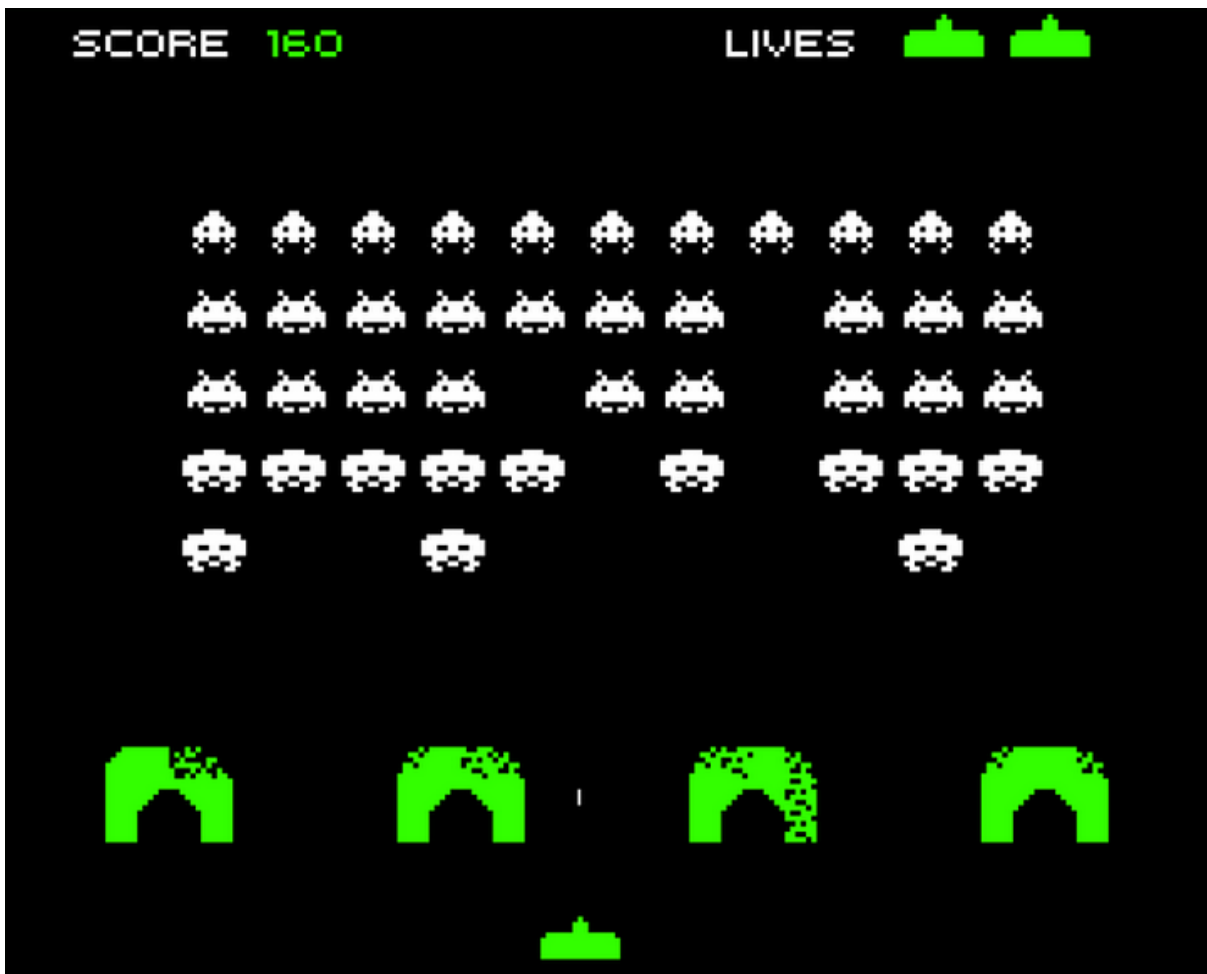# Invaders - Python – Microsoft Arcade

The following instructions will take you through the steps of creating a game replicating the famous 1978 game space invaders by Taito where you must defend against wave after wave of aliens.

Use the D-Pad to move your tank left and right and the A button to fire the tanks cannon.


