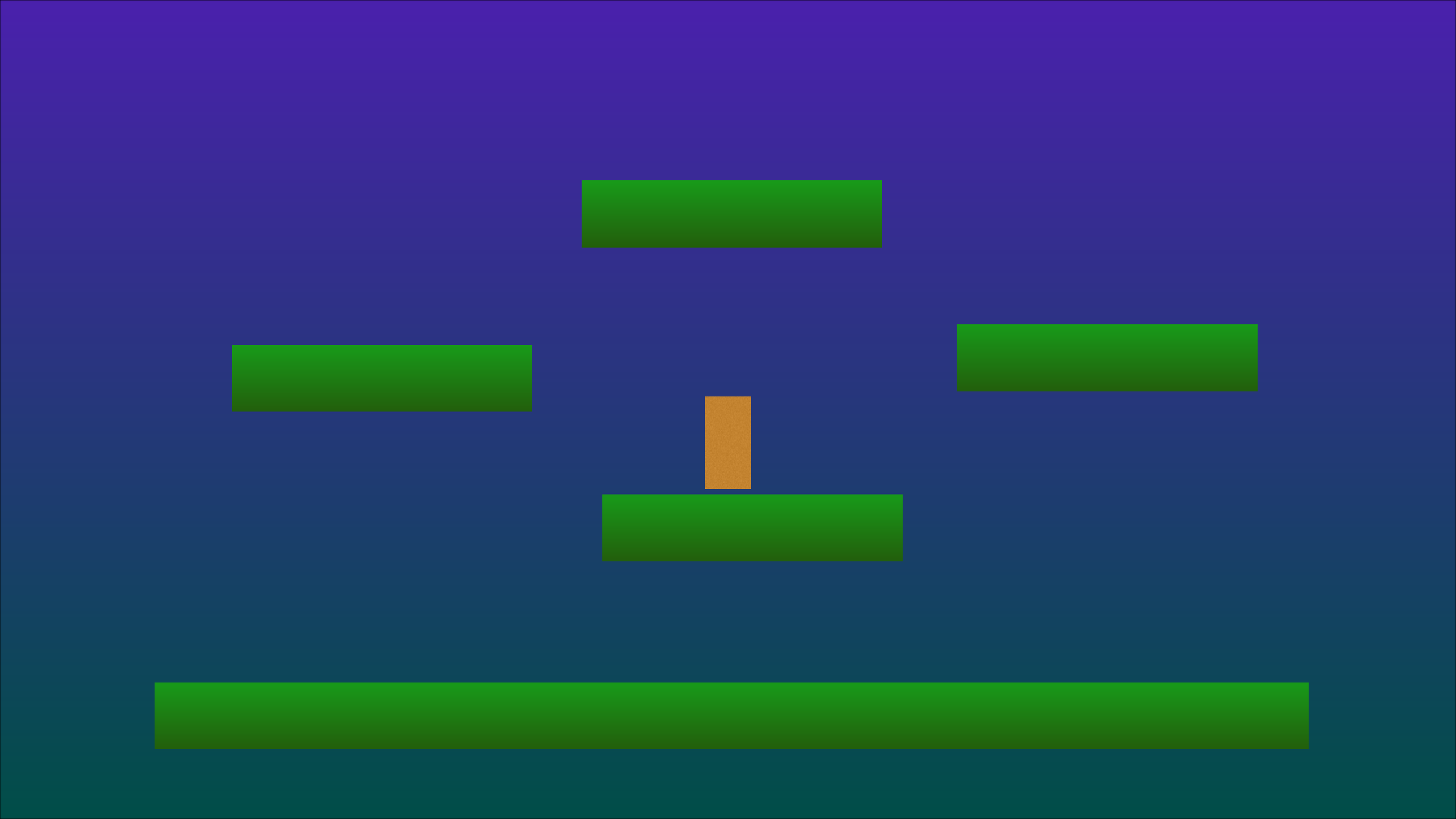
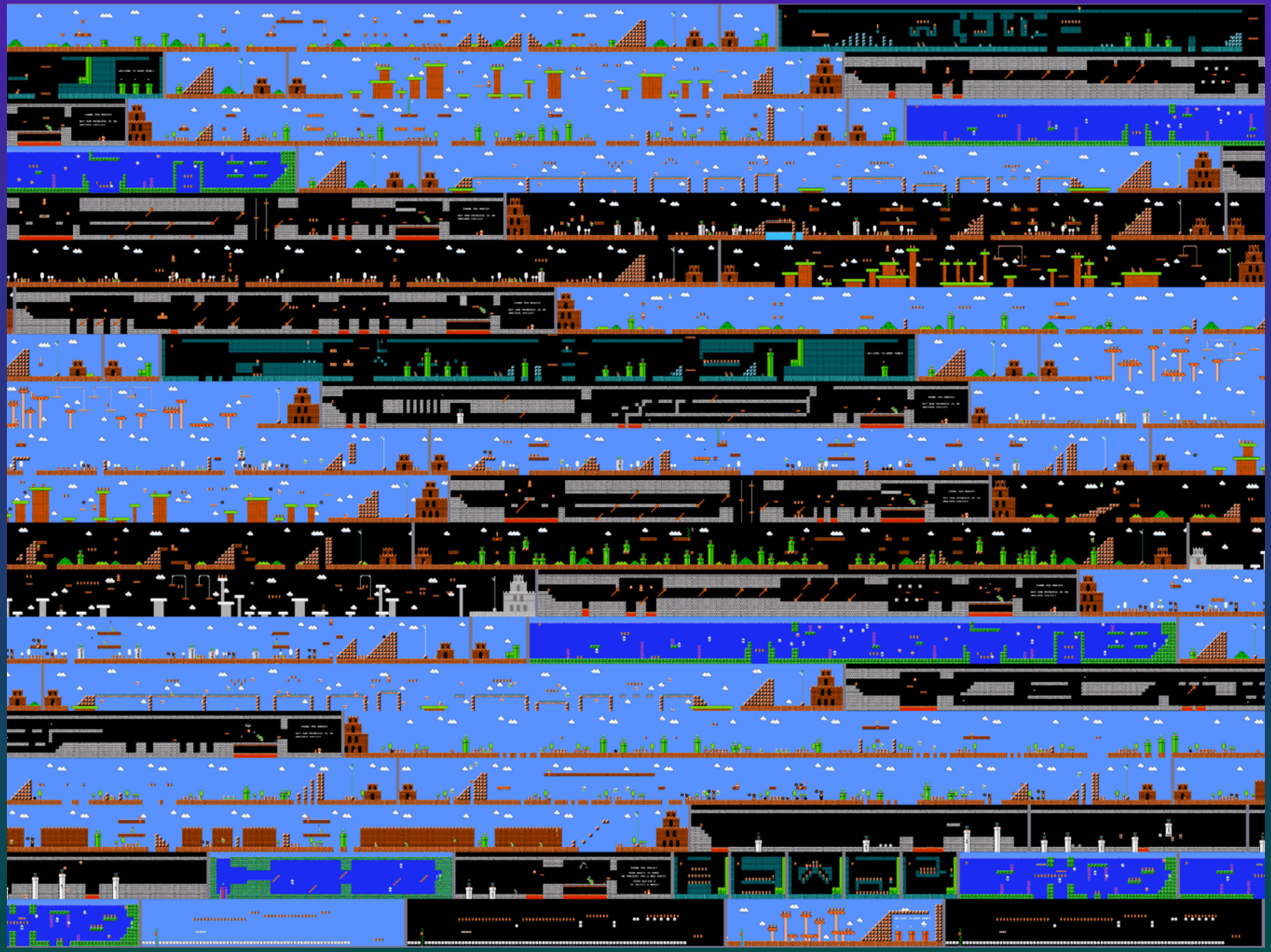
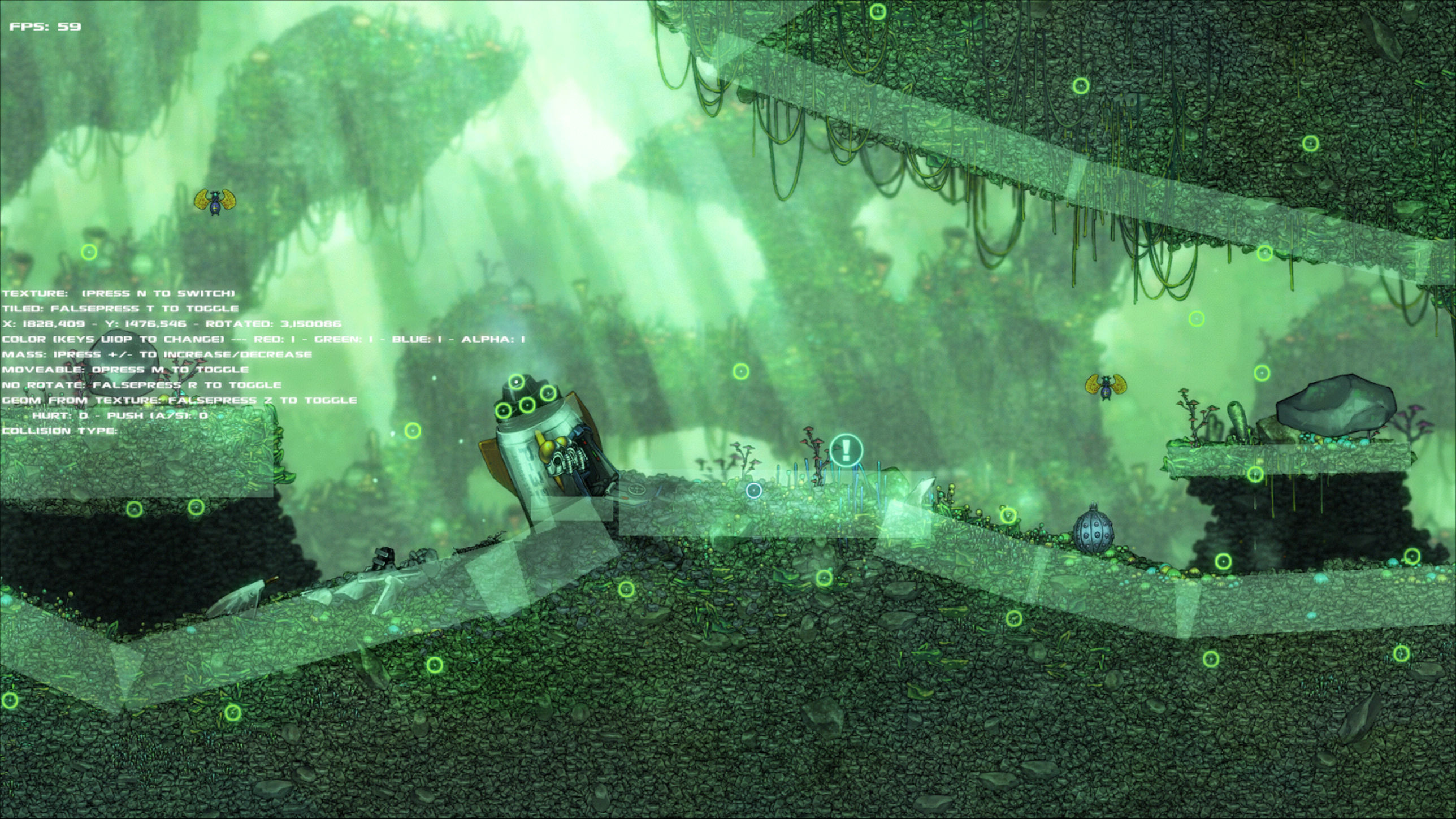
Creating worlds.

