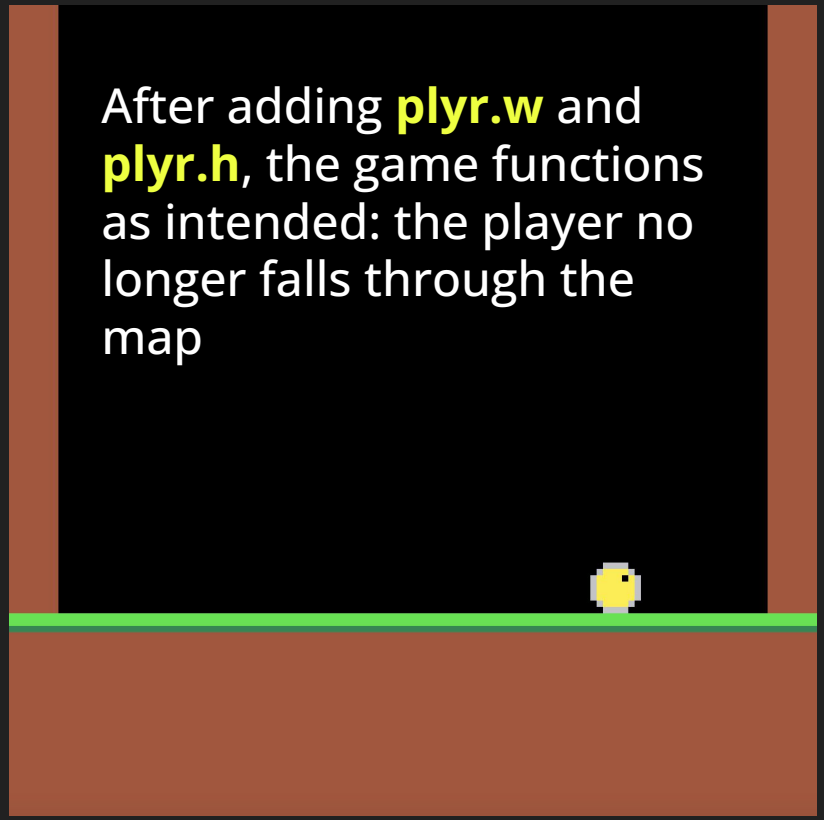
After adding **plyr.w** and **plyr.h**, the game functions as intended: the player no longer falls through the map



But you'll notice *a side effect is that the player can no longer jump*

The player's dy is always being set to 0 now, so our *map collision is overriding the jump*

Step 08: Jumping, Part 2

Download Example File: platformer_08_jumping2.p8

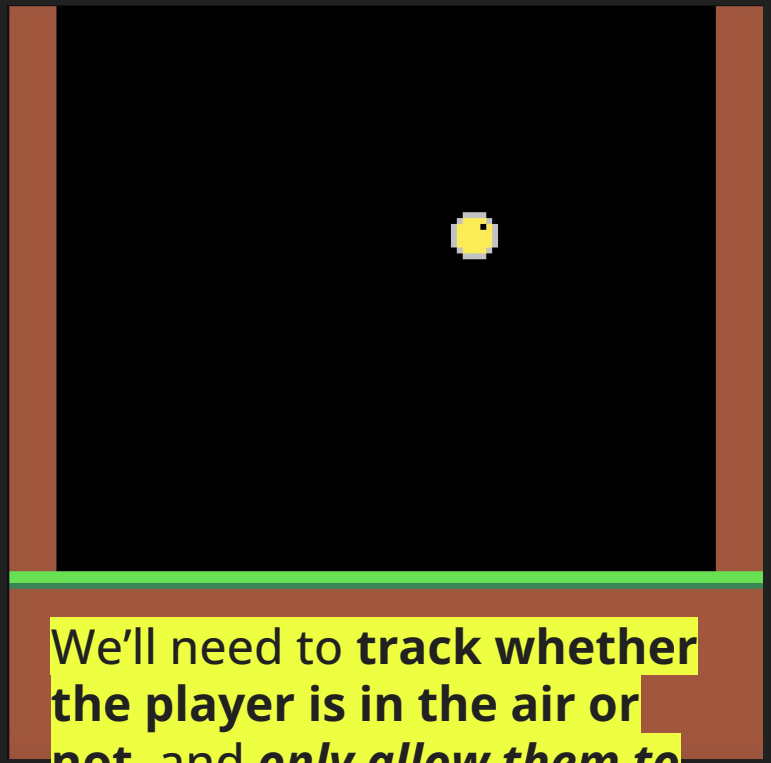
Our problem was that ***our map collision function was preventing the player from jumping***, because ***dy is always being set to 0 once the player is touching the ground***

We can fix this and allow jumping again by **adding a condition** to our if statement for map collision:

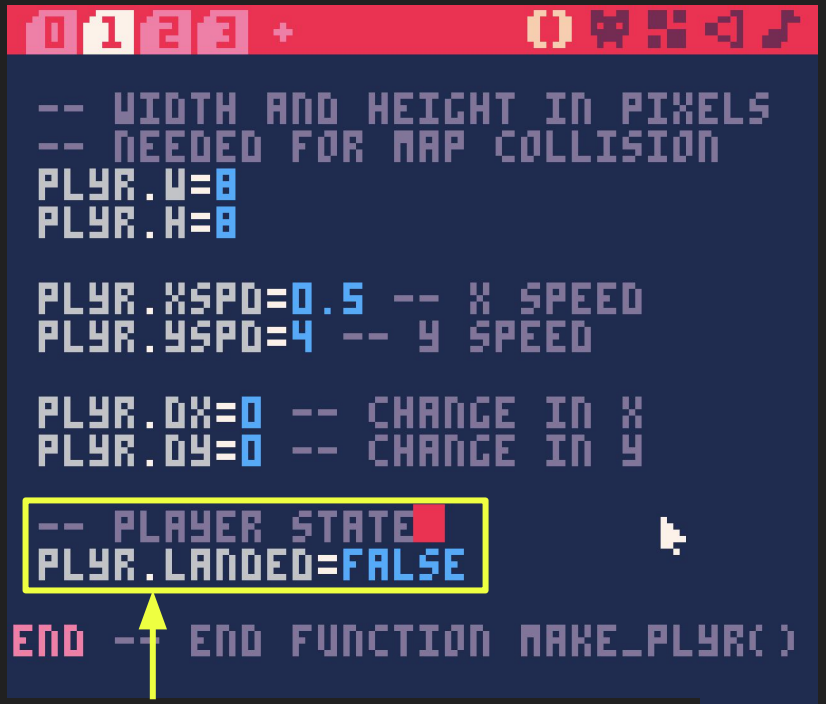
Use the keyword **AND** to stack conditions

We want to specify that *we only want to **stop** the player from moving if they are **already** moving down* (in other words, **if dy > 0**)

This allows the player to jump again, but *there's another issue: they can still jump indefinitely* (essentially floating like in Flappy Bird)



We'll need to **track whether the player is in the air or not**, and ***only allow them to jump if they're not already in the air***



We'll need to track whether the player is in the air or not, and ***only allow them to jump if they're not already in the air*** – I added a variable called **plyr.landed** to my make_plyr() function, and set it to **false** initially

```
-- WIDTH AND HEIGHT IN PIXELS
-- NEEDED FOR MAP COLLISION
PLYR.W=8
PLYR.H=8

PLYR.XSPD=0.5 -- X SPEED
PLYR.YSPD=4 -- Y SPEED

PLYR.DX=0 -- CHANGE IN X
PLYR.DY=0 -- CHANGE IN Y

-- PLAYER STATE
PLYR.LANDED=FALSE

END -- END FUNCTION MAKE_PLYR()
```

We'll need to track whether the player is in the air or not, and ***only allow them to jump if they're not already in the air*** – I added a variable called **plyr.landed** to my make_plyr() function, and set it to **false** initially

```
  PLYR.DX += PLYR.XSPD
END -- END IF BTN(🅾️)

-- JUMP
IF BTNP(🅾️) OR BTNP(❎) THEN
  PLYR.DY -= PLYR.YSPD
  PLYR.LANDED=FALSE
END -- END IF BTNP(🅾️/❎)

-- STOP FALLING WHEN A SOLID
-- TILE IS BELOW THE PLAYER
IF MCOLLIDE(PLYR,"DOWN",0)
AND PLYR.DY > 0 THEN
  PLYR.DY = 0
  PLYR.LANDED=TRUE
END -- END IF MCOLLIDE

-- UPDATE X,Y BY THE CALCULATED
-- CHANGE (DELTA X, DELTA Y)
```

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We can then **set landed to true when collision is detected with the ground**, and **back to false again when the jump key is pressed**

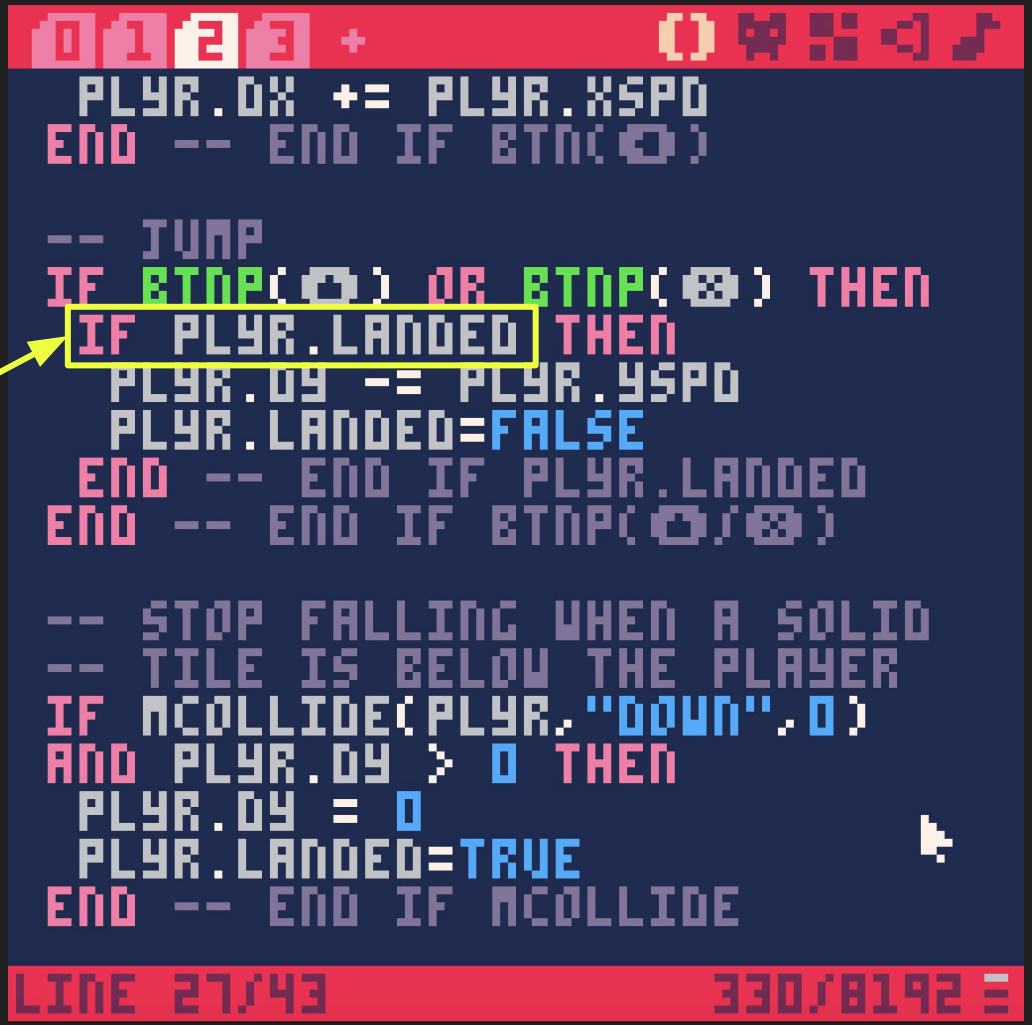
Finally, we need to add one more condition to allow the player to jump:

The player can only jump if they are not already in the air – in other words:

plyr.landed must be true

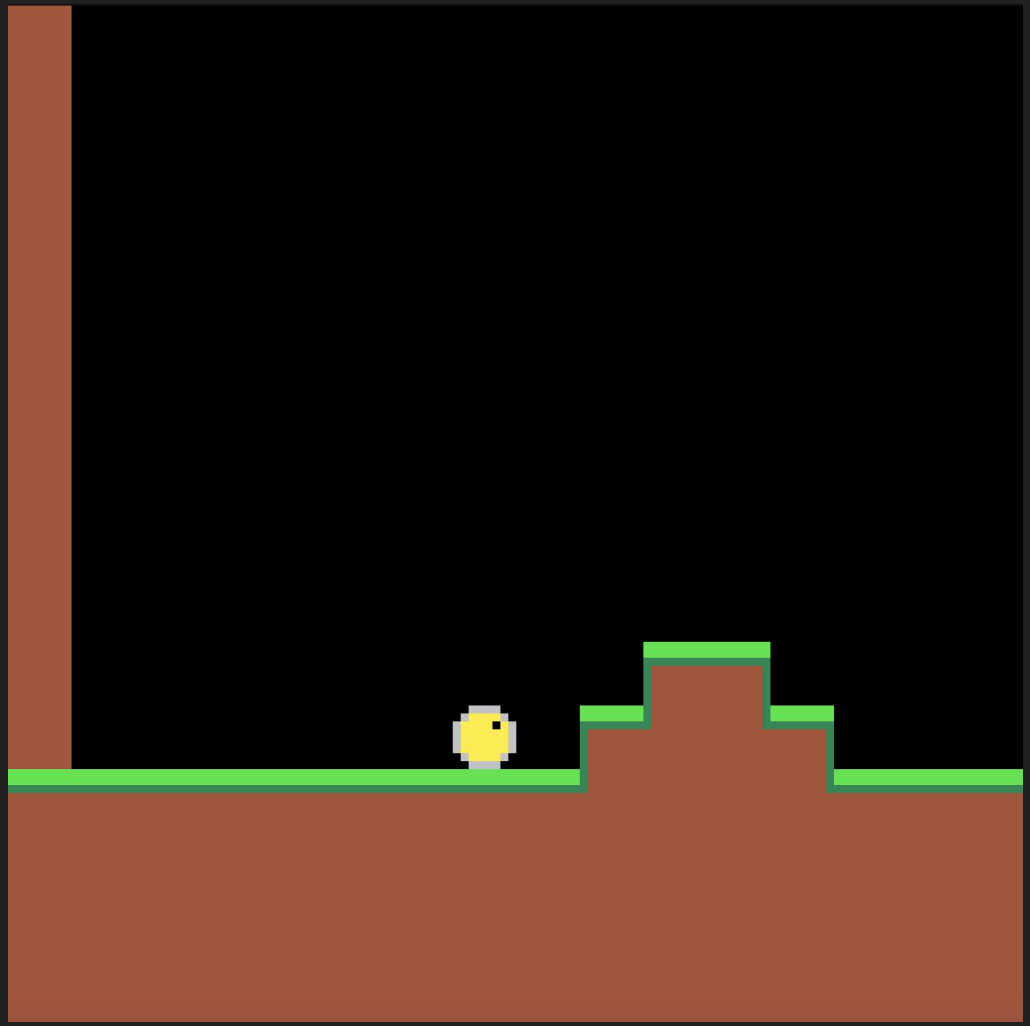
(we could express this as player.landed == true, or simply player.landed for short)

If you wanted to allow a double jump, you could include a variable tracking the number of jumps since last landing

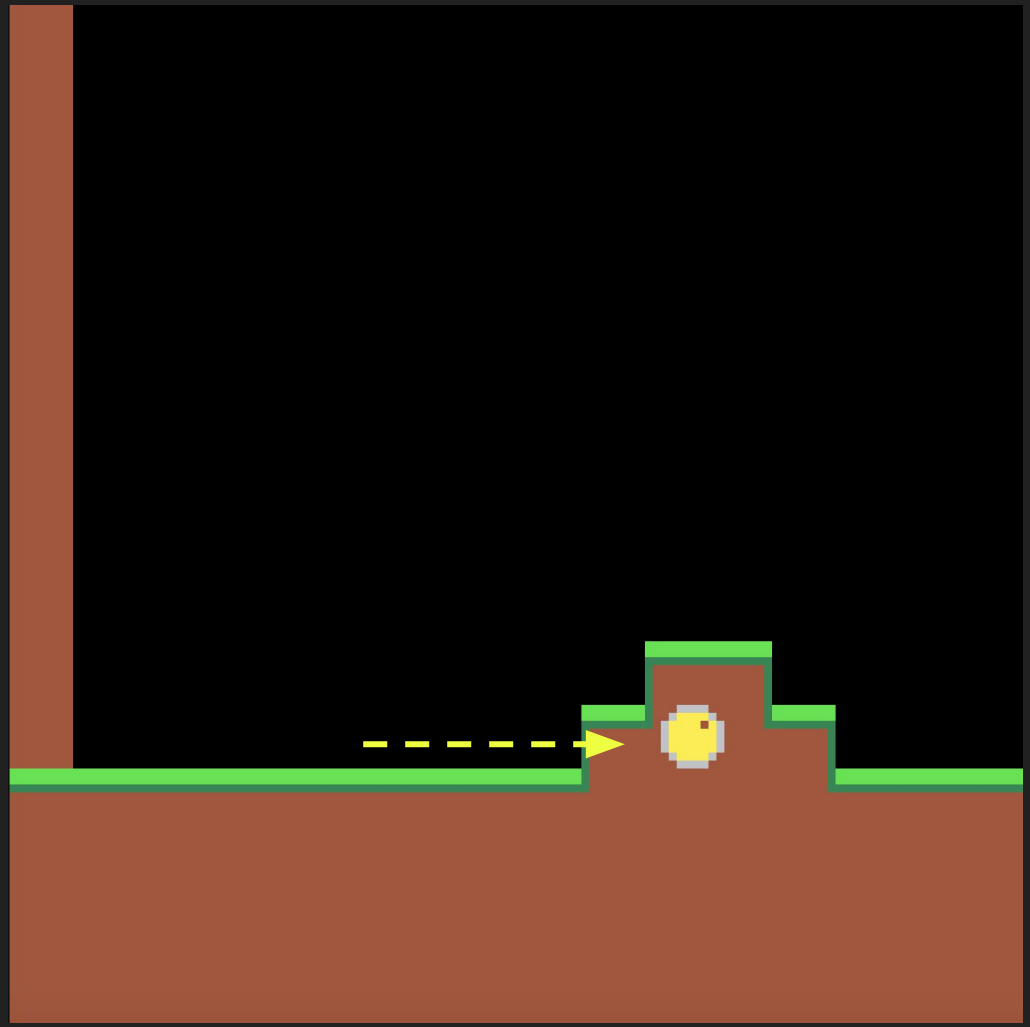


Step 09: Walls

Download Example File: platformer_09_walls.p8

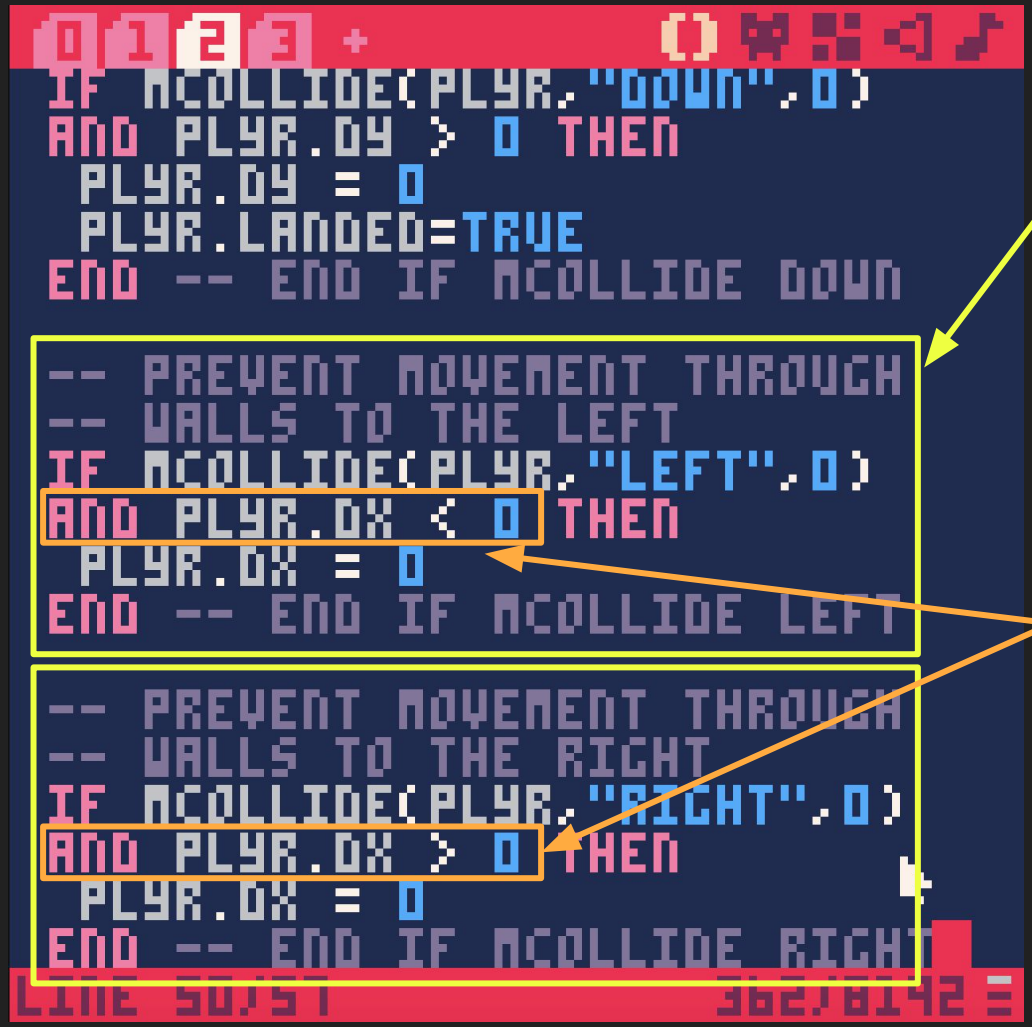


We added collision with the ground, but what if the player approaches a solid tile *horizontally*?



Right now, they would move right through walls as if they don't exist

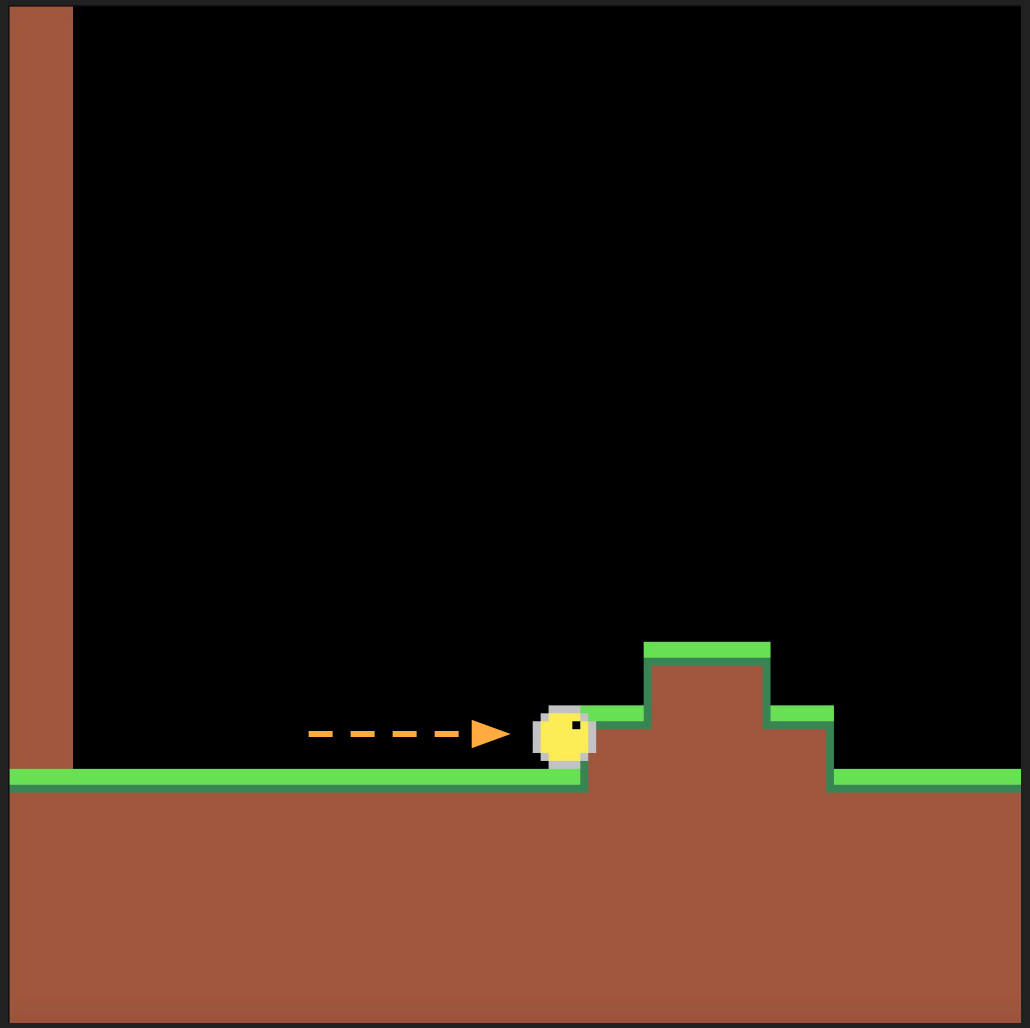
Let's fix that by using our map collision function **mcollide** to check for flag 0 to the player's **left** and **right**



After we check for solid tiles below the player, we can check to the left and right