Controls

To control the players character, use the direction keys on the console. Alternatively, it may be easier to use the keyboard mappings for the keys as follows

	Up				
	(↑ or W)				
Left		**Right**		**B**	**A**
(← or A)		(→ or D)		(E, X or Enter)	(Q, Z or Space)
	Down				
	(↓ or S)				

Invaders - Python – Microsoft Arcade

Step 1 – Setup MakeCode Arcade for Python development

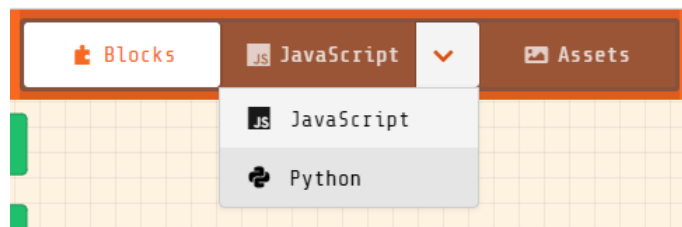Navigate to https://arcade.makecode.com and create a new project by pressing the "New Project" icon.
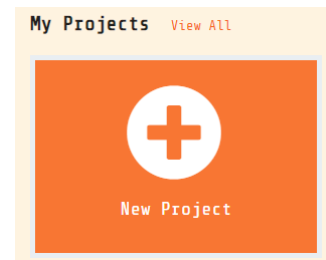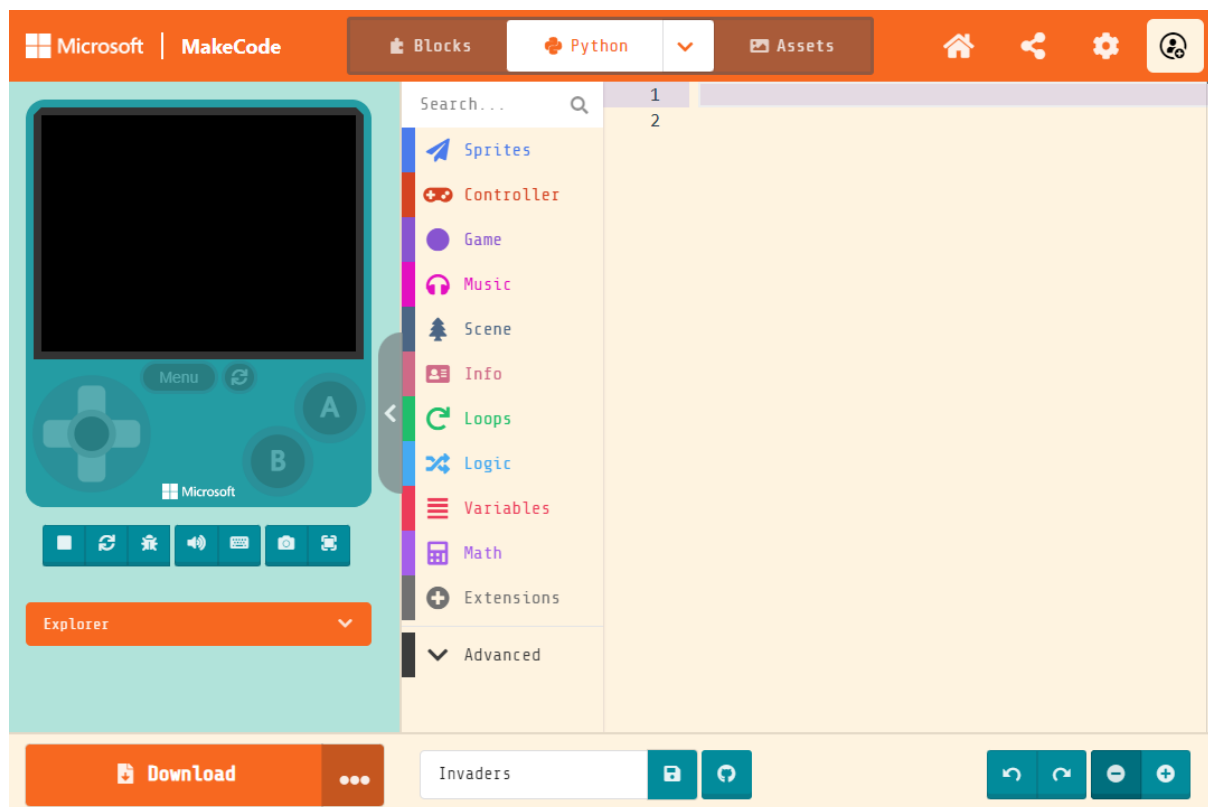
Name your game Invaders and click Create.
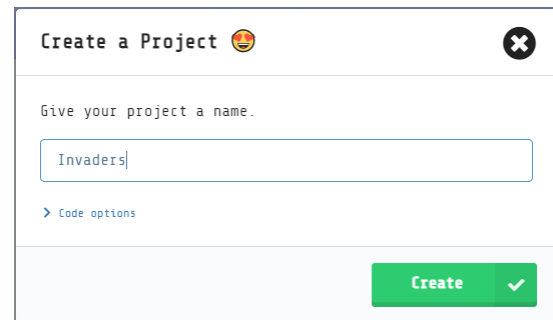
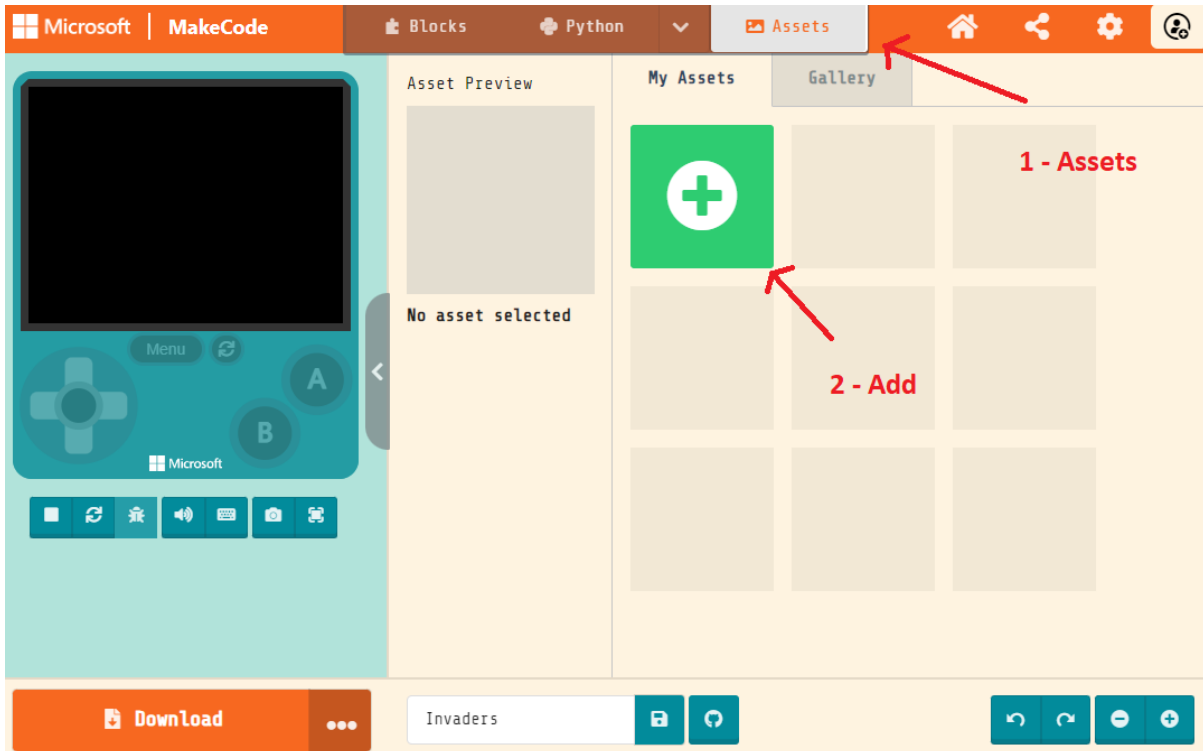From the top bar menu, click the down arrow and select Python.