Part 1



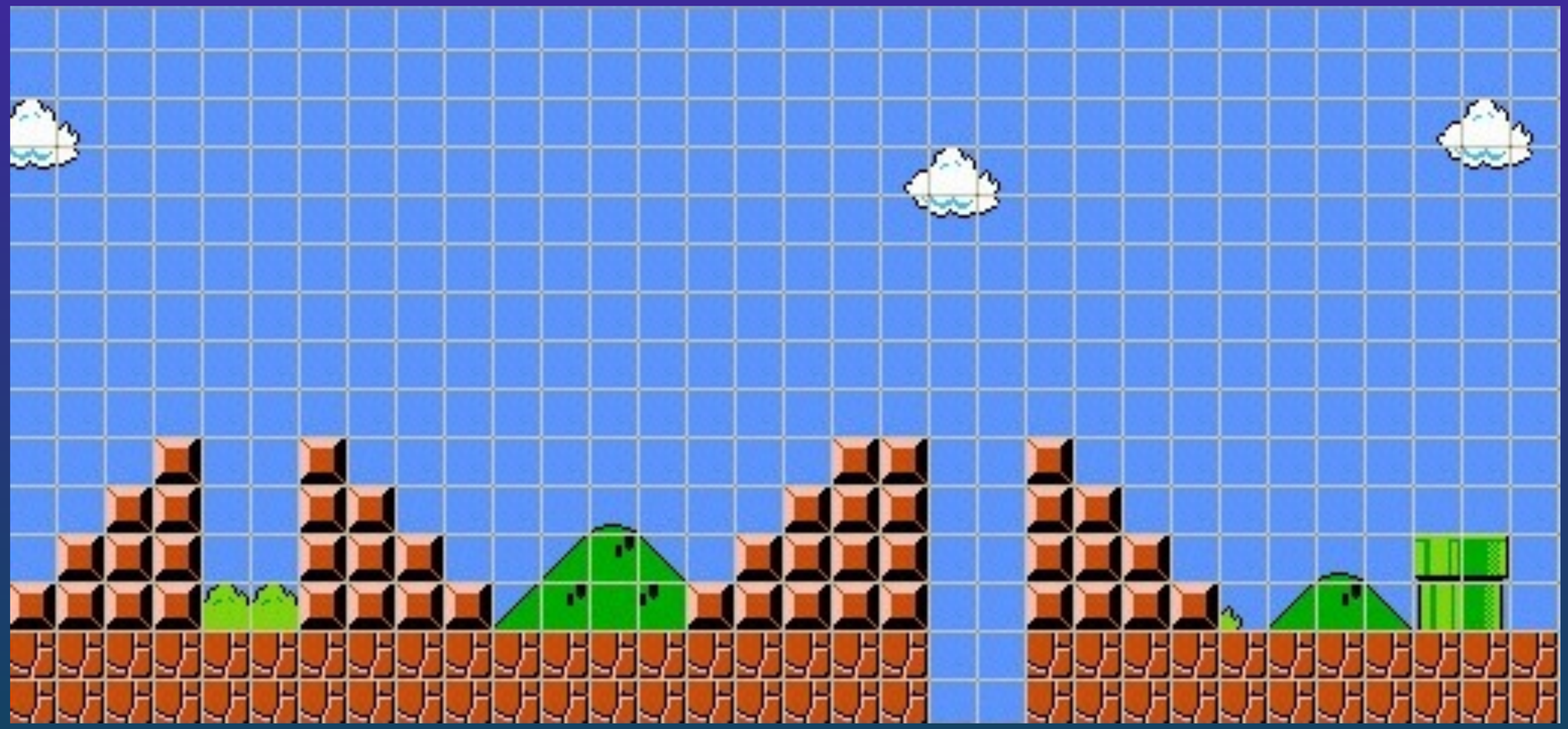



HEALTH
FUEL
EXIT
BLAST-CARBINE

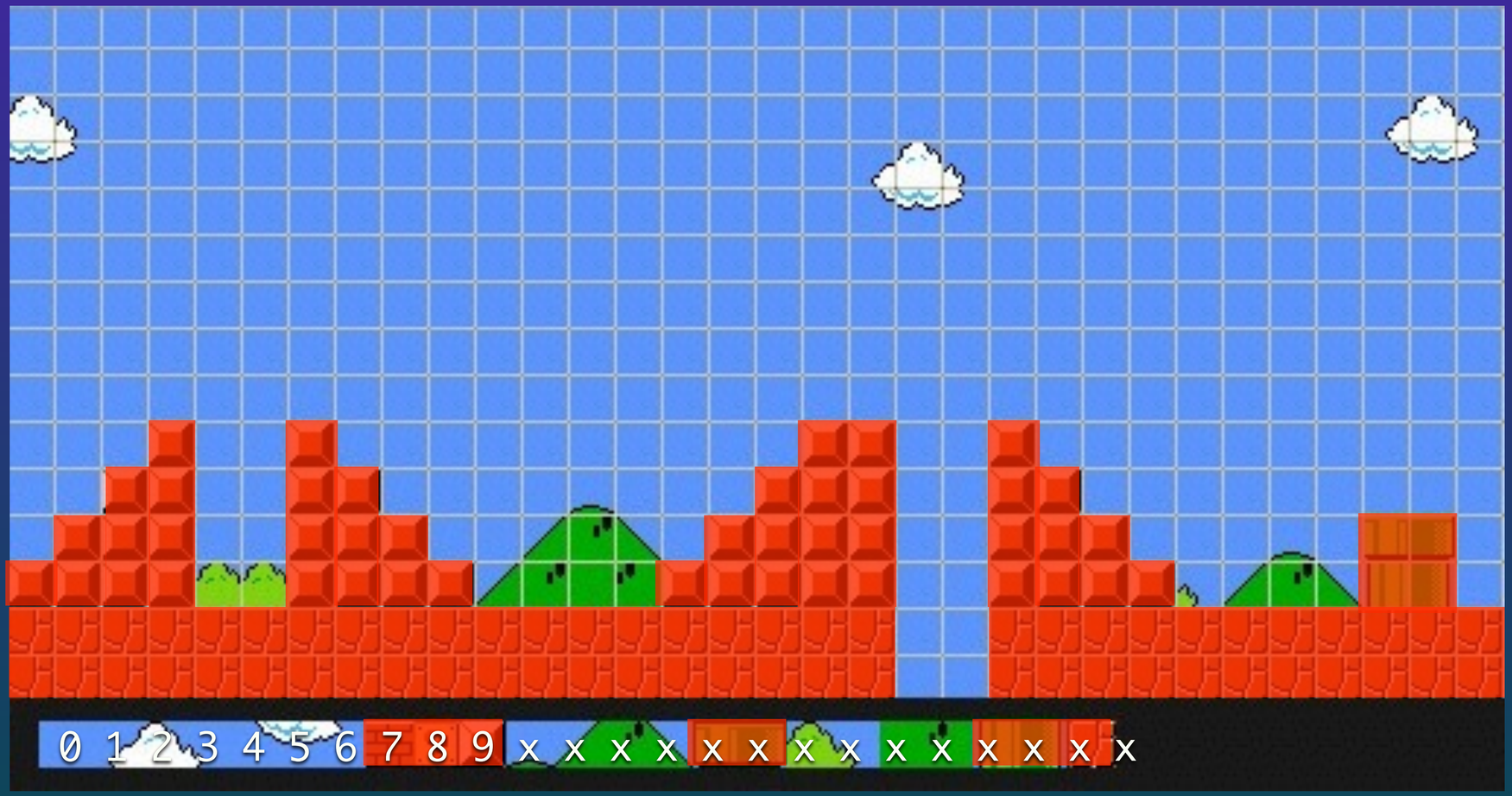

FPS: 59
TEXTURE: (PRESS N TO SWITCH)
TILED: FALSEPRESS T TO TOGGLE
X: 1828,409 - Y: 1476,546 - ROTATED: 3,150086
COLOR (KEYS UIOP TO CHANGE) --- RED: 1 - GREEN: 1 - BLUE: 1 - ALPHA: 1
MASS: 1PRESS +/- TO INCREASE/DECREASE
MOVEABLE: 0PRESS M TO TOGGLE
NO ROTATE: FALSEPRESS R TO TOGGLE
GEOM FROM TEXTURE: FALSEPRESS Z TO TOGGLE
HURT: 0 - PUSH (A/S): 0
COLLISION TYPE:

Tile-based levels.


