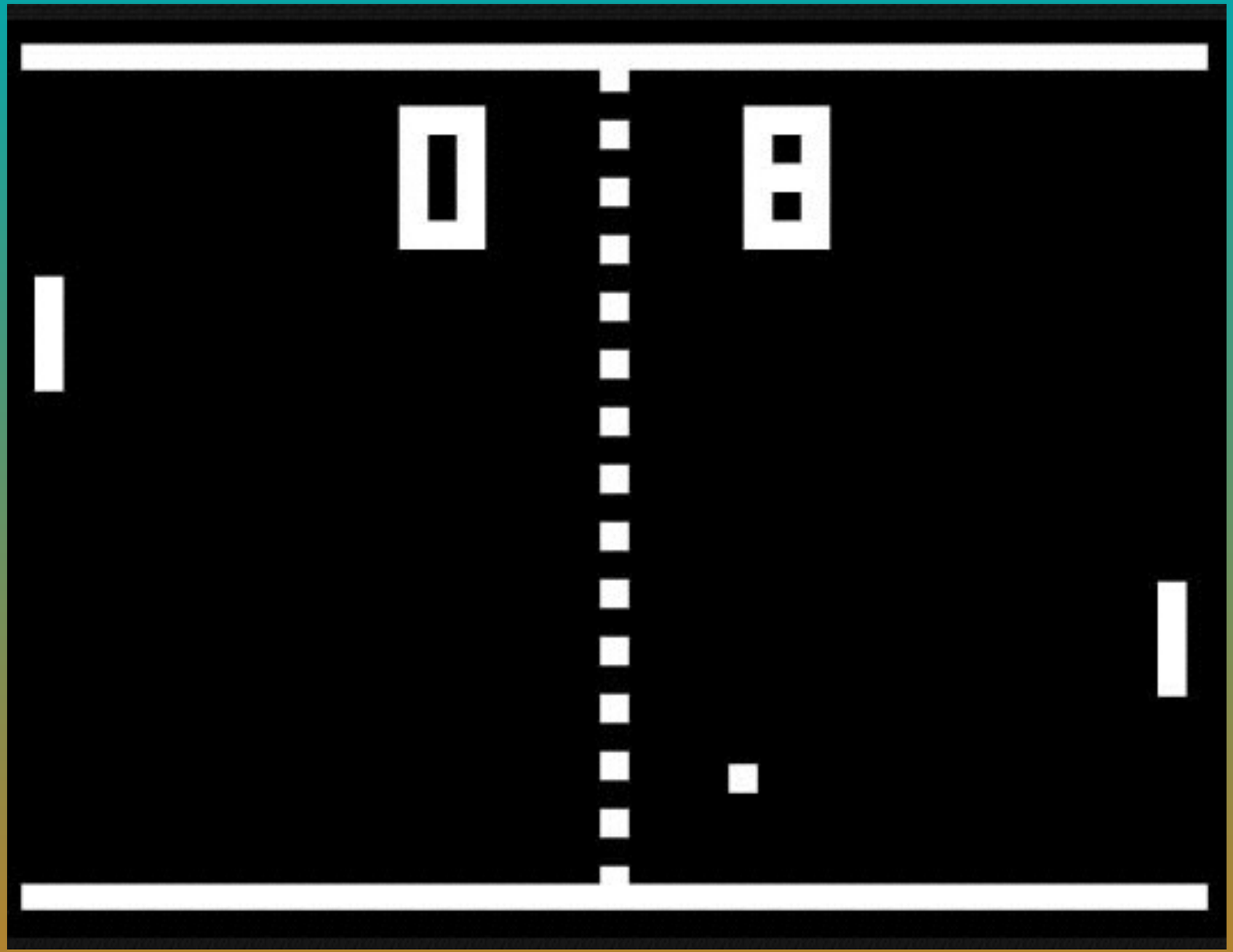
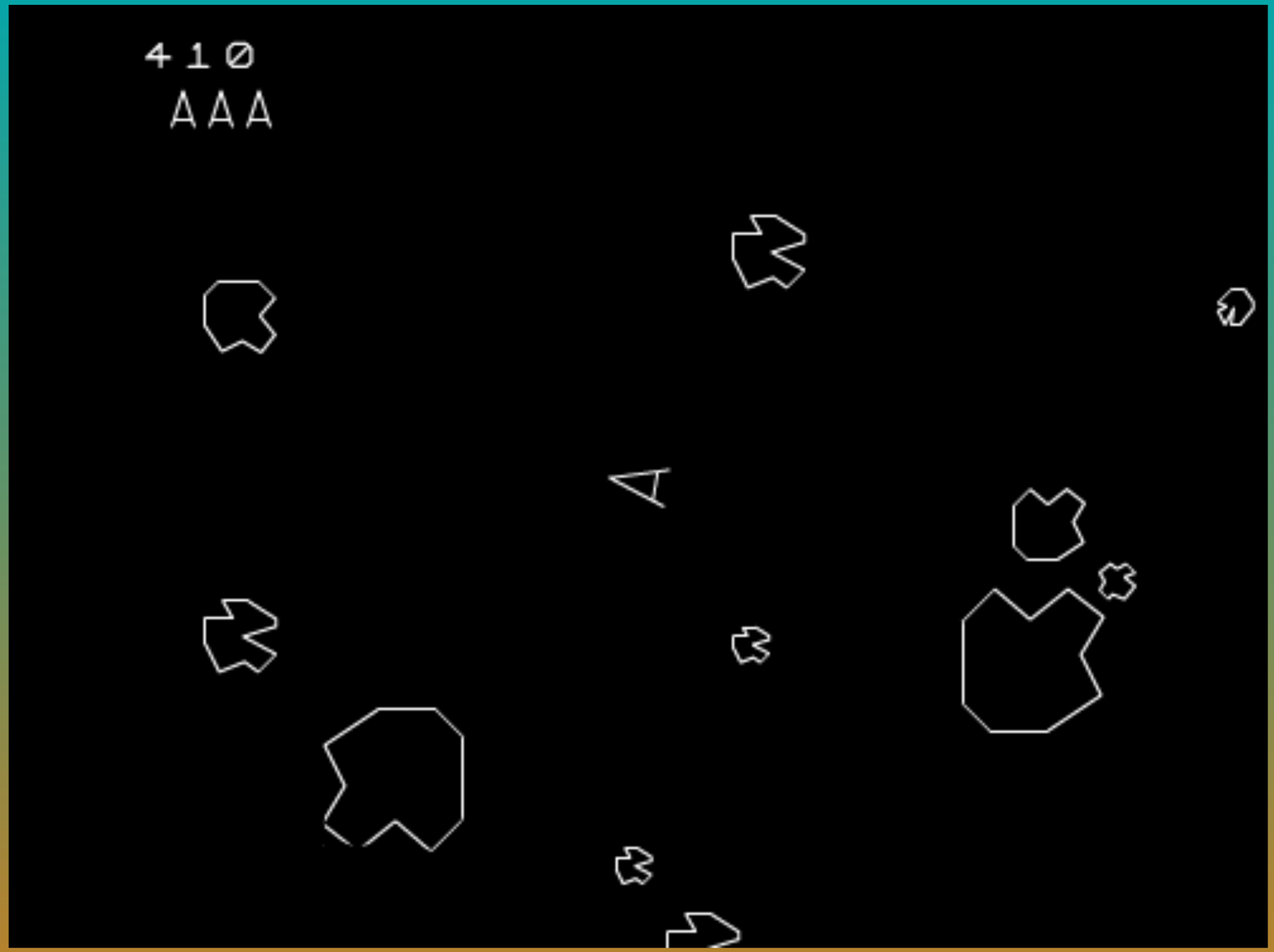
Basic gameplay programming.


PONG
PLAYER 1
PLAYER 2




ASTEROIDS


410
AAA

Movement.

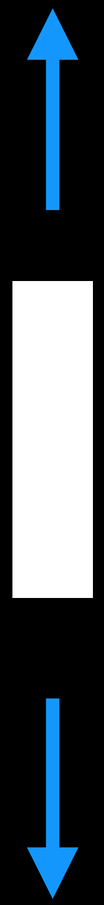
```
float lastFrameTicks = 0.0f;
```

During our loop:

```
float ticks = (float)SDL_GetTicks()/1000.0f;
float elapsed = ticks - lastFrameTicks;
lastFrameTicks = ticks;
```

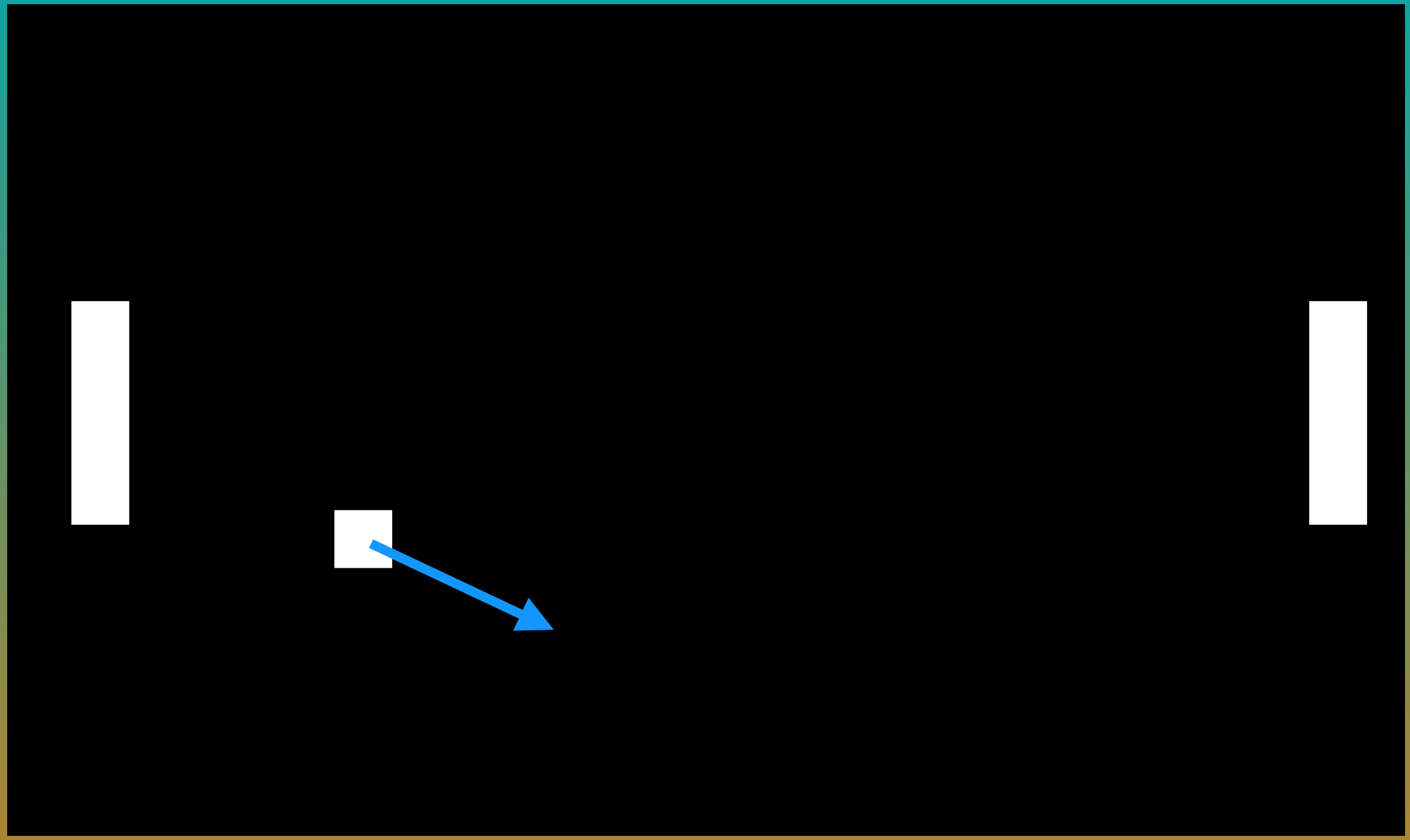
“elapsed” is how many seconds elapsed since last frame.
We will use this value to move everything in our game.

Linear motion.

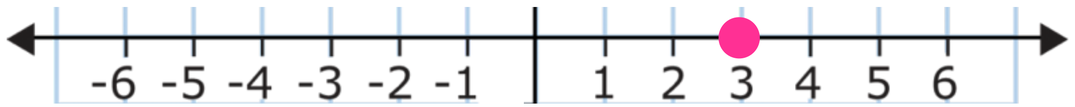


y_position += elapsed_seconds *
distance_to_travel_in_one_second

Directional motion.



Vectors



A vector is like a number..
but it has a magnitude and a direction!