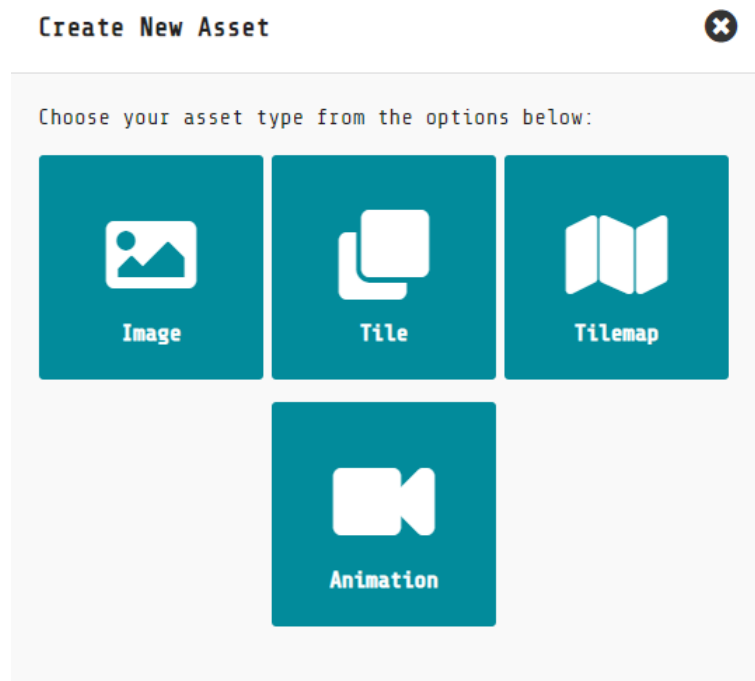You should be presented with an editor that looks like this.