MARIO
000500
×01
WORLD
1-1
TIME
321




0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
2 3 0 0 0 0 0 0 0 0 0
5 6 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 9 0 0 9 0 0 0 0
0 0 9 9 0 0 9 9 0 0 0
0 9 9 9 0 0 9 9 9 0 0
0 1 2 3 4 5 6 7 8 9 x x x x x x x x x x x x x x

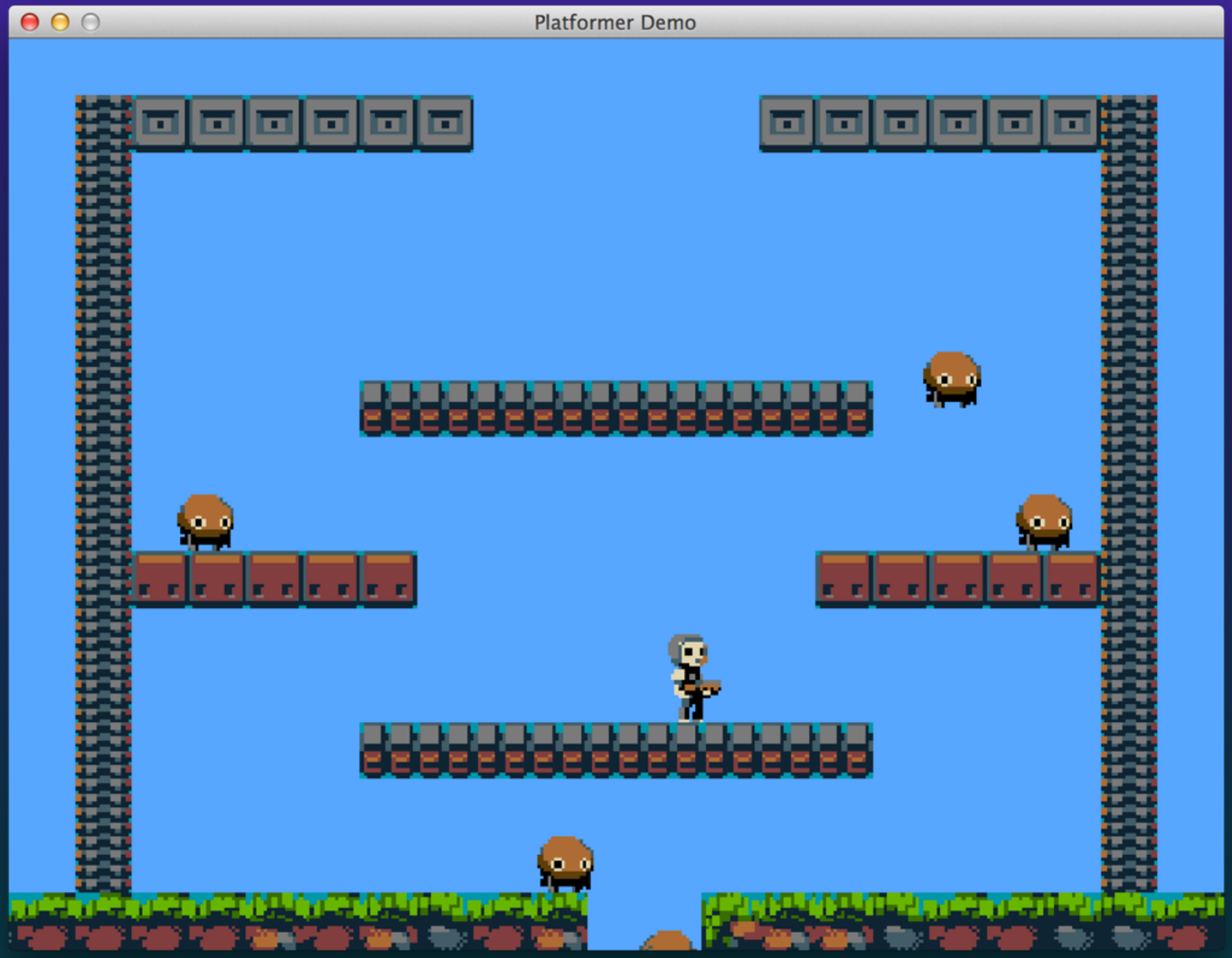


solids = 7,8,9,14,15,20,21,22


1
3
8
16


3D
OFF


1
4
4
$0


Platformer Demo

```
void ClassDemoApp::buildLevel() {
    int blockIndex = 0;

    for(int i=0; i < 9; i++) {
        blocks[blockIndex].sprite = SheetSprite(spriteSheetTexture, 5);
        blocks[blockIndex].width = 2.0/8.0f;
        blocks[blockIndex].height = 2.0/8.0f;
        blocks[blockIndex].isStatic = true;
        blocks[blockIndex].y = (2.0/8.0f * -4) - 1.0f/8.0f;
        blocks[blockIndex].x = (-2.0/8.0f * 4) + (2.0/8.0f * i);
        entities.push_back(&blocks[blockIndex]);
        blockIndex++;
    }

    for(int i=0; i < 9; i++) {
        blocks[blockIndex].sprite = SheetSprite(spriteSheetTexture, 5);
        blocks[blockIndex].width = 2.0/8.0f;
        blocks[blockIndex].height = 2.0/8.0f;
        blocks[blockIndex].isStatic = true;
        blocks[blockIndex].y = (2.0/8.0f * 2) - 1.0f/8.0f;
        blocks[blockIndex].x = (-2.0/8.0f * 4) + (2.0/8.0f * i);
        entities.push_back(&blocks[blockIndex]);
        blockIndex++;
    }

    for(int i=0; i < 5; i++) {
        blocks[blockIndex].sprite = SheetSprite(spriteSheetTexture, 6);
        blocks[blockIndex].width = 2.0/8.0f;
        blocks[blockIndex].height = 2.0/8.0f;
        blocks[blockIndex].isStatic = true;
        blocks[blockIndex].y = (2.0/8.0f * -1) - 1.0f/8.0f;
        blocks[blockIndex].x = (-2.0/8.0f * 8) + (2.0/8.0f * i);
        entities.push_back(&blocks[blockIndex]);
```

```
void ClassDemoApp::buildLevel() {
    int blockIndex = 0;

    for(int i=0; i < 9; i++) {
        blocks[blockIndex].sprite = SheetSprite(spriteSheetTexture, 5);
        blocks[blockIndex].width = 2.0/8.0f;
        blocks[blockIndex].height = 2.0/8.0f;
        blocks[blockIndex].isStatic = true;
        blocks[blockIndex].y = (2.0/8.0f * -4) - 1.0f/8.0f;
        blocks[blockIndex].x = (-2.0/8.0f * 4) + (2.0/8.0f * i);
        entities.push_back(&blocks[blockIndex]);
        blockIndex++;
    }

    for(int i=0; i < 9; i++) {
        blocks[blockIndex].sprite = SheetSprite(spriteSheetTexture, 5);
        blocks[blockIndex].width = 2.0/8.0f;
        blocks[blockIndex].height = 2.0/8.0f;
        blocks[blockIndex].isStatic = true;
        blocks[blockIndex].y = (2.0/8.0f * 2) - 1.0f/8.0f;
        blocks[blockIndex].x = (-2.0/8.0f * 4) + (2.0/8.0f * i);
        entities.push_back(&blocks[blockIndex]);
        blockIndex++;
    }

    for(int i=0; i < 5; i++) {
        blocks[blockIndex].sprite = SheetSprite(spriteSheetTexture, 6);
        blocks[blockIndex].width = 2.0/8.0f;
        blocks[blockIndex].height = 2.0/8.0f;
```

Defining a tile map level.

Storing level data as a 2-dimensional array.

```
unsigned char levelData[LEVEL_HEIGHT][LEVEL_WIDTH];
```

```
unsigned char levelData[0] = {0,20,4,4,4,4,4,4,0,0,0,0,0,0,4,4,4,4,4,4,20,0};
```

```
unsigned char level1Data[LEVEL_HEIGHT][LEVEL_WIDTH] =
{
    {11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11},
    {0,20,4,4,4,4,4,4,0,0,0,0,0,0,4,4,4,4,4,4,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,6,6,6,6,6,6,6,6,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,6,6,6,6,6,0,0,0,0,0,0,0,6,6,6,6,6,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,6,6,6,6,6,6,6,6,0,0,0,0,0,20,0},
    {0,20,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,20,0},
    {0,20,125,118,0,0,116,0,0,0,0,0,0,0,0,0,0,117,0,127,20,0},
    {2,2,2,2,2,2,2,2,2,3,0,0,1,2,2,2,2,2,2,2,2,2},
    {32,33,33,34,32,33,33,34,33,35,100,101,35,32,33,32,34,32,33,32,33,33}
};
```

```
void ClassDemoApp::buildLevel() {
    memcpy(levelData, level1Data, LEVEL_HEIGHT*LEVEL_WIDTH);
}
```

Rendering a tile map level.

Need to render the entire tilemap in one array.


Hello

Go through the tiles line by line and add vertices to a single array. Keep in mind that our Y axis points upwards, while tile indexes count downwards.

```
for(int y=0; y < LEVEL_HEIGHT; y++) {
    for(int x=0; x < LEVEL_WIDTH; x++) {

        float u = (float)(((int)levelData[y][x]) % SPRITE_COUNT_X) / (float) SPRITE_COUNT_X;
           float v = (float)(((int)levelData[y][x]) / SPRITE_COUNT_X) / (float) SPRITE_COUNT_Y;

           float spriteWidth = 1.0f/(float)SPRITE_COUNT_X;
           float spriteHeight = 1.0f/(float)SPRITE_COUNT_Y;

           vertexData.insert(vertexData.end(), {
           TILE_SIZE * x, -TILE_SIZE * y,
           TILE_SIZE * x, (-TILE_SIZE * y)-TILE_SIZE,
           (TILE_SIZE * x)+TILE_SIZE, (-TILE_SIZE * y)-TILE_SIZE,
           (TILE_SIZE * x)+TILE_SIZE, -TILE_SIZE * y
           });

           texCoordData.insert(texCoordData.end(), { u, v,
               u, v+(spriteHeight),
               u+spriteWidth, v+(spriteHeight),
               u+spriteWidth, v
           });
    }
}
```

We can optimize by not drawing empty grid tiles at all.