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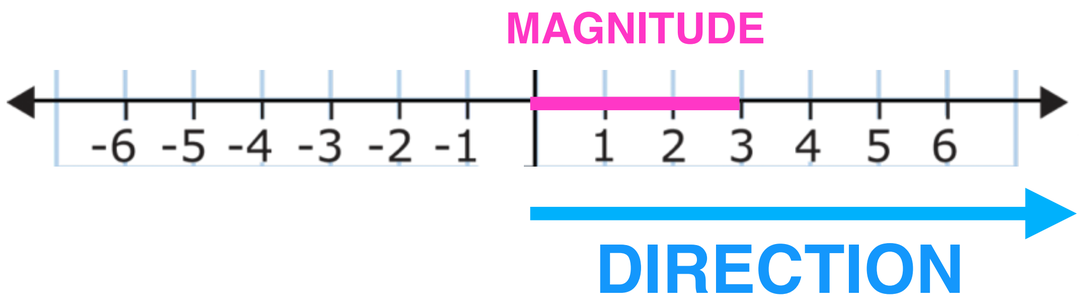
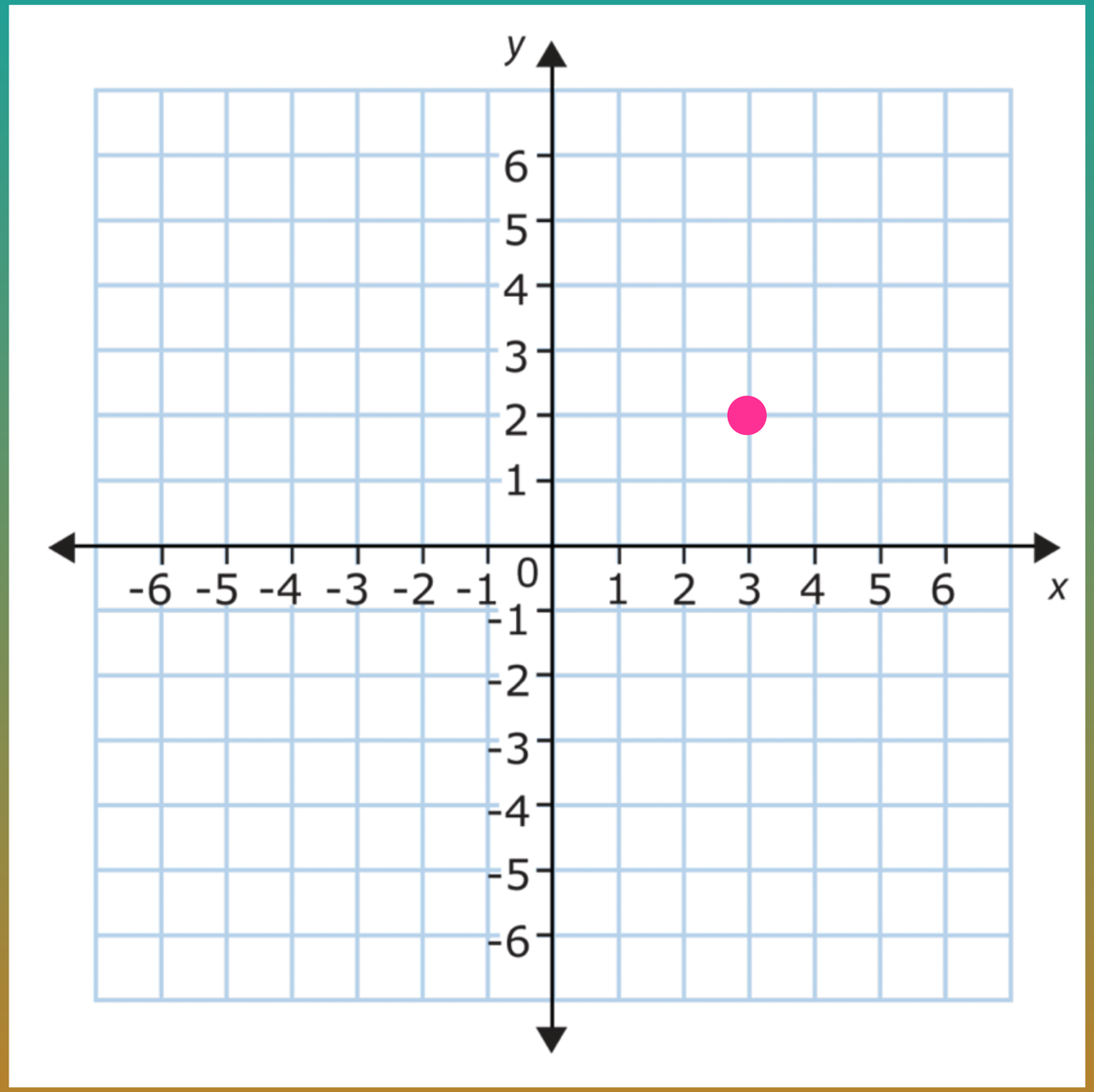
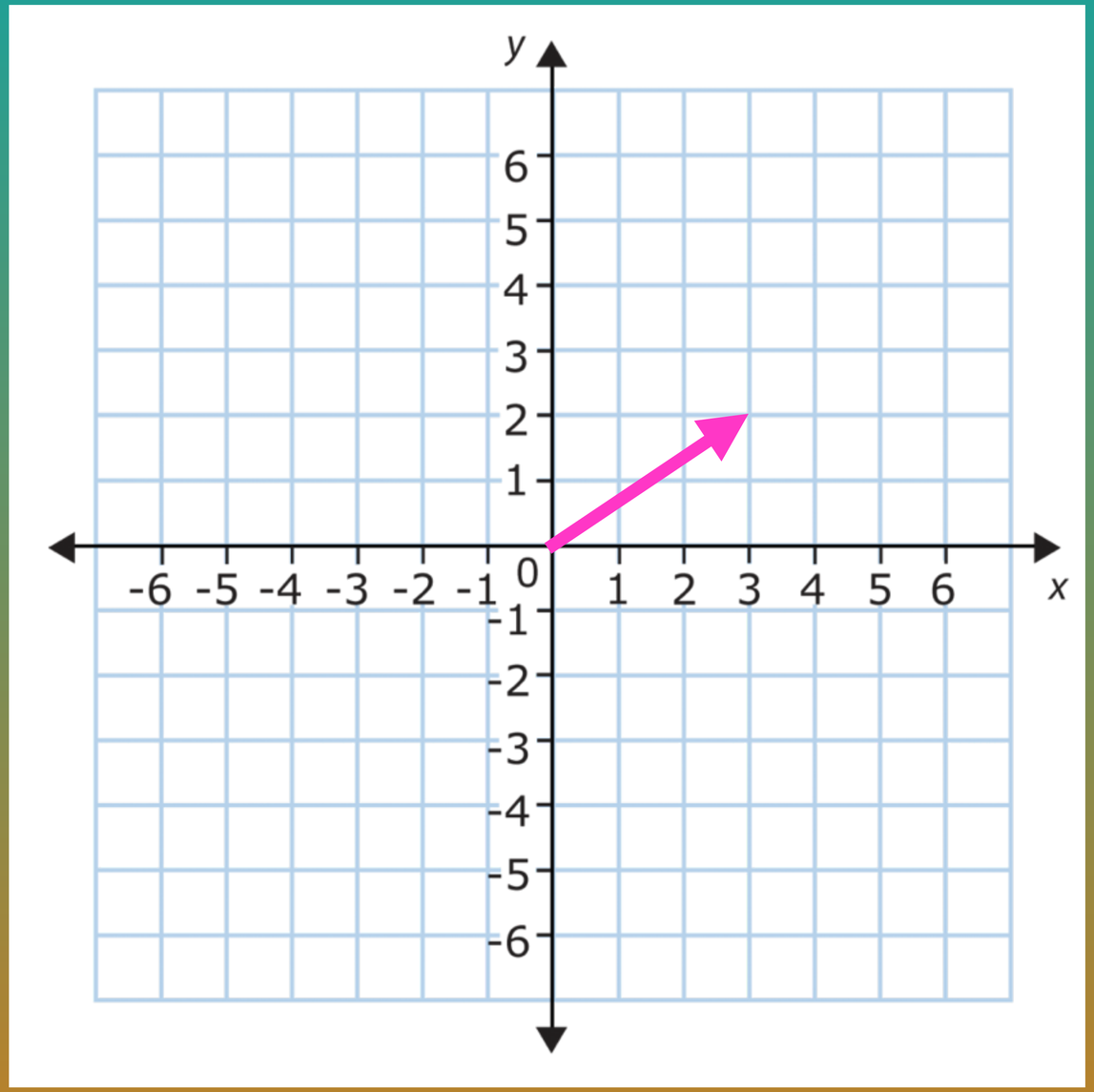


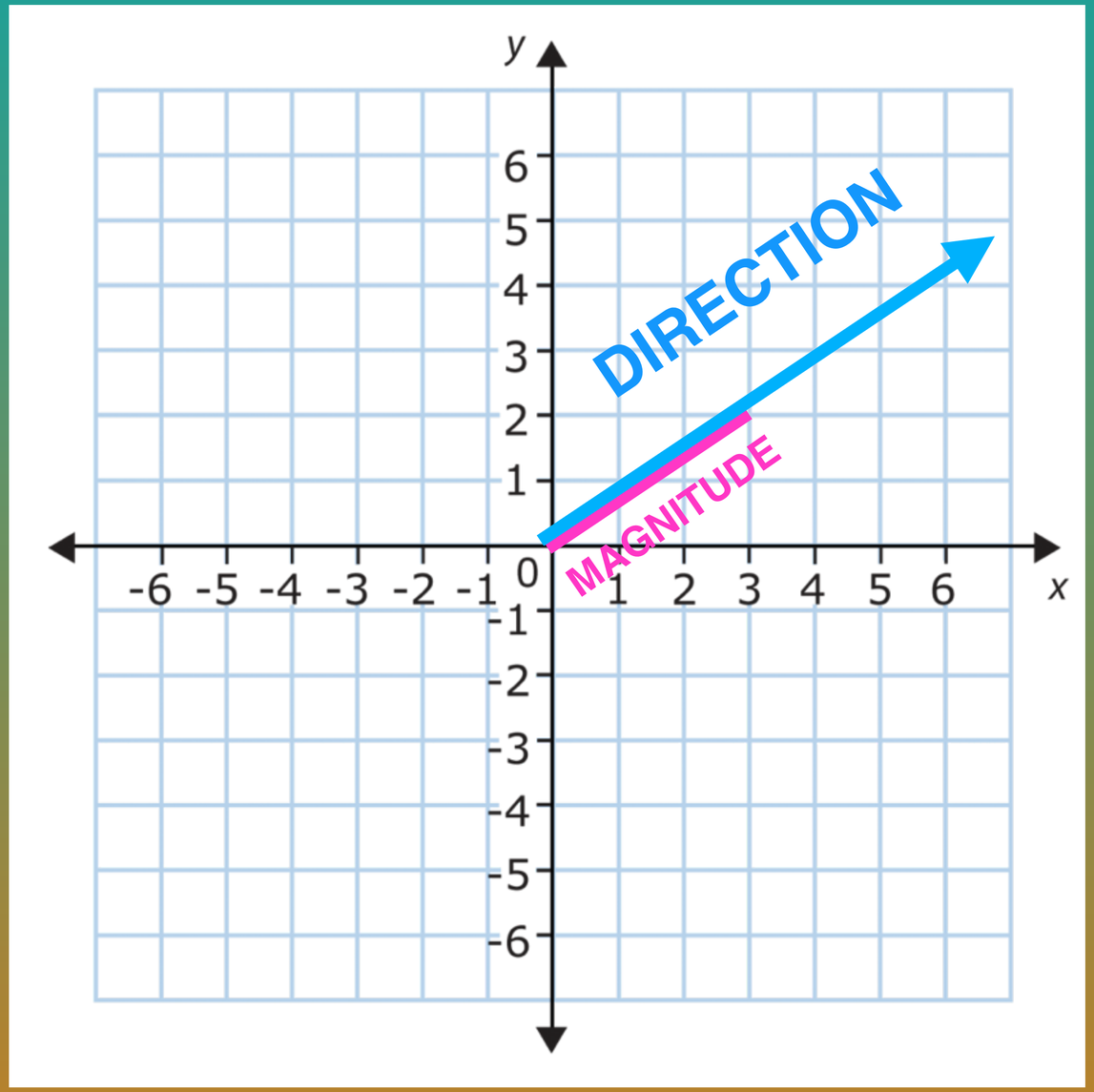
A vector is like a number..
but it has a magnitude and a direction!



A 2D vector is like a 2D coordinate, but has a magnitude and a direction.