Invaders - Python – Microsoft Arcade

Step 2 – Create the tank sprite

From the top bar menu, select "Assets" and then click the "Add" button:

From the "Create New Asset" dialogue, select "Image".

Invaders - Python – Microsoft Arcade

Change the sprites size to 16 x 8, name to tank, draw the tank and click done. The image below is an example inspired by the original game but you can use your own imagination to draw your tank.
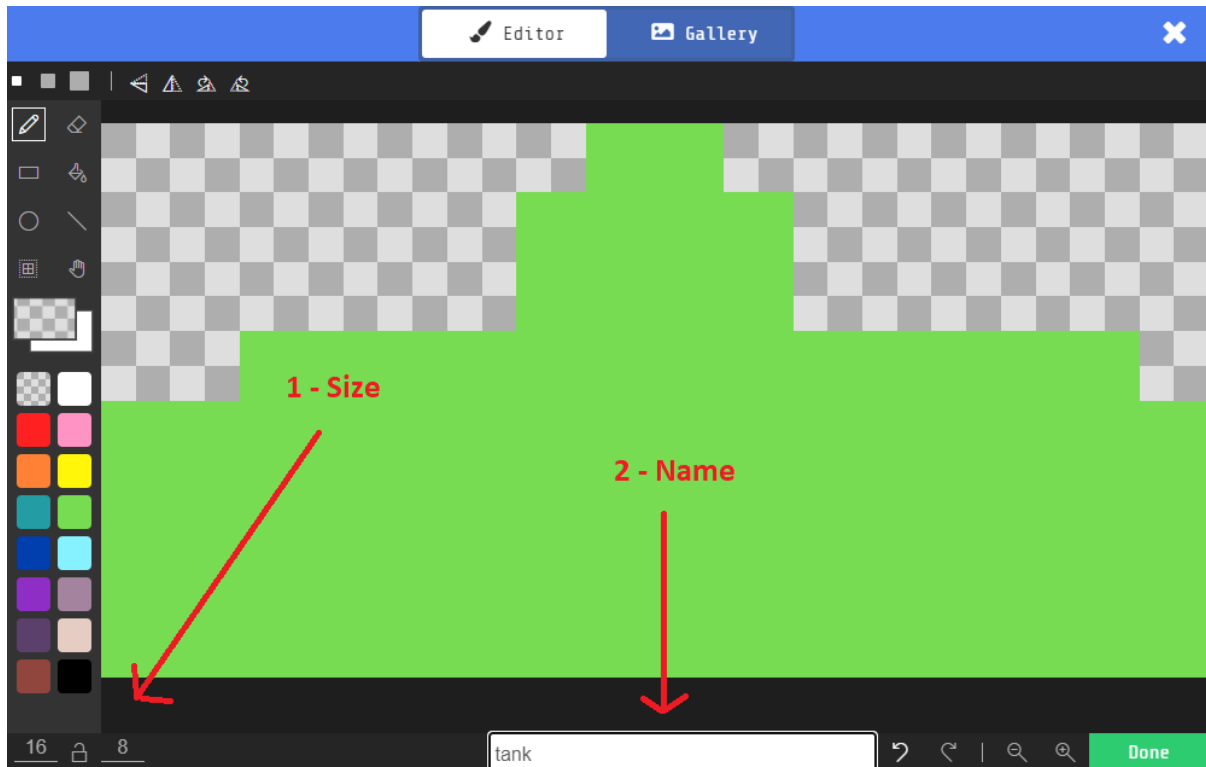
Switch back to Python using the top bar menu and enter the following code which will create a tank sprite and allow it to be moved left and right with the controller.

```python
tank = sprites.create(assets.image("tank"), SpriteKind.player)
tank.set_position(80, 115)
controller.move_sprite(tank, 100, 0)
```

Test out your code by pressing play on the simulator.