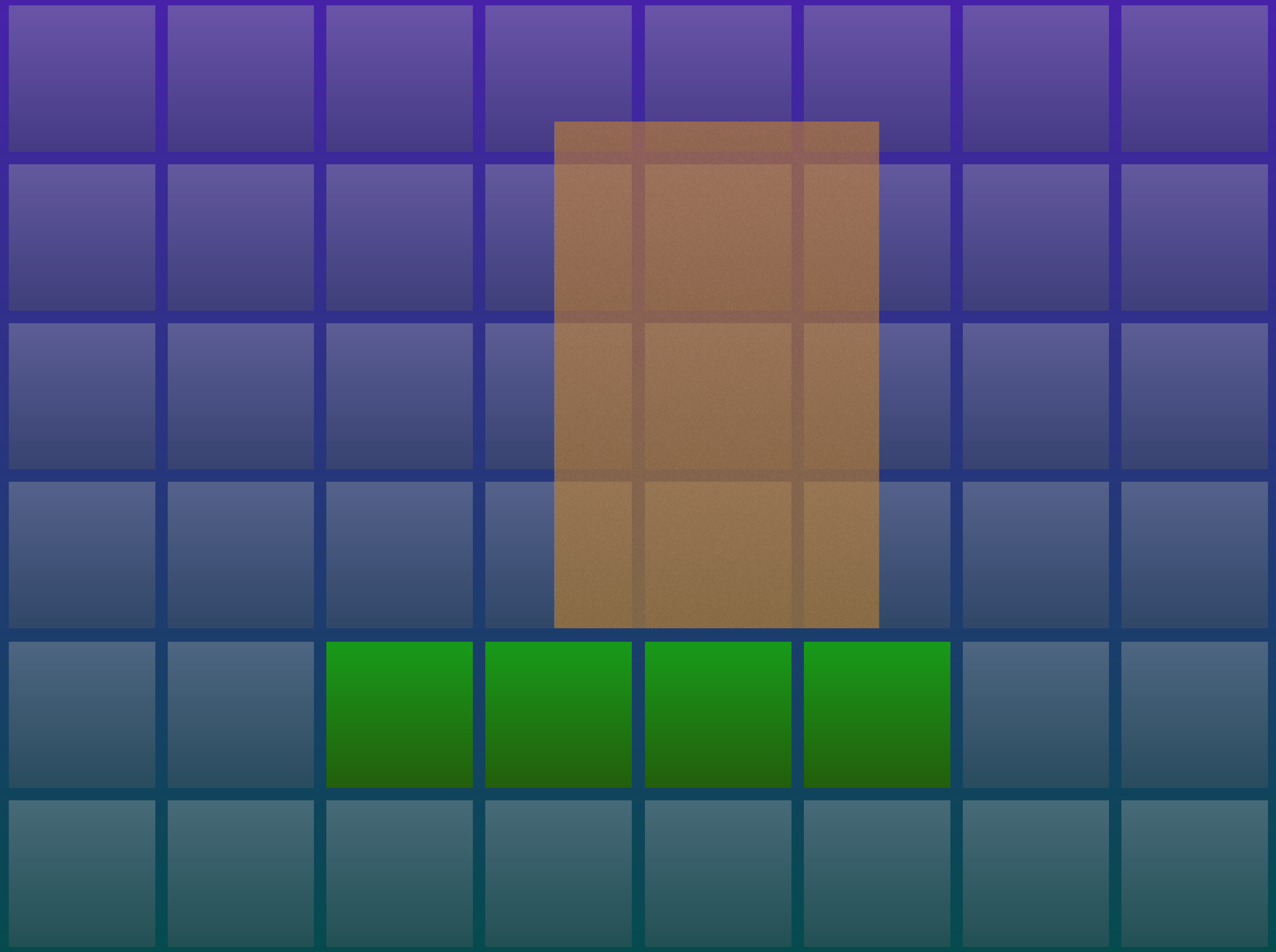
```
for(int y=0; y < LEVEL_HEIGHT; y++) {
    for(int x=0; x < LEVEL_WIDTH; x++) {

        if(levelData[y][x] != 0) {
            // add vertices
        }
    }
}
```

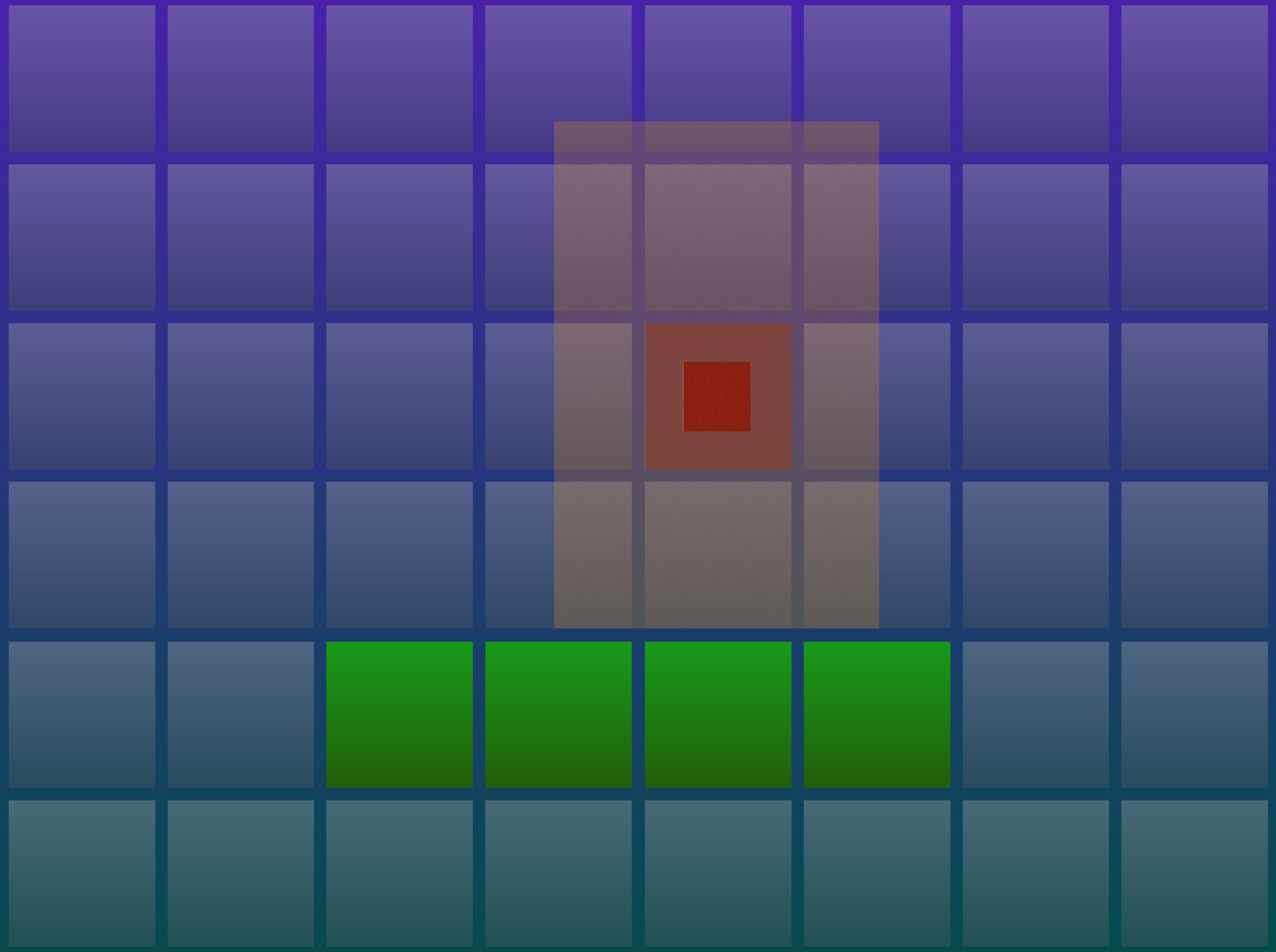
Translate to center on screen.

```
glLoadIdentity();
glTranslatef(-TILE_SIZE * LEVEL_WIDTH/2, TILE_SIZE * LEVEL_HEIGHT/2, 0.0f);
```

Colliding with a tilemap.

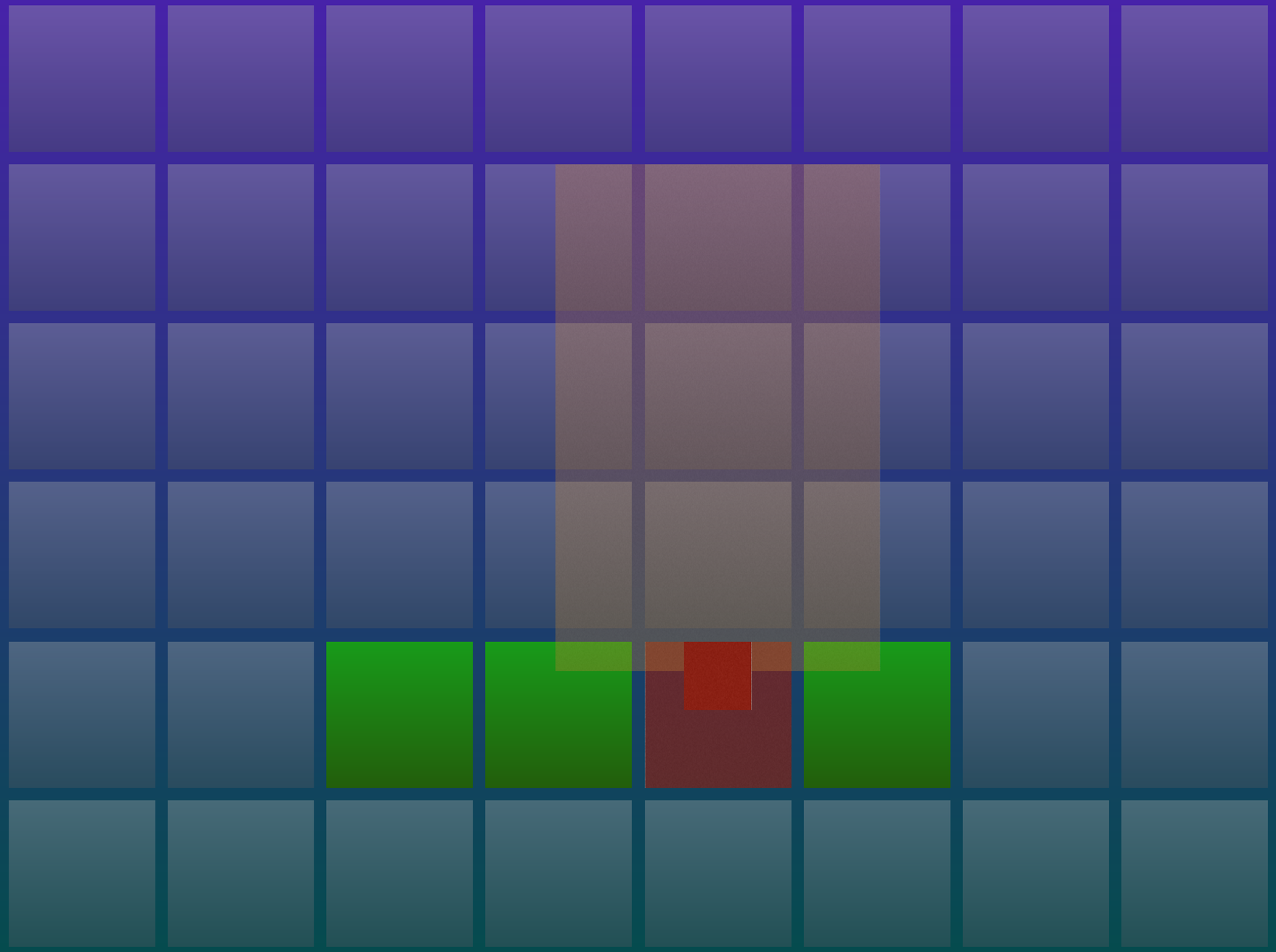


Convert our entity position
to the grid coordinates and check
if that tile is solid.