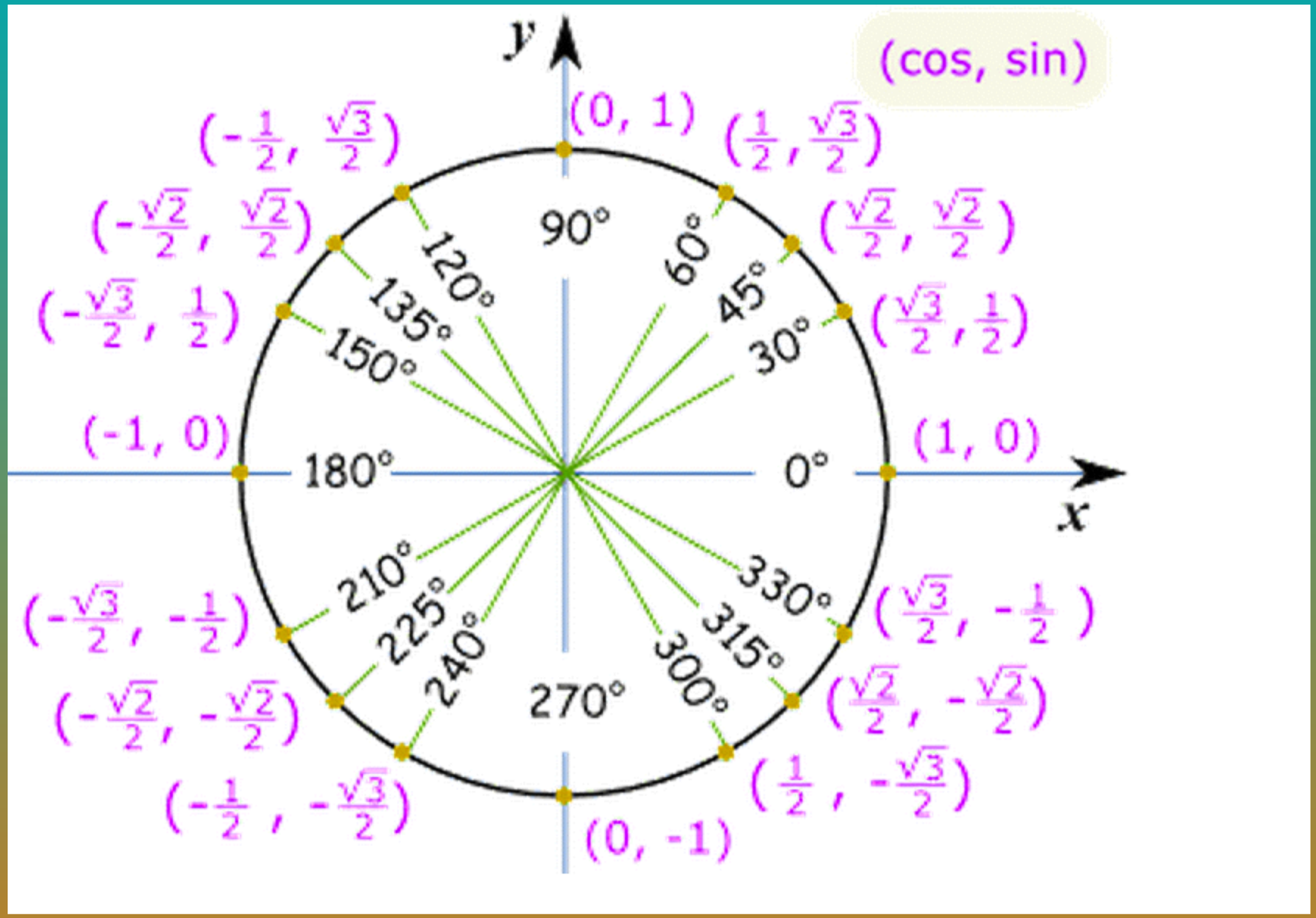
A 2D vector is like a 2D coordinate, but has a magnitude and a direction.

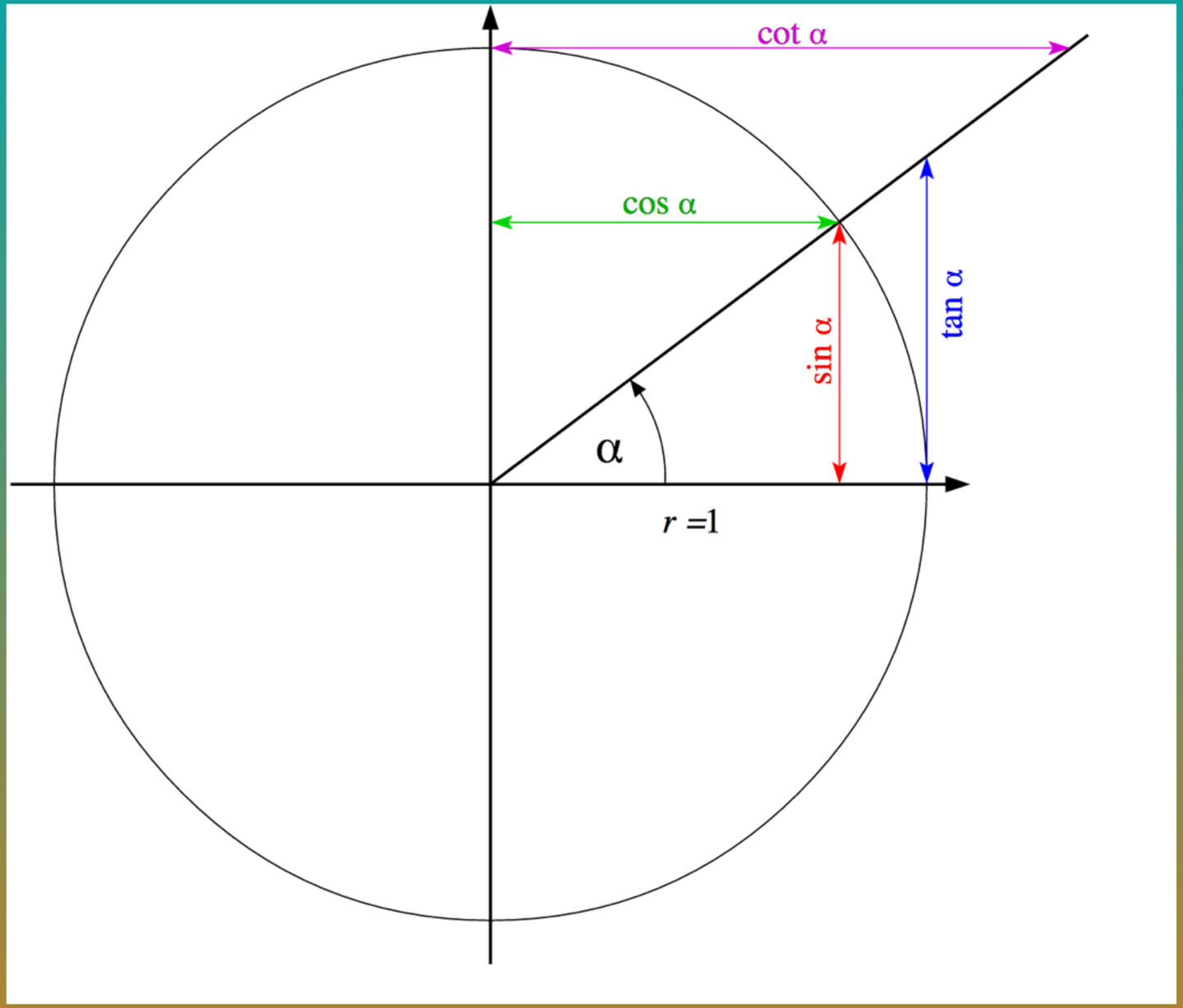


A 2D vector is like a 2D coordinate, but has a magnitude and a direction.

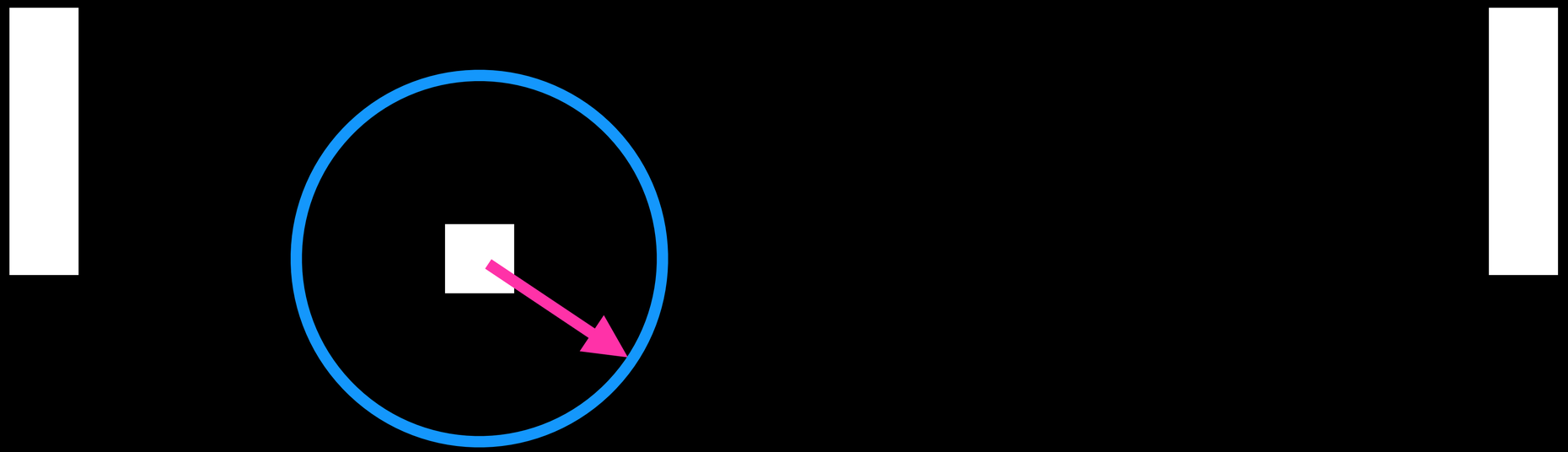
2D direction??

Unit vector!

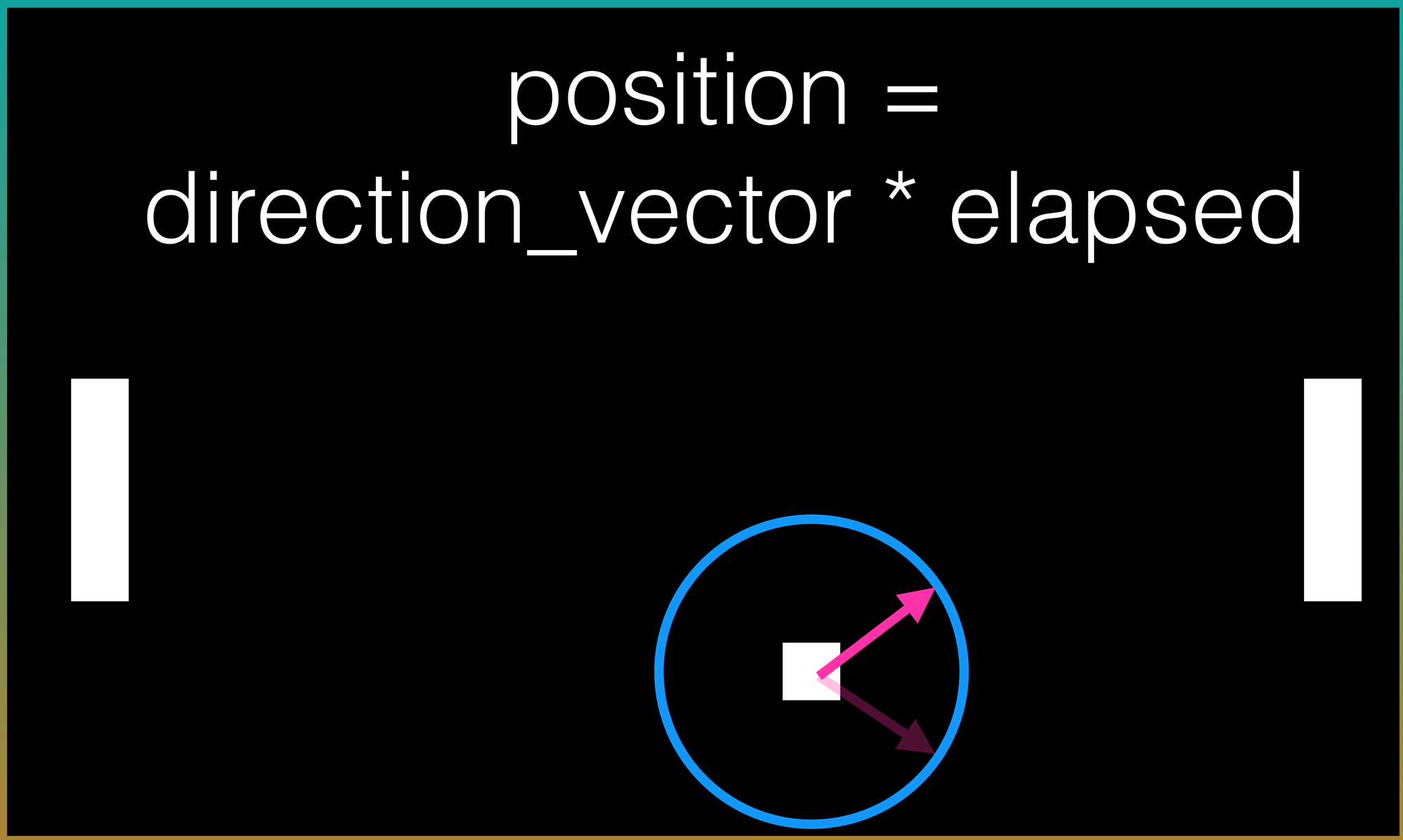

(cos, sin)
y
x
(0, 1)
$(\frac{1}{2}, \frac{\sqrt{3}}{2})$
$(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
$(\frac{\sqrt{3}}{2}, \frac{1}{2})$
(1, 0)
$(\frac{\sqrt{3}}{2}, -\frac{1}{2})$
$(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$
$(\frac{1}{2}, -\frac{\sqrt{3}}{2})$
(0, -1)
$(-\frac{1}{2}, -\frac{\sqrt{3}}{2})$
$(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$
$(-\frac{\sqrt{3}}{2}, -\frac{1}{2})$
(-1, 0)
$(-\frac{\sqrt{3}}{2}, \frac{1}{2})$
$(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
$(-\frac{1}{2}, \frac{\sqrt{3}}{2})$
90°
60°
45°
30°
0°
330°
315°
300°
270°
240°
225°
210°
180°
150°
135°
120°


cot α
cos α
sin α
tan α
α
r =1

position =
direction_vector * elapsed



position =
direction_vector * elapsed



Reading keyboard input.