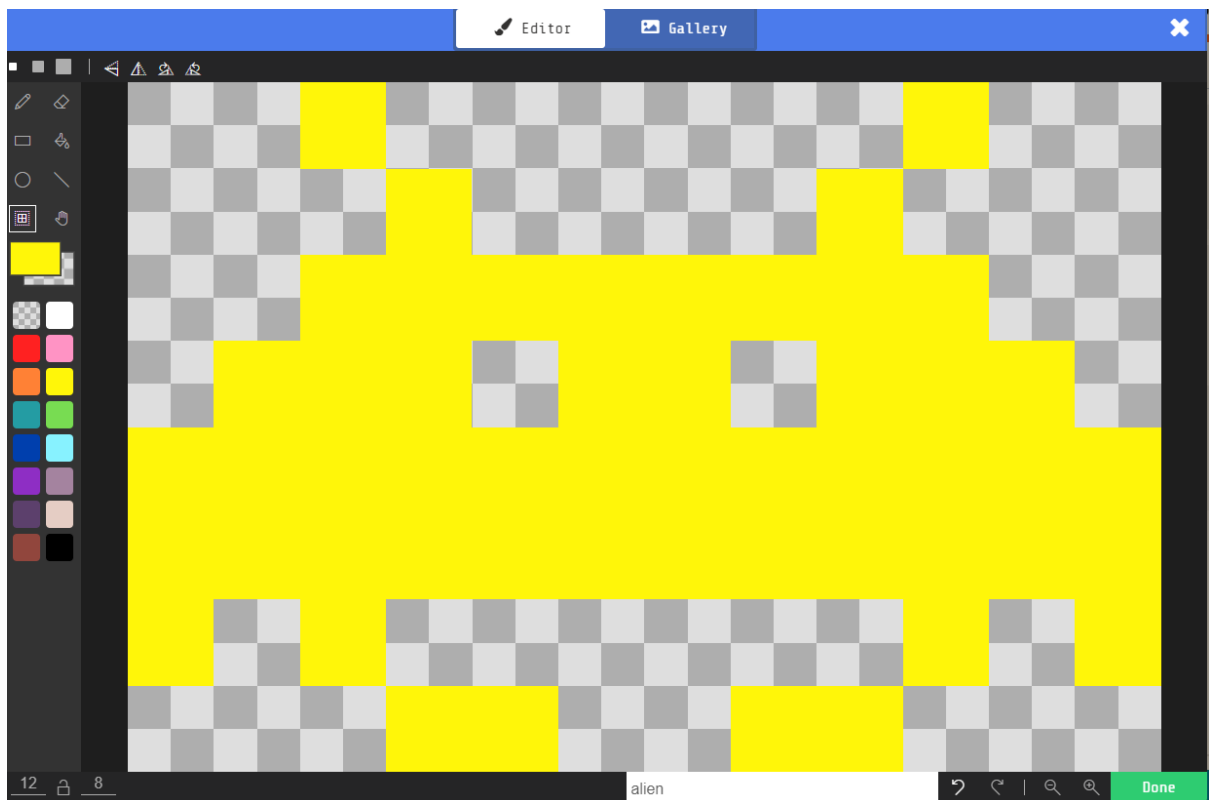# Invaders - Python – Microsoft Arcade

Step 3 – Create the alien sprites

In the same way that you did for the tank, create a 12 x 8 sprite with the name alien. You can draw the alien in any style or colour that you like, the image below is just an example.

Switch back to Python using the top bar menu and enter the following code which creates defines a function which creates 4 rows of 8 aliens and calls it:

```python
def createAliens():
    for y in range(4):
        for x in range(8):
            alien = sprites.create(assets.image("alien"), SpriteKind.enemy)
            alien.set_position((x * (12 + 4)) + 24, (y * (8 + 6) + 20))


createAliens()
```


