Mathematical model

Defined the Problem

- Measure the safety space for the Robot to freely moves its arm
- Measure the dangers space

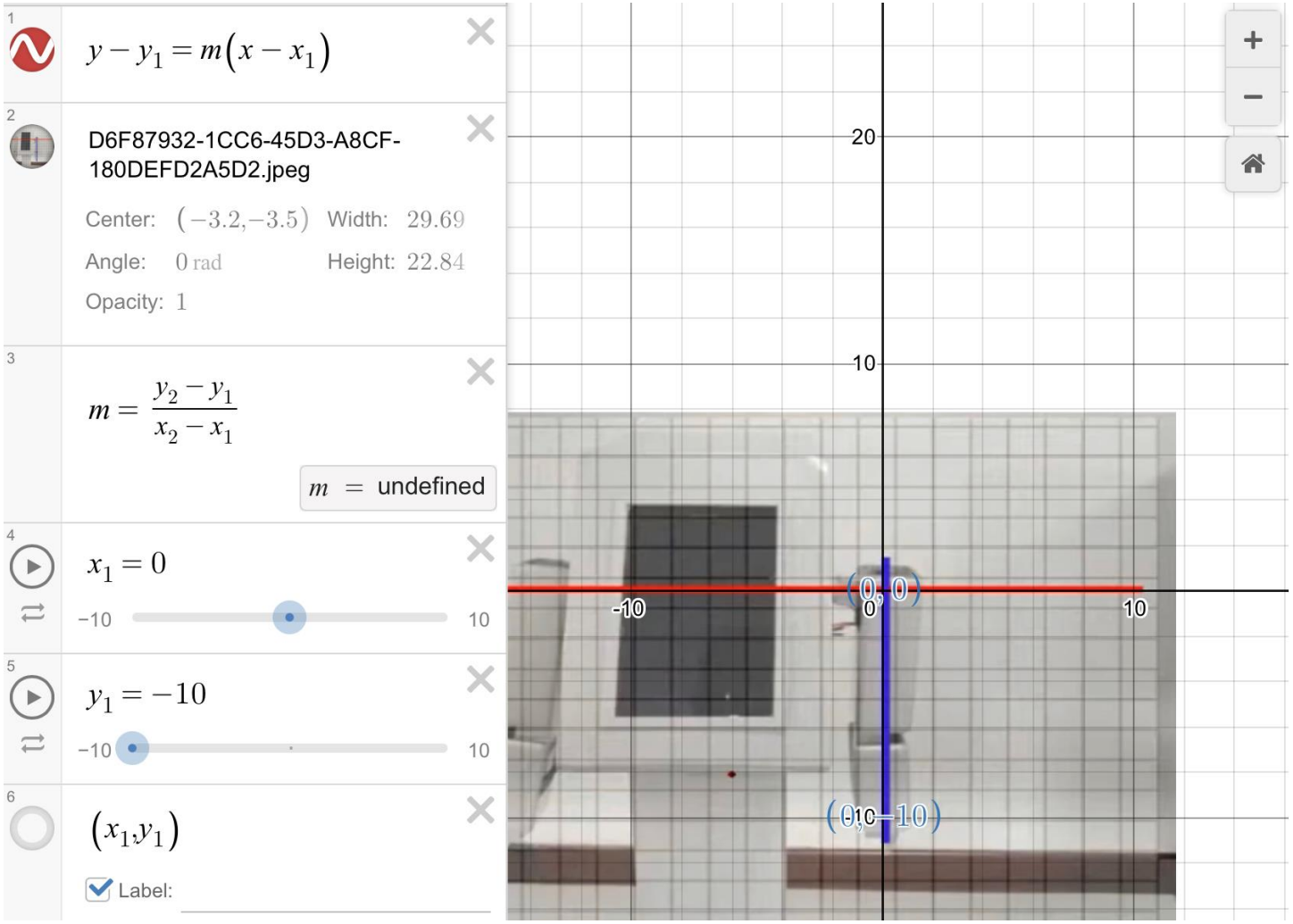
Defined the Variables

- On X-axis = highest point the Arm will reach
- On Y-axis = the lowest point the Arm will reach