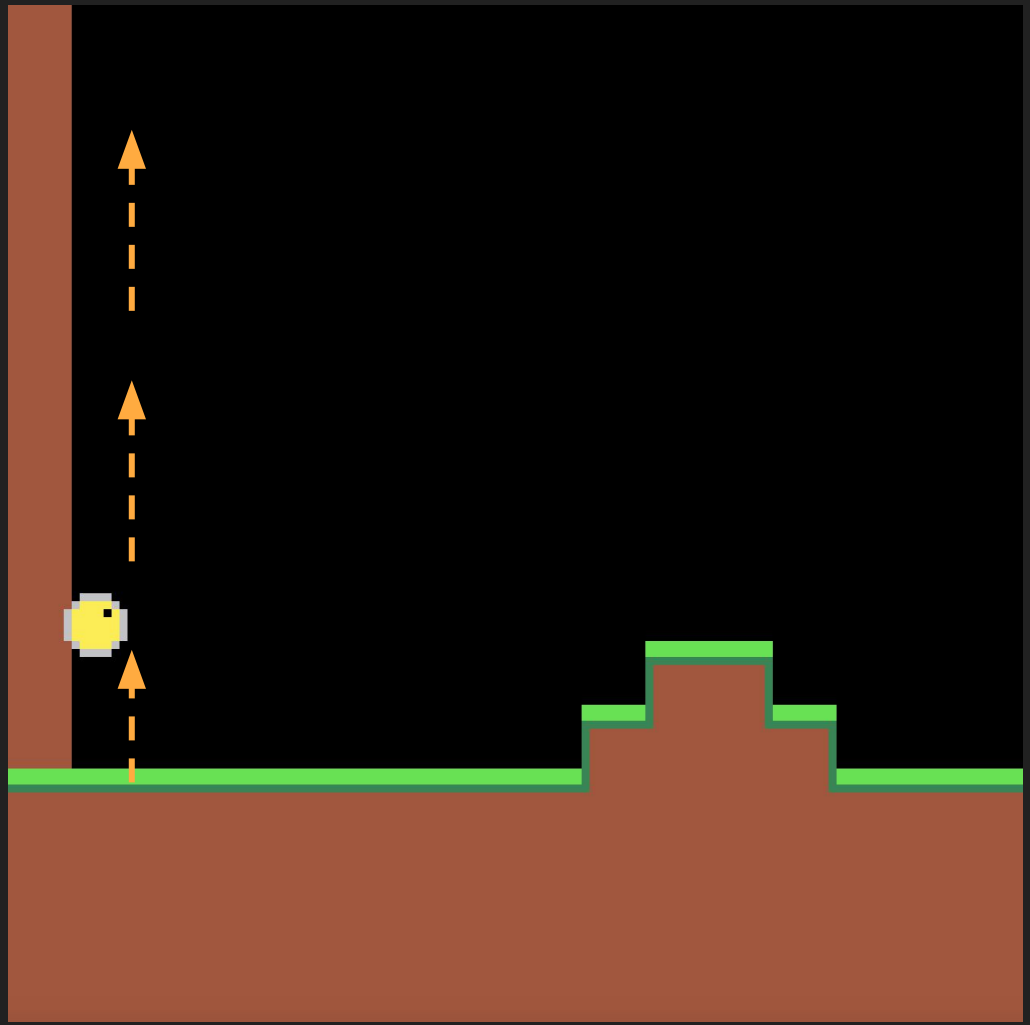
Learning from what happened when our jumping was accidentally disabled, we'll make sure we ***only apply this collision check (and stop the player's horizontal movement) if they are moving in that direction to begin with***

In other words, if dx is less than 0 (moving left) or greater than 0 (moving right)

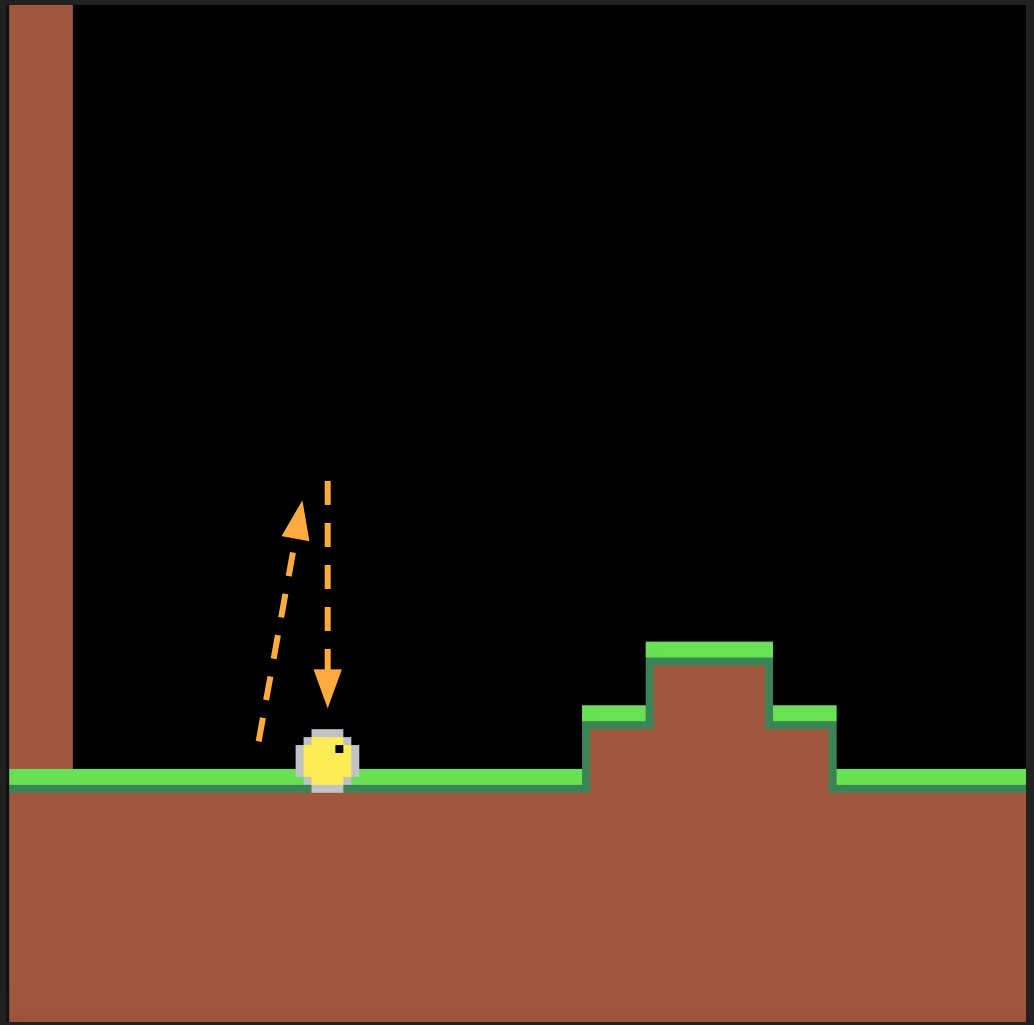


Now the player is prevented from moving through walls, but *sometimes they get stuck a few pixels into the walls*

This is because the player's speed occasionally allows them to still move between frames where collision is being checked



The player can *exploit this glitch* by getting stuck in the wall on the left or right side and then *jumping up the wall indefinitely*

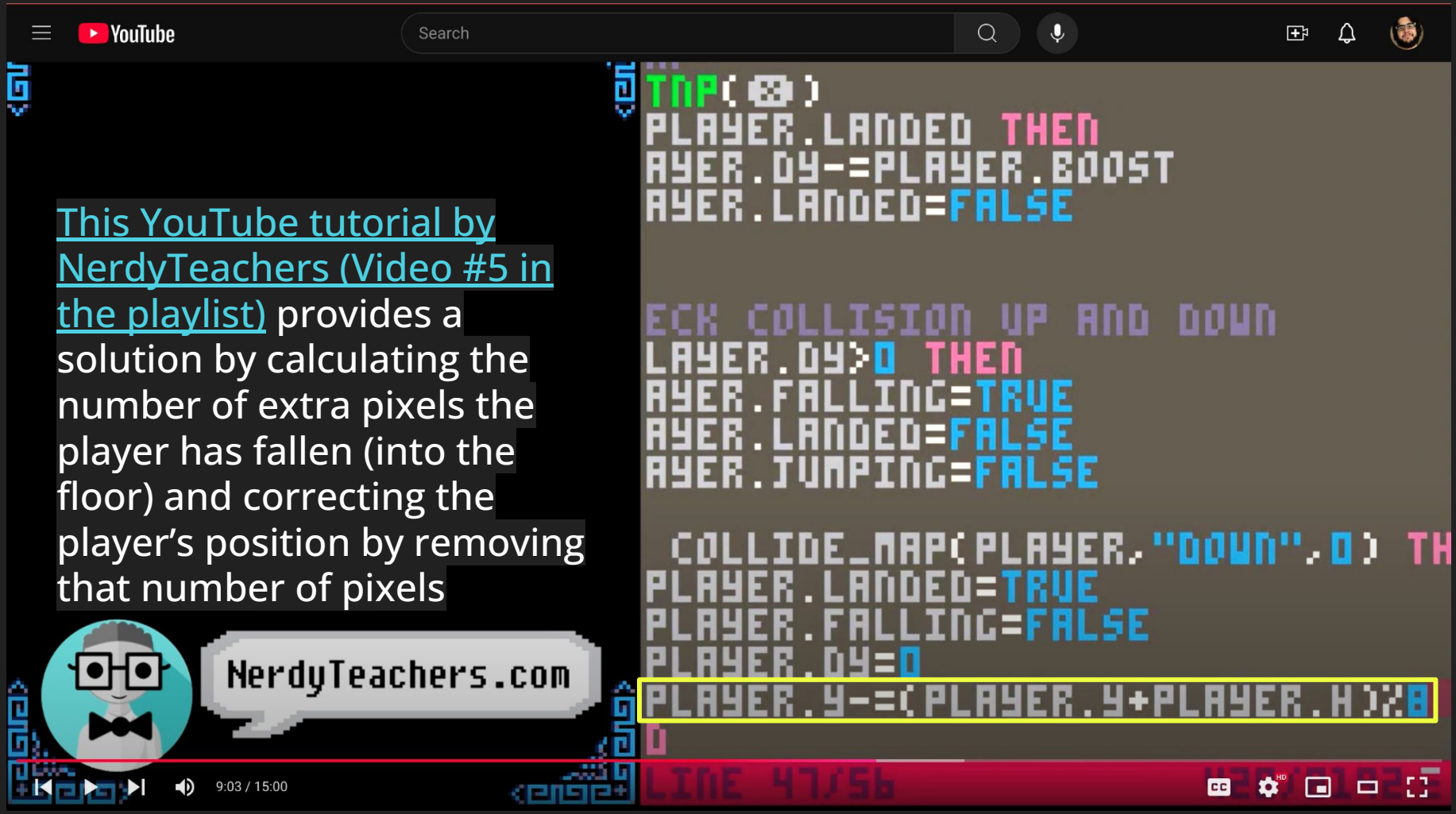


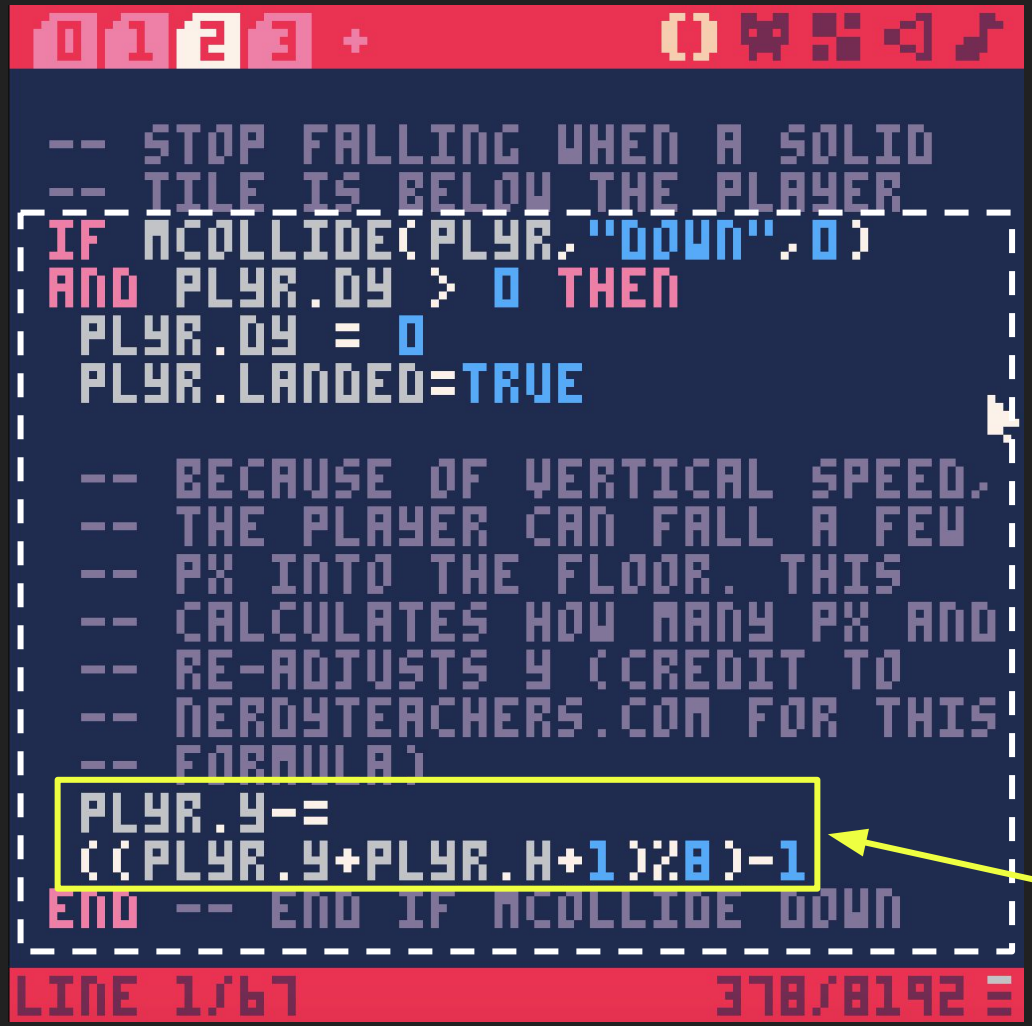
And sometimes *after jumping, the player gets stuck a few pixels into the floor*

You'll notice *this prevents horizontal movement*, because technically the wall tile is being detected adjacent to the player in this case

Step 10: Movement Refined

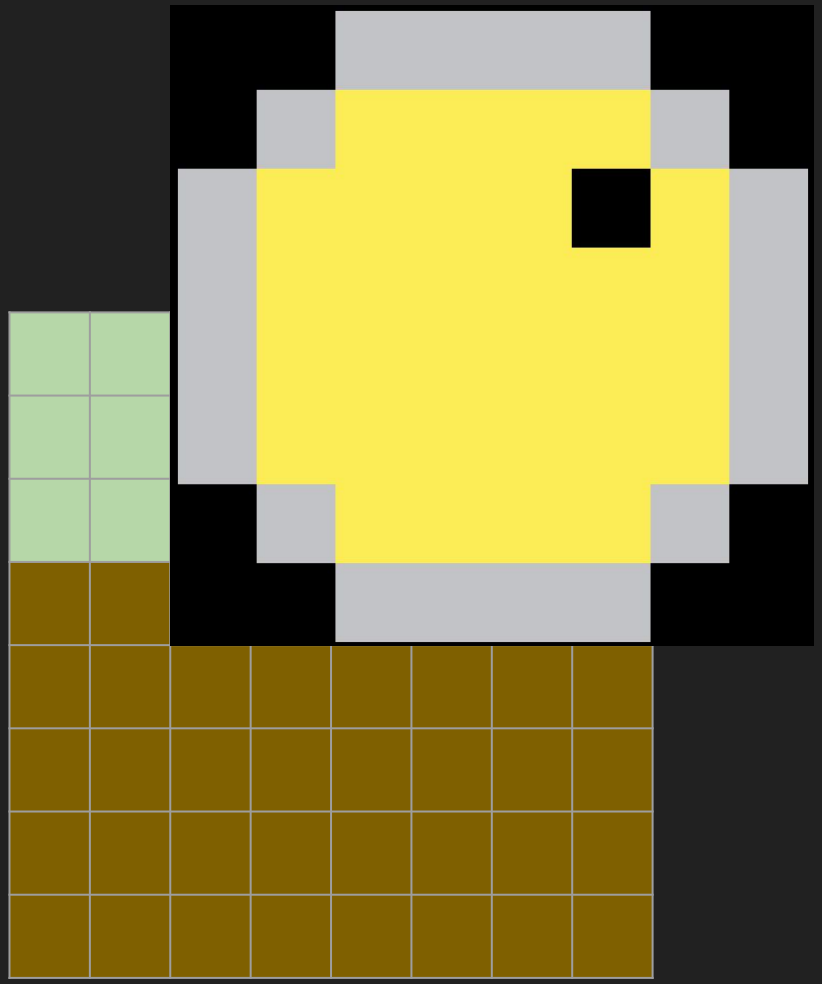
Download Example File: platformer_10_movement_refined.p8


YouTube
Search
This YouTube tutorial by NerdyTeachers (Video #5 in the playlist) provides a solution by calculating the number of extra pixels the player has fallen (into the floor) and correcting the player's position by removing that number of pixels
NerdyTeachers.com
9:03 / 15:00
TNP(0)
PLAYER.LANDED THEN
AYER.DY-=PLAYER.BOOST
AYER.LANDED=FALSE
ECK COLLISION UP AND DOWN
LAYER.DY>0 THEN
AYER.FALLING=TRUE
AYER.LANDED=FALSE
AYER.JUMPING=FALSE
COLLIDE_MAP(PLAYER,"DOWN",0) TH
PLAYER.LANDED=TRUE
PLAYER.FALLING=FALSE
PLAYER.DY=0
PLAYER.Y-=(PLAYER.Y+PLAYER.H)%8
0
LINE 47/56



Because the solution uses a bit more complicated math (*the* **%** *operator calculates the remainder of an equation after division*), I'll allow you to copy and paste this into your code, as I've done with my in-progress game here

Add it to the end of your if statement handling collision below the player



```
plyr.y-=((plyr.y+plyr.h+1)%8)-1
```

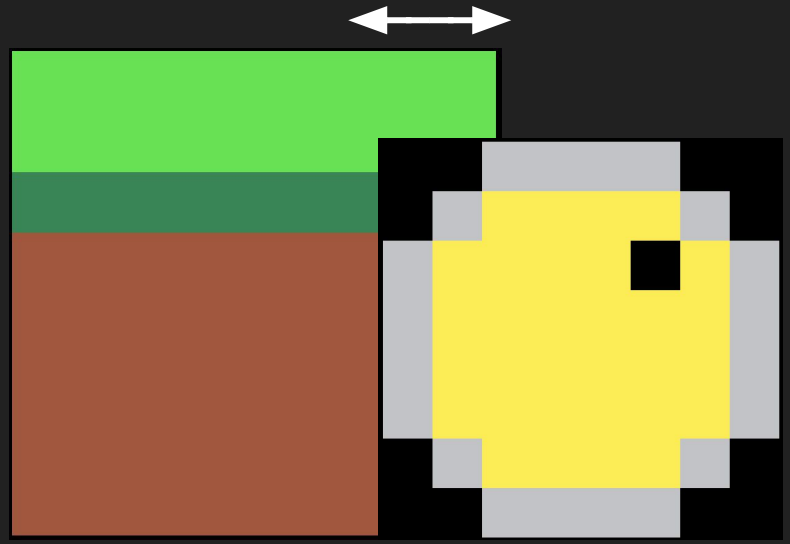
The important thing is understanding generally what this math accomplishes:

This equation:

- Takes the y coordinate one pixel below the player (y+h+1)
- Divides it by 8
- And calculates the remainder by using the **%** operator (called modulo or modulus)
- Then subtracts that value from the player's y to move it up however many pixels it's off by

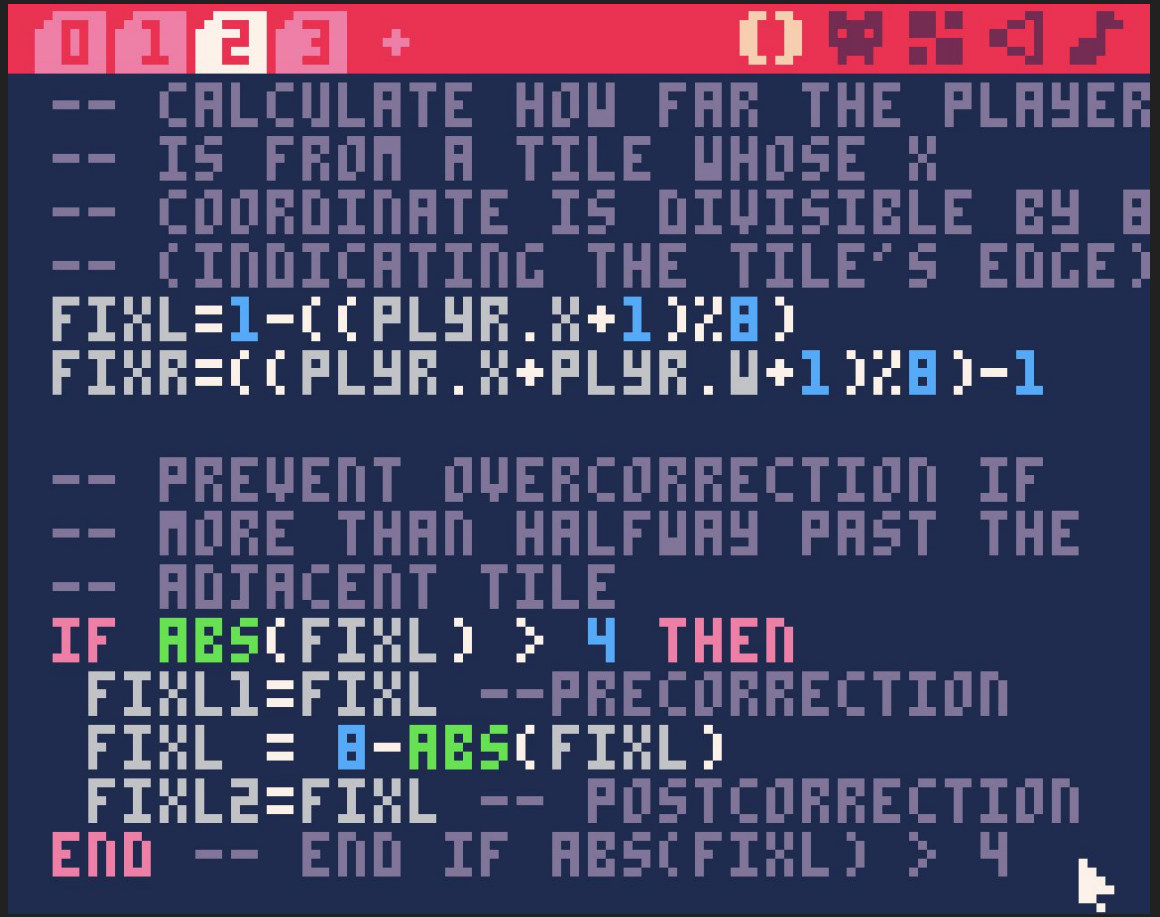
We can apply this logic to the x-axis as well, to prevent the player from getting stuck in walls

This code calculates how far away the player is (on both the left and right) from the nearest x coordinate divisible by 8 (which would indicate a tile edge)



```
-- CALCULATE HOW FAR THE PLAYER
-- IS FROM A TILE WHOSE X
-- COORDINATE IS DIVISIBLE BY 8
-- (INDICATING THE TILE'S EDGE)
FIXL=1-((PLYR.X+1)%8)
FIXR=((PLYR.X+PLYR.W+1)%8)-1

-- PREVENT OVERCORRECTION IF
-- MORE THAN HALFWAY PAST THE
-- ADJACENT TILE
IF ABS(FIXL) > 4 THEN
 FIXL = 8-ABS(FIXL)
END -- END IF ABS(FIXL) > 4

-- PREVENT MOVEMENT THROUGH
-- WALLS TO THE LEFT
IF MCOLLIDE(PLYR,"LEFT",0)
AND PLYR.DX < 0 THEN
```

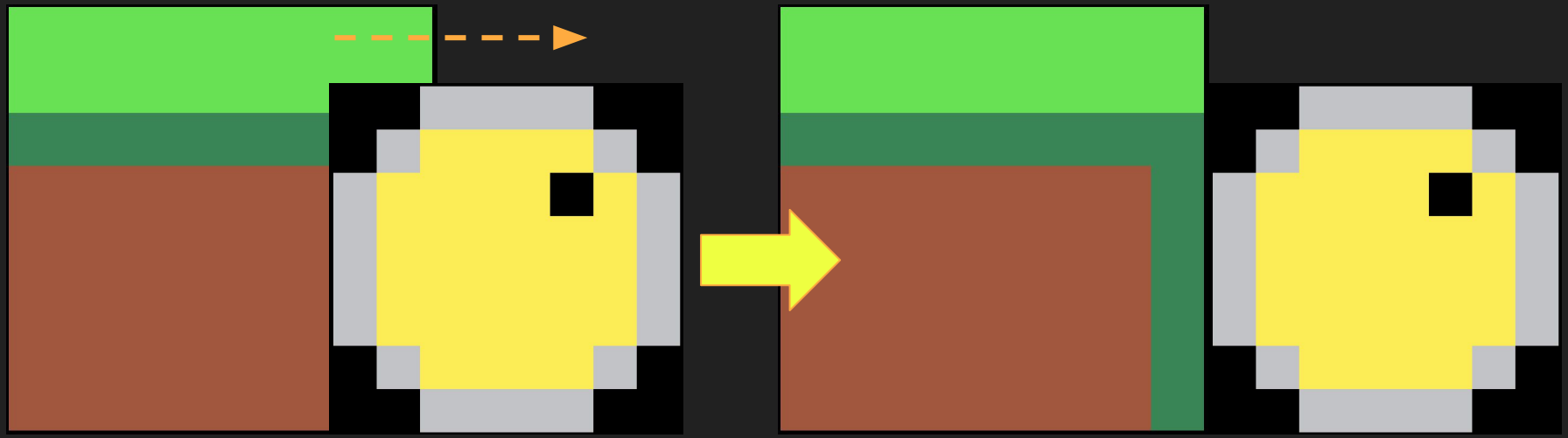
In your player movement function, after checking collision below, but before checking collision to the left and right, add the code that calculates variables called **fixl** (fix left) and **fixr** (fix right)



Then, in your if statement checking collision with wall tiles on the left:

Add fixl to the player's x to move the player the necessary number of pixels to the right, out of the wall to the left

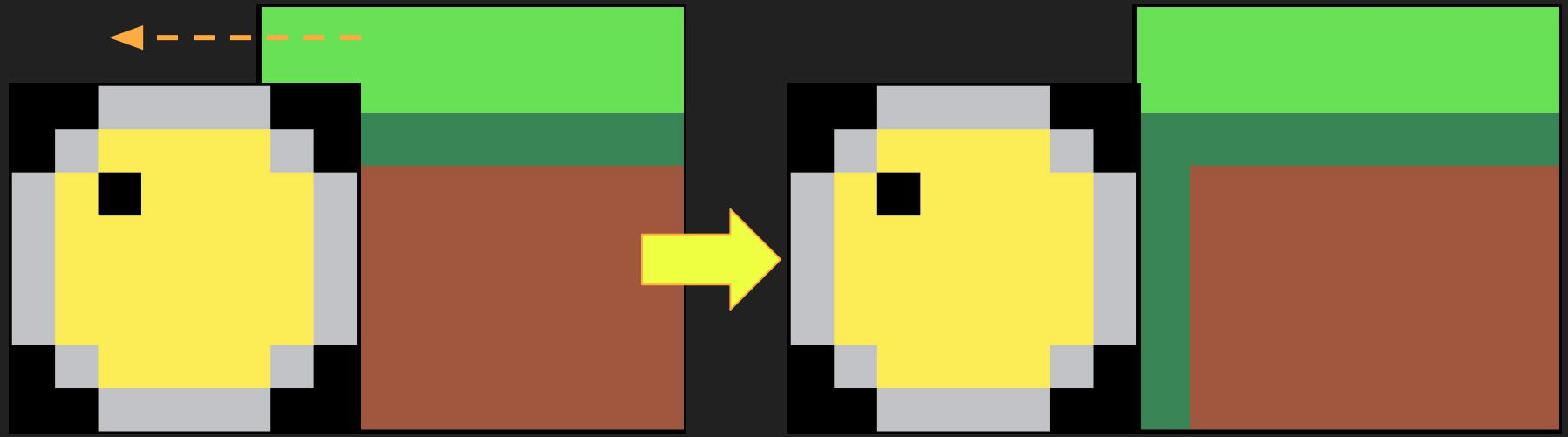
```
-- PREVENT MOVEMENT THROUGH
-- WALLS TO THE LEFT
IF MCOLLIDE(PLYR,"LEFT",0)
AND PLYR.DX < 0 THEN
 PLYR.DX = 0

 -- APPLY CORRECTION TO AVOID
 -- GETTING STUCK IN THE WALL
 PLYR.X+=FIXL
END -- END IF MCOLLIDE LEFT
```



Then, in your if statement checking collision with wall tiles on the right:

Subtract fixr from the player's x to move the player the necessary number of pixels to the left, out of the wall to the right

```
-- PREVENT MOVEMENT THROUGH
-- WALLS TO THE RIGHT
IF MCOLLIDE(PLYR,"RIGHT",0)
AND PLYR.DX > 0 THEN
 PLYR.DX = 0

 -- APPLY CORRECTION TO AVOID
 -- GETTING STUCK IN THE WALL
 PLYR.X-=FIXR
END -- END IF MCOLLIDE RIGHT
```



Bonus: map collision correction illustrated

Download Example File: platformer_10a_correction_illustrated.p8

Our player movement is now pretty clean!