This code uses two loops to create the rows and columns of aliens with the x and y co-ordinates being used to set the position of the centre of the sprite.
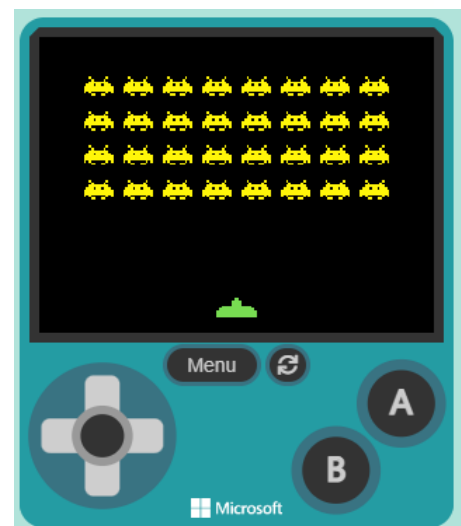
Invaders - Python – Microsoft Arcade

Step 4 – Shooting the aliens
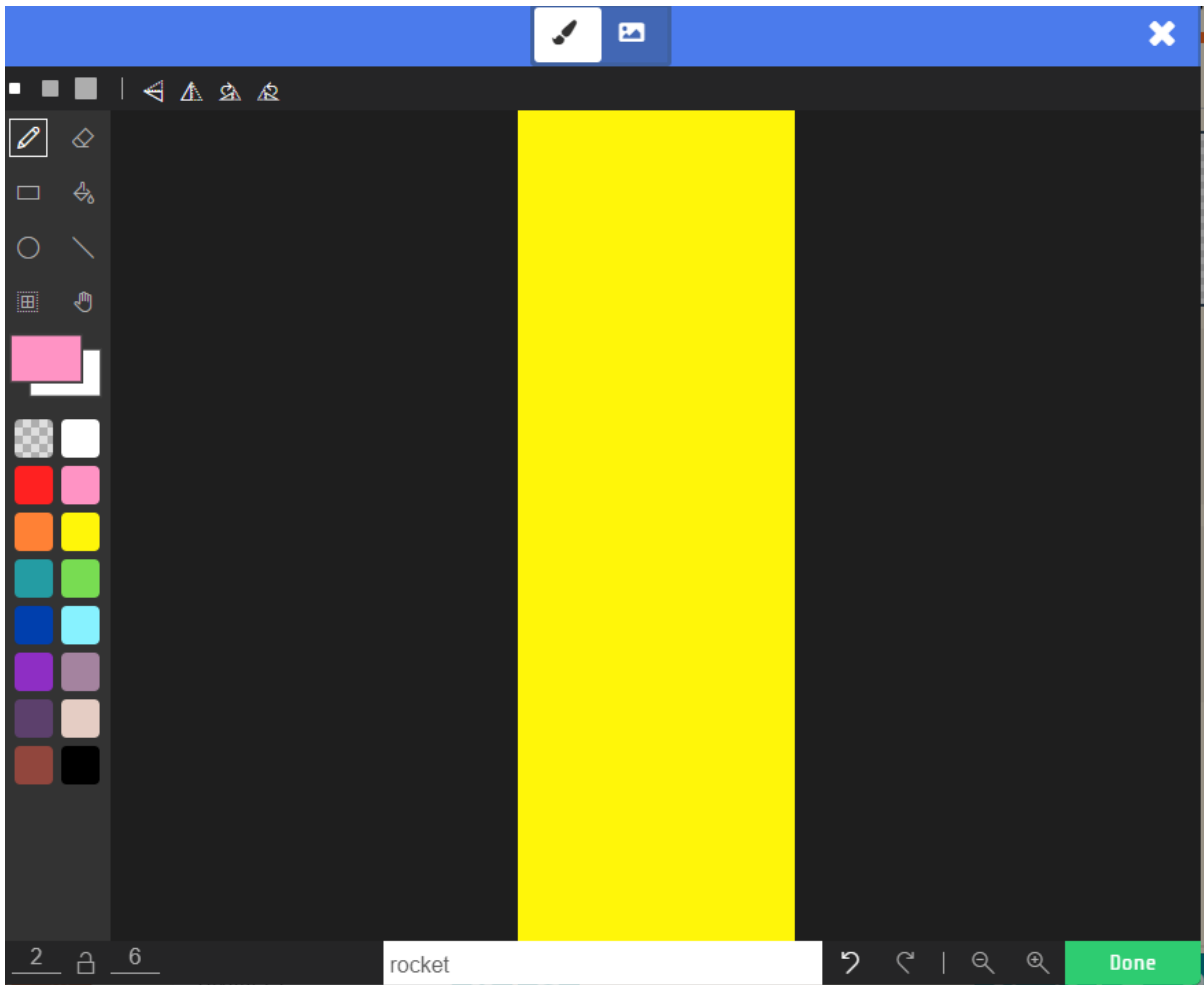
Create a 2 x 6 sprite called rocket which will be used to show your tanks rockets.