Polling input vs. input events.

Polling input

Checking to see if a key is pressed.
Useful for continuous player actions, such as movement,
or checking modifier keys.

`Uint8 *SDL_GetKeyboardState(int *numkeys);`

Returns a pointer to an array of key states. A value of 1 means that the key is pressed and a value of 0 means that it is not. Indexes into this array are obtained by using SDL_Scancode values. The pointer returned is a pointer to an internal SDL array. It will be valid for the whole lifetime of the application and should not be freed by the caller. We can pass it a pointer to an int if we want to know the size of the array.

```
const Uint8 *keys = SDL_GetKeyboardState(NULL);

if(keys[SDL_SCANCODE_LEFT]) {
    // go left!
} else if(keys[SDL_SCANCODE_RIGHT]) {
    // go right!
}
```

SDL Scancodes:

Start with SDL_SCANCODE_

List here:
https://wiki.libsdl.org/SDL_Scancode

Input events.

Knowing exactly when the player pressed or released a key. Useful for action events like shooting or jumping.

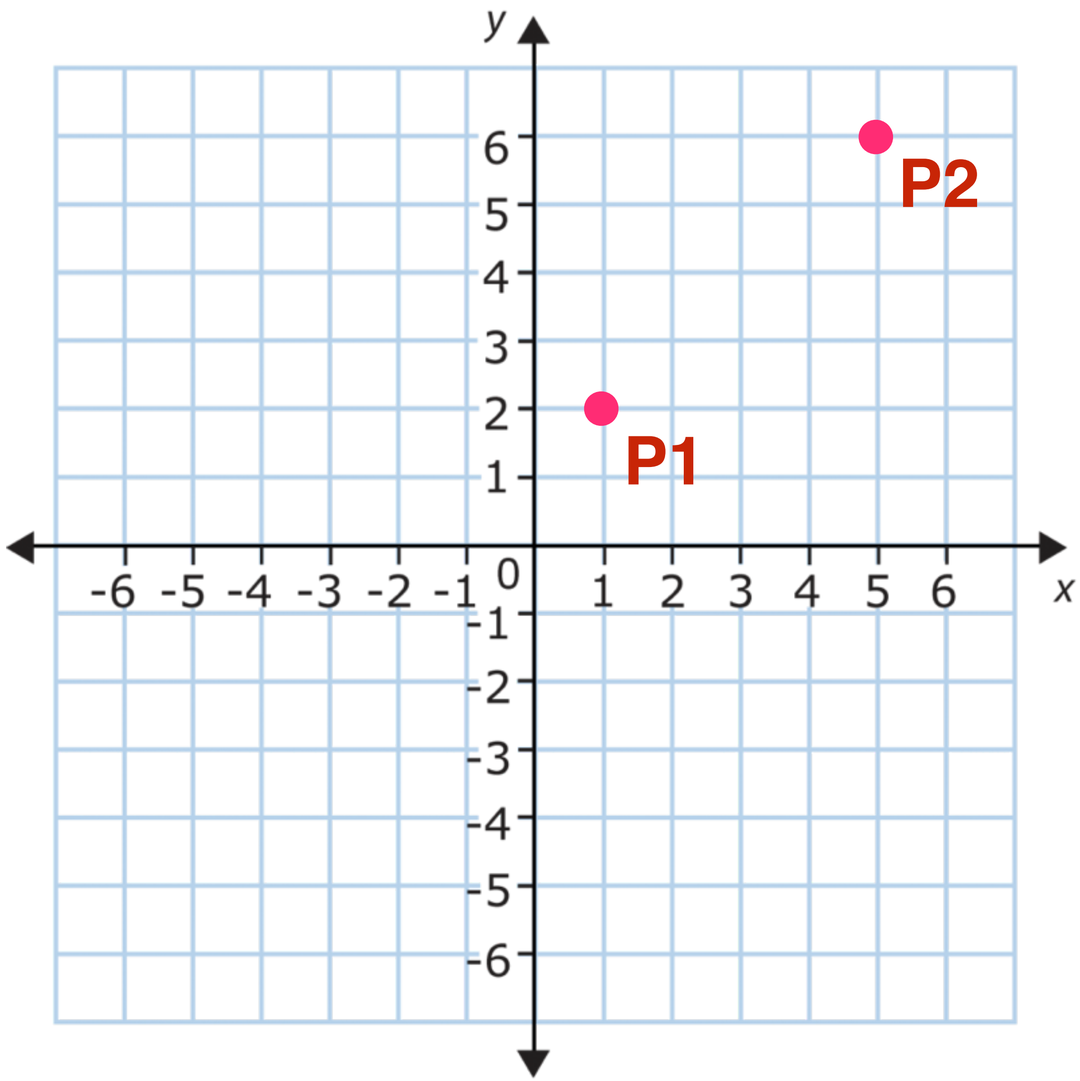
To read input events, we use our event loop to see if the event has a type of SDL_KEYDOWN or SDL_KEYUP. We can then check the key that was pressed or released by checking the “key” member of the SDL event structure.

```
while (SDL_PollEvent(&event)) {
    if (event.type == SDL_QUIT || event.type == SDL_WINDOWEVENT_CLOSE) {
        done = true;
    } else if(event.type == SDL_KEYDOWN) {
        if(event.key.keysym.scancode == SDL_SCANCODE_SPACE) {
            // DO AN ACTION WHEN SPACE IS PRESSED!
        }
    }
}
```

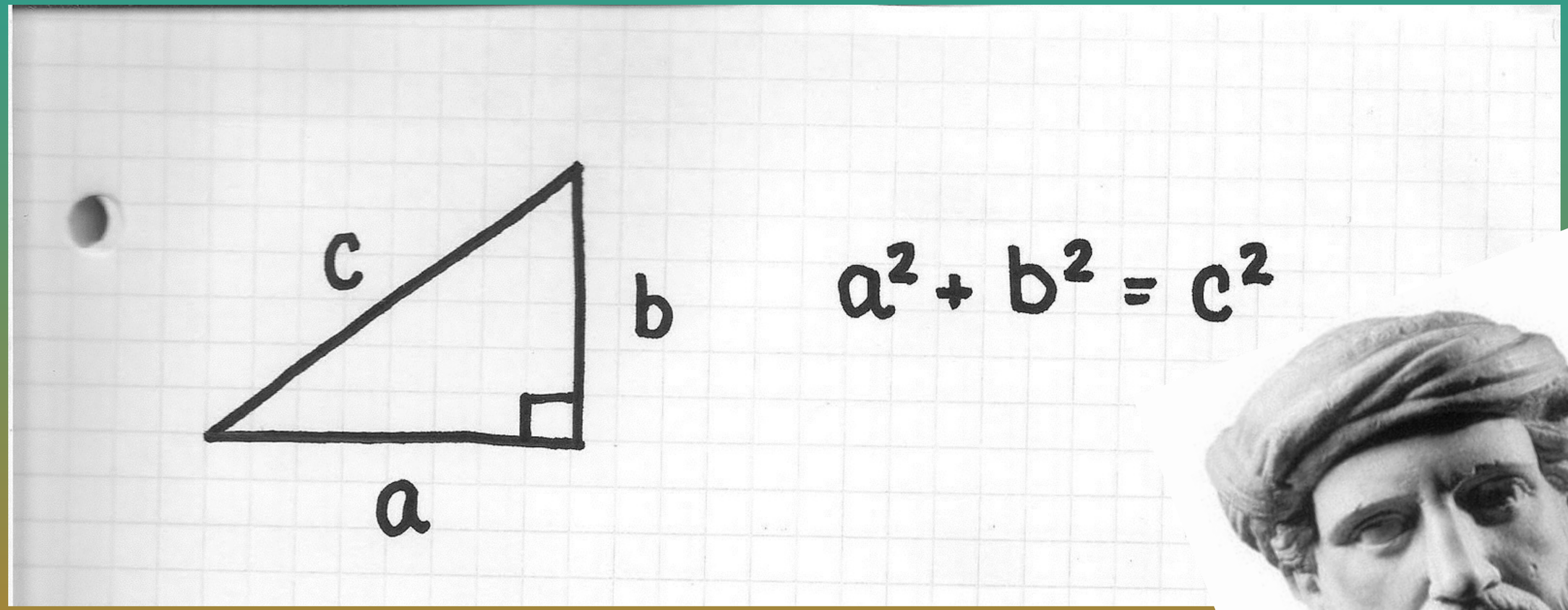
Collision detection.

Collision detection.

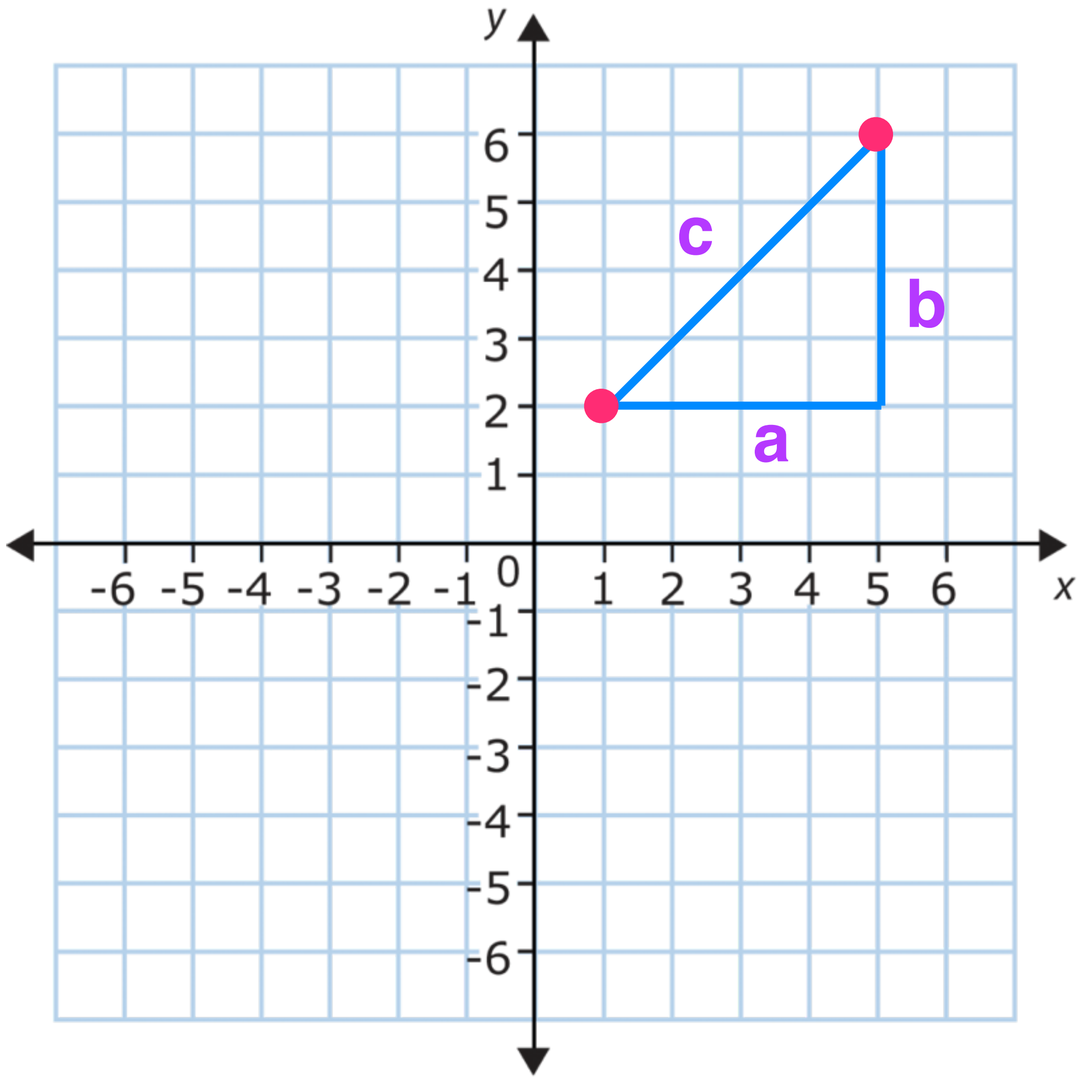
Circle-circle collision detection.