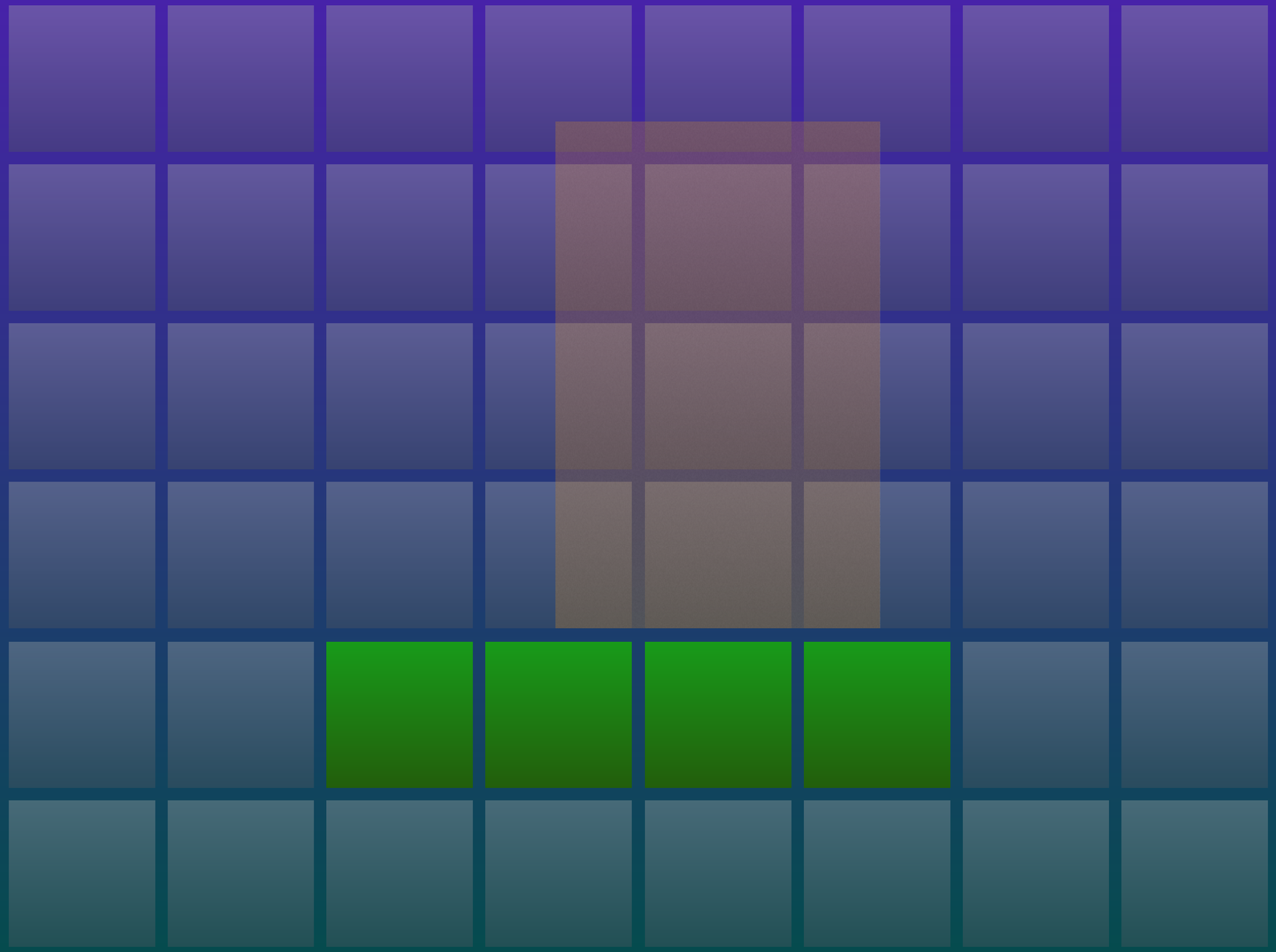


```
void worldToTileCoordinates(float worldX, float worldY, int *gridX, int *gridY) {
    *gridX = (int)((worldX + (WORLD_OFFSET_X)) / TILE_SIZE);
    *gridY = (int)((-worldY + (WORLD_OFFSET_Y)) / TILE_SIZE);
}
```

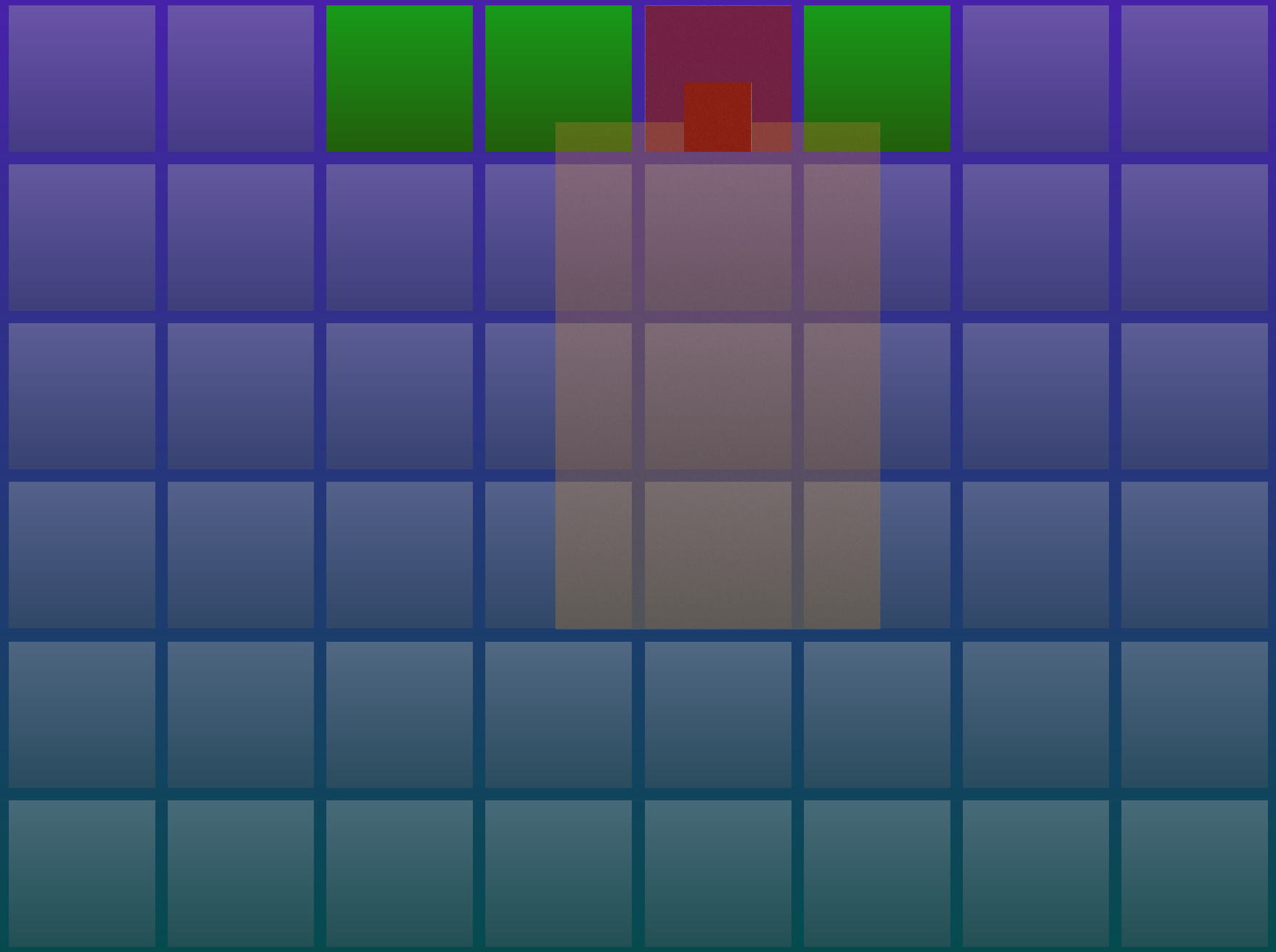
We don’t want to collide using the entity’s center, so check the point at the bottom (-half height).



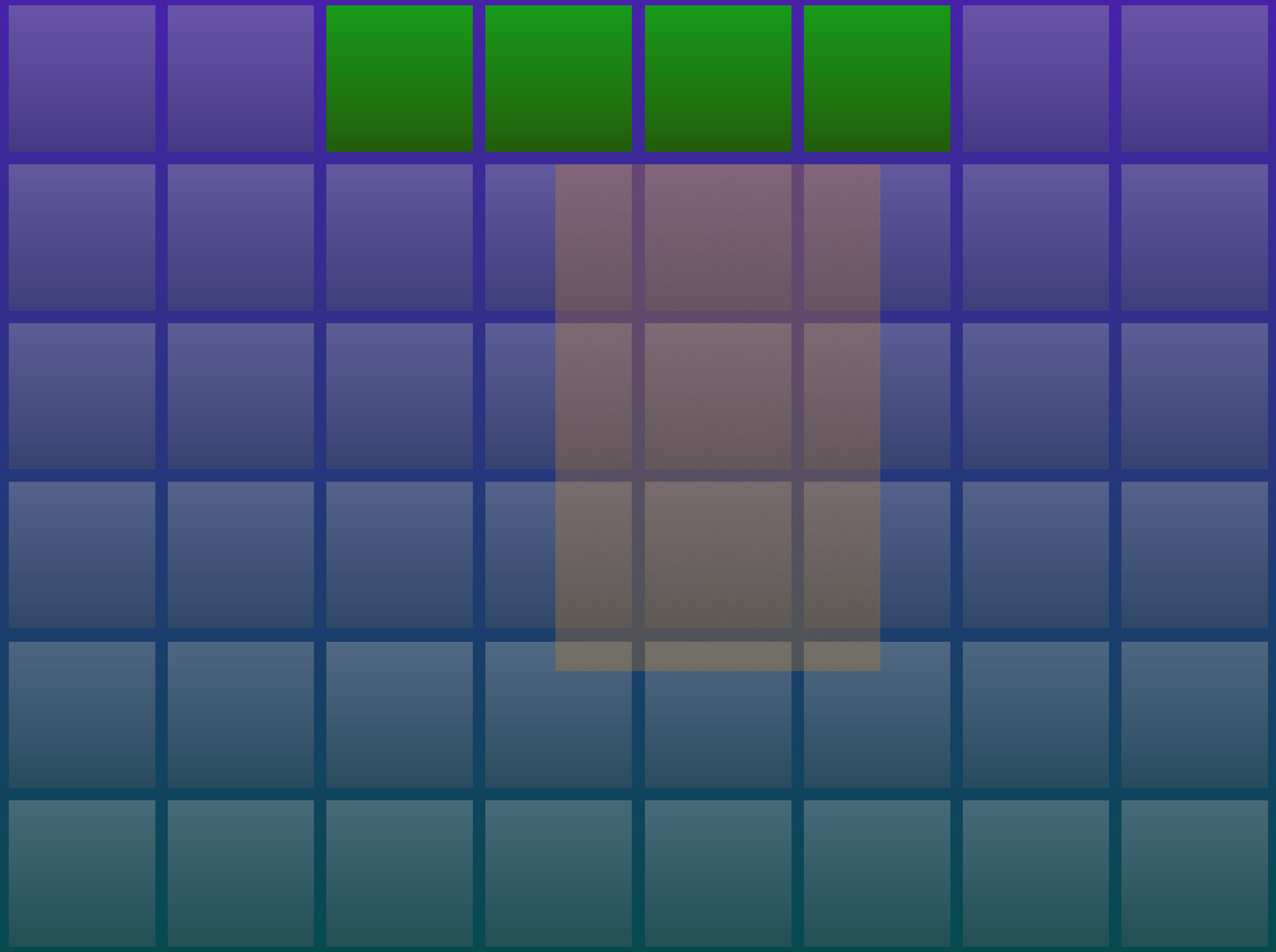
If the tile is solid, adjust our Y-coordinate up by the difference between the point we are testing and the top of the tile and set Y-velocity to 0, set bottom collision flag..