Enter the following code which allows the player to shoot a rocket if none are on the screen.

```
rocketImg = assets.image("rocket")

def shoot():
    if len(sprites.all_of_kind(SpriteKind.projectile)) == 0:
        rocket = sprites.create(rocketImg, SpriteKind.projectile)
        rocket.set_flag(SpriteFlag.AUTO_DESTROY, True)
        rocket.x = tank.x
        rocket.y = tank.y - 4
        rocket.set_velocity(0, -100)

controller.player1.on_button_event(ControllerButton.A, ControllerButtonEvent.PRESSE
D, shoot)
```

Try out your game so far. You should be able to move the tank left, move right, and shoot rockets at the stationary aliens, though the rockets just fly through them. Put the game into full screen mode.

Invaders - Python – Microsoft Arcade

Step 5 – Shooting the aliens

Now it's time to shoot the aliens. Add the following code to your game.

```python
info.set_score(0)

def hitAlien(alien, rocket):
    alien.start_effect(effects.spray, 250)
    alien.destroy()
    rocket.destroy()
    info.change_score_by(1)

sprites.on_overlap(SpriteKind.enemy, SpriteKind.projectile, hitAlien)
```

This sets the score at the start of the game to zero, creates a method to handle the alien and rocket overlapping and then destroys both sprites.
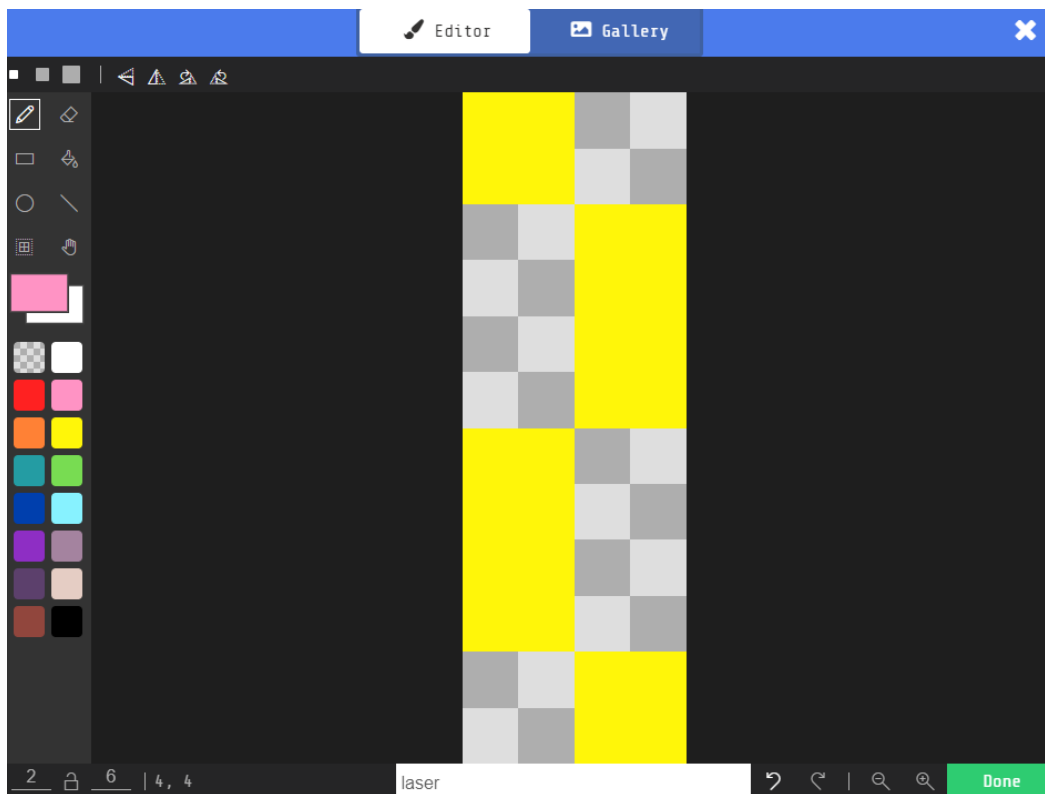
Try playing your game.

Invaders - Python – Microsoft Arcade

Step 6 – The aliens shoot back

Create a 2 x 6 sprite called laser which will be used to show your aliens lasers.