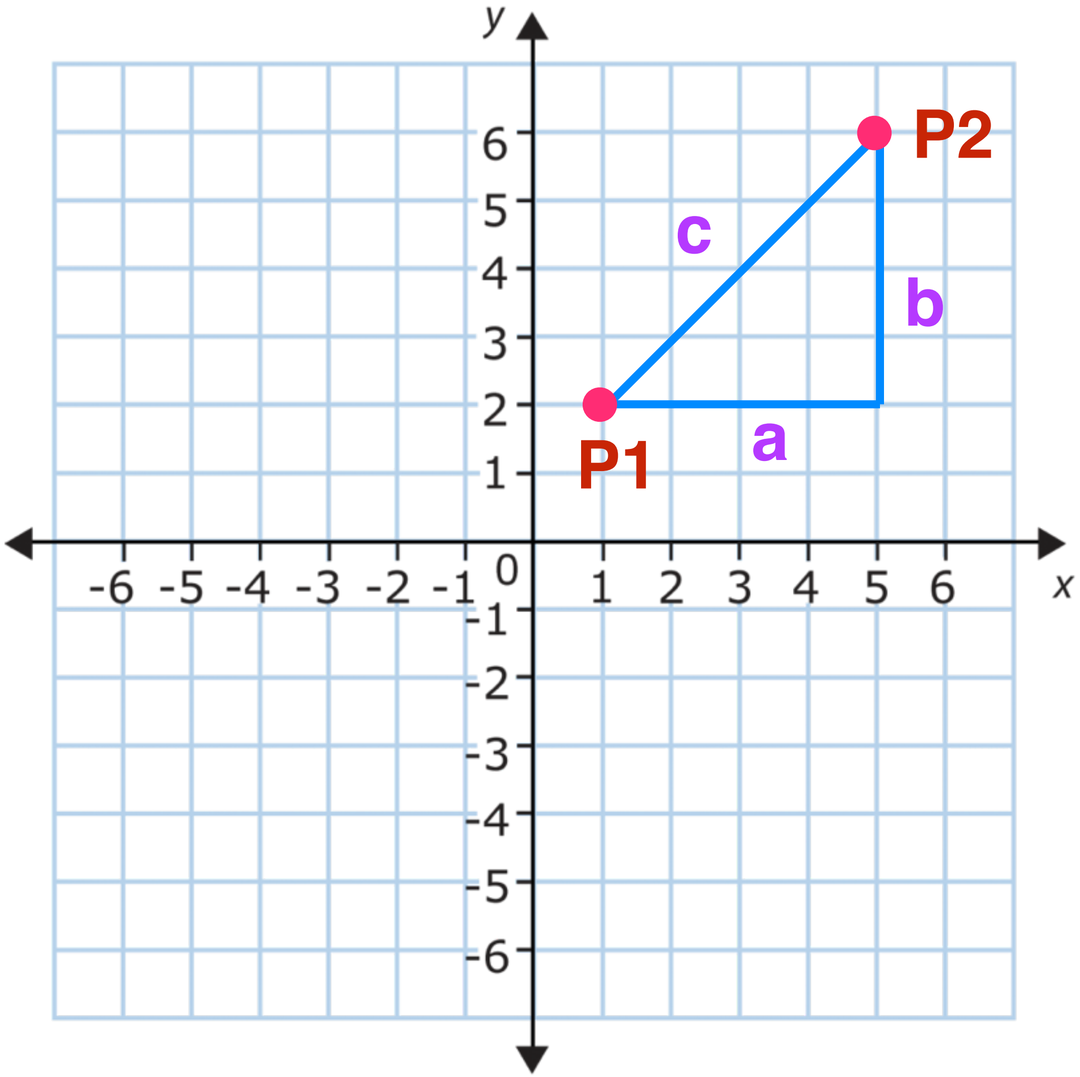

y
x
P1
P2
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6
6 5 4 3 2 1 -1 -2 -3 -4 -5 -6

Pythagorean theorem



Distance between 2 points.





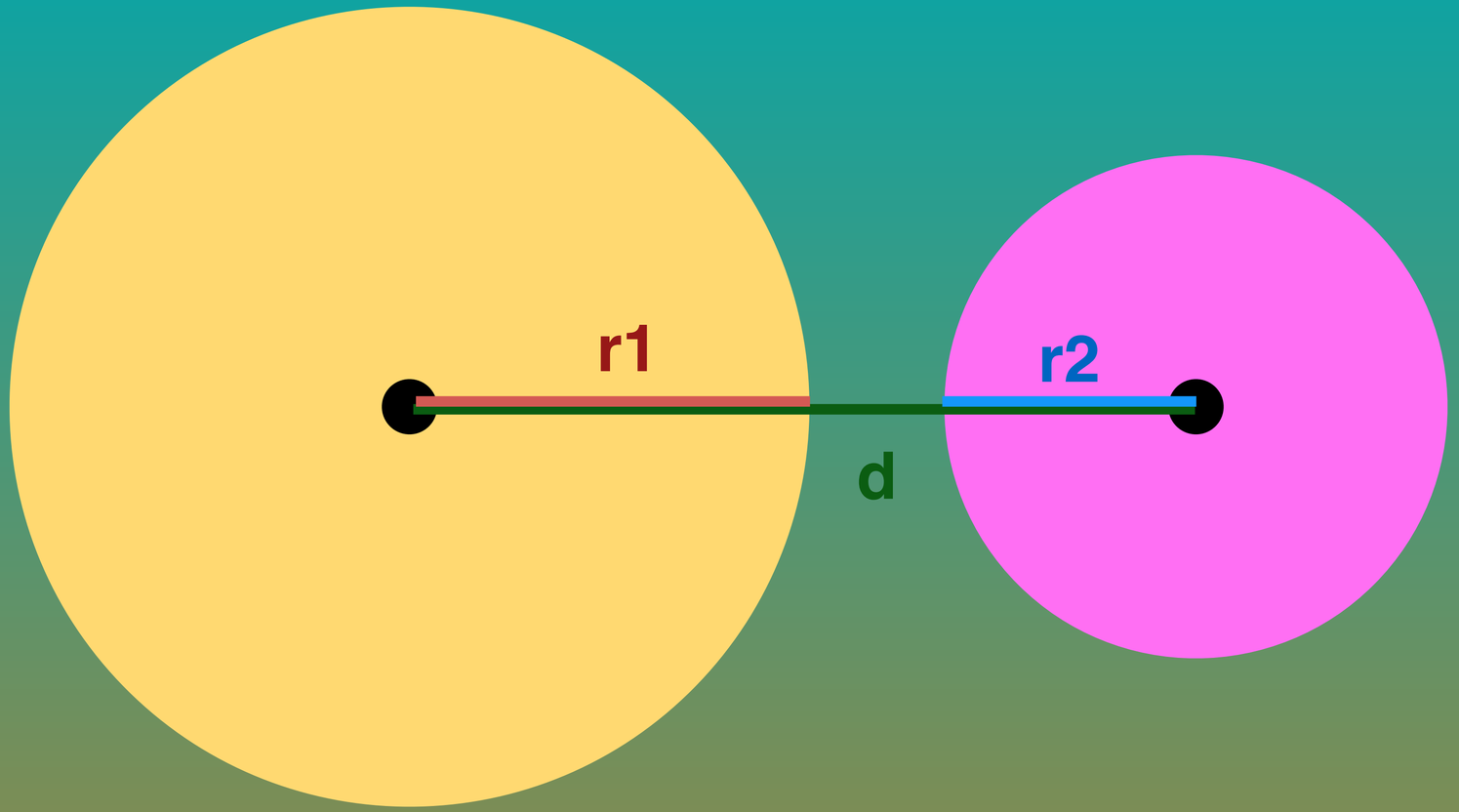
$$a = x_2 - x_1$$

$$b = y_2 - y_1$$

$$c^2 = a^2 - b^2$$

$$c = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

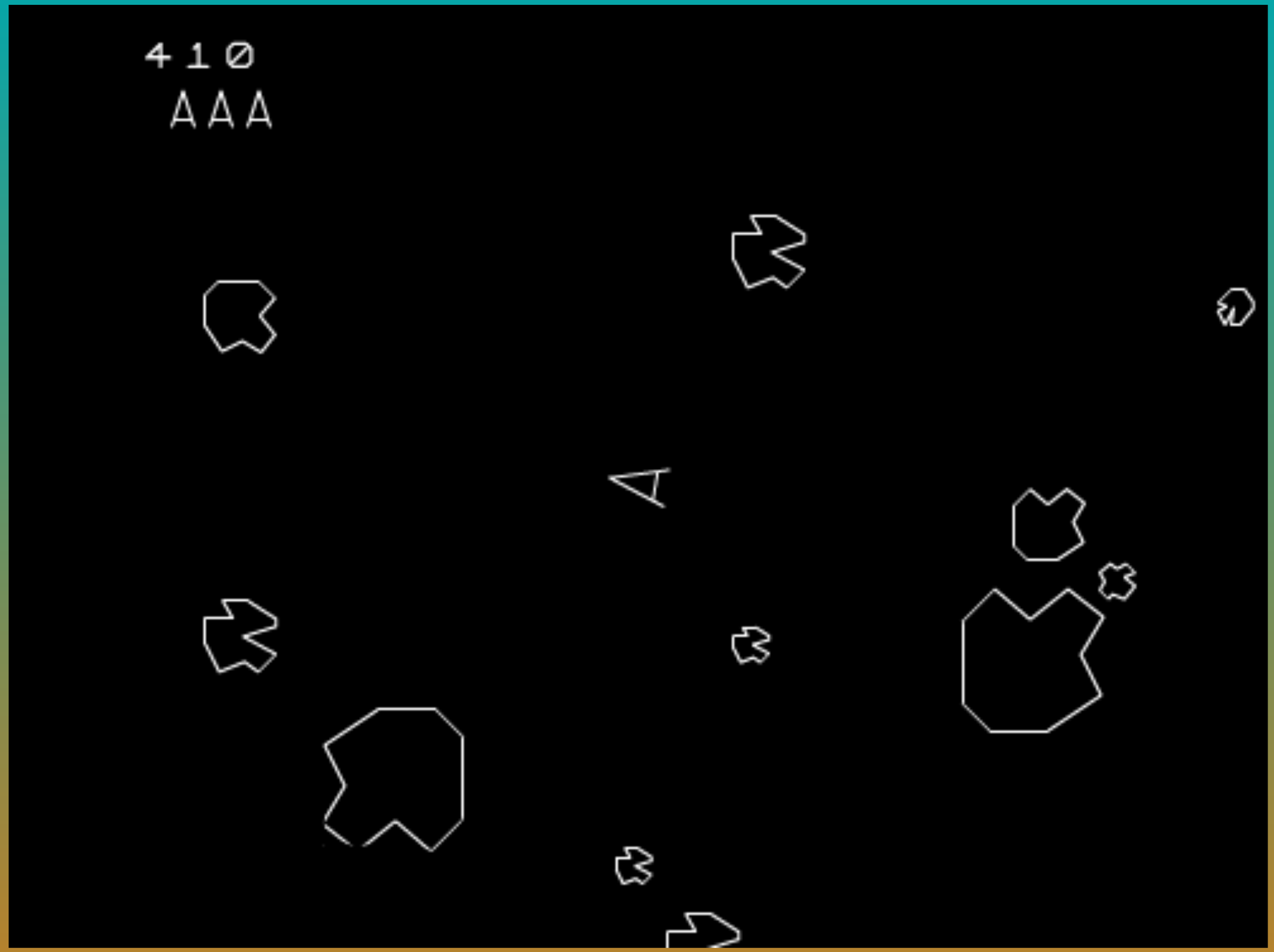
Circle-circle collision detection.

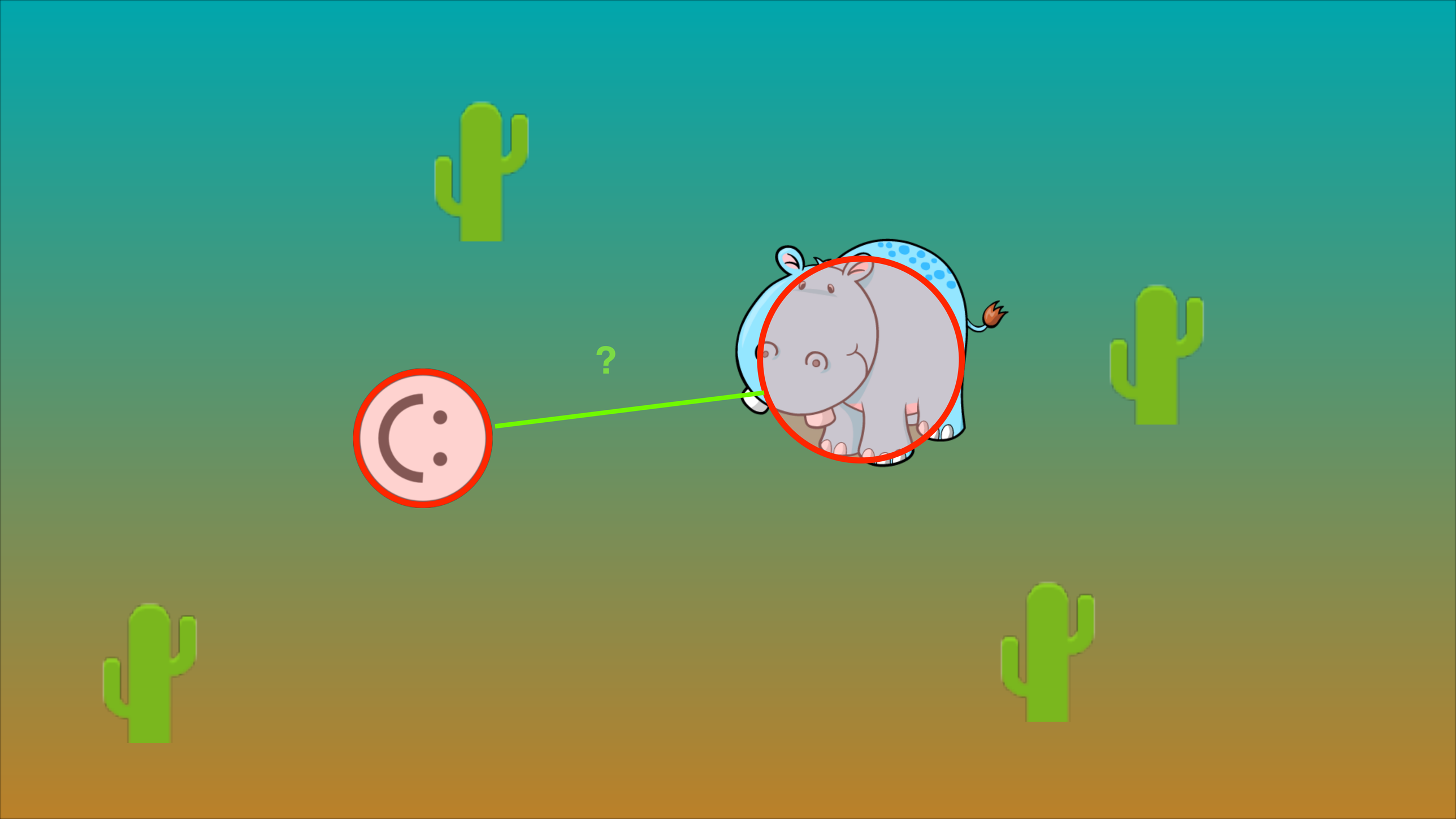


If the distance between two circles is less than
or equal to the sum of their radii, the circles are colliding!