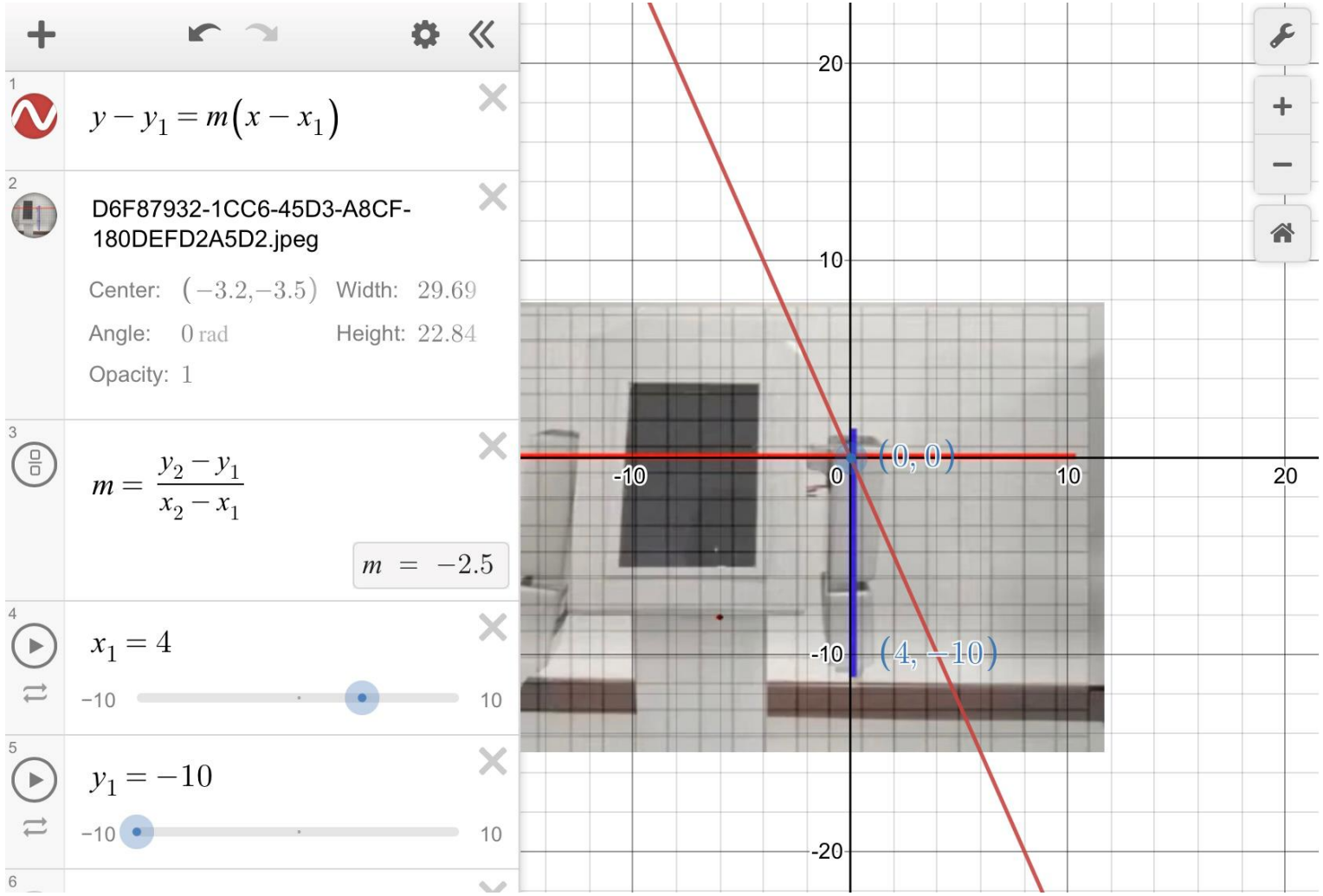
The appropriate Equation

- The liner Equation m so that we could measure the safety space
- (Y-Y1)=m(x-x1)
- Solve for the slop , so that the slop is safety space for the arm to reach
- M=(y2-y1)/(x2-x1)
- Could be solved either by (Pen and Pepper) or by DESMOS