Enter the following code which allows the aliens to shoot a laser if none are on the screen.

```python
laserKind = SpriteKind.create()
laserImg = assets.image("laser")

def aliensShoot():
    if len(sprites.all_of_kind(SpriteKind.enemy)) <= 0:
        return

    index = randint(0, len(sprites.all_of_kind(SpriteKind.enemy)) - 1)
    shooter = sprites.all_of_kind(SpriteKind.enemy)[index]

    for alien2 in sprites.all_of_kind(SpriteKind.enemy):
        if alien2.x == shooter.x:
            if alien2.y > shooter.y:
                shooter = alien2

    laser = sprites.create(laserImg, laserKind)
    laser.set_flag(SpriteFlag.AUTO_DESTROY, True)
    laser.x = shooter.x
    laser.y = shooter.y + 8
    laser.set_velocity(0, 100)
```

```python
lastShoot = 0

def updateAliens():
    global lastShoot
    if game.runtime() - lastShoot > 1000:
        lastShoot = game.runtime()
        aliensShoot()

game.on_update(updateAliens)

def hitPlayer(player, laser):
    player.start_effect(effects.spray, 250)
    laser.destroy()
    info.change_life_by(-1)

sprites.on_overlap(SpriteKind.player, laserKind, hitPlayer)

def hitLaser(rocket, laser):
    rocket.start_effect(effects.spray, 250)
    rocket.destroy()
    laser.destroy()

sprites.on_overlap(SpriteKind.projectile, laserKind, hitLaser)
info.set_life(3)
```

The aliens should now be able to shoot back. If the tank is hit by a laser a life is lost.

The tanks rockets will destroy a laser when they collide.

Invaders - Python – Microsoft Arcade

Step 7 – Moving the aliens

Add the following code to allow the aliens to do their characteristic move from left to right. We also want the aliens to move faster each time one gets destroyed but the aliens will shoot back at the same speed.

```python
direction = 1
dropped = False

def aliensMove():
    global direction
    mostLeft = 160
    mostRight = 0

    for alien2 in sprites.all_of_kind(SpriteKind.enemy):
        if alien2.left < mostLeft:
            mostLeft = alien2.left
        if alien2.right > mostRight:
            mostRight = alien2.right

    if mostLeft <= 4:
        if direction != 1:
            direction = 1
            drop()
            return

    if mostRight >= 156:
        if direction != -1:
            direction = -1
            drop()
            return

    for alien in sprites.all_of_kind(SpriteKind.enemy):
        alien.x = alien.x + (4 * direction)

def drop():
    global dropped
    dropped = True
    for alien in sprites.all_of_kind(SpriteKind.enemy):
            alien.y = alien.y + 4
```

Invaders - Python – Microsoft Arcade

To make this work, the aliensMove() function needs to be added to the updateAliens() function:

```python
lastMove = 0
moveInterval = 1000


def updateAliens():
    global lastShoot
    if game.runtime() - lastShoot > 1000:
        lasShoot = game.runtime()
        aliensShoot()

    global lastMove
    if game.runtime() - lastMove > moveInterval:
        lastMove = game.runtime()
        aliensMove()
```

Then add this code to the end of the hitAlien() function:

```python
global interval
moveInterval -= 25
```

Experiment with using different values for changing the moveInterval.

Step 8 – A new wave

If you manage to shoot all of the aliens, the game keeps playing. What really needs to happen is that the player is given a new life and a new wave of aliens appears. Add this code to the end of the hitAlien() method.

```python
if len(sprites.all_of_kind(SpriteKind.enemy)) <= 0:

    createAliens()

    info.change_life_by(1)
```

Step 9 – Aliens land

If any of the aliens manage to touch the ground then the game is over. This can be achieved

```python
def checkLanding():
    for alien in sprites.all_of_kind(SpriteKind.enemy):
        if alien.y >= 115:
            game.over(False)
```

Invaders - Python – Microsoft Arcade

Step 10 – Challenges

Use all that you have learned to complete the following challenges

1. Add a background image to your game.
2. Animate the aliens.
3. Add sound for the aliens moving and explosions.
4. Add a mothership every 5 seconds which scores 25 points if shot.

Help for solution

```python
global frame
frame *= -1
alienImg = assets.image("alien")
if frame == -1:
    alienImg = assets.image("alien2")


for alien3 in sprites.all_of_kind(SpriteKind.enemy):
    alien3.set_image(alienImg)
    music.ba_ding.play()
```