TIME: 00:15
SCORE: 500
PLAYER: 1

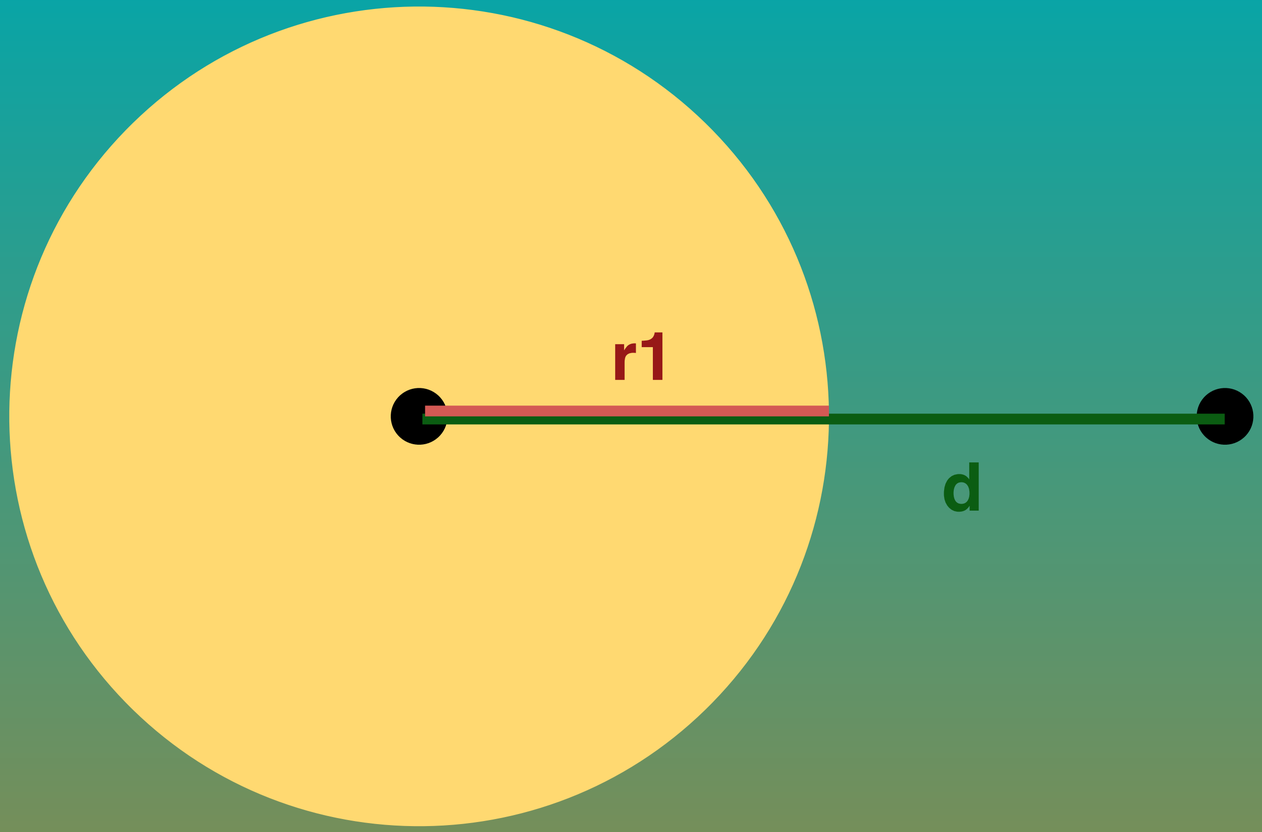

29
26
55
0
0
0
Polygon


410
AAA



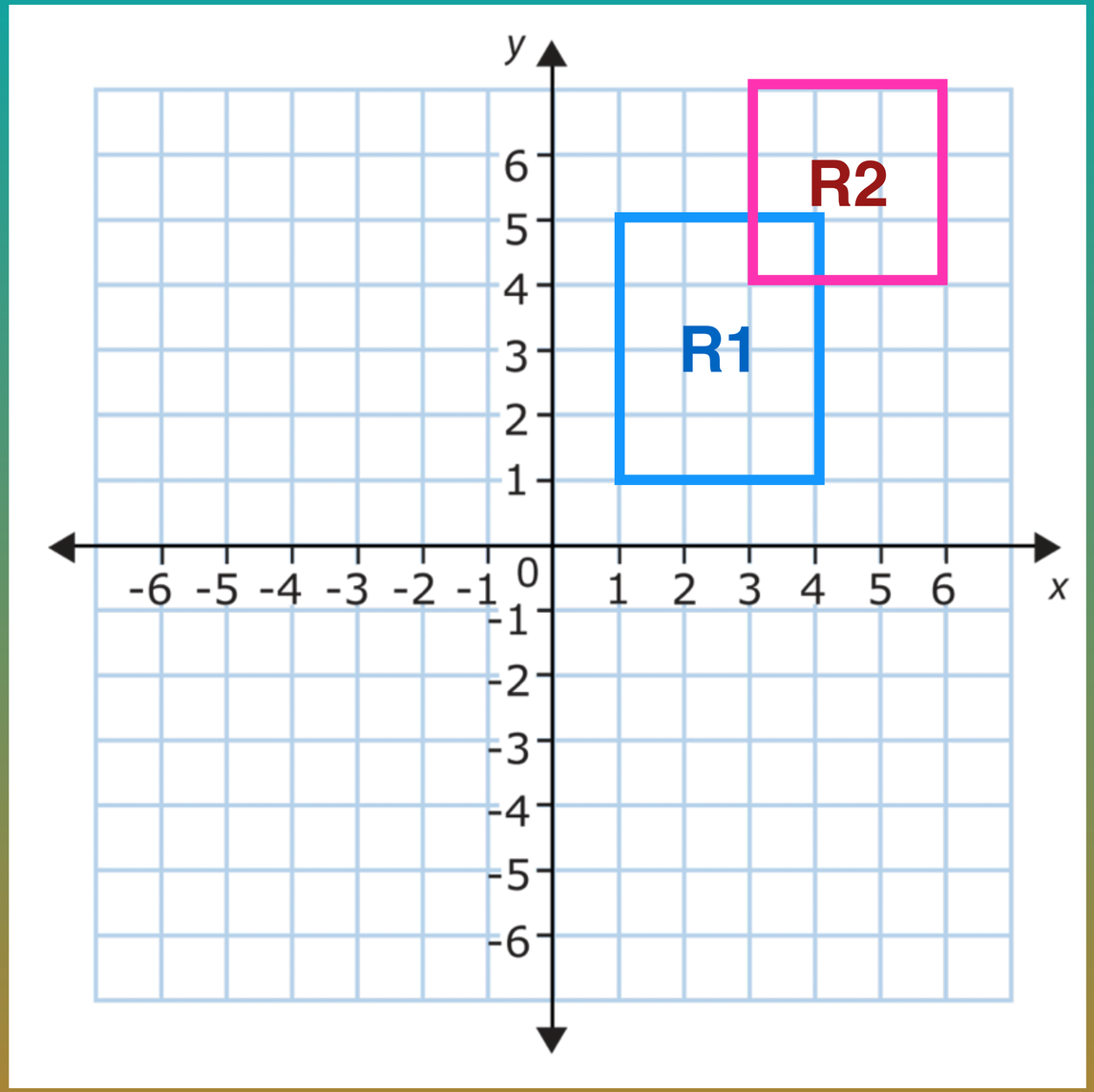

Project Flame
FPS:57

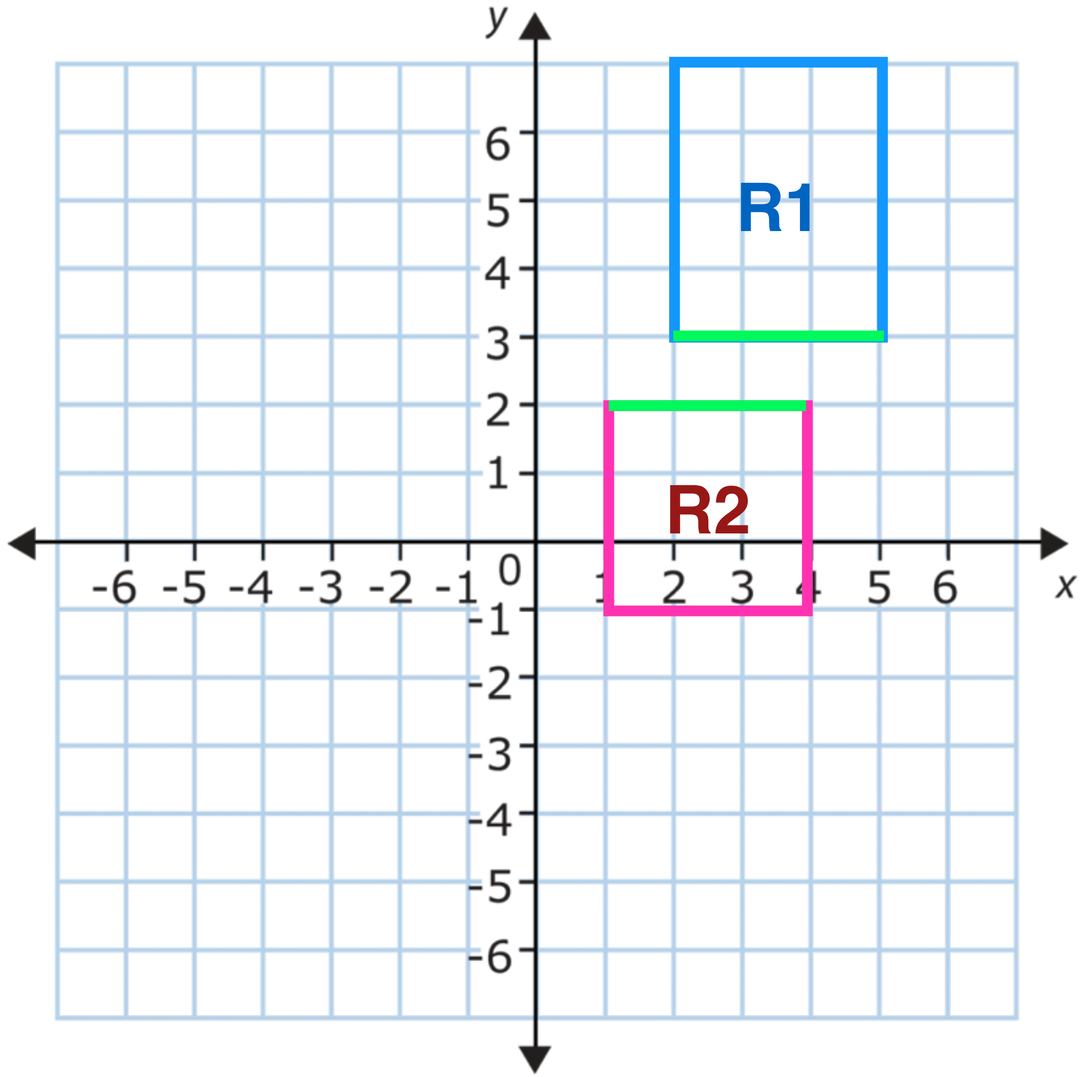
Circle-point collision detection.