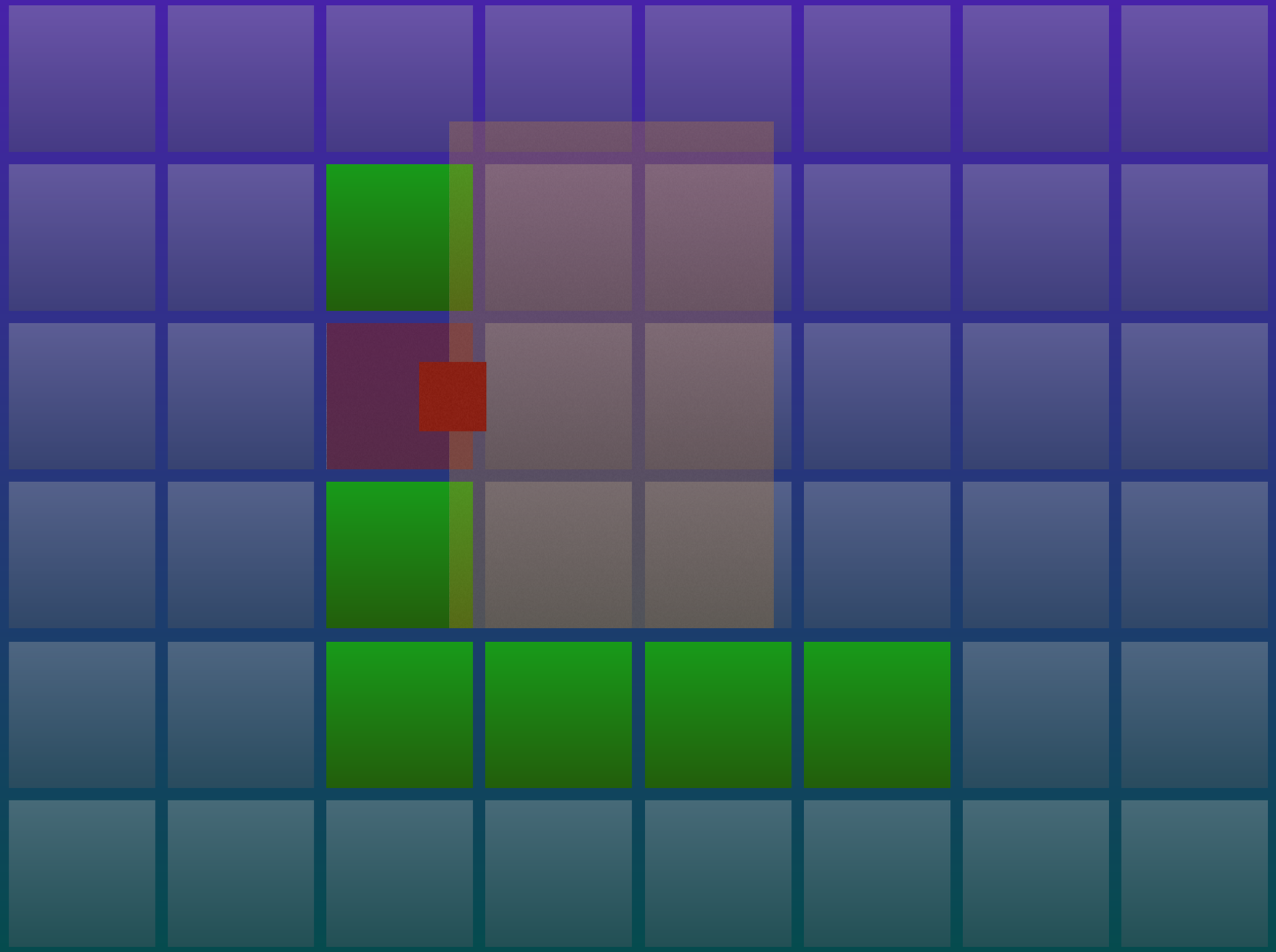
Now, check the point at the top…



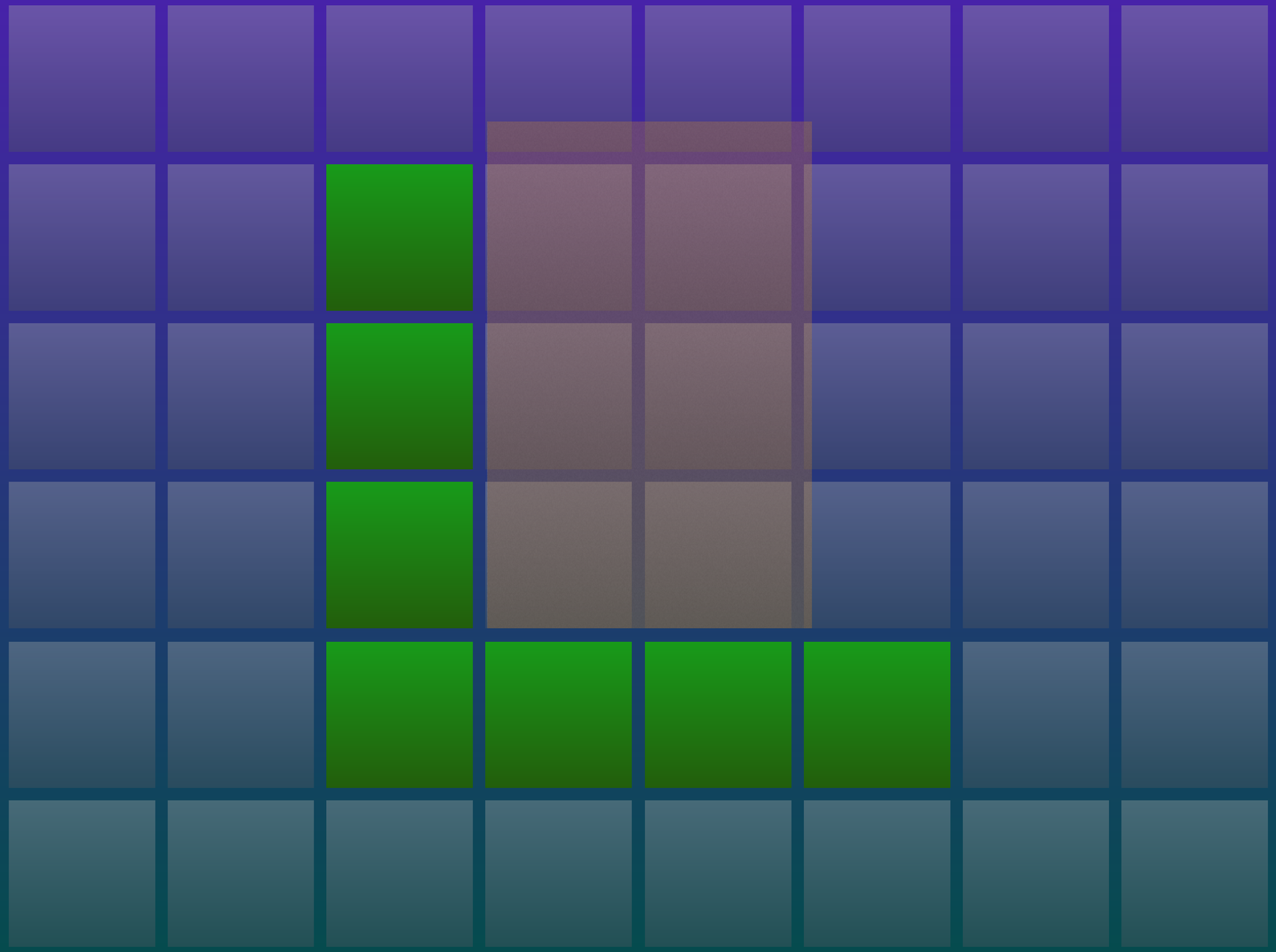
If the tile is solid, adjust our Y-coordinate down by the difference between the point we are testing and the bottom of the tile and set Y-velocity to 0, set top collision flag.