Next, we'll center the camera on the player so we can explore the rest of the map

Step 11: Camera

Download Example File: platformer_11_camera.p8

Positioning the Camera

- There is a built-in PICO-8 function for setting the camera, called camera()
- But it places the camera at **0,0** (the top-left corner of the screen)
- ***We need our camera to follow the player***, so we'll write a function to adjust its position based on the player's position

There is a built-in PICO-8 function for setting the camera, called camera()

But it places the camera at **0,0** (the top-left corner of the screen)

We need our camera to follow the player, so we'll write a function to adjust its position based on the player's position

I'll start this function on the next tab

```
-- TAB 2: MOVE PLAYER
-- TAB 3: MAP COLLISION FUNCTION
-- TAB 4: CAMERA FUNCTION

FUNCTION _INIT()
 FRIC = 0.85 -- FRICTION
 GRAV = 0.3 -- GRAVITY
 MAKE_PLYR() -- TAB 1
END -- END FUNCTION _INIT()

FUNCTION _UPDATE()
 MOVE_PLYR() -- TAB 2
 CAM_FOLLOW() -- TAB 4
END -- END FUNCTION _UPDATE()
```

LINE 18/30 444/8192

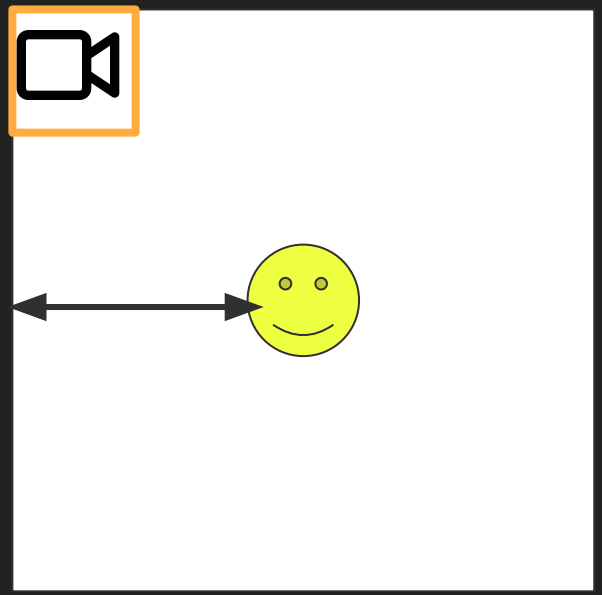
```
-- CAMERA
FUNCTION CAM_FOLLOW()

END -- END FUNCTION CAM_FOLLOW()
```

I'll start this function on the next tab

And I'll **call the function** in my _update() loop

Positioning the Camera

If I want the player to always be in the center, I need to set the camera half a screen to the player's left

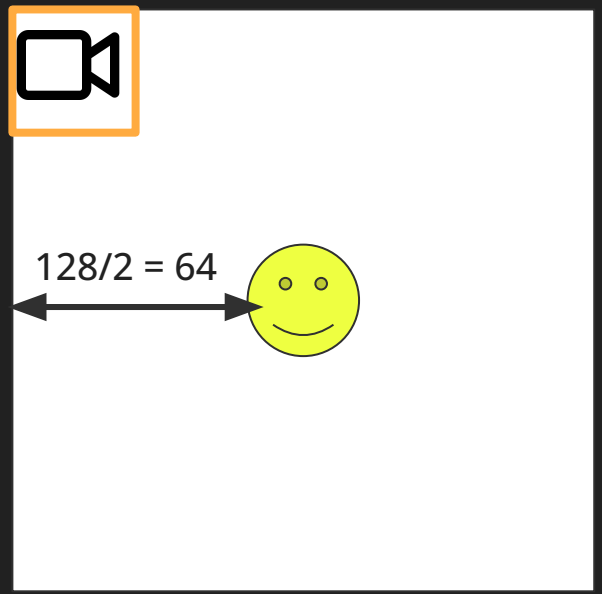


Positioning the Camera

If I want the player to always be in the center, I need to set the camera half a screen to the player's left

The screen is 128 pixels wide, so half of that is 64

That means that we must subtract 64 from the player's x coordinate to get the camera's x coordinate



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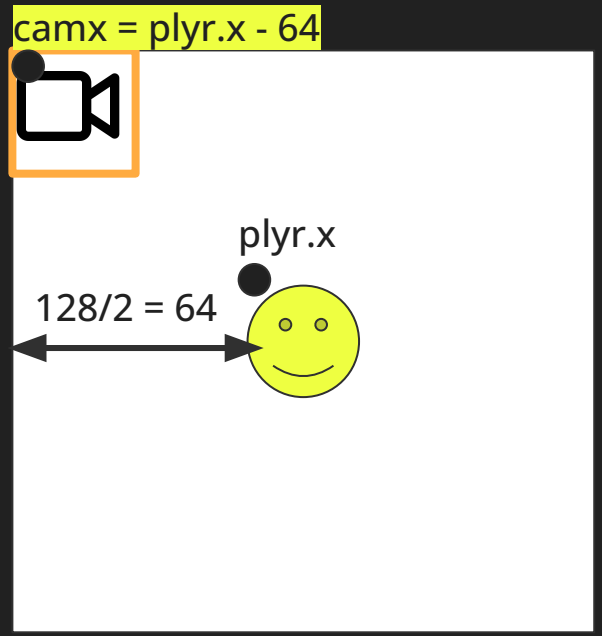

We can express this as:
camx = plyr.x - 64

Positioning the Camera

If I want the player to always be in the center, I need to set the camera half a screen to the player's left

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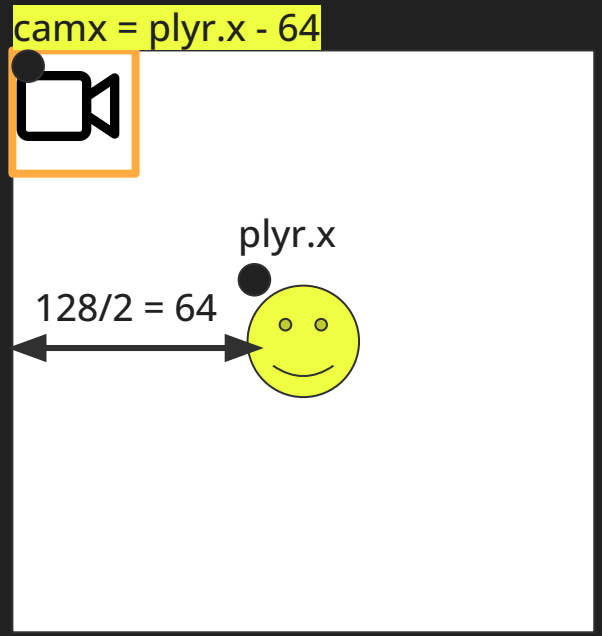


We can express this as:
camx = plyr.x - 64

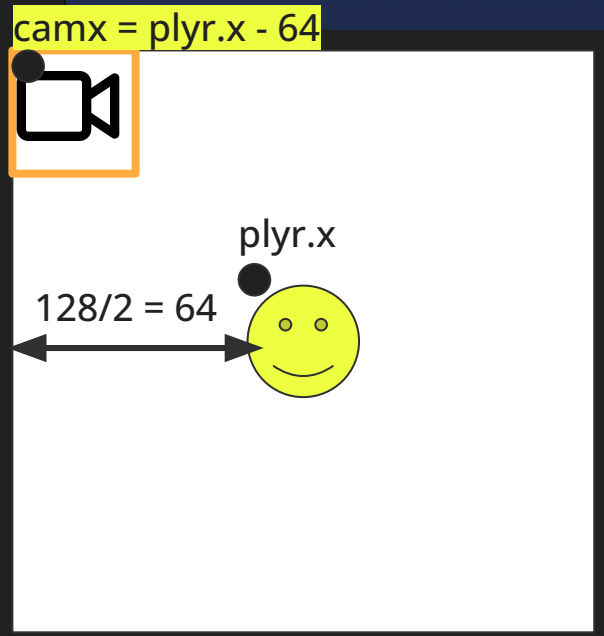
I can set camx to this value in my camera function

```
-- CAMERA
FUNCTION CAM_FOLLOW()
 CAMX = PLYR.X - 64
 CAMY = 0
 CAMERA(CAMX,CAMY)
END -- END FUNCTION CAM_FOLLOW()
```

Let’s zoom in on the code

Here I’m setting **camx** equal to 64 less than the player’s x position

```
-- CAMERA
FUNCTION CAM_FOLLOW()
 CAMX = PLYR.X - 64
 CAMY = 0
 CAMERA(CAMX,CAMY)
END -- END FUNCTION CAM_FOLLOW()
```



Let’s zoom in on the code

Here I’m setting **camx** equal to 64 less than the player’s x position

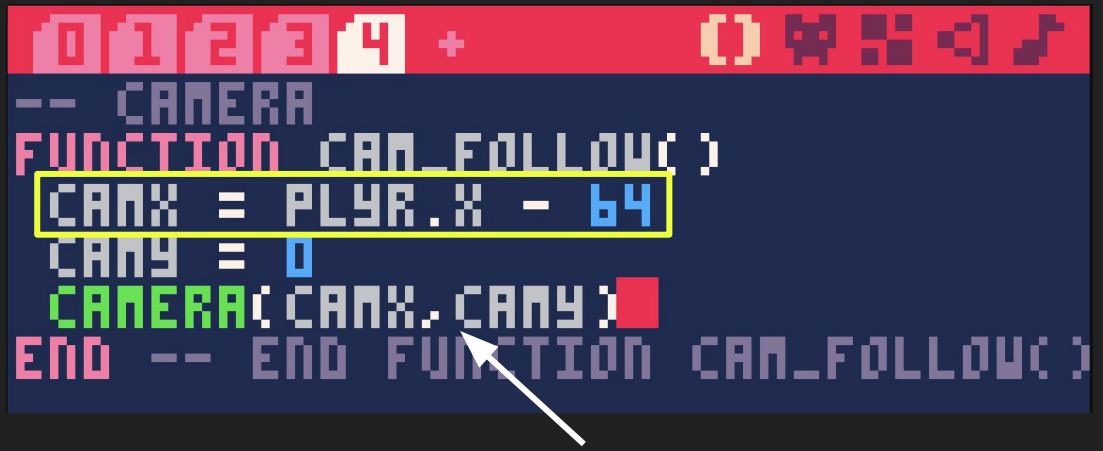
*The camera’s y position (**camy**) doesn’t need to change*, as long as we’ve drawn our level exactly 16 tiles tall (one screen height)

So I’ll leave camy as 0 for now

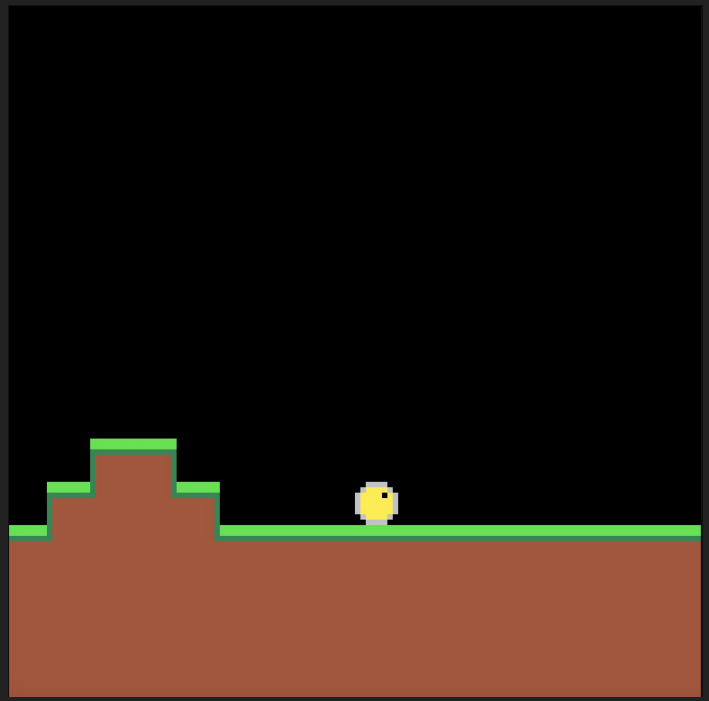
But I’ll *keep it a variable in case I want to change it later* – which I will if the player must be transported to a level that’s lower on the map

Let’s zoom in on the code

Here I’m setting **camx** equal to 64 less than the player’s x position



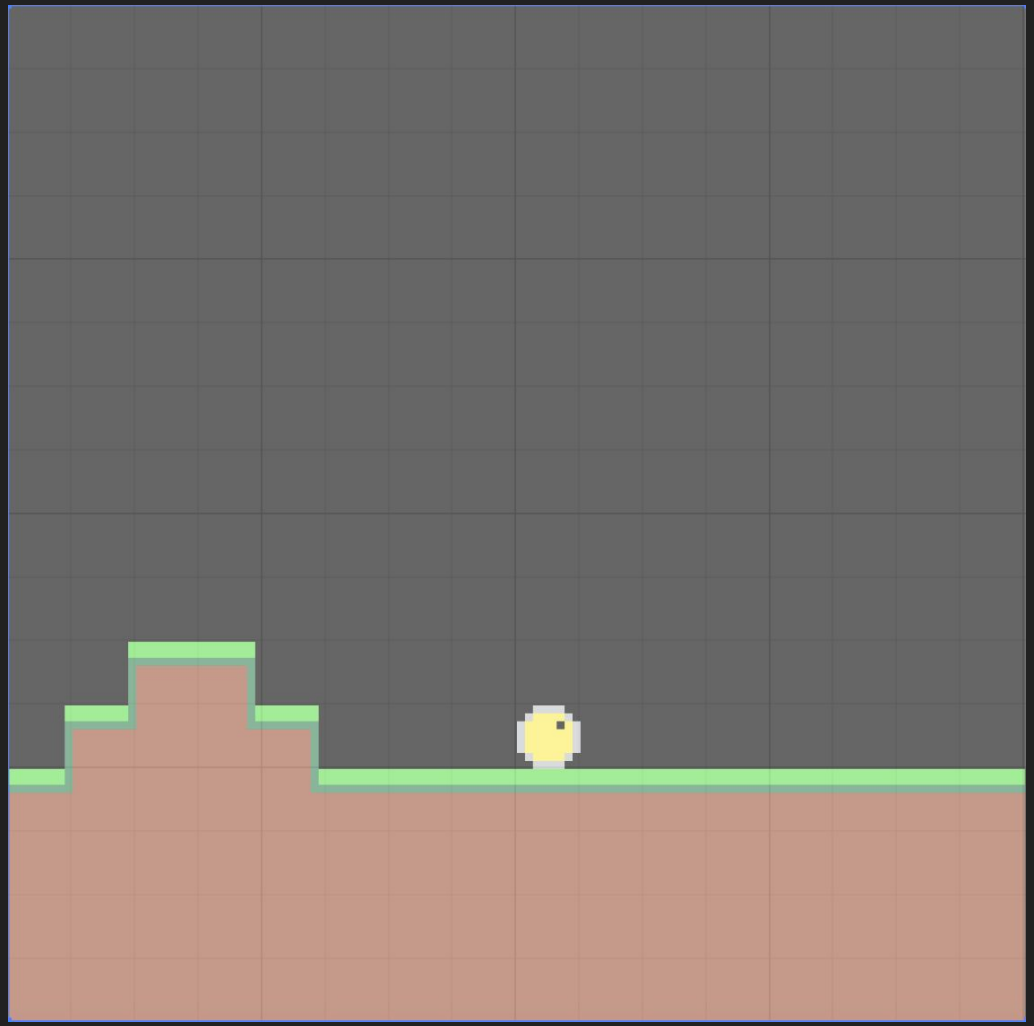
Finally, I must plug camx and camy into the camera() function to actually move it to those coordinates



```
-- CAMERA
FUNCTION CAM_FOLLOW()
 CAMX = PLYR.X - 64
 CAMY = 0
 CAMERA(CAMX,CAMY)
END -- END FUNCTION CAM_FOLLOW()
```

The result is pretty good – I can now move to the right, and the camera follows the player, revealing more of the map at the same time

But it’s not 100% perfect



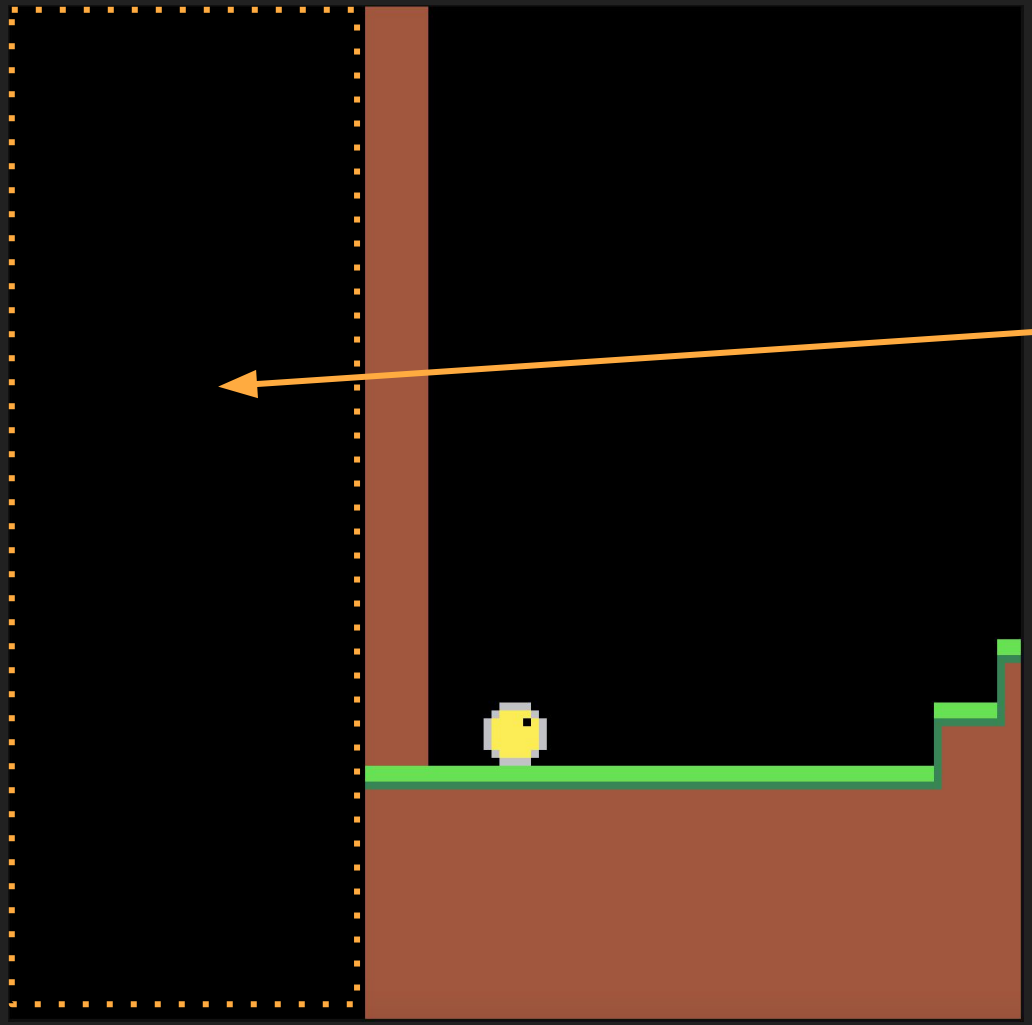
If I were to draw a grid over my screen, I can see that *the player sprite is just to the right of the center*

This is because the player is being drawn from the left

So to fine-tune our camera-positioning equation, we need to ***add half the player's width*** back after subtracting half the screen width

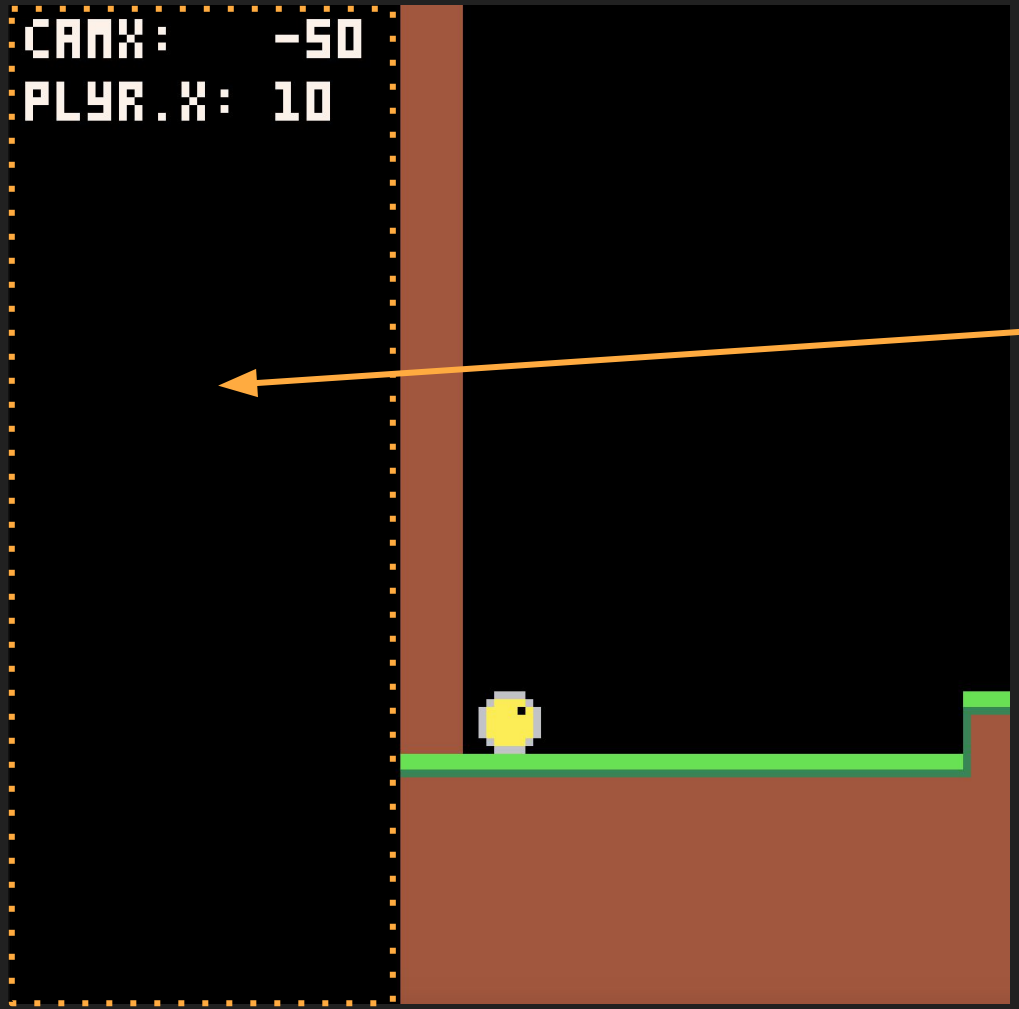
```
-- CAMERA
FUNCTION CAM_FOLLOW()
 CAMX = PLYR.X - 64 + PLYR.W/2
 CAMY = 0
 CAMERA(CAMX,CAMY)
END -- END FUNCTION CAM_FOLLOW()
```

You can see that by adding half the player's width, we perfect the equation and place the player directly in the center of the screen



There is an issue, however, if the player moves close enough to the left or right edge of the map:

We can see the blank space to the left of the map here because the camera is effectively 60 pixels to the left of the player, but the player is less than 60 pixels from the edge of the screen



There is an issue, however, if the player moves close enough to the left or right edge of the map:

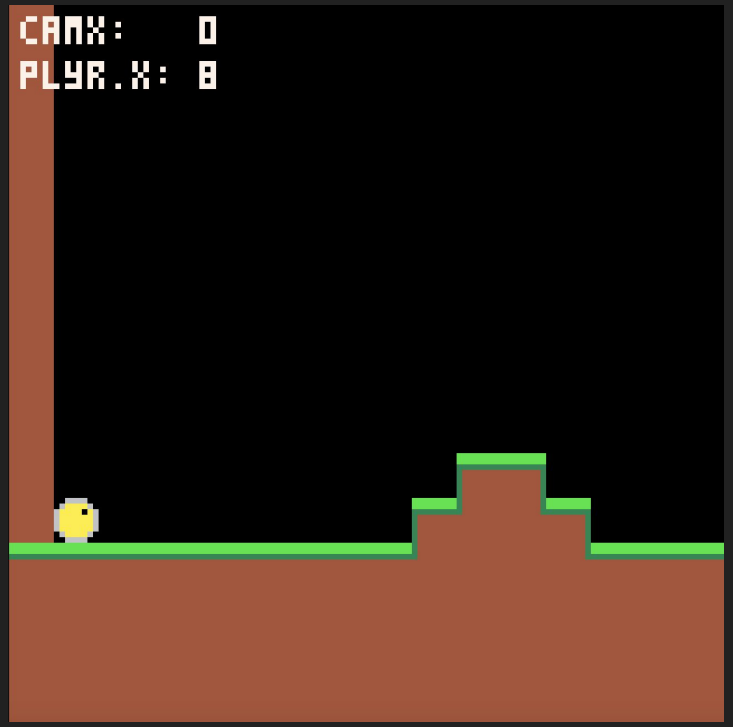
We can see the blank space to the left of the map here because the camera is effectively 60 pixels to the left of the player, but the player is less than 60 pixels from the edge of the screen

This becomes obvious when I print both the camera's and player's x coordinates

I'll add an **if** statement to override the player-centering camera behavior

If the camera's x coordinate is less than 0 (to the left of the map, which is why blank space is showing in that case), simply reset it to 0

Effectively creating a minimum value for camera x




```
-- CAMERA
FUNCTION CAM_FOLLOW()
 CAMX = PLYR.X - 64 + PLYR.W/2
 CAMY = 0

 -- PIN CAMERA TO LEFT EDGE
 IF CAMX < 0 THEN
  CAMX = 0
 END

 CAMERA(CAMX,CAMY)
END -- END FUNCTION CAM_FOLLOW()
```