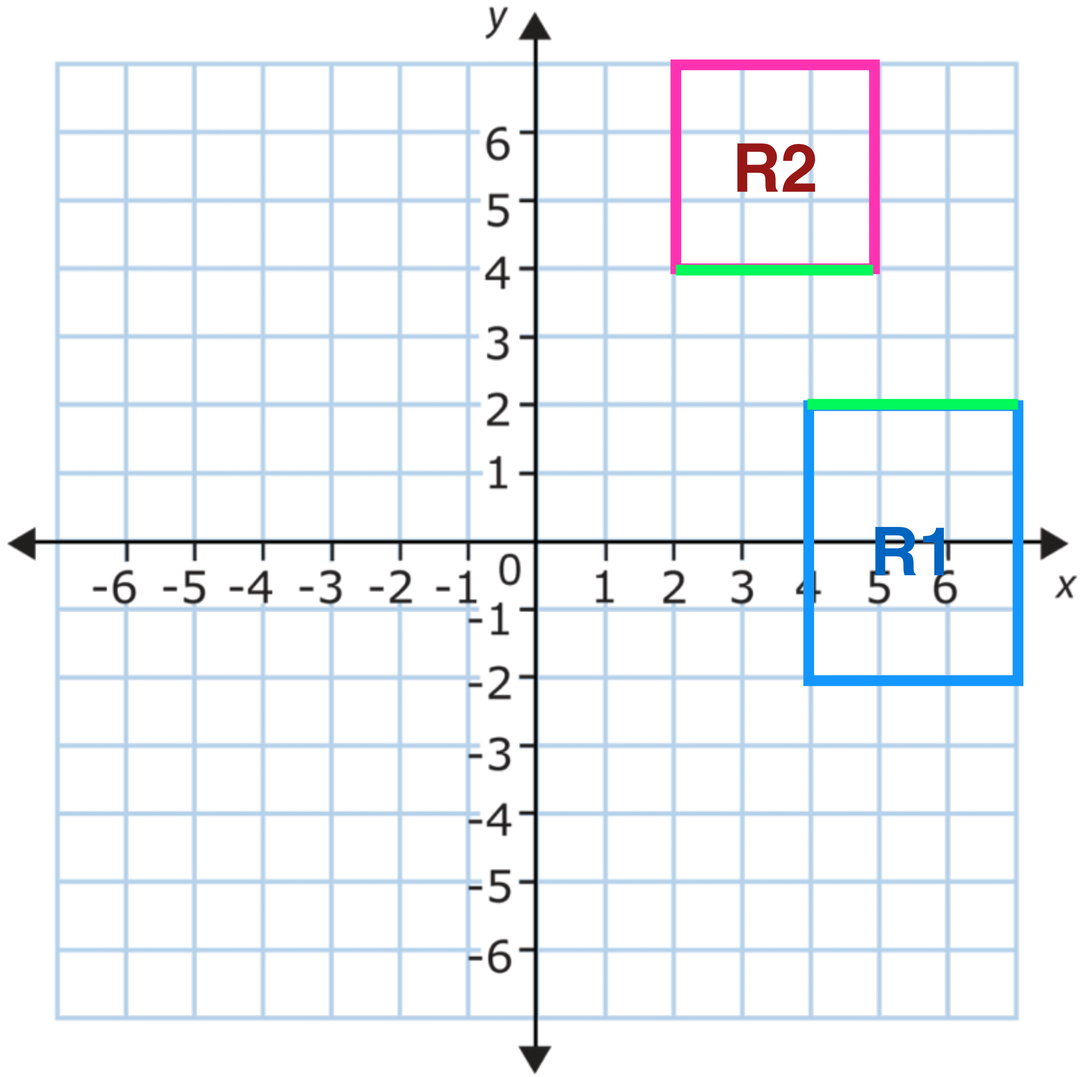
If the distance between the point and the
circle center is less than its radius, then they are colliding.

Box-box collision detection.

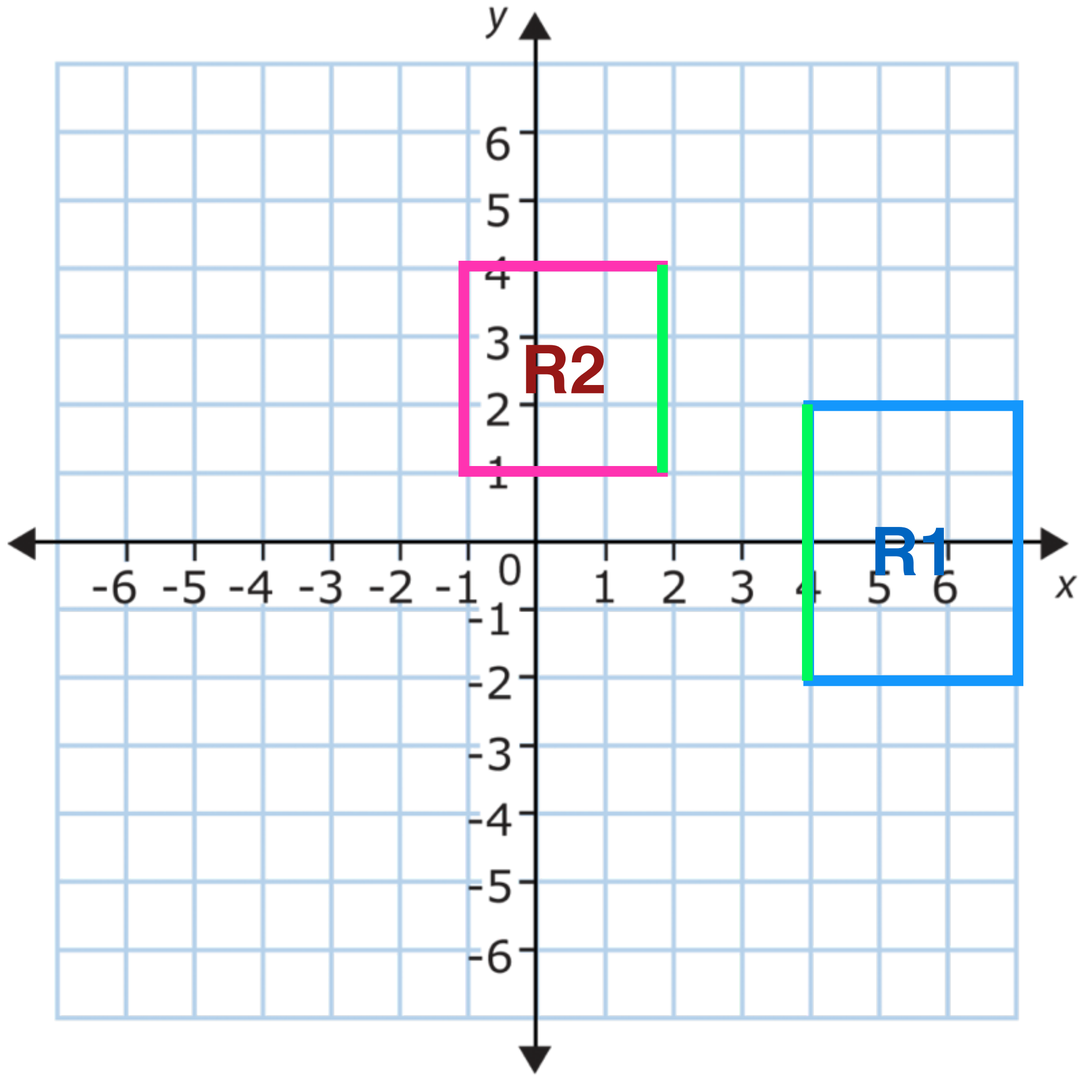

y
x
R2
R1
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-6 -5 -4 -3 -2 -1
1 2 3 4 5 6



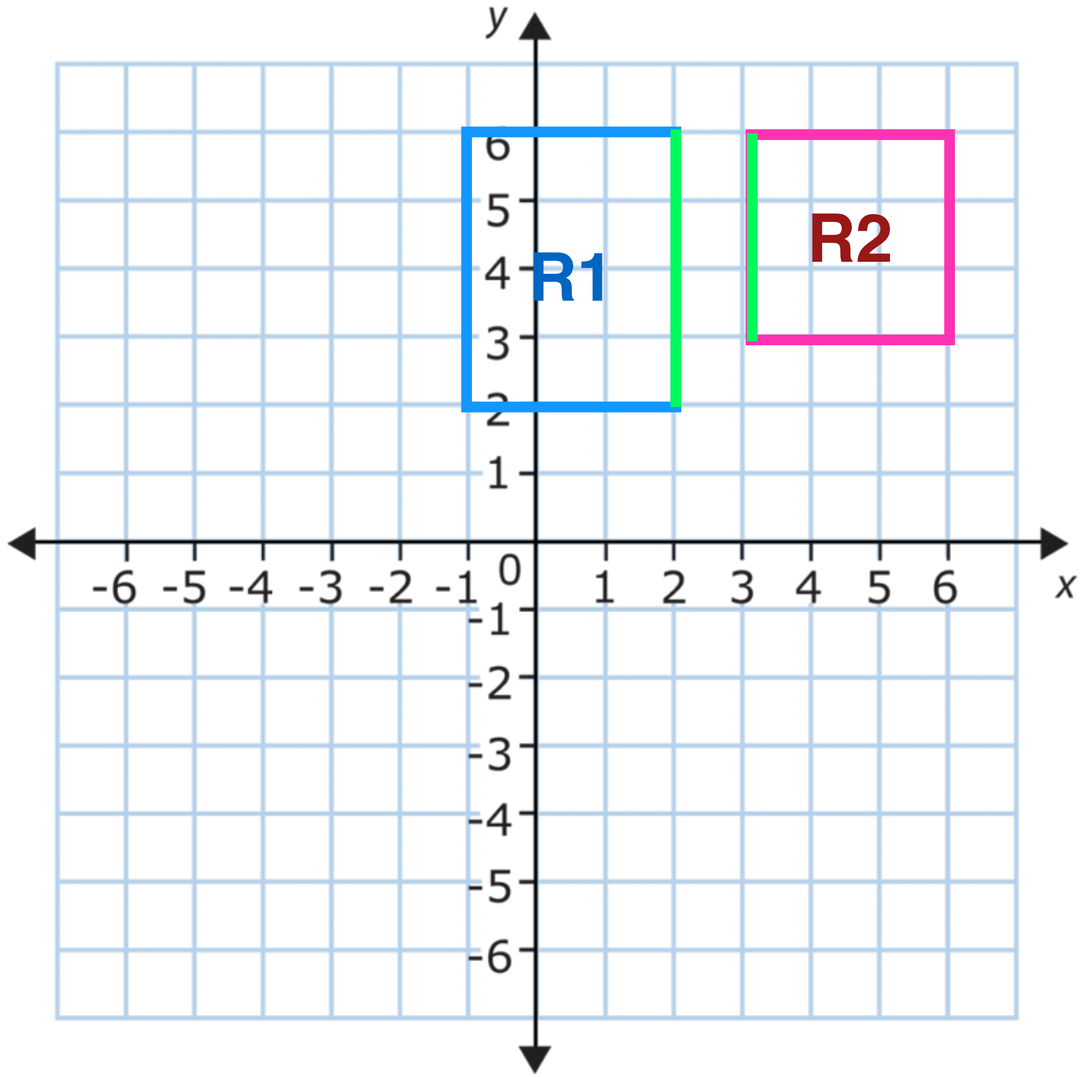
a) is R1's bottom higher than R2's top?



a) is R1's bottom higher than R2's top?
b) is R1's top lower than R2's bottom?



a) is R1's bottom higher than R2's top?
b) is R1's top lower than R2's bottom?
c) is R1's left larger than R2's right?



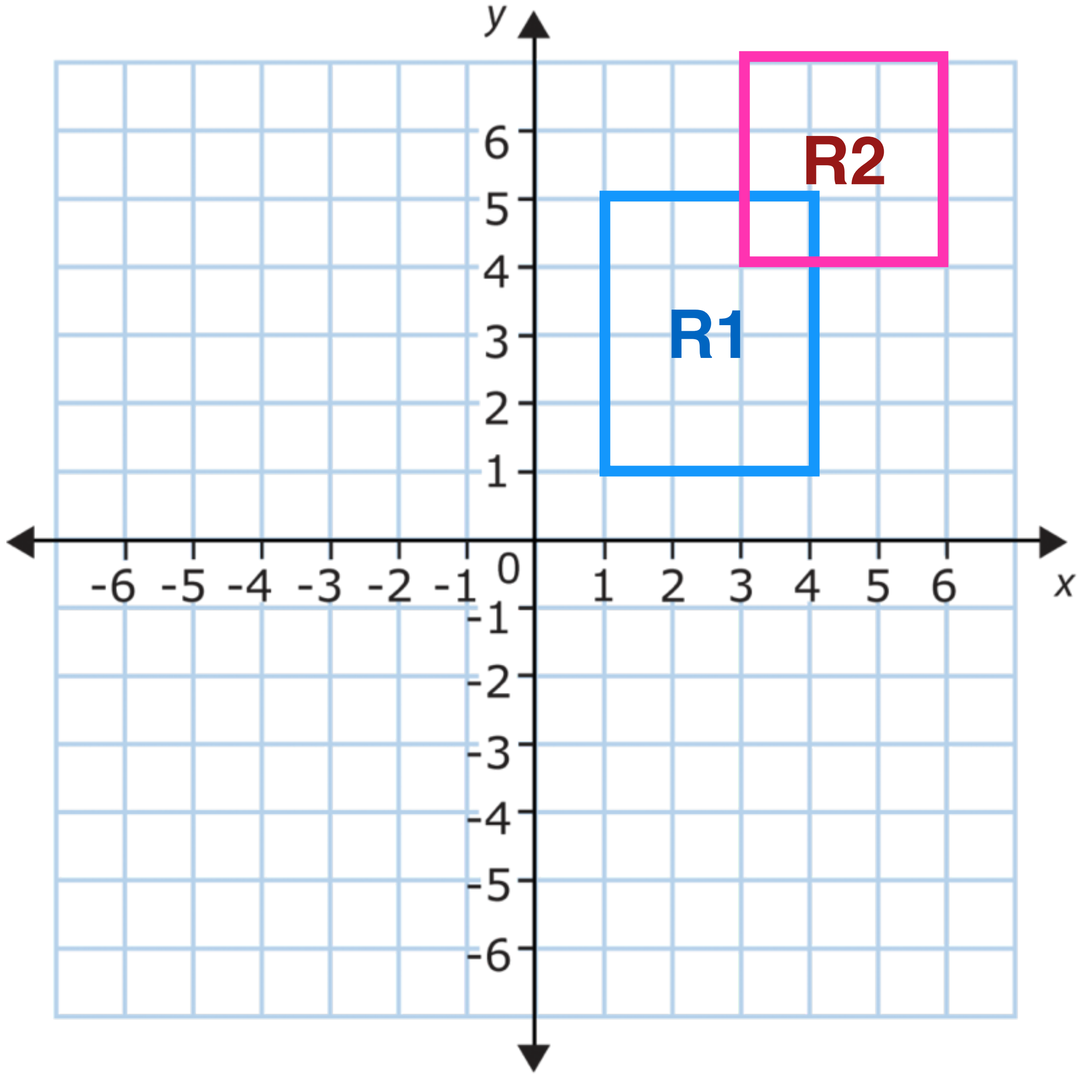
a) is R1's bottom higher than R2's top?
b) is R1's top lower than R2's bottom?
c) is R1's left larger than R2's right?
d) is R1's right smaller than R2's left