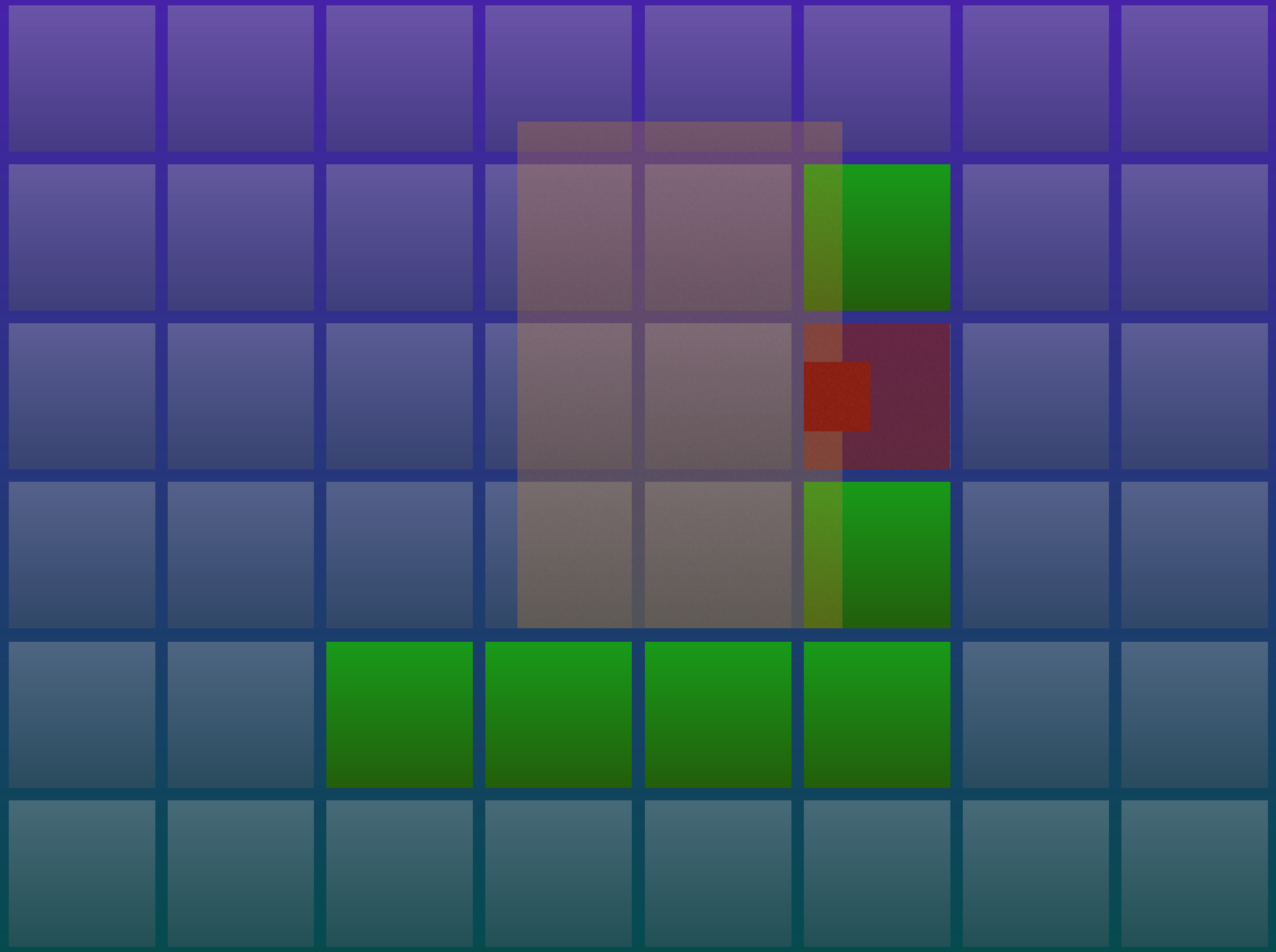
Now, on the left…



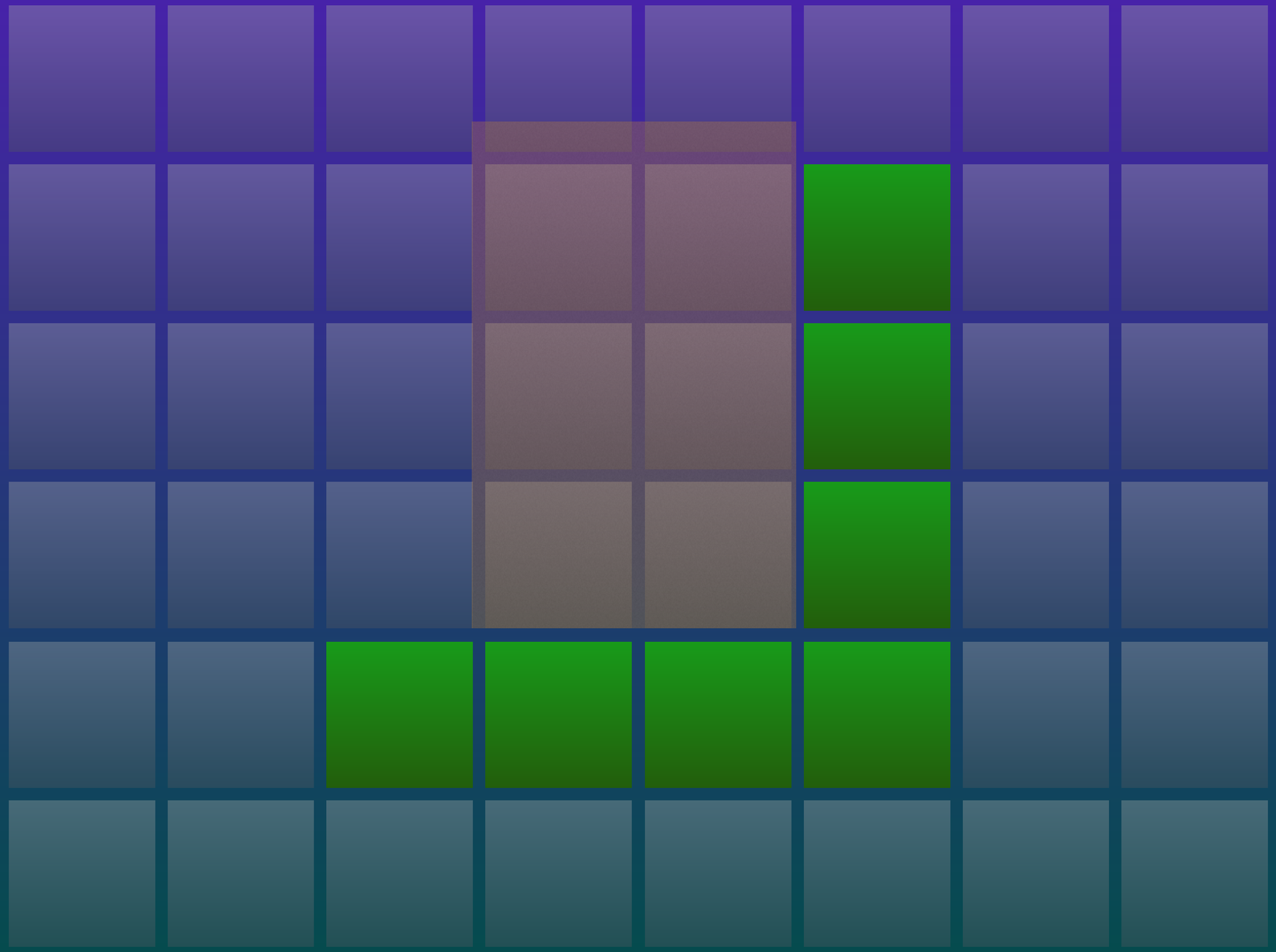
If the tile is solid, adjust our X-coordinate right by the difference between the point we are testing and the right of the tile and set X-velocity to 0, set left collision flag.