This solution prevents the camera from moving any farther to the left than the left edge of the map

Now that the player can explore the rest of the level, you should design the rest of it

Remember to make sure your level is precisely 16 tiles tall

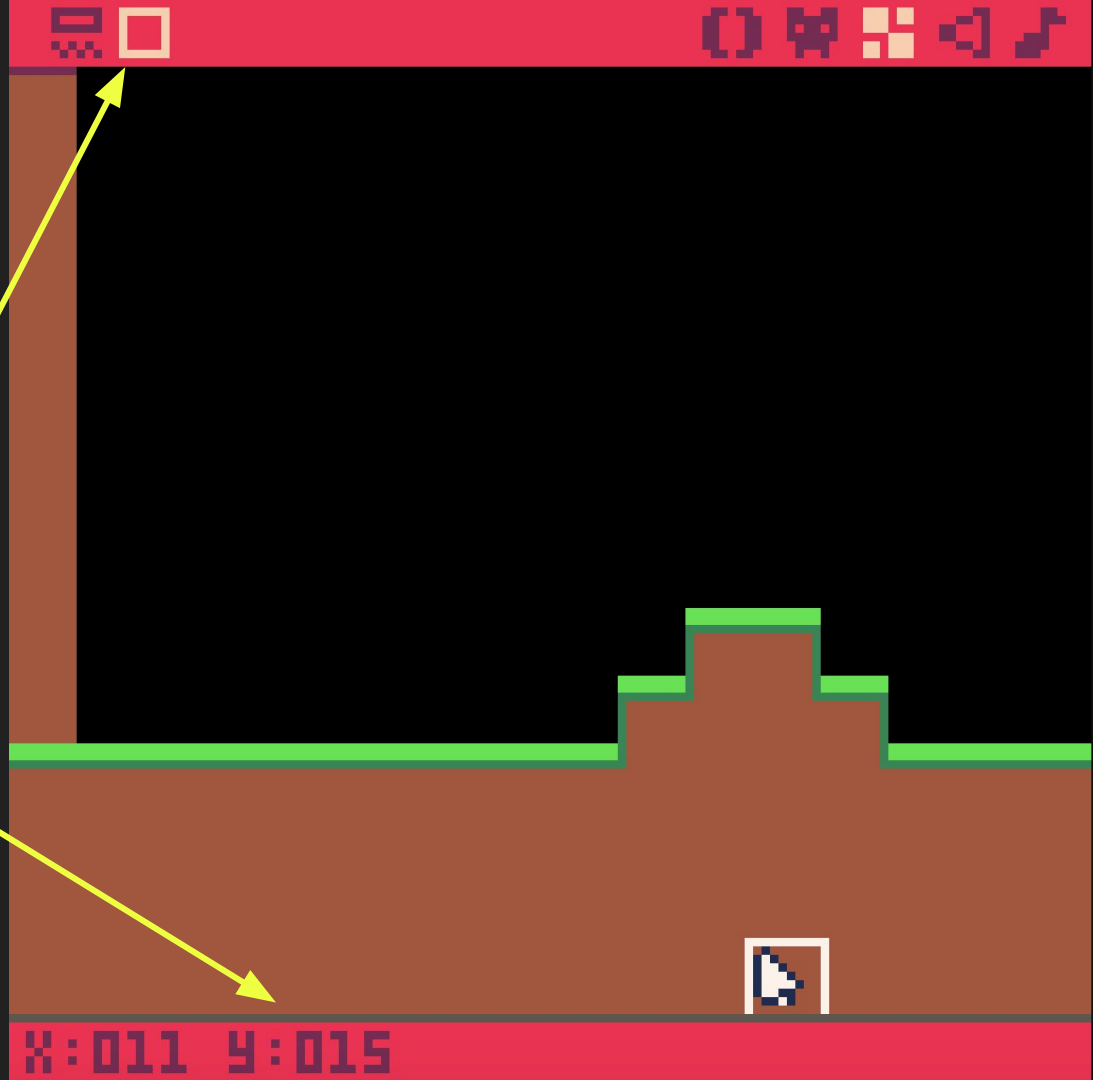
This will make controlling the camera’s y coordinate much simpler

Make sure your level is precisely 16 tiles tall

Click the square icon in the map editor to hide the lower tools and show the whole map screen

Hold space to see a grid

Mouse over the lowest cell on that grid – you should see **Y: 015** in the lower left of your screen, indicating the lowest tile on the first screen (*15, not 16, since it starts at 0*)



One thing you'll likely want to add is some pits to jump over

Let's cover how you can respawn the player after they fall down a pit

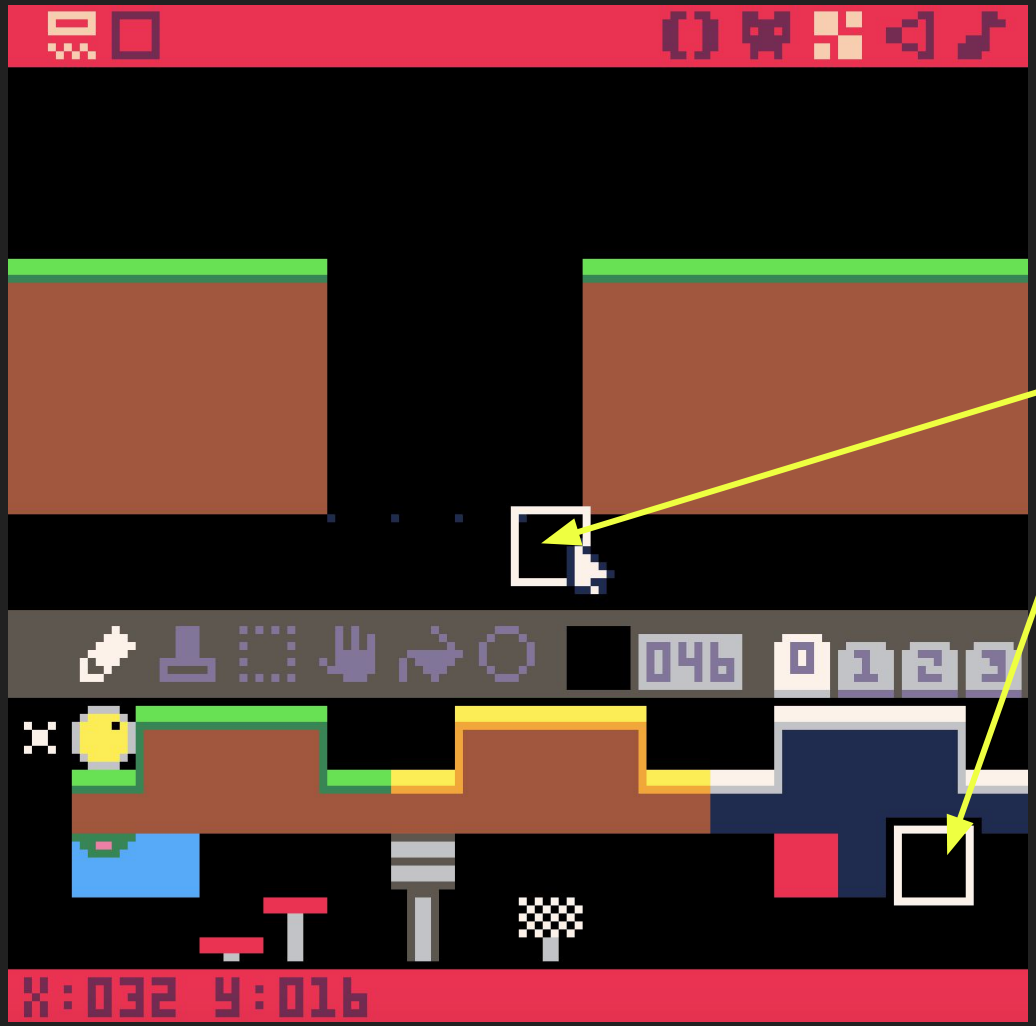
Step 12: Pits & Respawning

Download Example File: platformer_12_pits_and_respawn.p8

To detect when a player has fallen into a pit, we'll need map tiles that are designated as pits

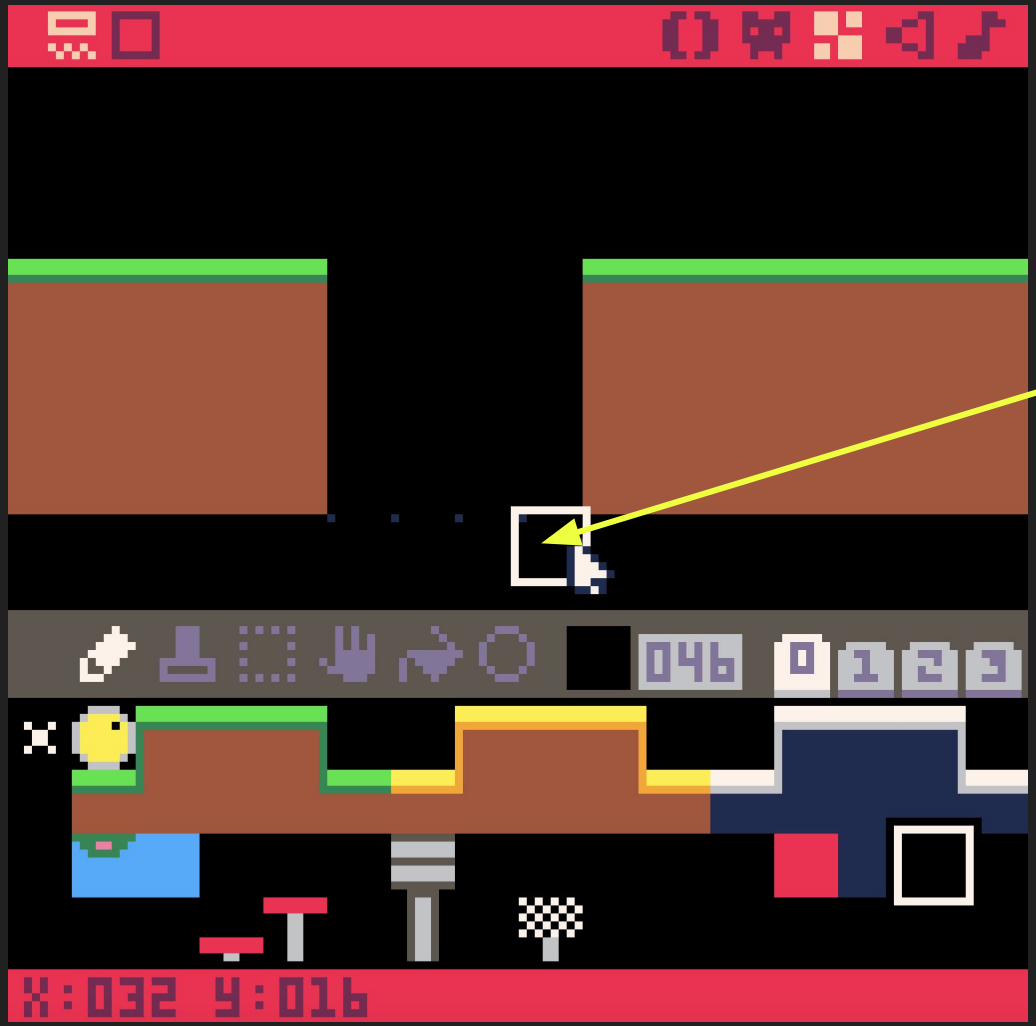
That means using a **sprite flag** to mark sprites as pit tiles

I chose a blank tile and turned **flag 7** on to use for pits



Next, I can paint with this specially flagged pit tile in my map editor

A convenient glitch in the map editor is that if you paint with blank tiles, they leave a blue dot in the top left corner of each tile, so you can actually see where you've placed your pits *(only in editing mode)*



I strategically placed my flagged tiles at the bottom of the pit

This will allow the player to fall into the pit for a few frames before they reach the flagged tiles

Otherwise, they would "die" very quickly, and might not see what happened

If I want to be very thorough, I could place these flagged tiles all across the bottom of my level, even where there aren't any pits

This would allow me to respawn the player if they ever somehow get out of bounds because of an unforeseen glitch

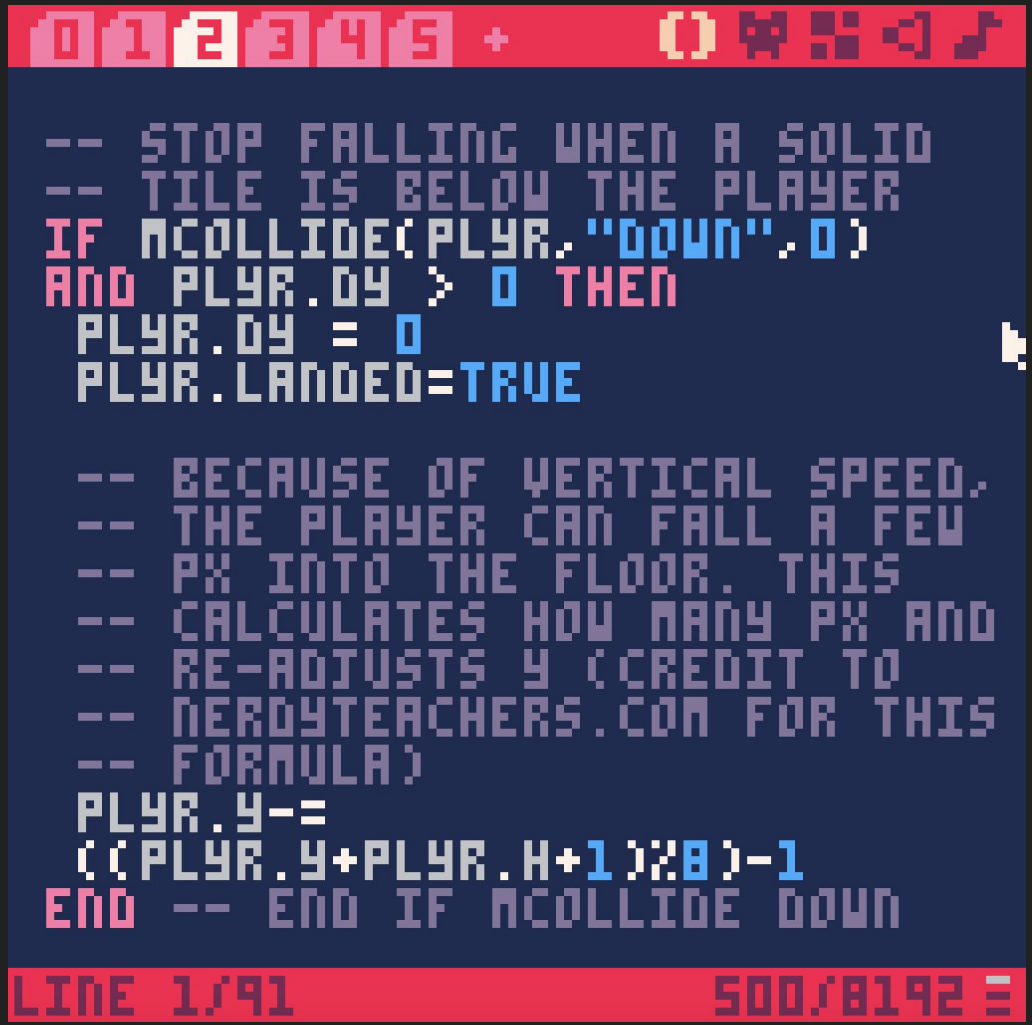
I call this a "**death plane**"

If I want to be very thorough, I could place these flagged tiles all across the bottom of my level, even where there aren't any pits

This would allow me to respawn the player if they ever somehow get out of bounds because of an unforeseen glitch

I call this a "**death plane**"

You can see the blue dots indicating blank tiles when you zoom out, too



To actually implement death and respawn, I can use our map collision function, **mcollide()**

Our condition (if statement) to check whether the player is touching a pit / the death plane (a tile with flag 7 turned on) will be very similar to checking for solid tiles below the player to stop falling

I'll copy this entire chunk of code from my move_plyr() function and paste it into a new function I'll write to handle respawning

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()

END -- END FUNCTION RESPAWN()
```

I've created a new function called **respawn()** on tab 5

It'll detect when the player touches a pit tile, then subtract a life and return the player to the start of the level *(or last checkpoint once those are implemented)*

I'll *call* the respawn() function in my **_update()** loop

```
 -- STARTING POSITION FOR CAMERA
 CAMX = 0
 CAMY = 0
END -- END FUNCTION _INIT()

FUNCTION _UPDATE()
 MOVE_PLYR() --  TAB 2
 CAM_FOLLOW() -- TAB 4
 RESPAWN() -- TAB 5
END -- END FUNCTION _UPDATE()

FUNCTION _DRAW()
 CLS() -- CLEAR SCREEN
 MAP() -- DRAW MAP
 SPR(PLYR.N,PLYR.X,PLYR.Y)
```

In the new **respawn()** function, I've pasted the chunk of code that checks for collision

We'll need to modify this, but it's a good start because the process will be similar

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()
 -- STOP FALLING WHEN A SOLID
 -- TILE IS BELOW THE PLAYER
 IF MCOLLIDE(PLYR,"DOWN",0)
 AND PLYR.DY > 0 THEN
  PLYR.DY = 0
  PLYR.LANDED=TRUE

  -- BECAUSE OF VERTICAL SPEED,
  -- THE PLAYER CAN FALL A FEW
  -- PX INTO THE FLOOR. THIS
  -- CALCULATES HOW MANY PX AND
  -- RE-ADJUSTS Y (CREDIT TO
  -- NERDYTEACHERS.COM FOR THIS
  -- FORMULA)
  PLYR.Y-=
  ((PLYR.Y+PLYR.H+1)%8)-1
 END -- END IF MCOLLIDE DOWN
```

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()
 -- STOP FALLING WHEN A SOLID
 -- TILE IS BELOW THE PLAYER
 IF MCOLLIDE(PLYR,"DOWN",0)
 AND PLYR.DY > 0 THEN
  PLYR.DY = 0
  PLYR.LANDED=TRUE

  -- BECAUSE OF VERTICAL SPEED,
  -- THE PLAYER CAN FALL A FEW
  -- PX INTO THE FLOOR. THIS
  -- CALCULATES HOW MANY PX AND
  -- RE-ADJUSTS Y (CREDIT TO
  -- NERDYTEACHERS.COM FOR THIS
  -- FORMULA)
  PLYR.Y-=
  ((PLYR.Y+PLYR.H+1)%8)-1
 END -- END IF MCOLLIDE DOWN
LINE 19/20                536/8192
```

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()
 -- STOP FALLING WHEN A SOLID
 -- TILE IS BELOW THE PLAYER
 IF MCOLLIDE(PLYR,"DOWN",0)
 AND PLYR.DY > 0 THEN

 END -- END IF MCOLLIDE DOWN
END -- END FUNCTION RESPAWN()
```

I can remove the part of the copied and pasted code that runs if the condition is true, since we're doing something different than stopping the player from falling

It's the *condition* that's similar

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()
 -- STOP FALLING WHEN A SOLID
 -- TILE IS BELOW THE PLAYER
 IF MCOLLIDE(PLYR,"DOWN",0)
 AND PLYR.DY > 0 THEN

 END -- END IF MCOLLIDE DOWN
END -- END FUNCTION RESPAWN()
```

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()
 -- STOP FALLING WHEN A SOLID
 -- TILE IS BELOW THE PLAYER
 IF MCOLLIDE(PLYR,"DOWN",7)
 AND PLYR.DY > 0 THEN

 END -- END IF MCOLLIDE DOWN
END -- END FUNCTION RESPAWN()
```

I'll need to **change the flag number** that we're checking for

We used flag 0 for solid tiles

But we're using flag 7 for pit / death tiles

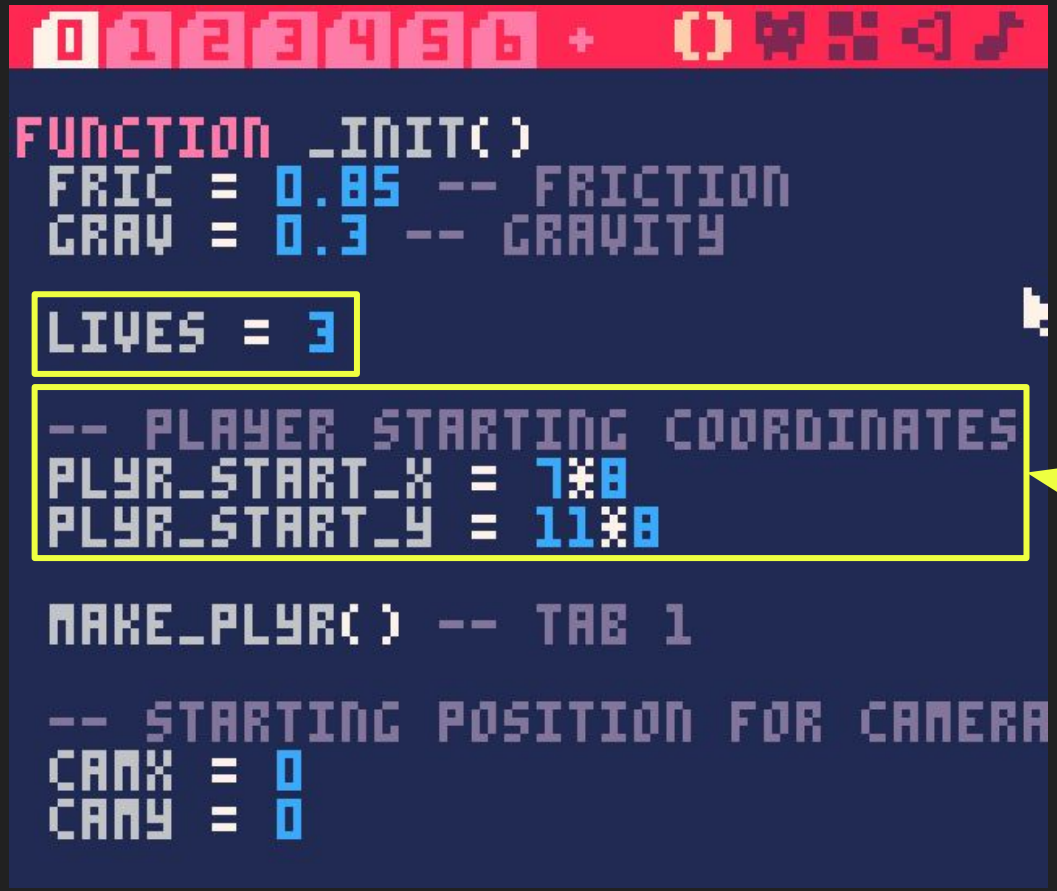
If the condition is **true** (the player is touching a death tile), we should **subtract a life**

We should also change the player's x,y position and return them to where they began the level

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()
 -- STOP FALLING WHEN A SOLID
 -- TILE IS BELOW THE PLAYER
 IF MCOLLIDE(PLYR,"DOWN",7)
 AND PLYR.DY > 0 THEN
  LIVES = LIVES - 1
  PLYR.X = PLYR_START_X
  PLYR.Y = PLYR_START_Y
 END -- END IF MCOLLIDE DOWN
END -- END FUNCTION RESPAWN()
```

I'll use variables named **plyr_start_x** and **plyr_start_y** to refer to the starting position

*I just need to make sure I **declare** them first (and declare the variable **lives** as well)*



In my **_init()** function, I'll declare variables for **lives**, **plyr_start_x**, and **plyr_start_y**

I'll use the same starting coordinates as I defined in my **make_plyr()** function

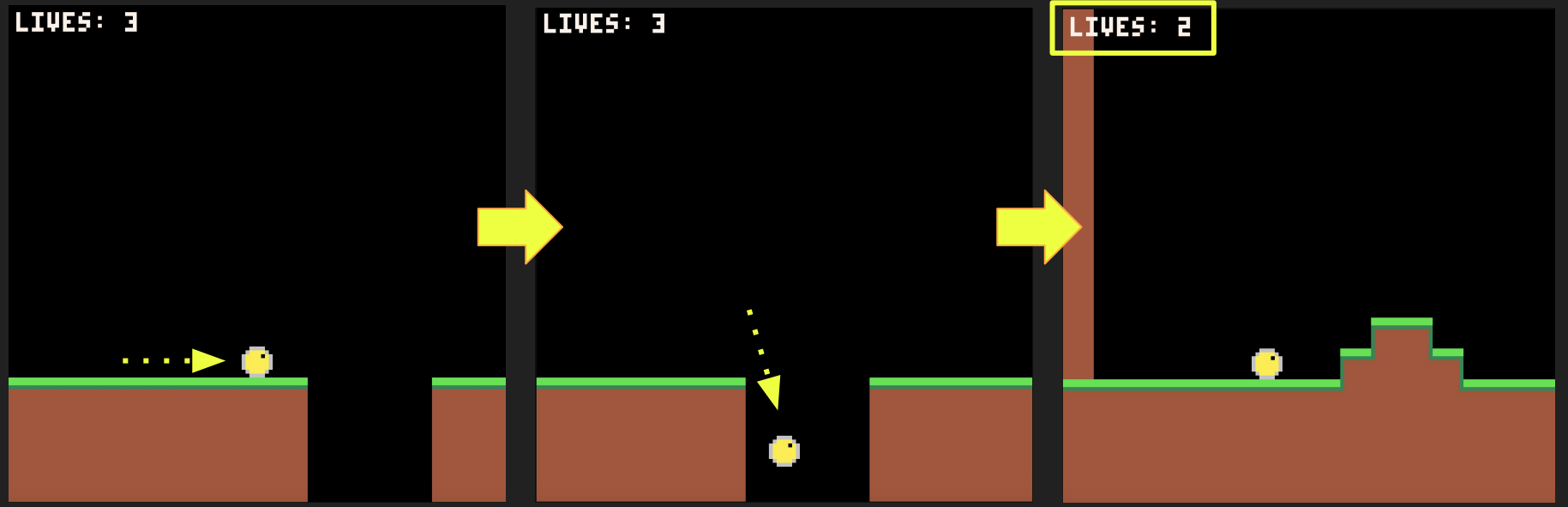
(We always need to declare variables before we refer to them elsewhere in the code)

I'll also **print** the number of **lives** so we can keep track of that value as it changes and make sure our respawn code is working

The full line of code reads:

```
print("lives: "..lives,camx+2,camy+2,7)
```

*We need to **add camx and camy to the coordinates for the text**; otherwise, it would no longer be visible when the camera moves with the player*



Test your game, and you should now see that the player returns to the starting position after falling down a pit – the number of lives is decreased by 1 as well

One last nice touch would be to add a **sound** when the player “dies”

I’ve made a failure chime on sound **02**

```
-- PITS AND RESPAWNING
FUNCTION RESPAWN()

 -- WHEN FALLING INTO A PIT,
 -- LOSE A LIFE AND RESPAWN THE
 -- PLAYER AT THE START
 IF MCOLLIDE(PLYR,"DOWN",7)
 AND PLYR.DY > 0 THEN
  LIVES = LIVES - 1
  SFX(2) -- PLAY FAILURE SOUND
  PLYR.X = PLYR_START_X
  PLYR.Y = PLYR_START_Y
 END -- END IF MCOLLIDE DOWN