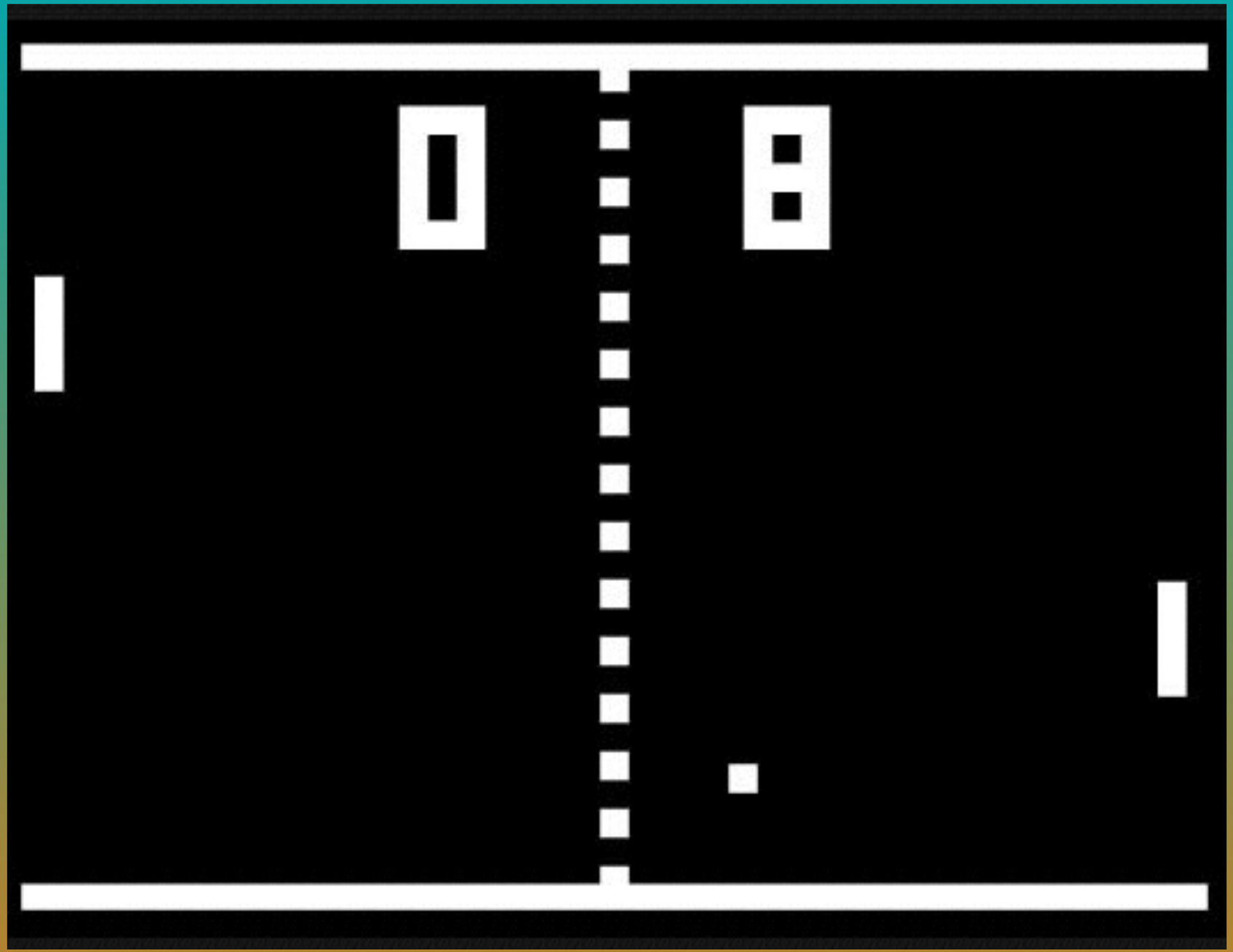
a) is R1's bottom higher than R2's top?
b) is R1's top lower than R2's bottom?
c) is R1's left larger than R2's right?
d) is R1's right smaller than R2's left

If ANY of the above are true, then the two rectangles are not intersecting!

OR

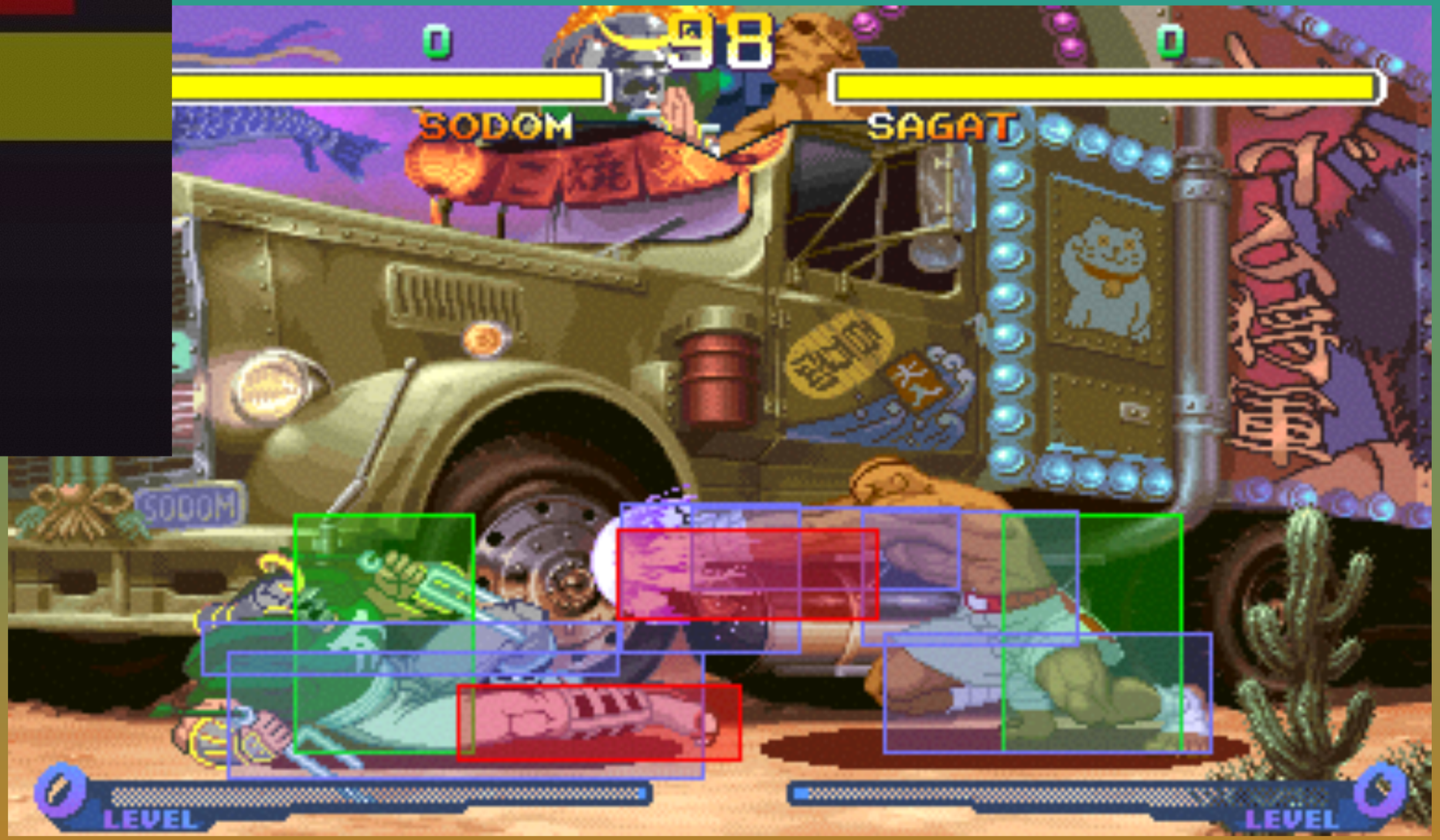
The rectangles are intersecting if NONE of the above are true.



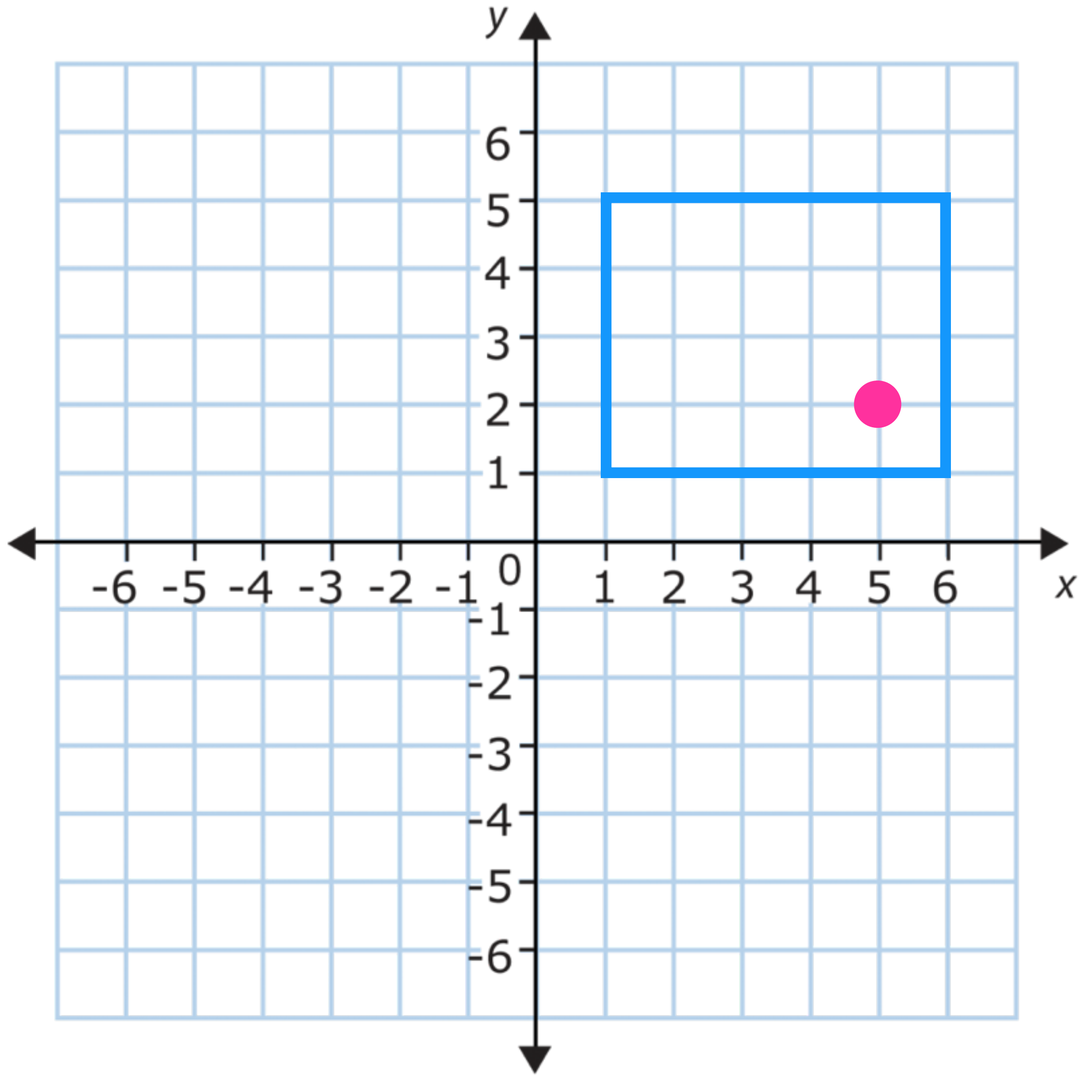



MARIO
004250
×05
WORLD
1-1
TIME
283
100


HP=UP REACH=0.68 1.28


0
98
0
SODOM
SAGAT
SODOM
LEVEL
LEVEL

Box-point collision detection.



collision is happening if:

- point x is larger than box left and smaller than box right

- point y is larger than box bottom and smaller than box top