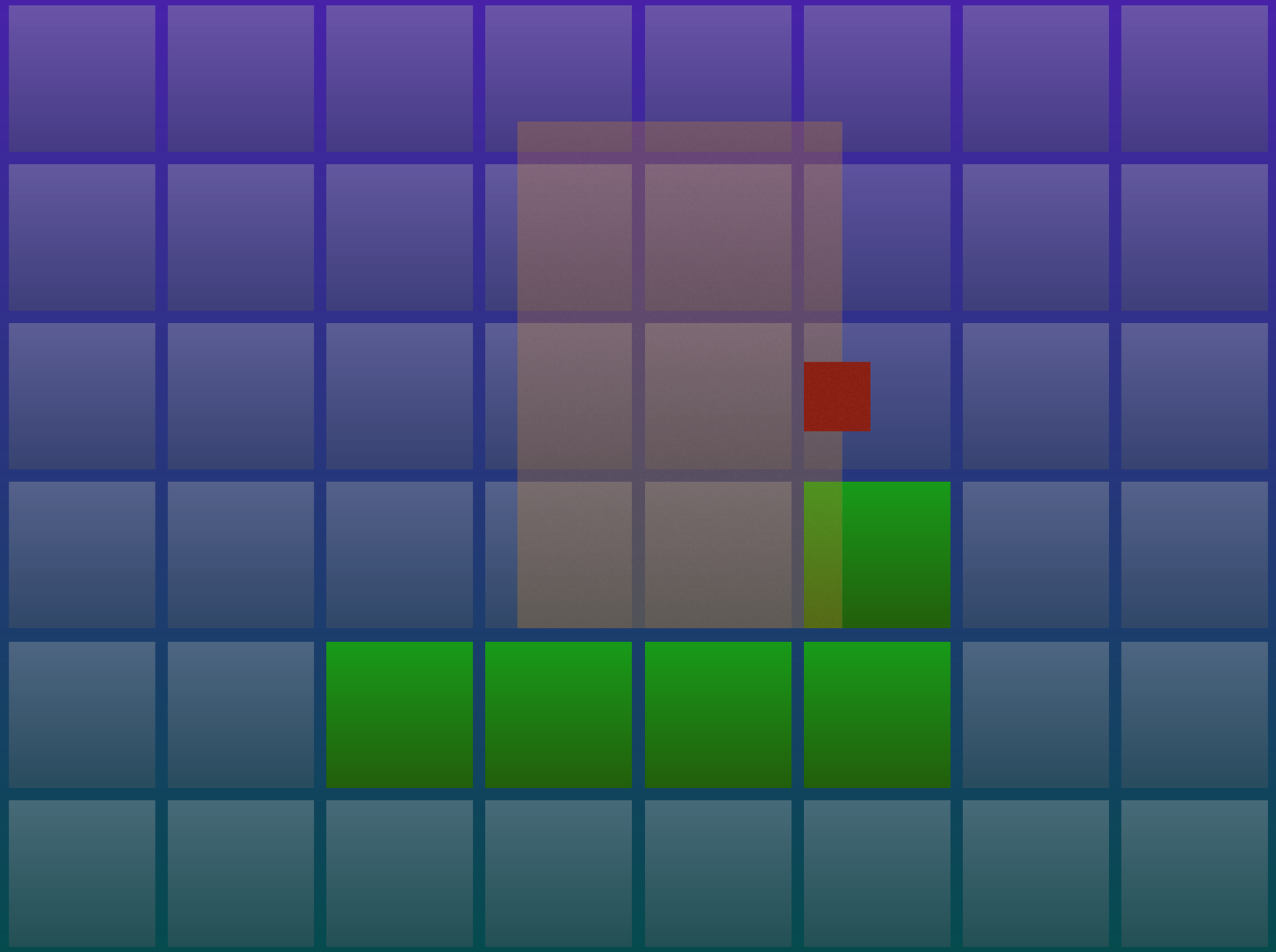
Now, finally, on the right…

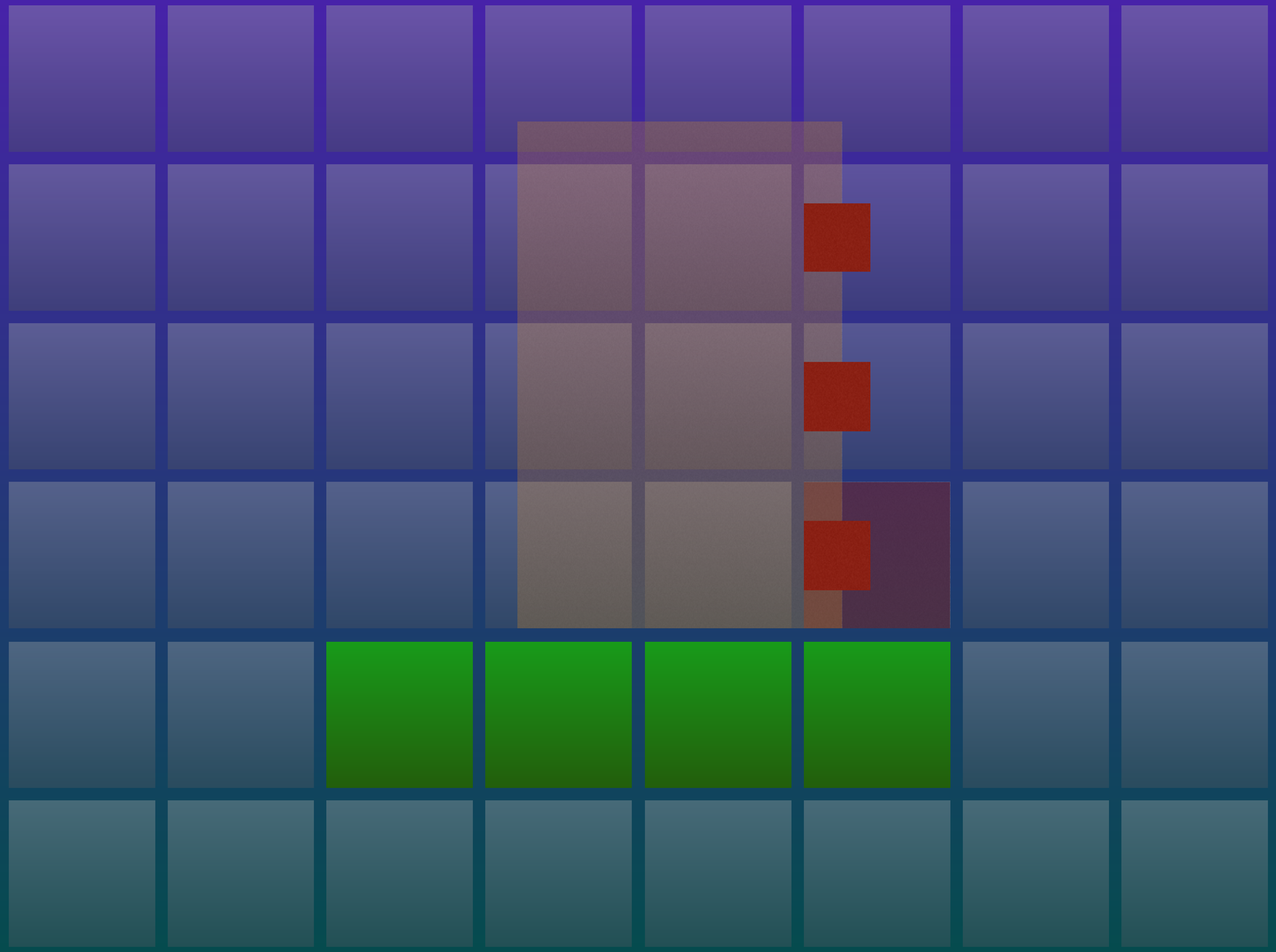


If the tile is solid, adjust our X-coordinate left by the difference between the point we are testing and the left of the tile and set X-velocity to 0, set right collision flag..



You may test additional points along the sprite if it is larger than a tile.

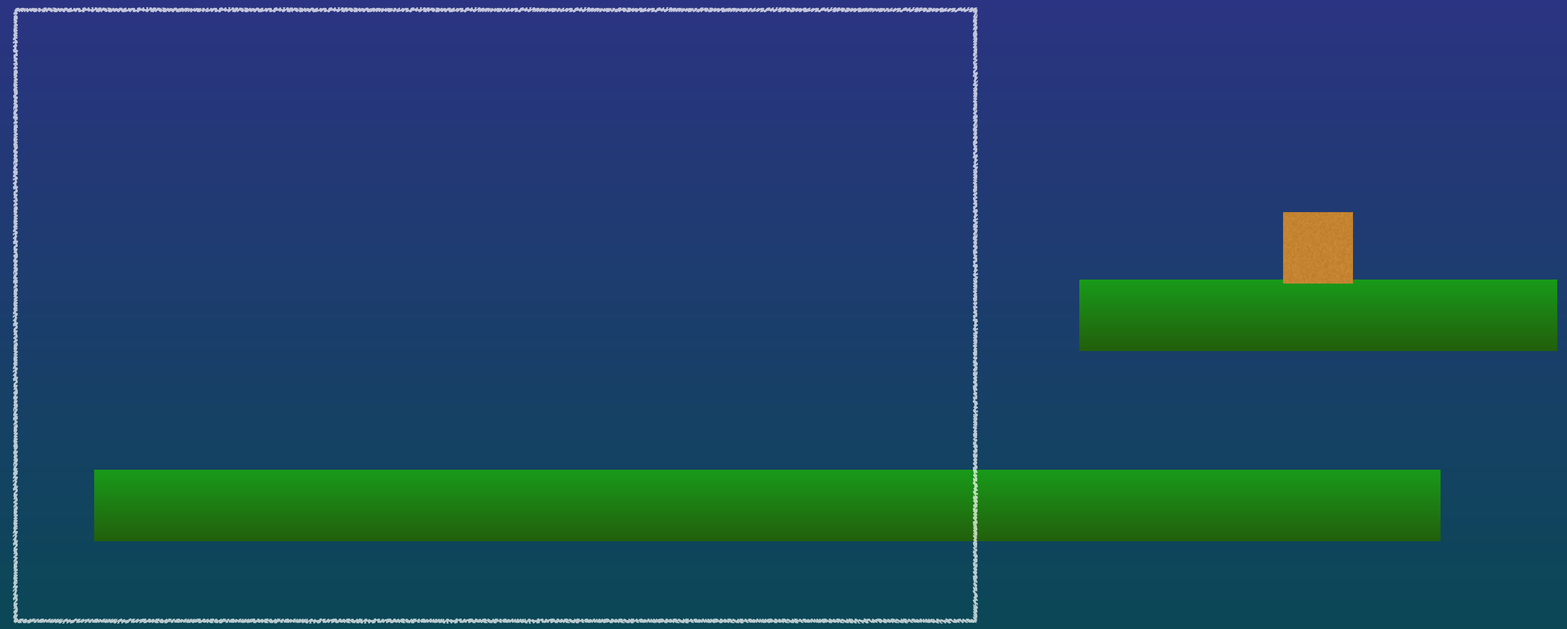




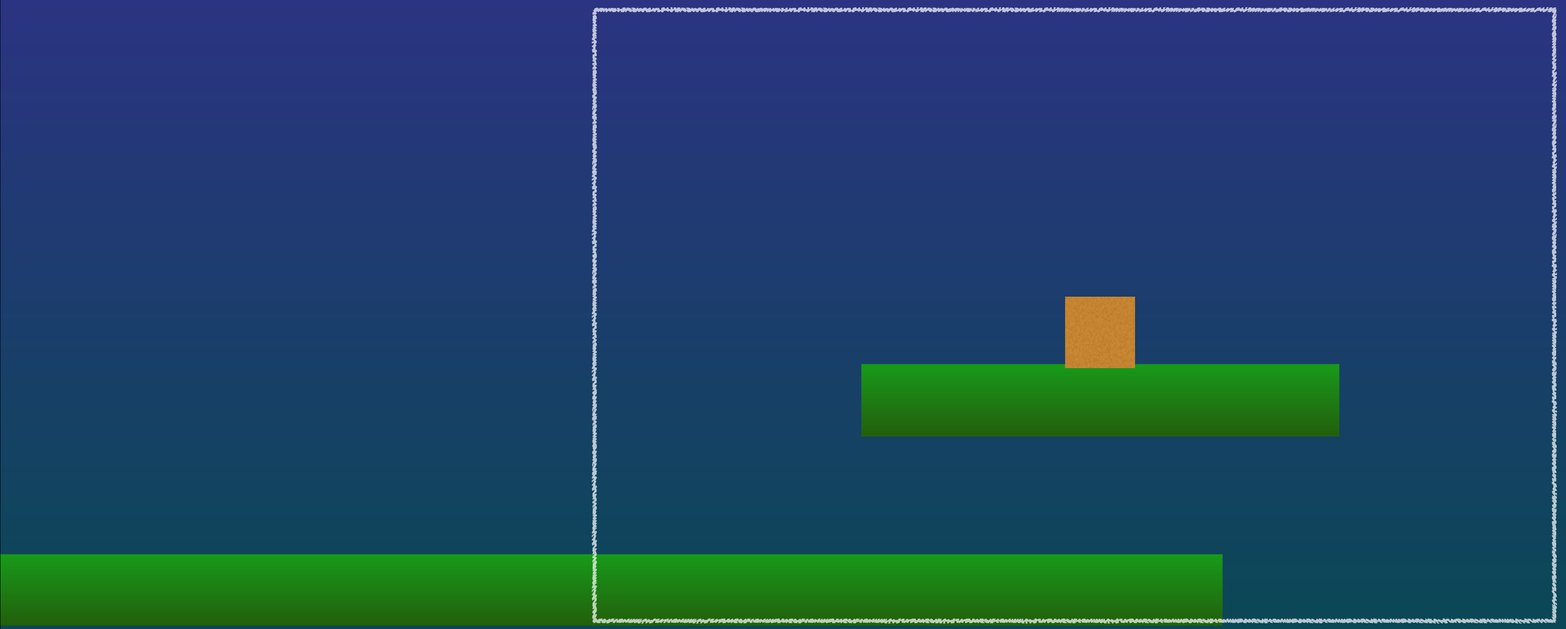
Scrolling

What is scrolling?

We need to translate everything so
that the player is in the center of the screen.



Call glTranslate before we render anything with the inverse of the player's position.



The problem with glLoadIdentity()

```
void glPushMatrix ();
```

Push the current matrix to the stack.

```
glPushMatrix();
```

```
void glPopMatrix ();
```

Pops the matrix from the stack and sets the current matrix to it.

```
glPopMatrix();
```

To transform our entities without affecting the modelview matrix, we must save the current matrix using glPushMatrix, do our transforms and render, then restore the matrix using glPopMatrix.

```
glMatrixMode(GL_MODELVIEW);
```

MODELVIEW IN STACK

MODELVIEW IN STACK

CURRENT MODELVIEW

```
glMatrixMode(GL_MODELVIEW);
glPushMatrix();
```

CURRENT MODELVIEW

MODELVIEW IN STACK

MODELVIEW IN STACK

CURRENT MODELVIEW

```
glMatrixMode(GL_MODELVIEW);
glPushMatrix();
glTranslatef(x, y, 0.0f);
// Draw stuff
```

CURRENT MODELVIEW

MODELVIEW IN STACK

MODELVIEW IN STACK

CURRENT MODELVIEW

```
glMatrixMode(GL_MODELVIEW);
glPushMatrix();
glTranslatef(x, y, 0.0f);
// Draw stuff
glPopMatrix();
```

MODELVIEW IN STACK

MODELVIEW IN STACK

CURRENT MODELVIEW