END -- END FUNCTION RESPAWN()
```

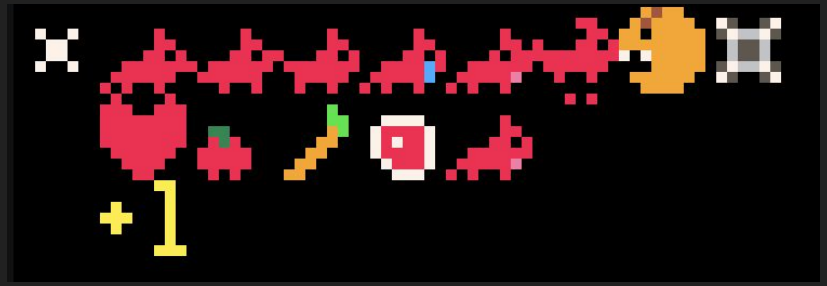

To actually play the sound, use the sfx() function, and include the sound number in the parentheses

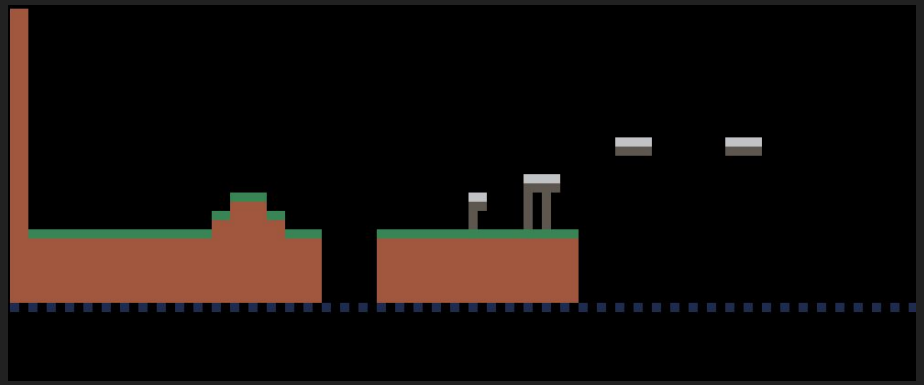
Our platformer is coming along nicely . . . another nice touch would be an animated player sprite

Step 13: Animated Sprite

Download Example File: platformer_13_animated_sprite.p8

Please note that, for the next few examples, I am using a reworked sprite sheet and map, and code may be organized on different tabs than in the screenshots (which were from an earlier version of the examples)





Please note that, for the next few examples, I am using a reworked sprite sheet and map, and code may be organized on different tabs than in the screenshots (which were from an earlier version of the examples)

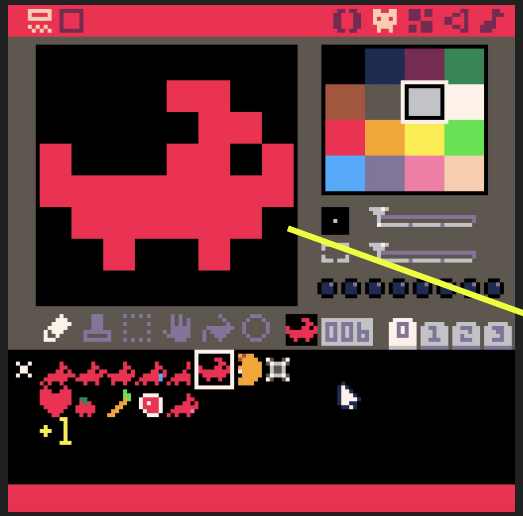
```
-- ANIMATE PLAYER SPRITE
FUNCTION ANIMATE()

END -- END FUNCTION ANIMATE()
```

I'll begin by creating a new function called animate()

(no, there's no pre-existing function for this like there was for camera)

And I'll *call* my function in _update()

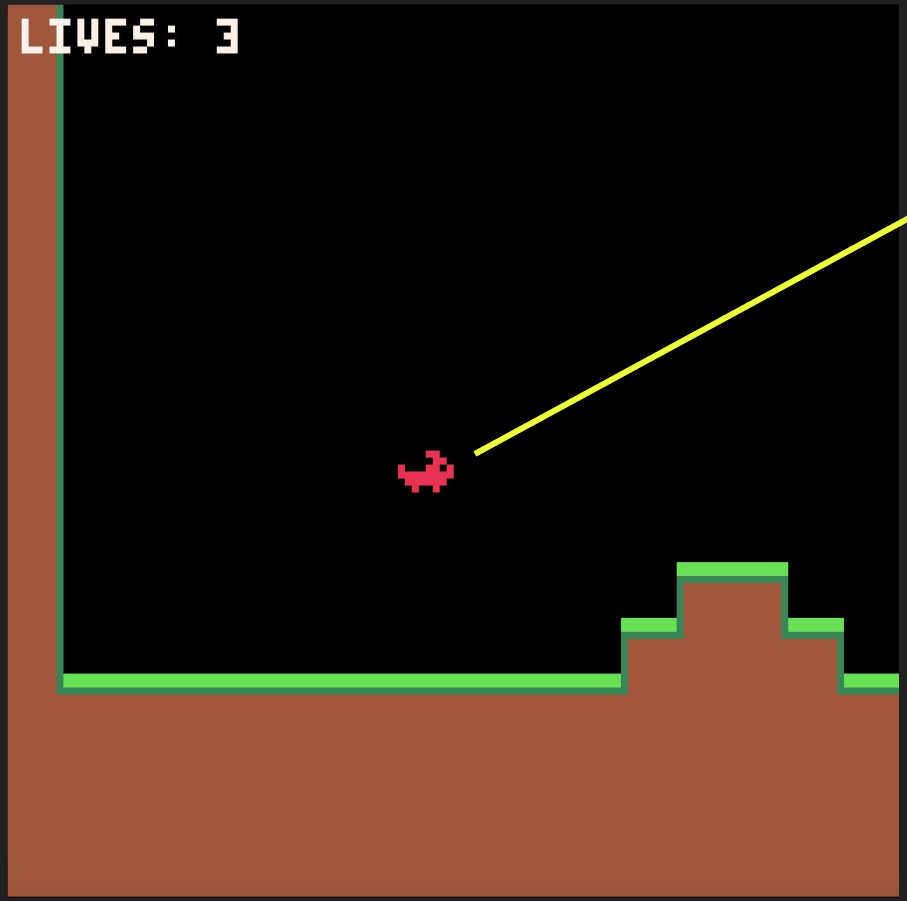
```
FUNCTION _UPDATE()
 MOVE_PLYR() --  TAB 2
 CAM_FOLLOW() -- TAB 4
 RESPAWN() -- TAB 5
 ANIMATE() -- TAB 6
END -- END FUNCTION _UPDATE()

FUNCTION _DRAW()
 CLS() -- CLEAR SCREEN
 MAP() -- DRAW MAP
 SPR(PLYR.N,PLYR.X,PLYR.Y)

 -- PRINT LIVES
 PRINT("LIVES: "..LIVES,CAMX+2,C
```

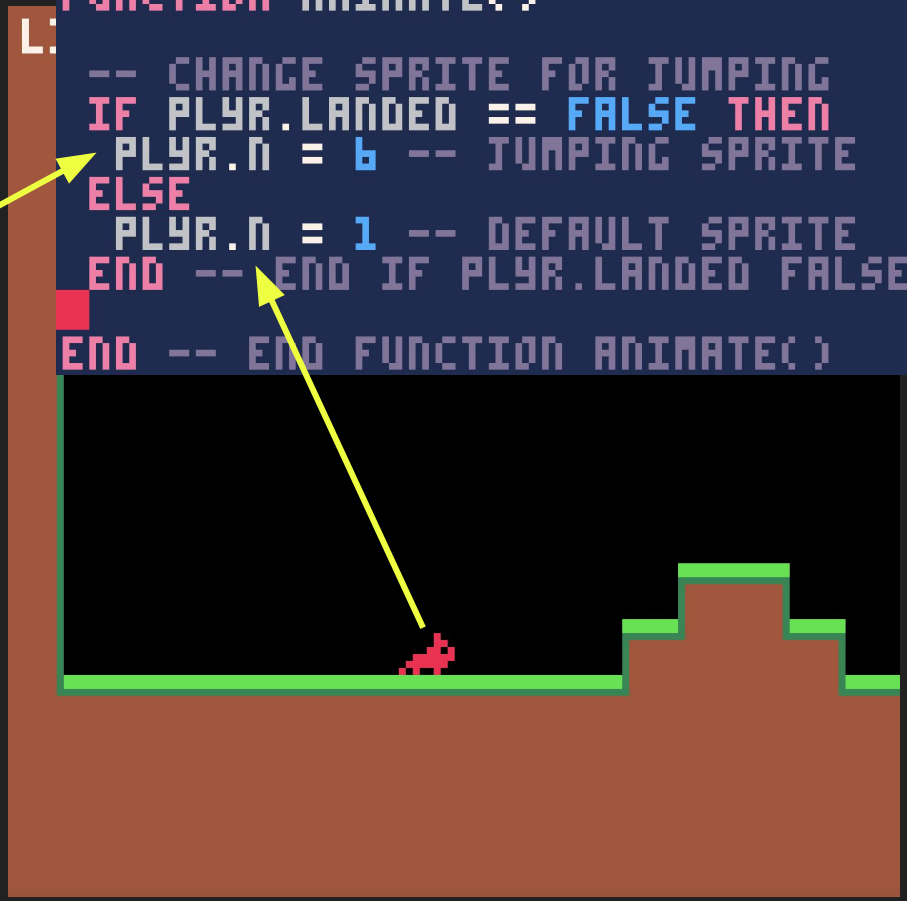


```
-- ANIMATE PLAYER SPRITE
FUNCTION ANIMATE()

 -- CHANGE SPRITE FOR JUMPING
 IF PLYR.LANDED == FALSE THEN
  PLYR.N = 6 -- JUMPING SPRITE
 ELSE
  PLYR.N = 1 -- DEFAULT SPRITE
 END -- END IF PLYR.LANDED FALSE

END -- END FUNCTION ANIMATE()
```

- One thing this function should do is display a different sprite when the player is jumping
- We know they are jumping when plyr.landed is not true
- So in that case, we can change the value for the player's sprite number
- And use **else** to change the sprite number back to the default in all other cases

Different sprites when the character is jumping (left) vs. landed (right)

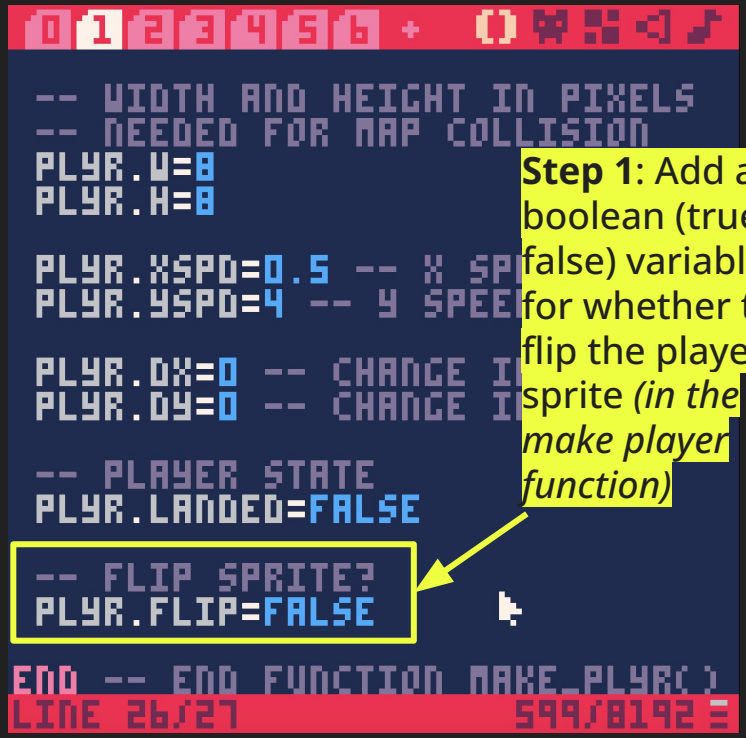




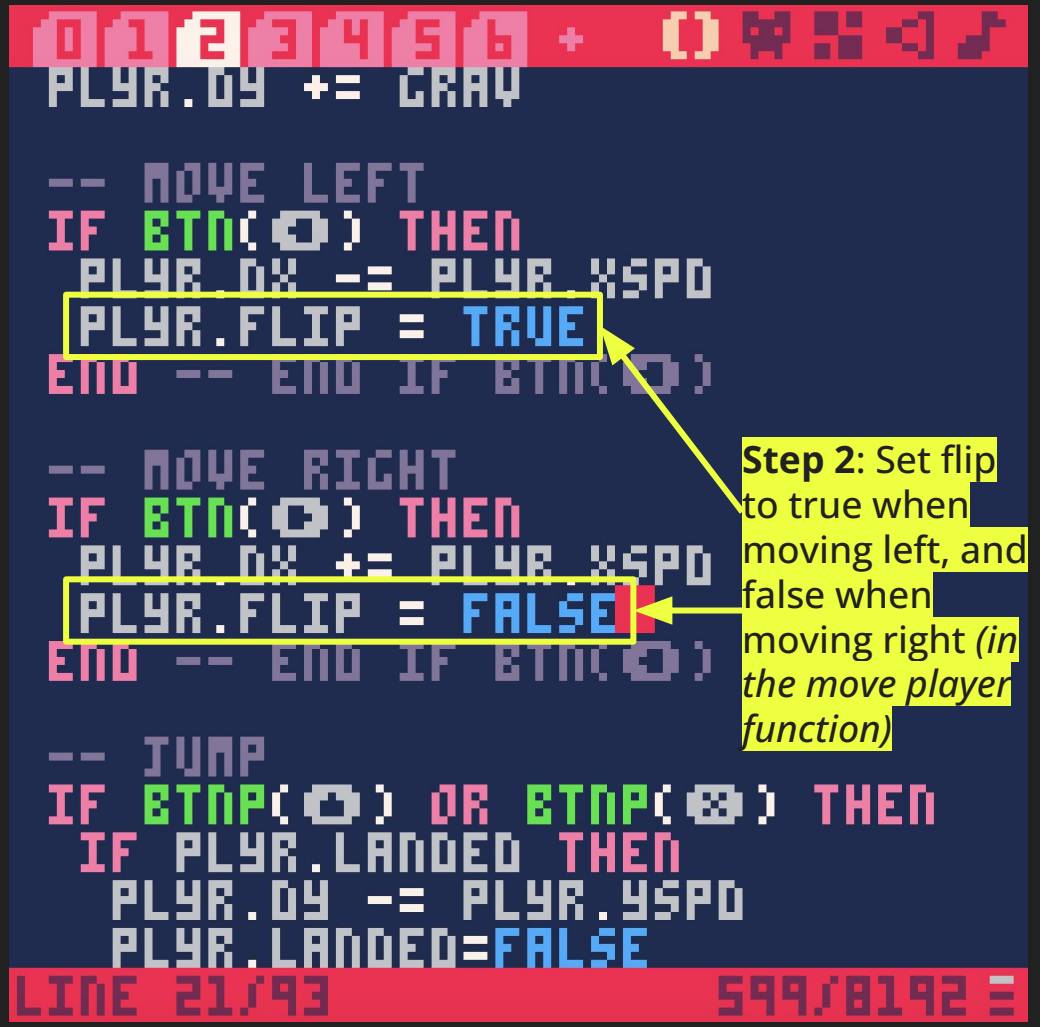
```
-- ANIMATE PLAYER SPRITE
FUNCTION ANIMATE()

 -- CHANGE SPRITE FOR JUMPING
 IF PLYR.LANDED == FALSE THEN
  PLYR.N = 6 -- JUMPING SPRITE
 ELSE
  PLYR.N = 1 -- DEFAULT SPRITE
 END -- END IF PLYR.LANDED FALSE

END -- END FUNCTION ANIMATE()
```

Another thing we should do is flip the sprite when facing left

(we could have done this earlier, but I'll do it now while we're focusing on controlling how the sprite displays)



Step 1: Add a boolean (true or false) variable for whether to flip the player sprite *(in the make player function)*



Step 2: Set flip to true when moving left, and false when moving right *(in the move player function)*

The player sprite now faces left when moving left (and right when facing right)

```
PLYR.DY += GRAV

-- MOVE LEFT
IF BTN(⬅) THEN
 PLYR.DX -= PLYR.XSPD
 PLYR.FLIP = TRUE
END -- END IF BTN(⬅)

-- MOVE RIGHT
IF BTN(➡) THEN
 PLYR.DX += PLYR.XSPD
 PLYR.FLIP = FALSE
END -- END IF BTN(➡)

-- JUMP
IF BTNP(🅾) OR BTNP(❎) THEN
 IF PLYR.LANDED THEN
  PLYR.DY -= PLYR.YSPD
  PLYR.LANDED=FALSE
```

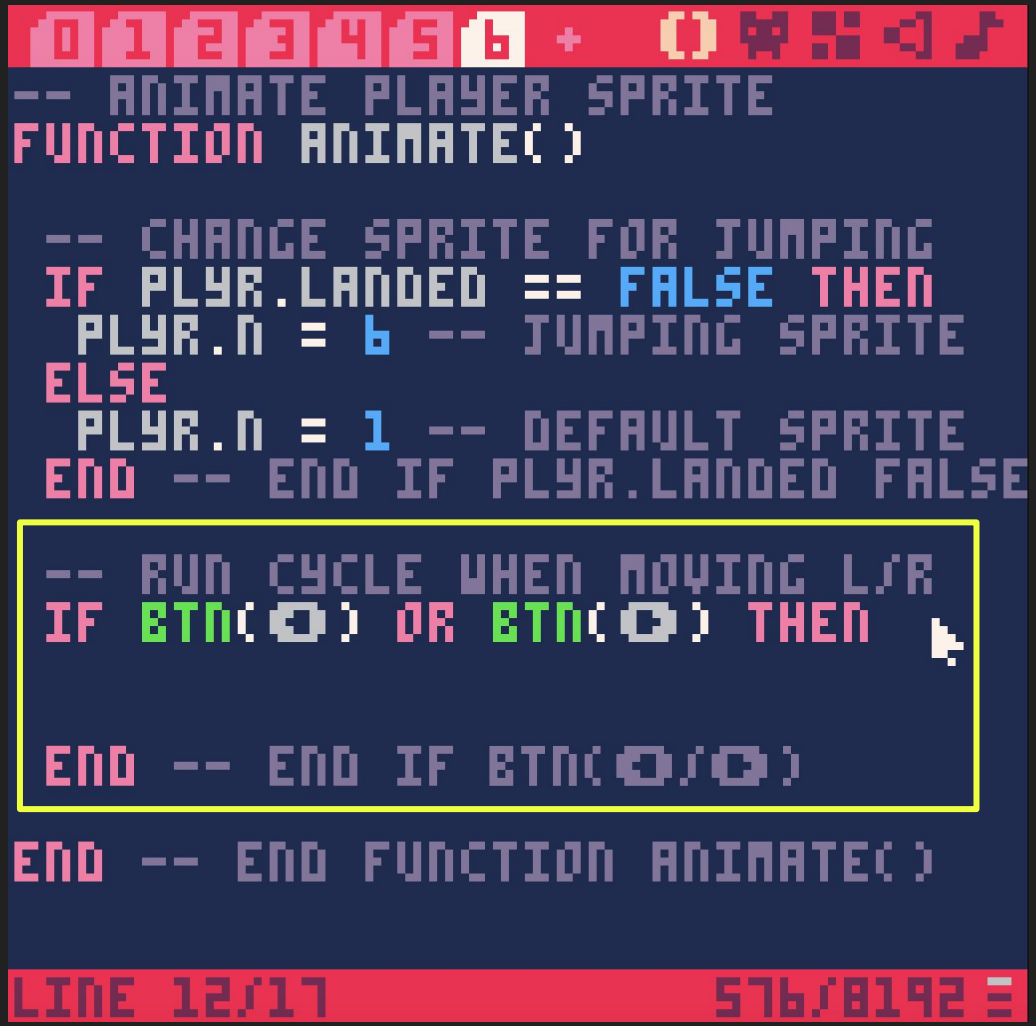
Set flip to true when moving left, and false when moving right *(in the move player function)*

Next, we'll make a run cycle for our player

It's a good idea to place the frames for an animation cycle consecutively

So you can just add 1 to the sprite number variable in your code

(plyr.n = plyr.n + 1)



We know we only want to play the animation while the player is moving horizontally

So the condition in our **if** statement can be that ***either the left or right arrow key must be pressed*** in order to play the animation

```
-- ANIMATE PLAYER SPRITE
FUNCTION ANIMATE()

 -- CHANGE SPRITE FOR JUMPING
 IF PLYR.LANDED == FALSE THEN
  PLYR.N = 6 -- JUMPING SPRITE
 ELSE
  PLYR.N = 1 -- DEFAULT SPRITE
 END -- END IF PLYR.LANDED FALSE

 -- RUN CYCLE WHEN MOVING L/R
 IF BTN(0) OR BTN(1) THEN

   PLYR.N = PLYR.N + 1

 END -- END IF PLYR.DX

END -- END FUNCTION ANIMATE()
```

LINE 14/18 583/8192

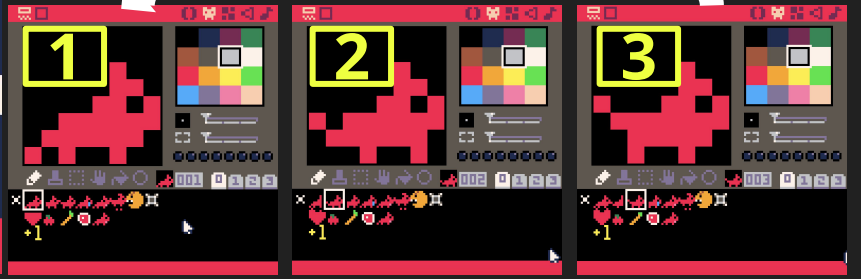
Inside the if statement for the key press, we can add 1 to our player sprite variable

+1 +1

```
  PLYR.N = 6 -- JUMPING SPRITE
ELSE
  PLYR.N = 1 -- DEFAULT SPRITE
END -- END IF PLYR.LANDED FALSE

-- RUN CYCLE WHEN MOVING L/R
IF BTN(⬅) OR BTN(➡) THEN

  -- GO TO NEXT SPRITE
  PLYR.N = PLYR.N + 1

  -- LOOP BACK TO FIRST FRAME
  IF PLYR.N > 3 THEN
    PLYR.N = 1
  END -- END IF PLYR.N > 3

END -- END IF PLYR.DX

END -- END FUNCTION ANIMATE()
```

LINE 20/24 593/8192

Then, when we get past the last frame in the animation (sprite 3), we change the value for the sprite number back to 1 (the first frame)

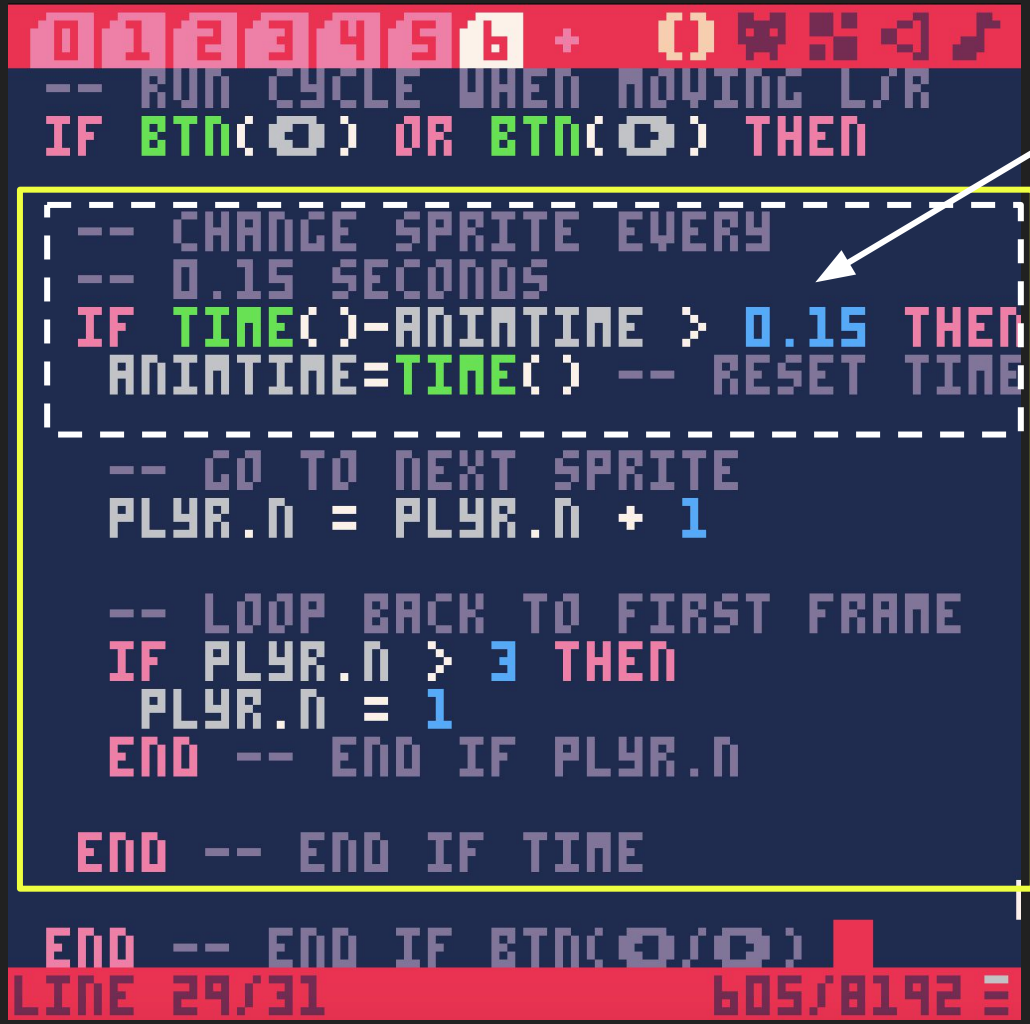


We want the sprite to change with a bit of time between each frame

So we need to add a **timer**

I'll add a new variable for the timer, called ***animtime***, in my **_init()** function

Start the timer at **0**

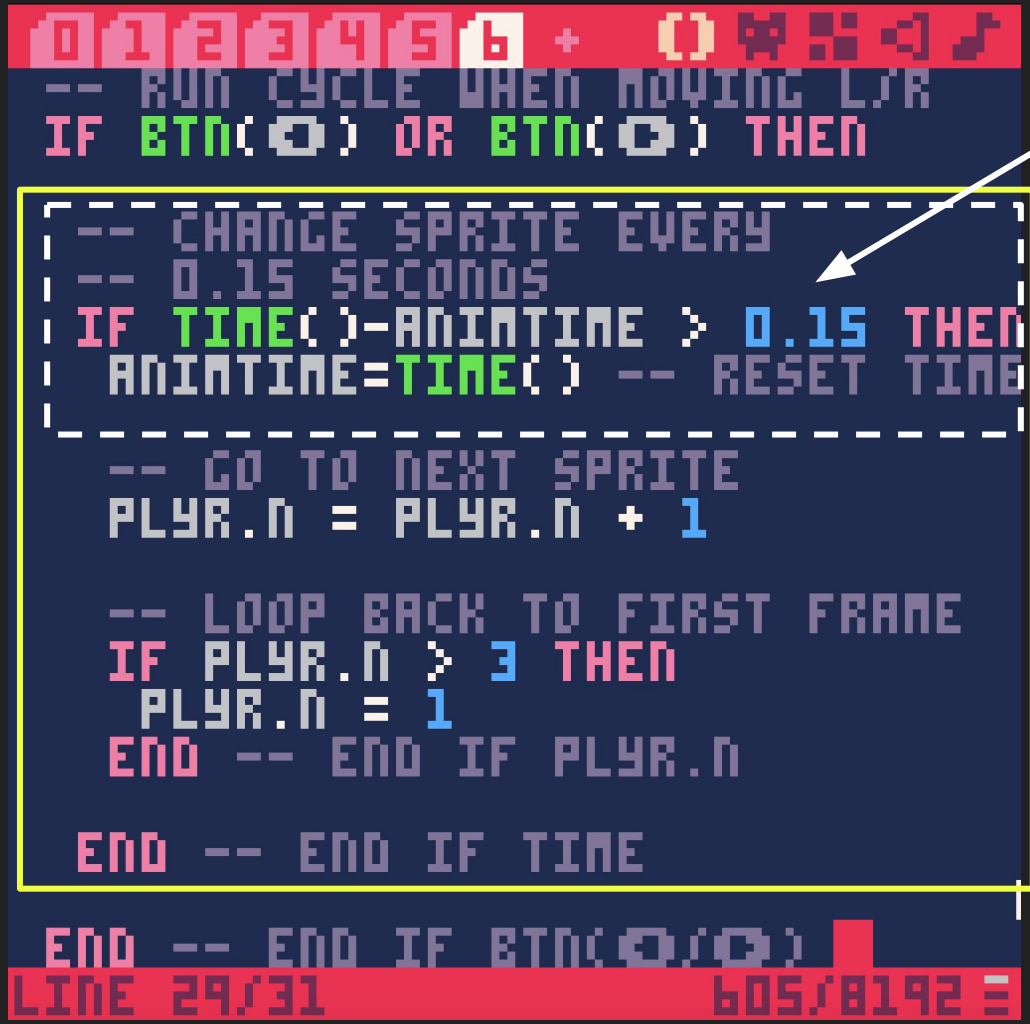


Then, back in our animation function, we can add a condition (if statement), *nested inside the condition for the button press*, that we only change the sprite if **0.15** seconds have elapsed

The function time() tracks how much time has elapsed since the game has started running

If animtime starts at 0, then once 0.15 seconds have elapsed, time() will be equal to 0.15

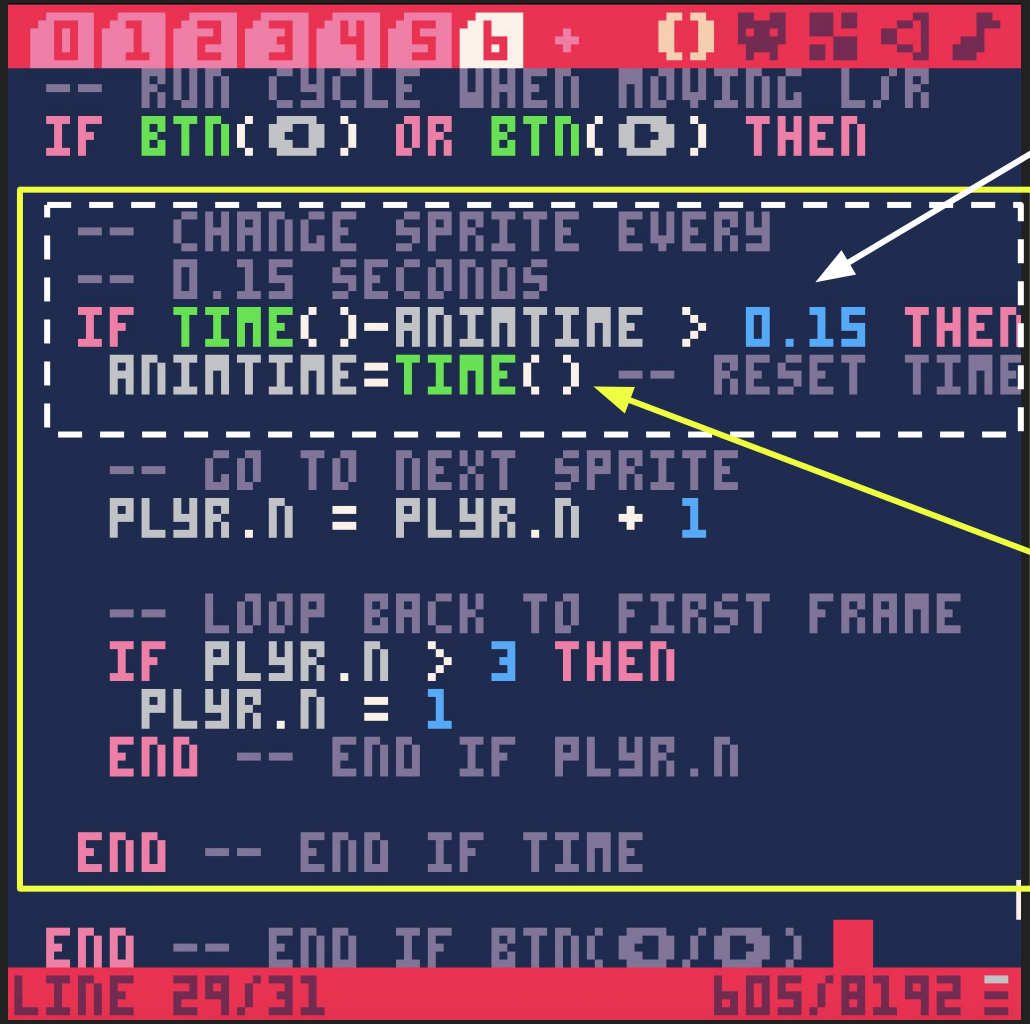
time() - animtime
= 0.15 - 0
= 0.15



If **animtime** starts at **0**, then once 0.15 seconds have elapsed, **time()** will be equal to **0.15**

time() - animtime
= 0.15 - 0
= 0.15

This means the condition in the if statement will be met, and the code inside the if statement will run



If **animtime** starts at **0**, then once 0.15 seconds have elapsed, **time()** will be equal to **0.15**

time() - animtime
= 0.15 - 0
= 0.15

We then will **reset animtime to equal the current value of time()**

So when time() reaches 0.15, animtime will be set to 0.15

When time() reaches 0.30, the loop will run again

time()	animtime	> 0.15?
0.0-0.1499	0	false
0.15	0	true
0.15001-0.2999	0.15	false
0.30	0.15	true
0.31001-0.4499	0.30	false
0.45	0.30	true

Printing time() and animtime helps illustrate how the timer works to implement the animation

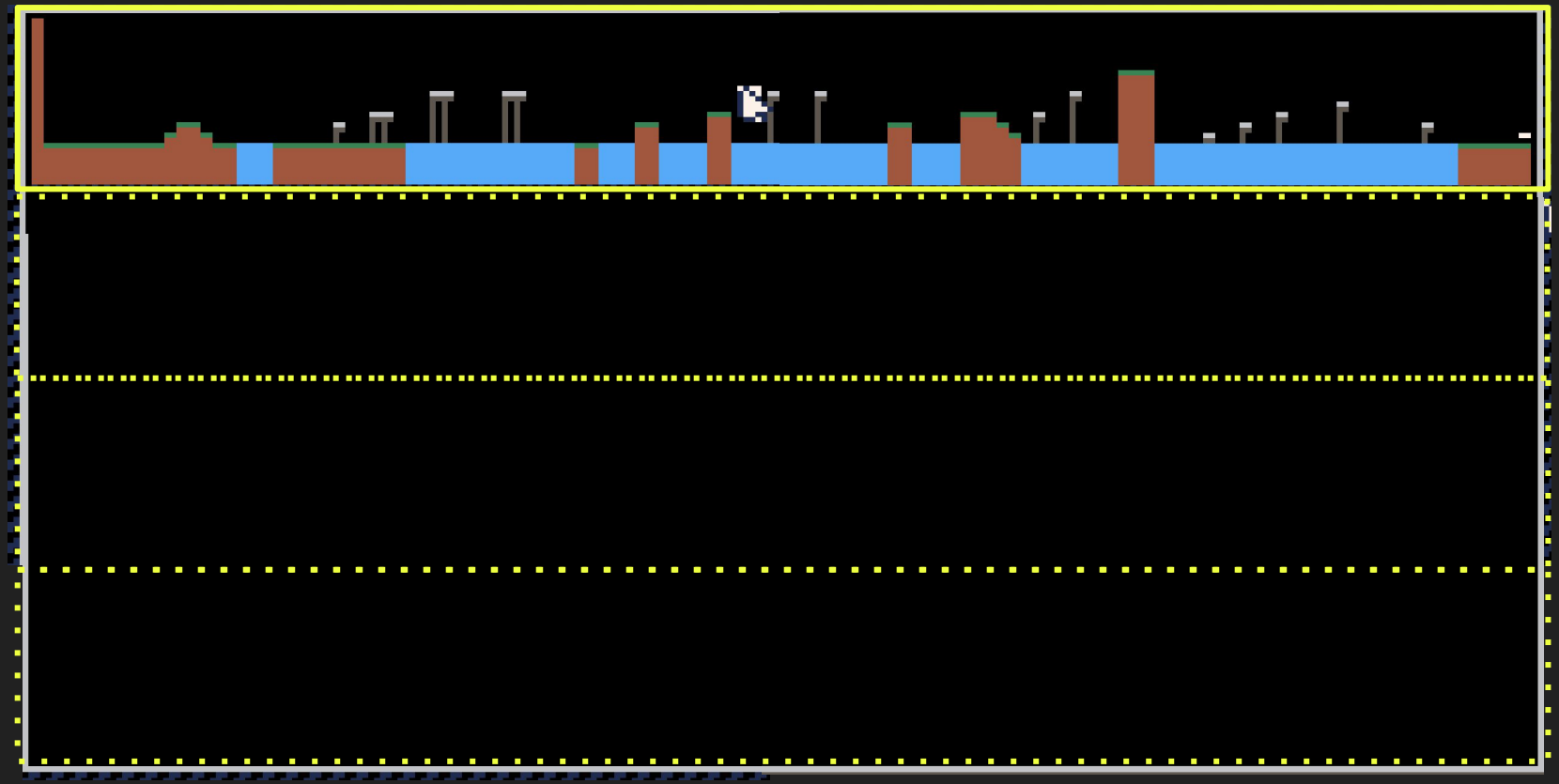
Bonus: triggering an animation by keypress

Download Example File: platformer_13a_toggle_animation.p8

Next, we’ll add additional levels

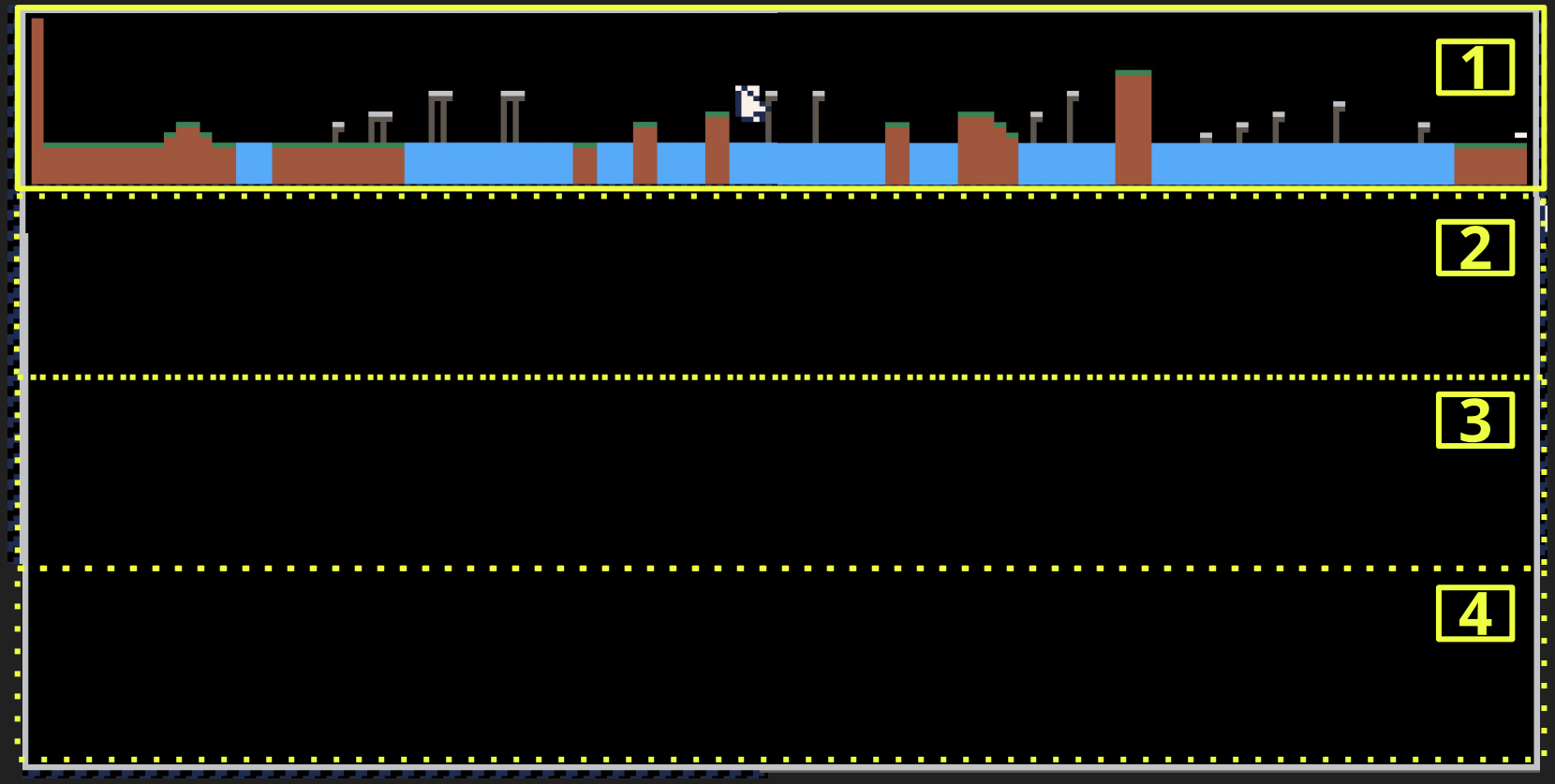
Step 14: Multiple Levels

Download Example File: platformer_14_multiple_levels.p8

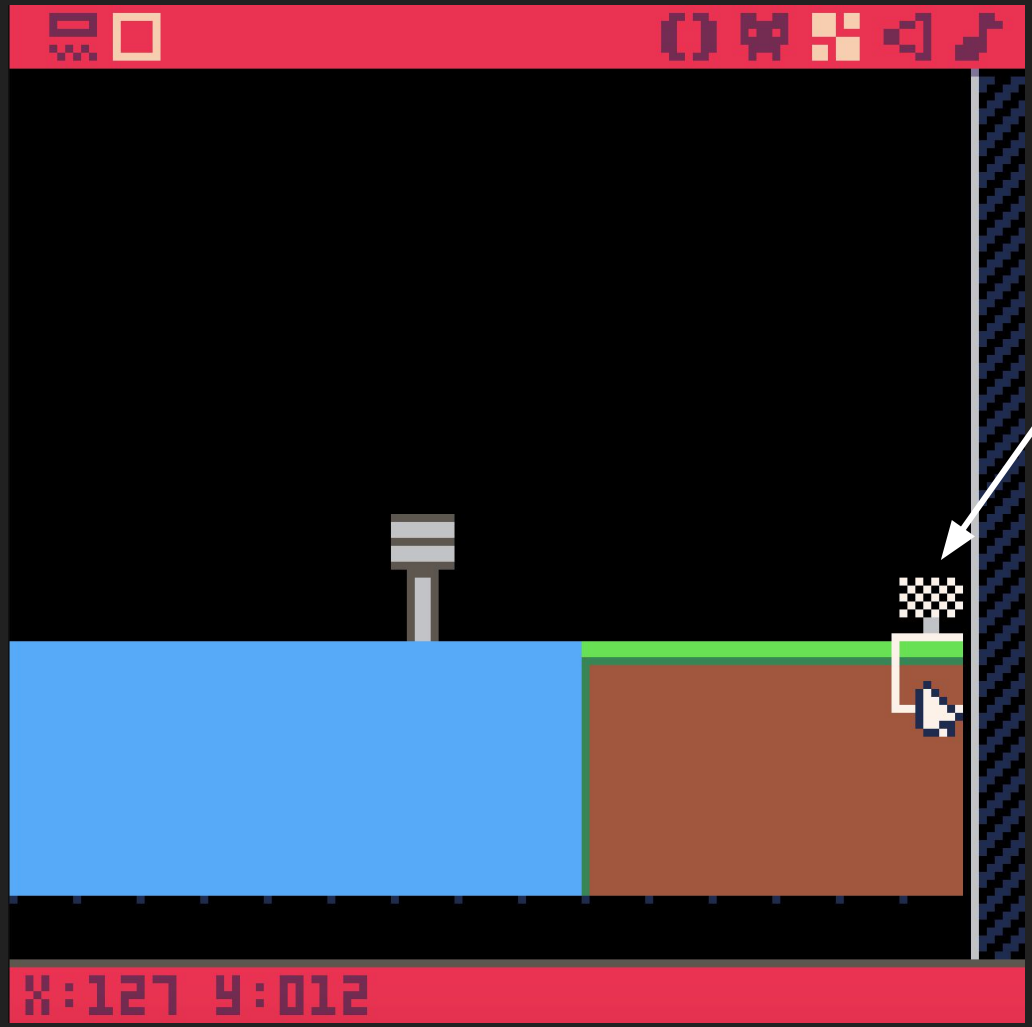


I’ve built my first “level” along the top row of the map

(this image is several screenshots spliced together; unfortunately, you can’t view the entire map at once in the editor)

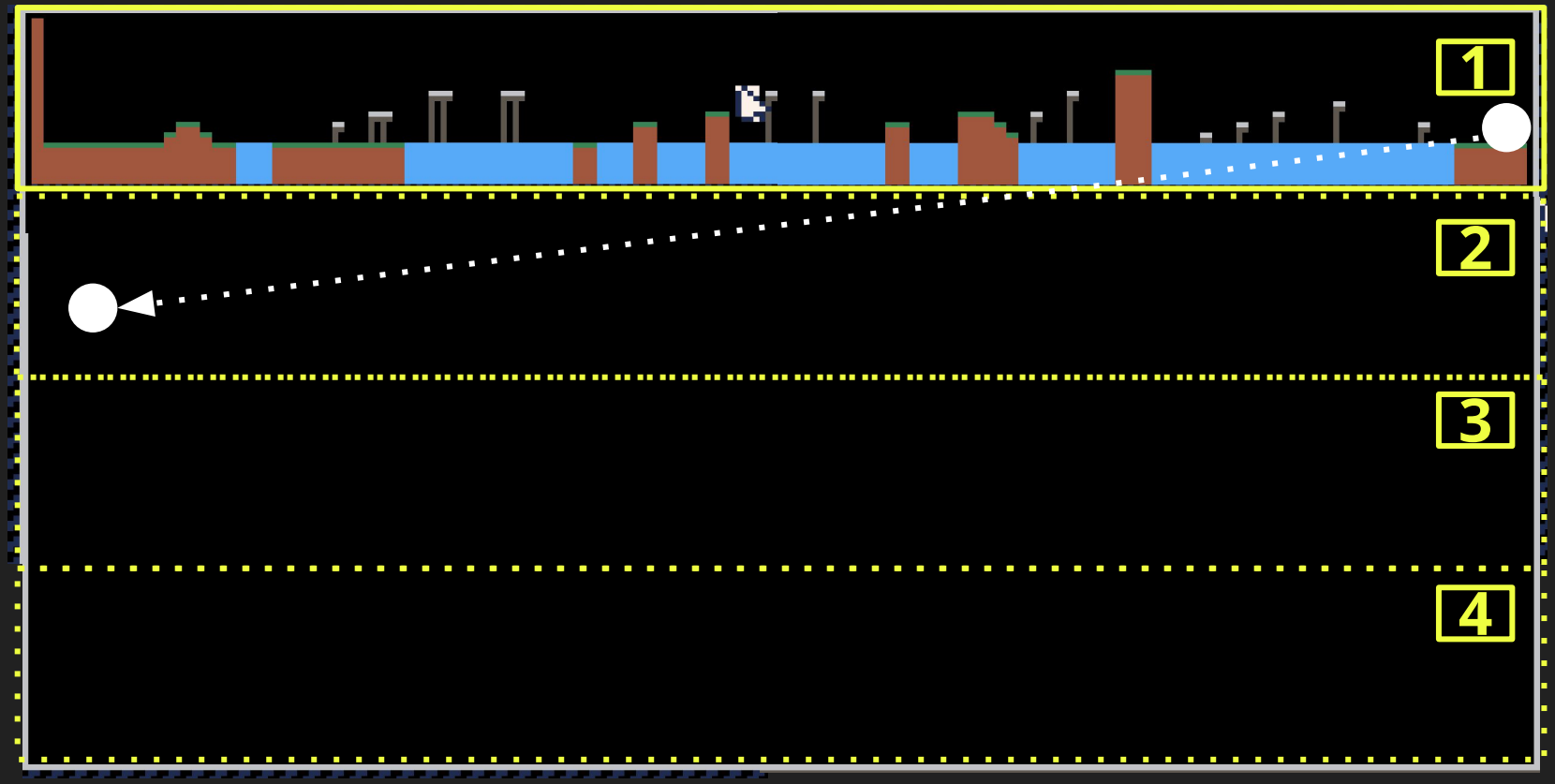


Notice how there is room for a total of four screens vertically
Each of these screens could contain a separate level
(you could also design your game like Celeste and have vertical progression)



At the far right end of my first level (the right edge of the map), I've placed a tile indicating the end of the level

I can draw my next level one "screen" below this one on the map, and set the player's x,y coordinates to that location once they reach this point



I can draw my next level one “screen” below the first, and set the player’s x,y coordinates to that location once they reach the end of the first level

I started drawing my second level one screen below the first

If the lowest tile on screen one is **15** (16 - 1 because we start at 0), the lowest tile on screen two will be **31** (16*2 - 1 = 32 - 1)

So I can start drawing there

And I can use these coordinates as the location to send my player once they've reached the end of the first level

```
-- STARTING POSITION FOR CAMERA
CAMX = 0
CAMY = 0

-- ANIMATION TIMER
ANIMTIME = 0
END -- END FUNCTION _INIT()

FUNCTION _UPDATE()
 MOVE_PLYR() --  TAB 2
 CAM_FOLLOW() -- TAB 4
 RESPAWN() -- TAB 5
 ANIMATE() -- TAB 6
 WARP() -- TAB 7
END -- END FUNCTION _UPDATE()

FUNCTION _DRAW()
 CLS() -- CLEAR SCREEN
```

LINE 38/49 645/8192

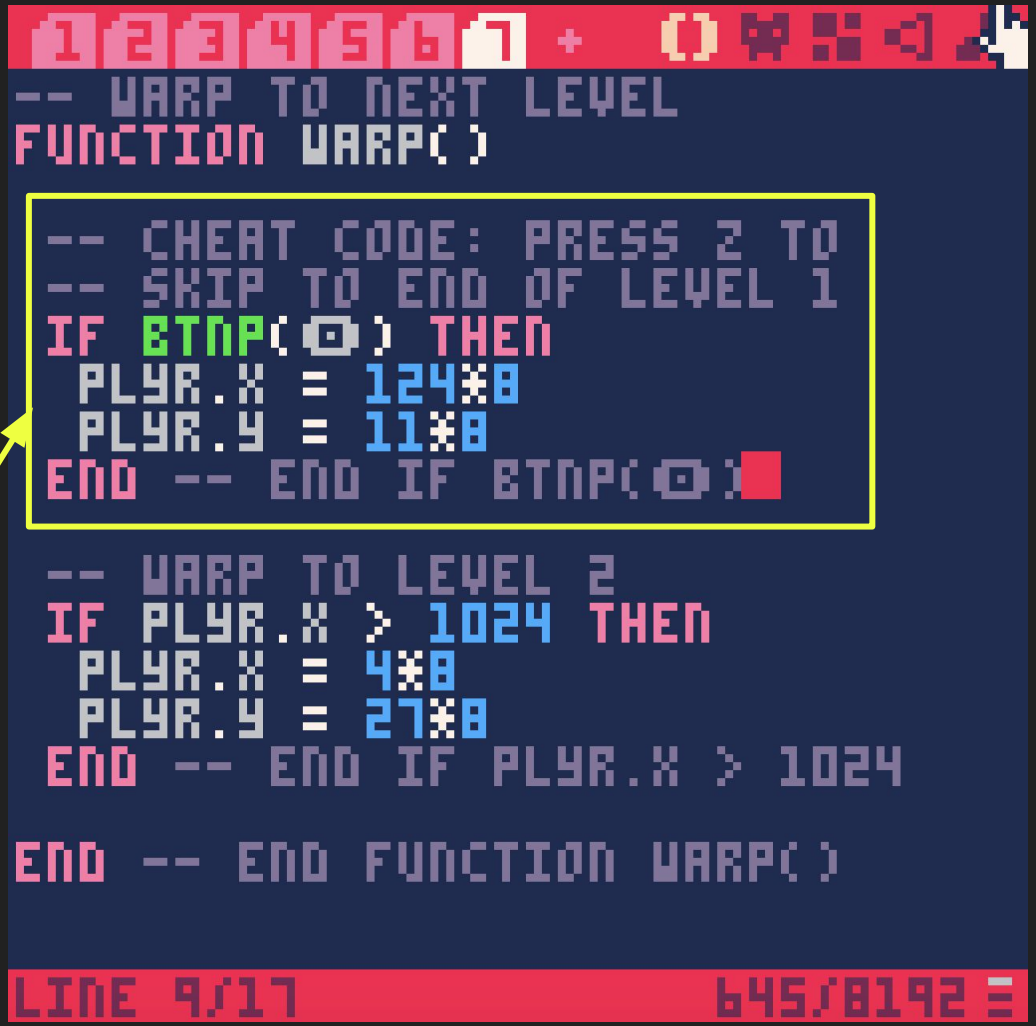
```
-- WARP TO NEXT LEVEL
FUNCTION WARP()

 -- WARP TO LEVEL 2
 IF PLYR.X > 1024 THEN
  PLYR.X = 4*8
  PLYR.Y = 27*8
 END -- END IF PLYR.X > 1024

END -- END FUNCTION WARP()
```

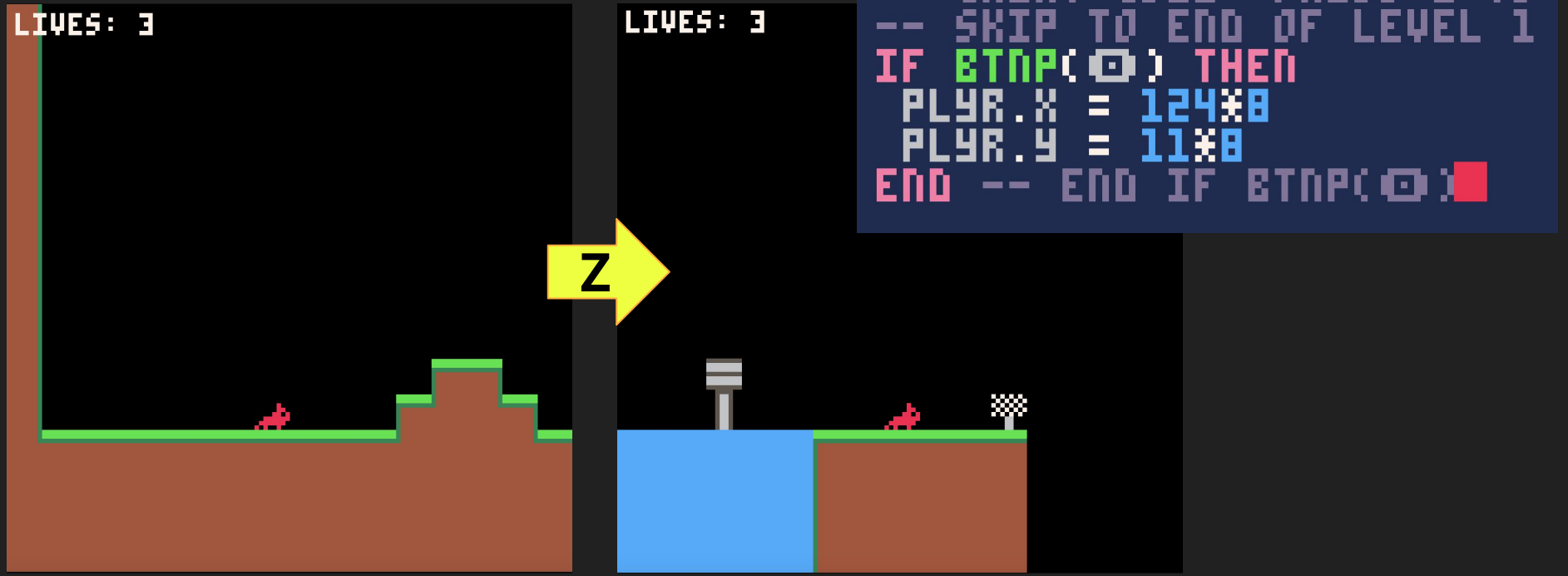
I've written a function called **warp()** that checks whether the player has reached the end of the map (***which is 1024px long***) and changes their x,y coordinates to where the second level begins

I've *called* my warp() function in _update()

While you should definitely playtest you game to make sure it's possible to make it through the first level, once you've done so, it would be convenient if you didn't have to play through the entire level just to test whether your warp function works

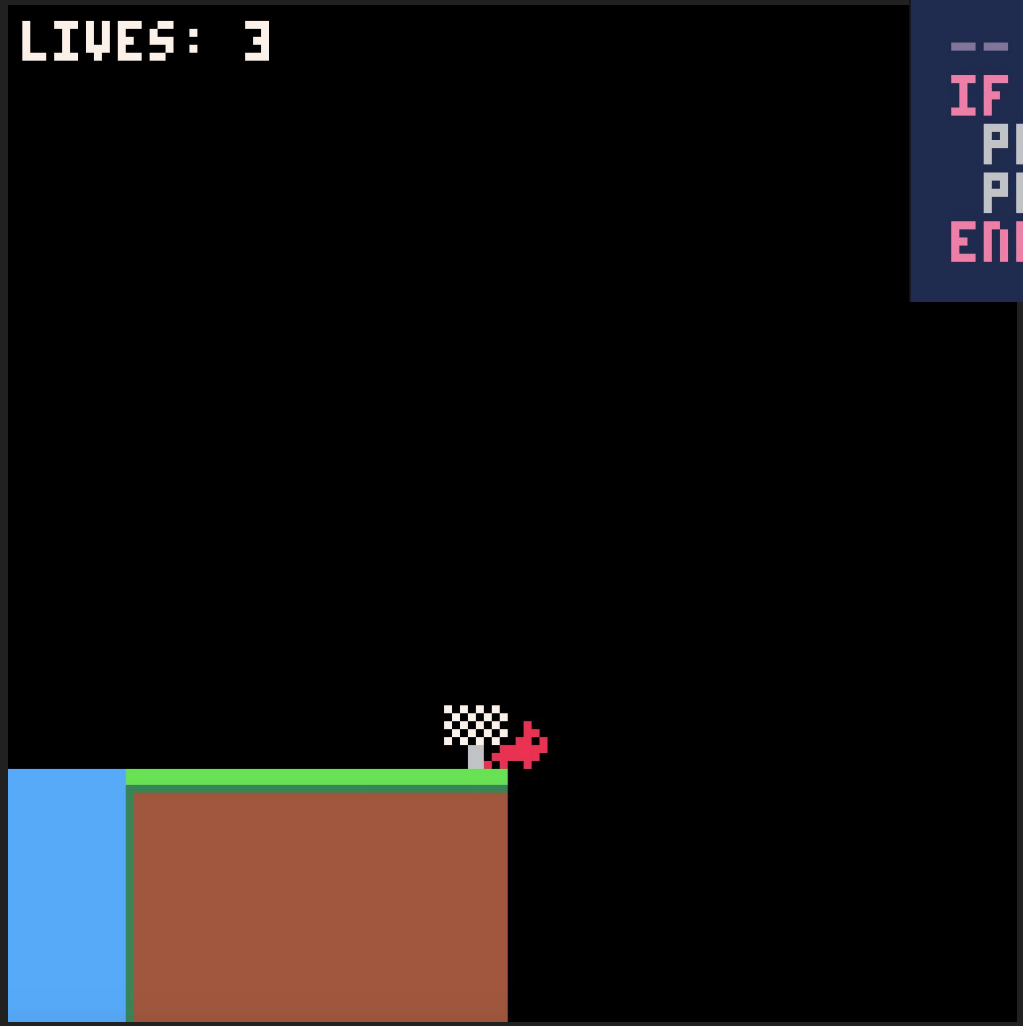
So I made a "cheat code" – the player can press Z to skip to the end of the first level – when the button is pressed, the player's x,y coordinates are changed





it would be convenient if you didn't have to play through the entire level just to test whether your warp function works

So I made a "cheat code" – the player can press Z to skip to the end of the first level – when the button is pressed, the player's x,y coordinates are changed




```
-- WARP TO LEVEL 2
IF PLYR.X > 1024 THEN
 PLYR.X = 4*8
 PLYR.Y = 27*8
END -- END IF PLYR.X > 1024
```

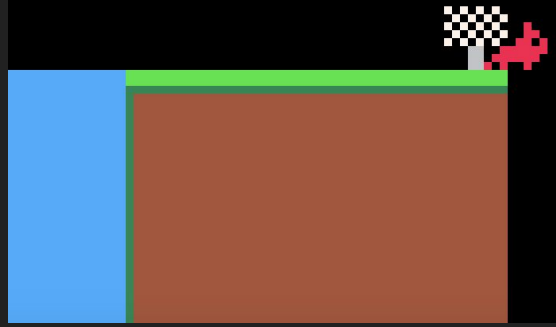
I might want to **tweak my condition** to trigger when the player reaches an x coordinate slightly less than 1024

Notice how they can walk off the edge of the map slightly (*and also see out of bounds; we'll want to* ***pin the camera*** *on this end of the map*)

LIVES: 3

Something definitely happens when the player reaches an x coordinate of 1024

However, it's not quite the result I wanted



LIVES: 3

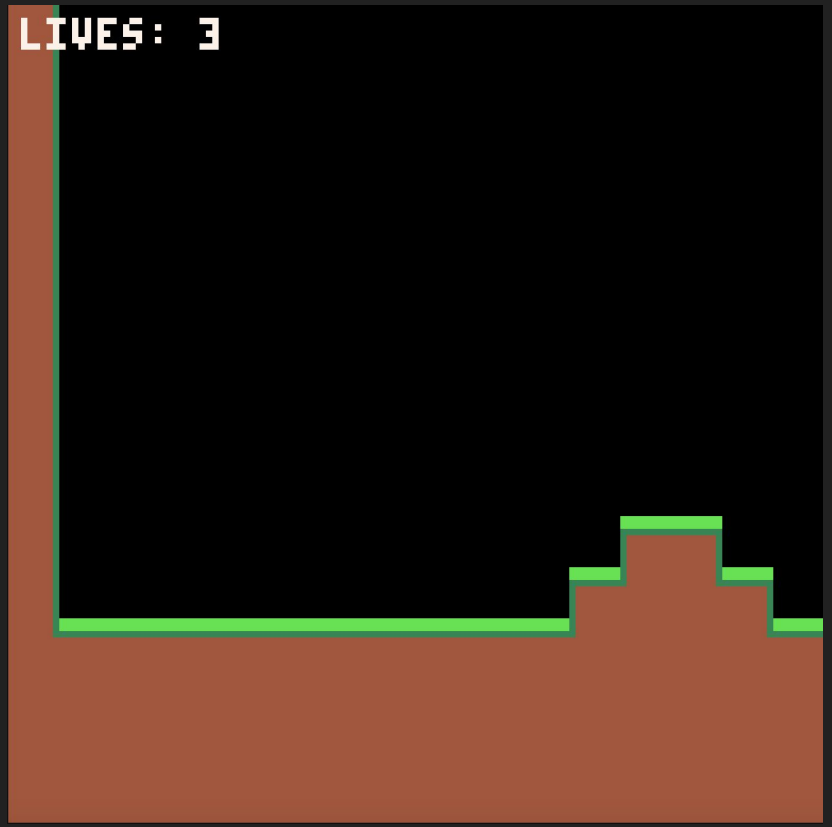
Why do I see the beginning of level 1?

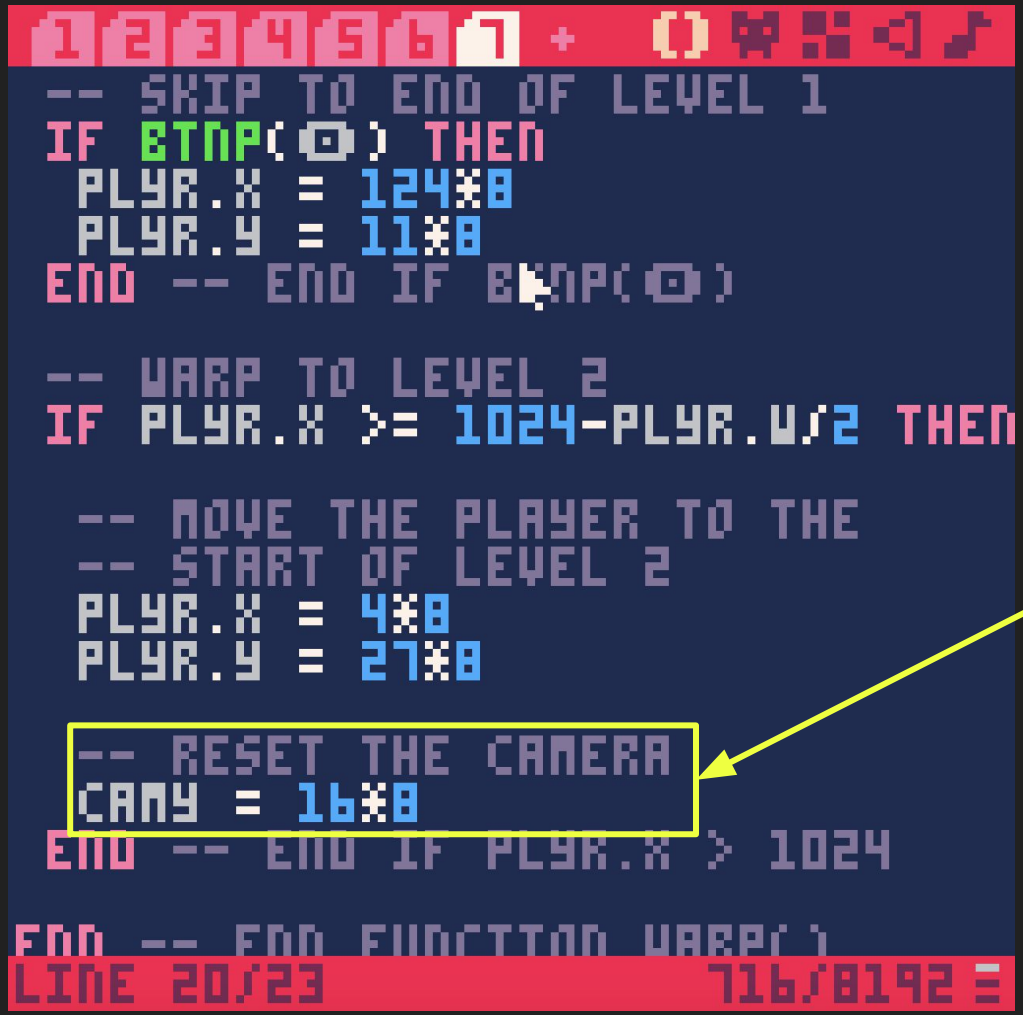
Where did my player go?

I see the left side of the first level, because we've moved the player to the left side of the map

But I don't see my player, because the player's y position was moved lower on the map, but the ***camera's*** *y position was not updated* to follow it

So we'll need to make those changes in our warp function

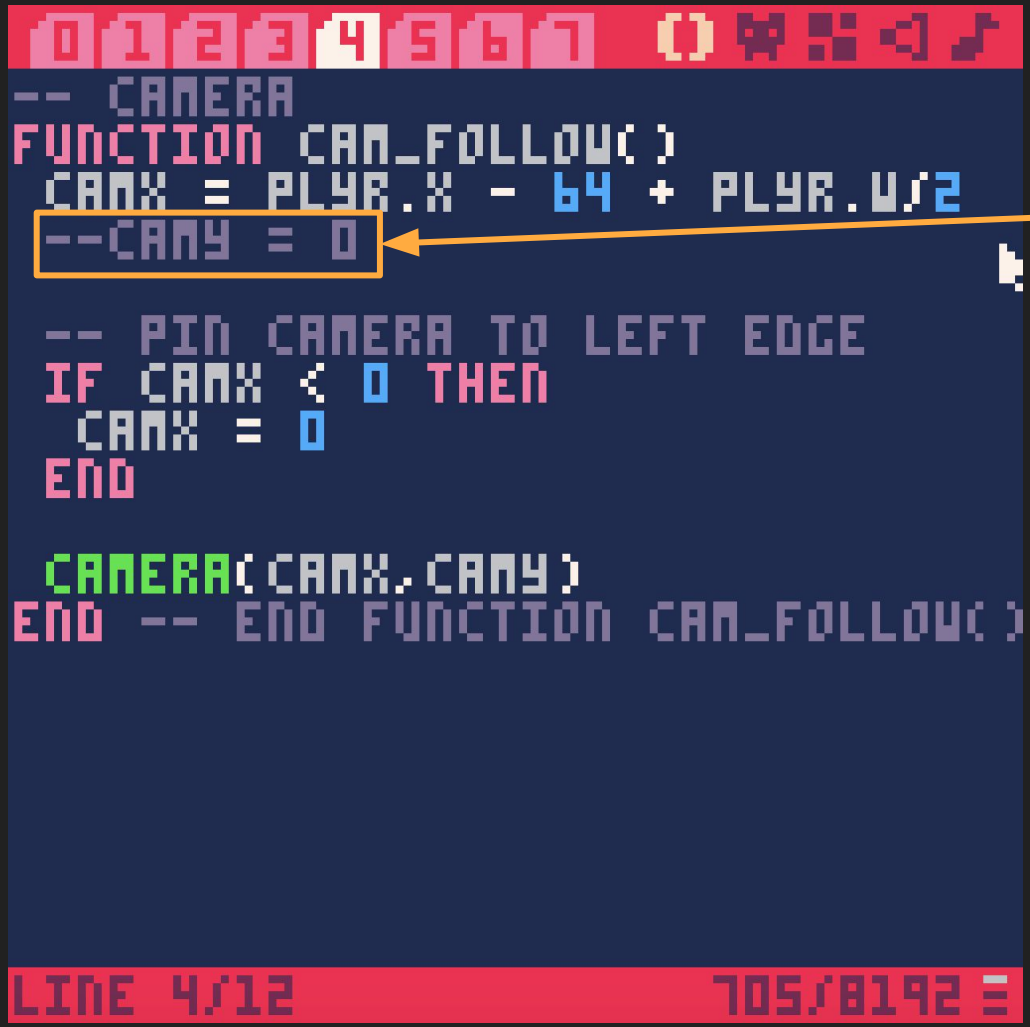




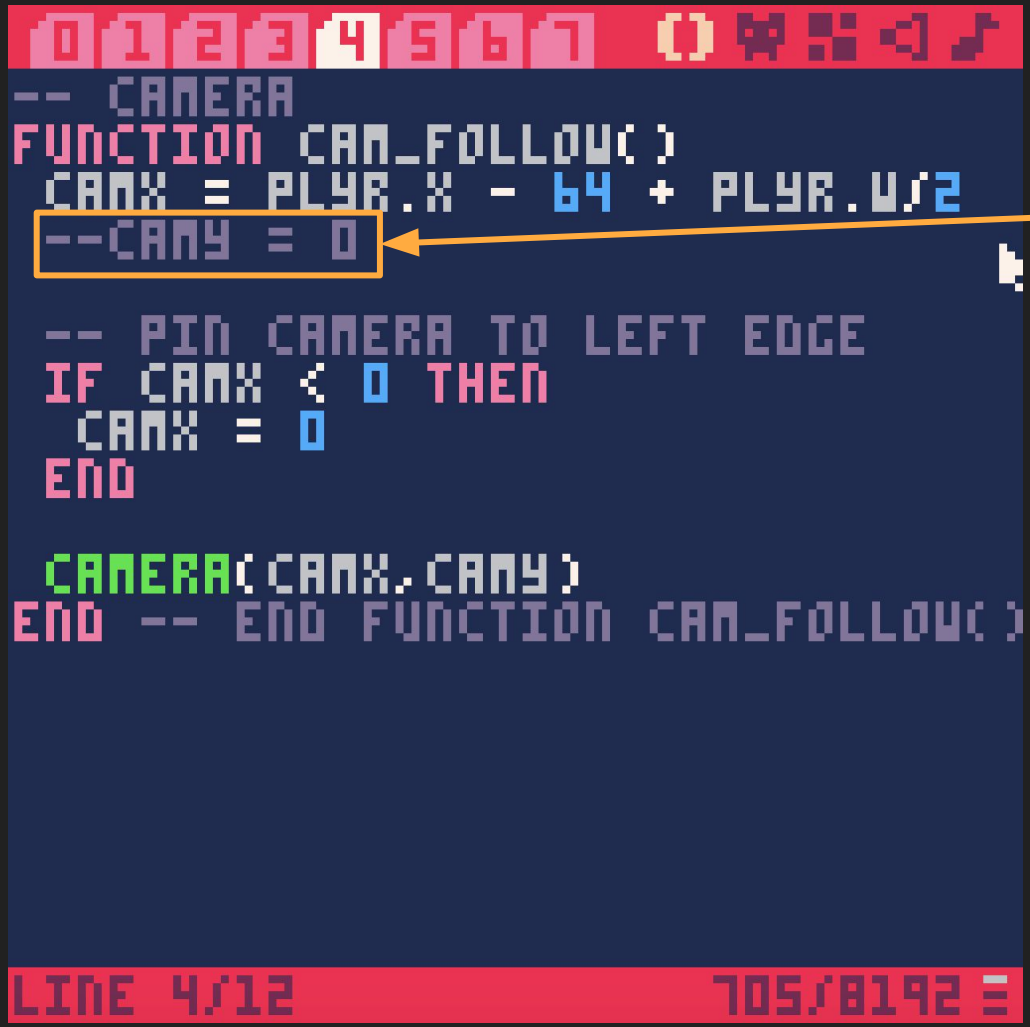
In our warp() function, we'll reset the camera position

We can leave the camera's x the same, since it always follows the player's x

But we must set the **camera's y** to 1 screen down (16 tiles down from the top of the map, multiplied by 8 pixels per map tile)



In order for our new camera y coordinate to take effect, we have to remove this line of code that was setting the camera's y to 0 (the default value) in our camera function

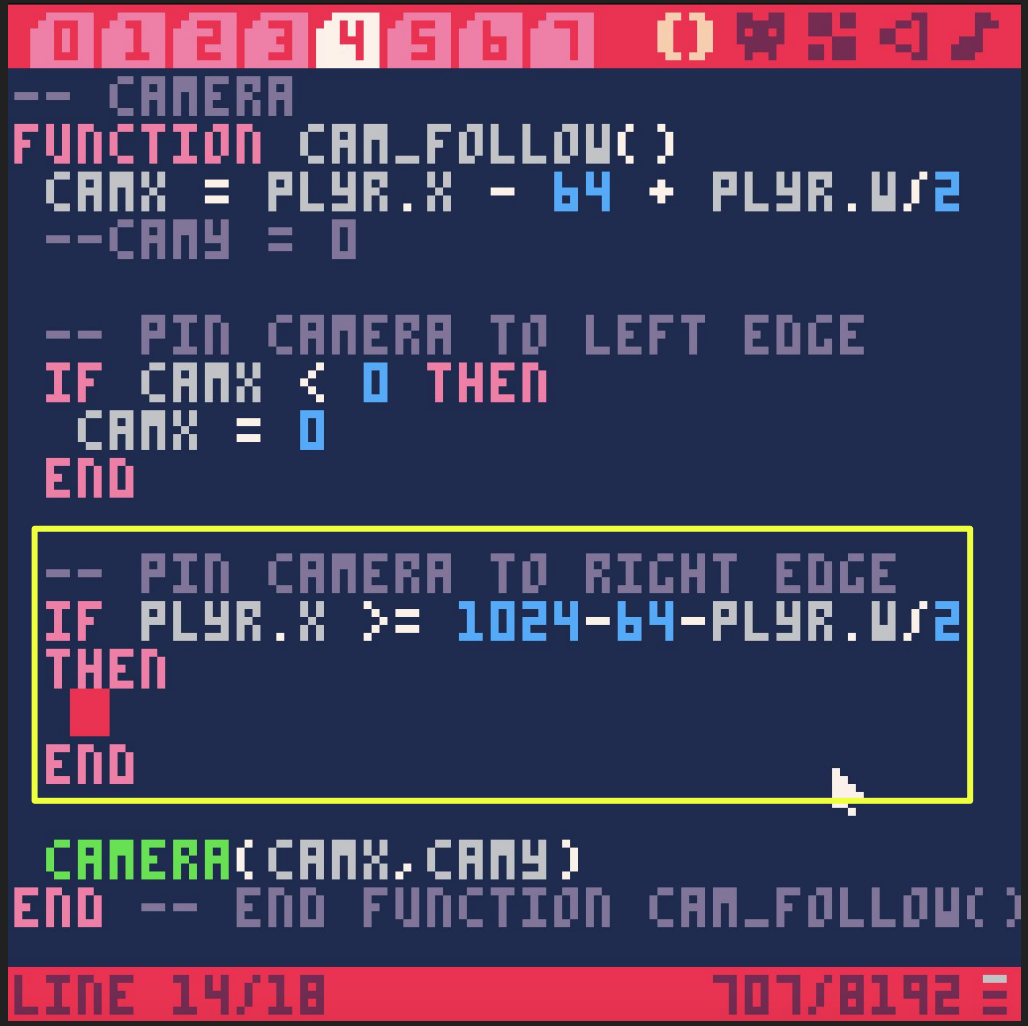


In order for our new camera y coordinate to take effect, we have to remove this line of code that was setting the camera's y to 0 (the default value) in our camera function

While we're in our camera function, we can also pin the camera to the right edge of the map when the player approaches, so that we don't see out of bounds

We know the out-of-bounds area will show when the player is within less than half a screen (64 pixels) of the right edge, minus half the player's width

So we'll make this the condition that must be met for us to adjust the camera:
if plyr.x == 1024 - 64 - plyr.w/2



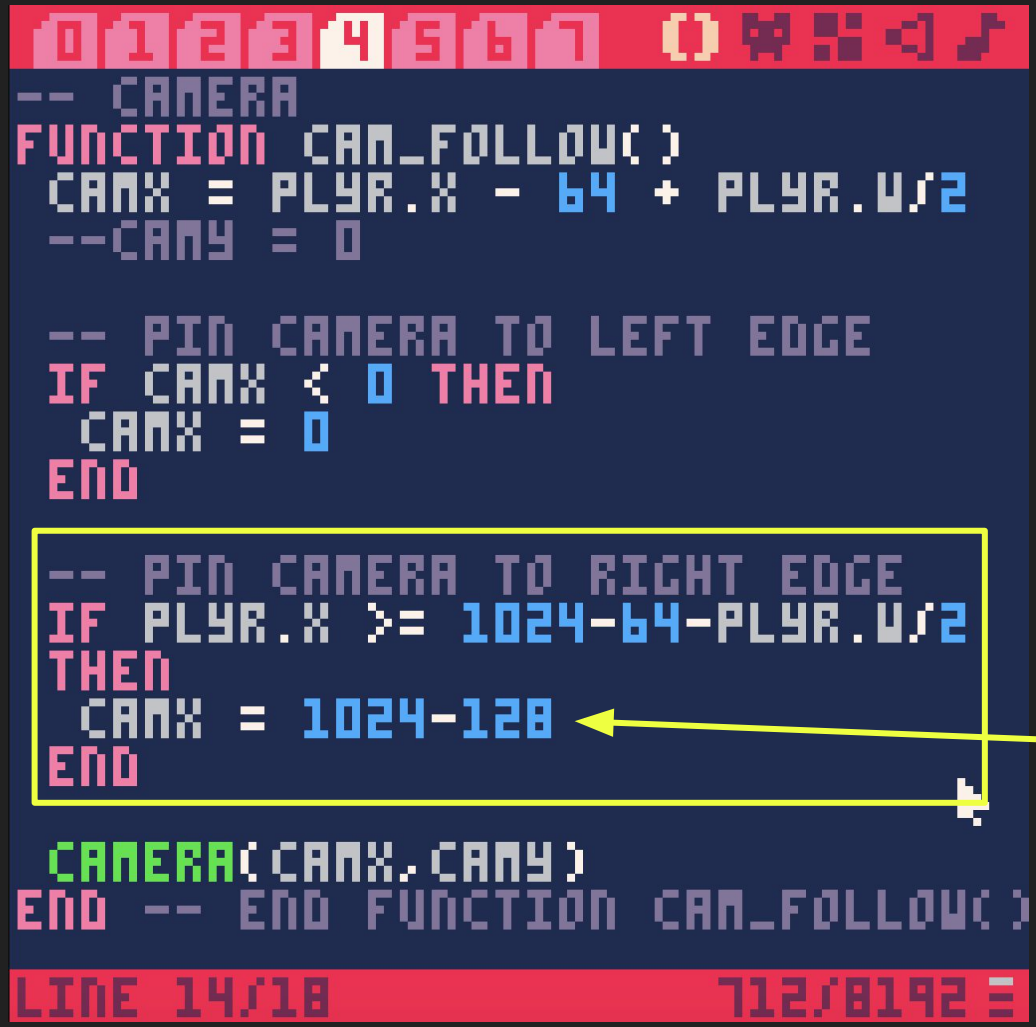
We know the out-of-bounds area will show when the player is within less than half a screen (64 pixels) of the right edge, minus half the player's width

So we'll make this the condition that must be met for us to adjust the camera:
if plyr.x == 1024 - 64 - plyr.w/2

And we know we want the right edge of the map to align with the right edge of the screen

So if the camera is always in the top-left of the screen, we know we need the camera's x coordinate to be one screen to the left of the map edge (128 pixels less than it)

So we can express the adjusted camera x as 1024-128



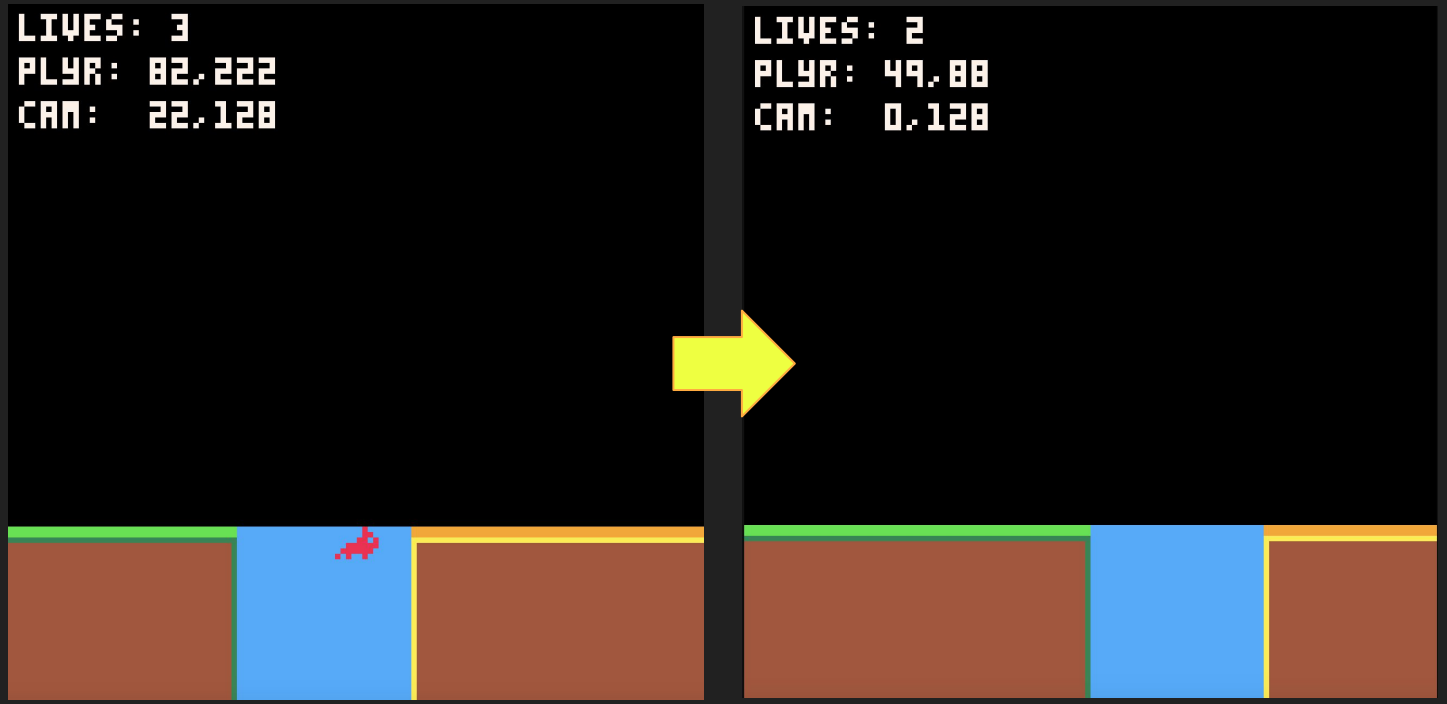
We know we want the right edge of the map to align with the right edge of the screen

So if the camera is always in the top-left of the screen, we know we need the camera's x coordinate to be one screen to the left of the map edge (128 pixels less than it)

So we can express the adjusted camera x as 1024-128

```
-- CAMERA
FUNCTION CAM_FOLLOW()
 CAMX = PLYR.X - 64 + PLYR.W/2
 --CAMY = 0

 -- PIN CAMERA TO LEFT EDGE
 IF CAMX < 0 THEN
  CAMX = 0
 END

 -- PIN CAMERA TO RIGHT EDGE
 IF PLYR.X >= 1024-64-PLYR.W/2
 THEN
  CAMX = 1024-128
 END

 CAMERA(CAMX,CAMY)
END -- END FUNCTION CAM_FOLLOW()
```

This adjustment pins the camera so it never displays the out-of-bounds area



There's still some fine-tuning that needs to be done overall:
When we fall in a pit after starting level 2, the player sprite disappears
This is because we are still respawning the player at coordinates corresponding to the level 1 starting position – ***these coordinates must be updated after advancing to the next level***

```
-- SKIP TO END OF LEVEL 1
IF BTNP(🅾️) THEN
 PLYR.X = 124*8
 PLYR.Y = 11*8
END -- END IF BTNP(🅾️)

-- WARP TO LEVEL 2
IF PLYR.X >= 1024-PLYR.W/2 THEN

 -- MOVE THE PLAYER TO THE
 -- START OF LEVEL 2
 PLYR.X = 4*8
 PLYR.Y = 27*8

 -- RESET THE CAMERA
 CAMY = 16*8
END -- END IF PLYR.X > 1024

END -- END FUNCTION WARP()
LINE 20/23                716/8192
```

Updated warp() function

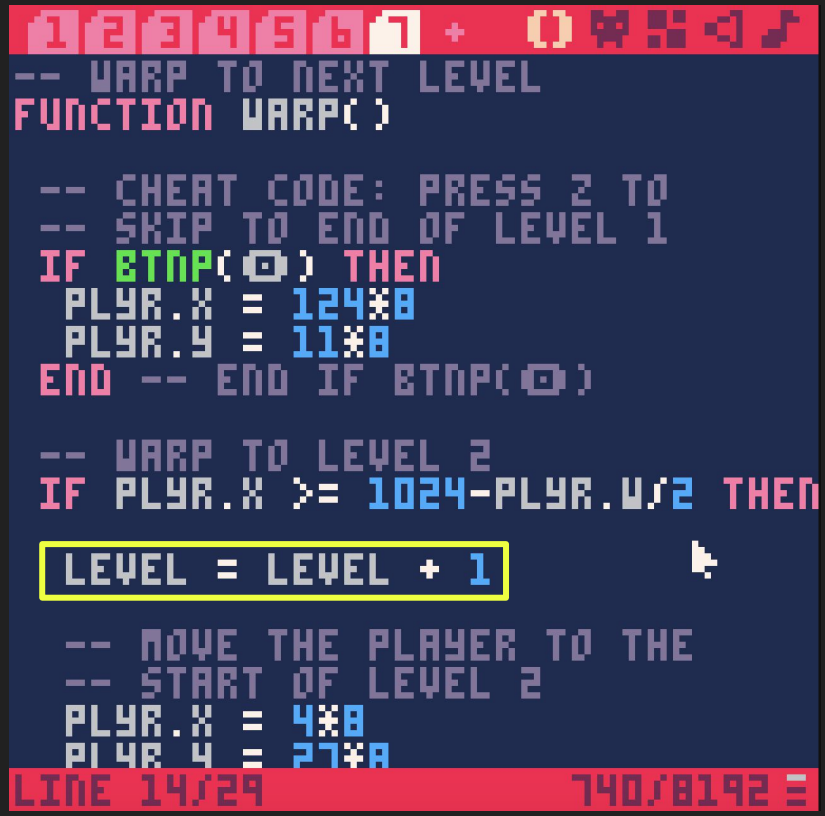
```
 PLYR.Y = 11*8
END -- END IF BTNP(🅾️)

-- WARP TO LEVEL 2
IF PLYR.X >= 1024-PLYR.W/2 THEN

 -- MOVE THE PLAYER TO THE
 -- START OF LEVEL 2
 PLYR.X = 4*8
 PLYR.Y = 27*8

 -- UPDATE THE RESPAWN COORDS
 PLYR_START_X = PLYR.X
 PLYR_START_Y = PLYR.Y

 -- RESET THE CAMERA
 CAMY = 16*8
END -- END IF PLYR.X > 1024
LINE 26/27                720/8192
```

There's still some fine-tuning that needs to be done overall:

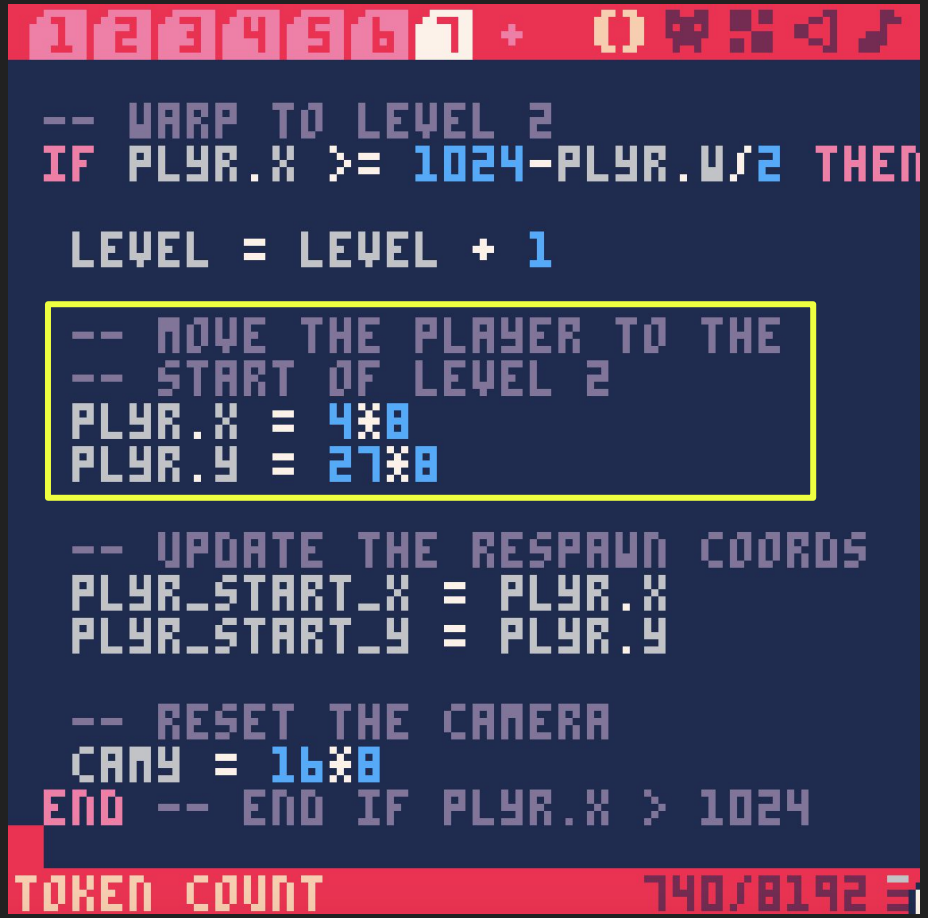
When we fall in a pit after starting level 2, the player sprite disappears

This is because we are still respawning the player at coordinates corresponding to the level 1 starting position – ***these coordinates must be updated after advancing to the next level***

I'll also add a variable called **level** in my _init() function



And I'll **add 1** to the value of **level** when we warp to it



It's important to **keep track of the current level**, because **where we warp the player to afterward will depend on that**

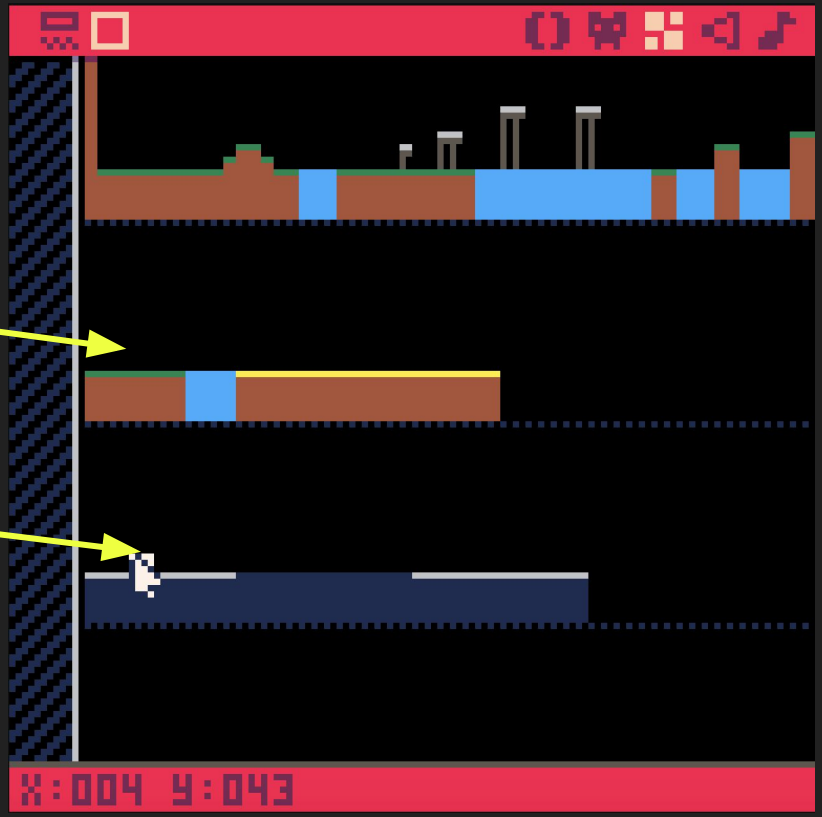
We should add an **if statement** here that only sets these new coordinates if **level**'s new value is 2

And then when **level** becomes 3, we would add another if statement and set the player to the coordinates for level 3

Our cheat codes will also need to be adjusted

```
-- START OF NEXT LEVEL AND
-- RESET THE CAMERA
IF LEVEL == 2 THEN
 PLYR.X = 4*8
 PLYR.Y = 27*8
 CAMY = 16*8
ELSEIF LEVEL == 3 THEN
 PLYR.X = 4*8
 PLYR.Y = 43*8
 CAMY = 32*8
ELSE
 -- RETURN TO START AFTER
 -- LAST LEVEL
 PLYR.X = 4*8
 PLYR.Y = 11*8
 CAMY = 0
 LEVEL = 1
END -- END IF LEVEL == 2/3
```

LINE 41/51 825/8192



Factoring the current **level** into the **warp()** function that sends the player to the next level

```
-- WARP TO NEXT LEVEL
FUNCTION WARP()

 -- CHEAT CODE: PRESS Z TO
 -- SKIP TO END OF LEVEL
 IF BTNP(🅾️) THEN
  IF LEVEL == 1 THEN
   PLYR.X = 124*8
   PLYR.Y = 11*8
  ELSEIF LEVEL == 2 THEN
   PLYR.X = 123*8
   PLYR.Y = 27*8
  ELSEIF LEVEL == 3 THEN
   PLYR.X = 121*8
   PLYR.Y = 43*8
  END -- END IF LEVEL 1/2/3
 END -- END IF BTNP(🅾️)

 -- WARP TO LEVEL 2
```

LINE 41/51 825/8192

Factoring the current **level** into the **cheat code** that sends the player to the end of the level

Now that we have different levels, it would be cool if they featured different gameplay

We could include different types of terrain (such as sand and ice) that affect the player’s movement speed

Step 15: Varied Terrain/Friction

Download Example File: platformer_15_terrain_and_friction.p8

I've turned on flag 2 for sand tiles
These will slow the player down

I've turned on flag 3 for ice tiles
These will speed the player up

*Please note that **I've turned flag 0 OFF** each of these because fget() becomes more complicated when there are multiple flags on for a sprite – we'll need to adjust our movement function to detect collision with these flags as well as regular solid tiles*

In _init(), I'll declare variables for each sprite flag

```
-- STOP FALLING WHEN A SOLID
-- TILE IS BELOW THE PLAYER
IF MCOLLIDE(PLYR,"DOWN",0)
AND PLYR.DY > 0 THEN
 PLYR.DY = 0
 PLYR.LANDED=TRUE

 -- BECAUSE OF VERTICAL SPEED,
 -- THE PLAYER CAN FALL A FEW
 -- PX INTO THE FLOOR. THIS
 -- CALCULATES HOW MANY PX AND
 -- RE-ADJUSTS Y (CREDIT TO
 -- NERDYTEACHERS.COM FOR THIS
 -- FORMULA)
 PLYR.Y-=
 ((PLYR.Y+PLYR.H+1)%8)-1
END -- END IF MCOLLIDE DOWN
```

TOKEN COUNT 825/8192

Here's how I'll ensure collision with the new types of terrain

```
-- STOP FALLING WHEN A SOLID
-- TILE IS BELOW THE PLAYER
IF
(
    MCOLLIDE(PLYR,"DOWN",0)
OR MCOLLIDE(PLYR,"DOWN",SAND)
OR MCOLLIDE(PLYR,"DOWN",ICE)
)
AND PLYR.DY > 0 THEN
 PLYR.DY = 0
 PLYR.LANDED=TRUE

 -- BECAUSE OF VERTICAL SPEED,
 -- THE PLAYER CAN FALL A FEW
 -- PX INTO THE FLOOR. THIS
 -- CALCULATES HOW MANY PX AND
 -- RE-ADJUSTS Y (CREDIT TO
 -- NERDYTEACHERS.COM FOR THIS
```

LINE 49/98 906/8192

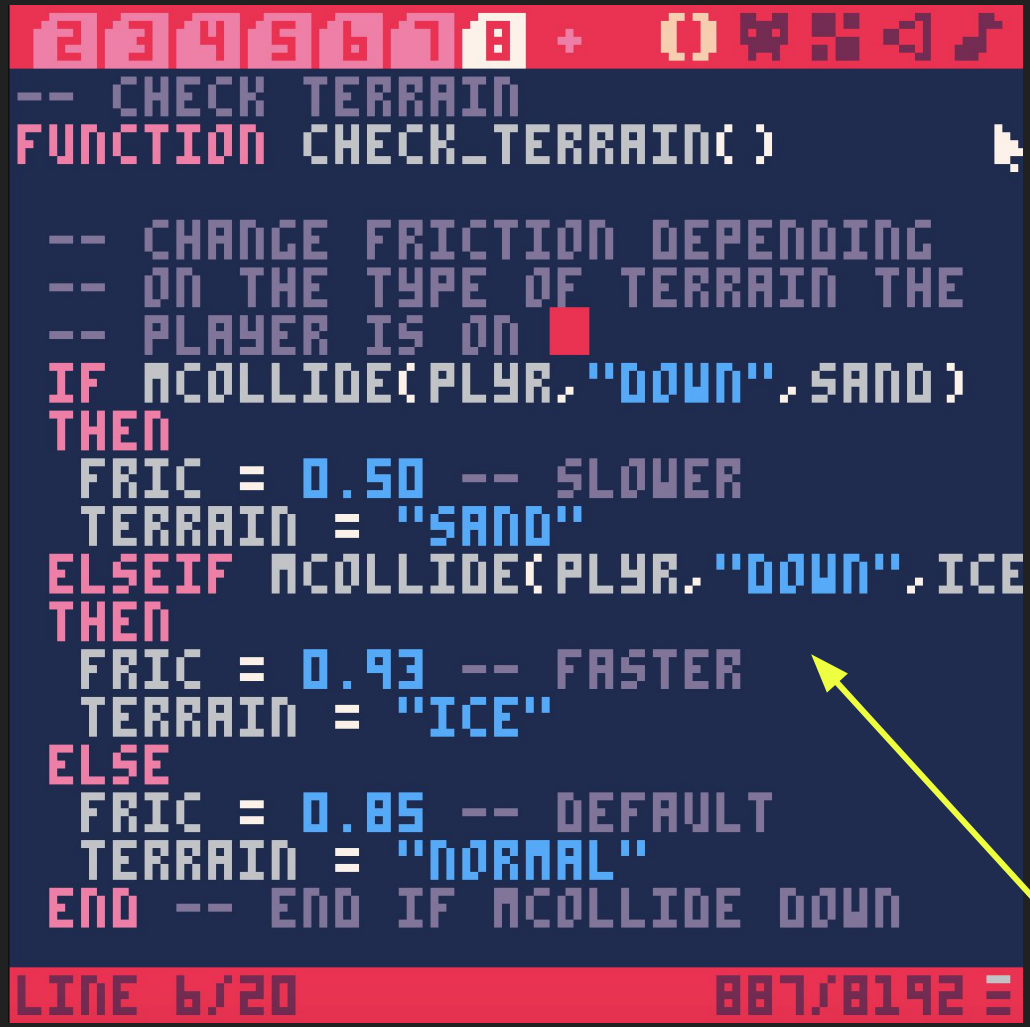
```
-- STOP FALLING WHEN A SOLID
-- TILE IS BELOW THE PLAYER
IF MCOLLIDE(PLYR,"DOWN",0)
AND PLYR.DY > 0 THEN
 PLYR.DY = 0
 PLYR.LANDED=TRUE

 -- BECAUSE OF VERTICAL SPEED,
 -- THE PLAYER CAN FALL A FEW
 -- PX INTO THE FLOOR. THIS
 -- CALCULATES HOW MANY PX AND
 -- RE-ADJUSTS Y (CREDIT TO
 -- NERDYTEACHERS.COM FOR THIS
 -- FORMULA)
 PLYR.Y-=
 ((PLYR.Y+PLYR.H+1)%8)-1
END -- END IF MCOLLIDE DOWN
```

TOKEN COUNT 825/8192

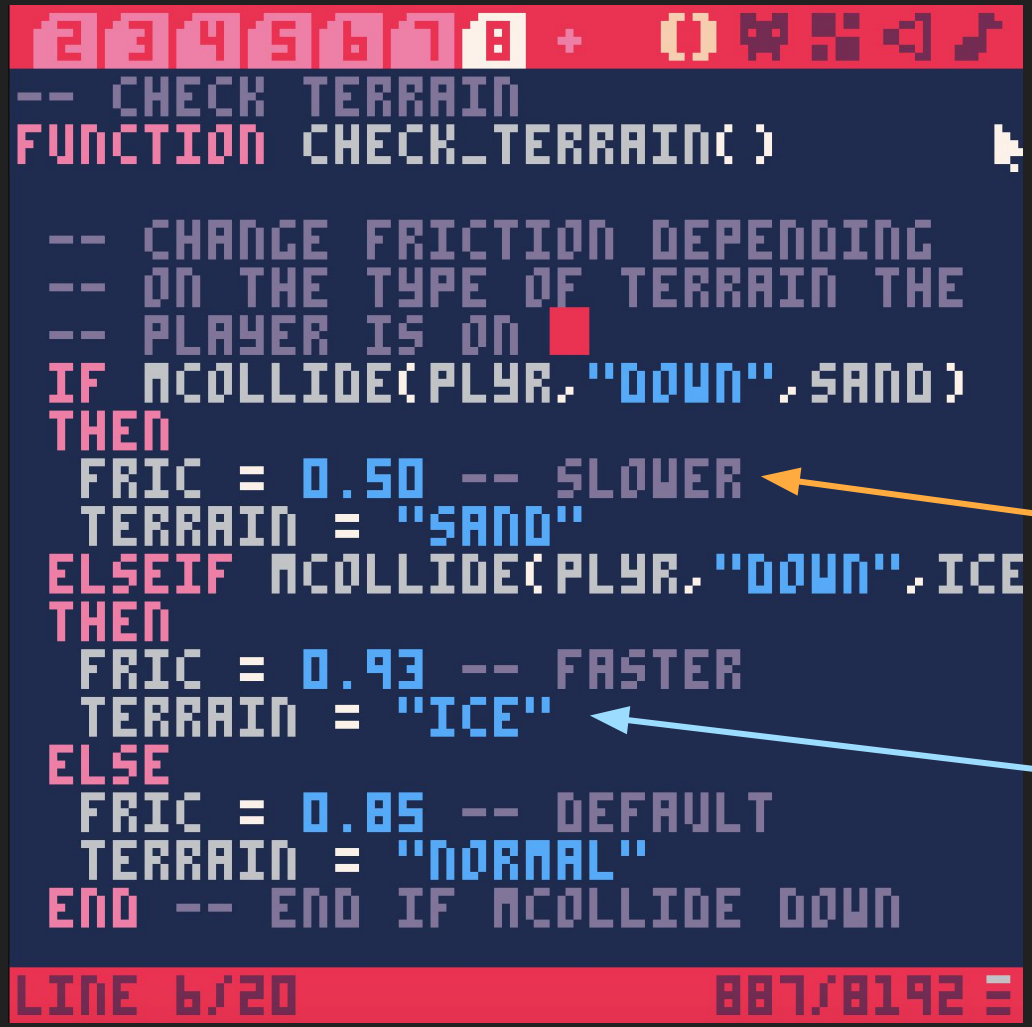
```
-- STOP FALLING WHEN A SOLID
-- TILE IS BELOW THE PLAYER
IF
(
   MCOLLIDE(PLYR,"DOWN",0)
OR MCOLLIDE(PLYR,"DOWN",SAND)
OR MCOLLIDE(PLYR,"DOWN",ICE)
)
AND PLYR.DY > 0 THEN
  PLYR.DY = 0
  PLYR.LANDED=TRUE

  -- BECAUSE OF VERTICAL SPEED,
  -- THE PLAYER CAN FALL A FEW
  -- PX INTO THE FLOOR. THIS
  -- CALCULATES HOW MANY PX AND
  -- RE-ADJUSTS Y (CREDIT TO
  -- NERDYTEACHERS.COM FOR THIS
```

LINE 49/98 906/8192

Note the **parentheses** to group my **stacking** **OR**-conditions



This is my new function to check terrain and set friction accordingly, called in _update()



Because we're multiplying the player's dx (effectively their speed) by friction, a smaller value makes the player move more slowly (like on sand)

And a higher value (closer to 1.0) makes the player move faster (like on ice)

You'll want to ***design your level to take advantage of the altered speed***

You could add difficulty to the sand level by requiring movement in tight spaces

And some long-distance jumps become possible in the ice level

Learning Resources

Step-by-Step Examples

1. platformer_01_starting_position.p8
2. platformer_02_horizontal_movement.p8
3. platformer_03_delta_x.p8
4. platformer_04_friction.p8
5. platformer_05_jumping.p8
6. platformer_06_gravity.p8
7. platformer_07_map_collision.p8
8. platformer_08_jumping_2.p8
9. platformer_09_walls.p8
10. platformer_10_movement_refined.p8

Step-by-Step Examples

11. platformer_11_camera.p8
12. platformer_12_pits_and_respawn.p8
13. platformer_13_animated_sprite.p8
14. platformer_14_multiple_levels.p8
15. platformer_15_terrain_and_friction.p8

Extras:

platformer_10a_correction_illustrated.p8

platformer_13a_toggle_animation.p8

More Learning Resources

- Side-Scrolling Platformer Game Tutorial Playlist by Nerdy Teachers on YouTube
- Function reference:
  - map()
  - mget()
  - fget()
  - mset()
  - camera()
  - time()

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</lesson>

Questions? Email me at mdimatteo@rider.edu anytime!