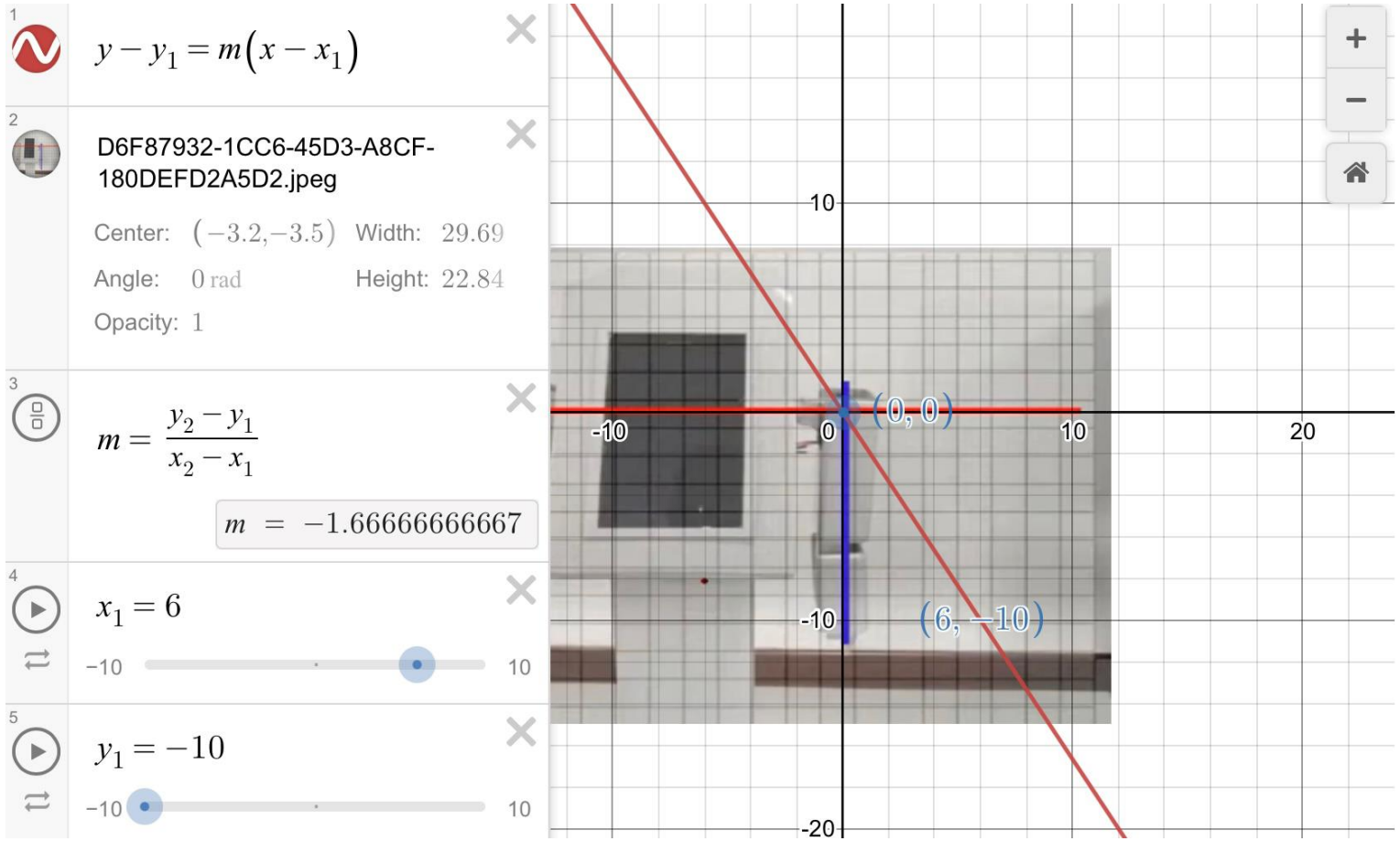
The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
m = undefined
4
$x_1 = 0$
−10 10
5
$y_1 = -10$
−10 10
6
(x_1, y_1)
Label:
20
10
-10
0
10
(0, 0)
(0, −10)

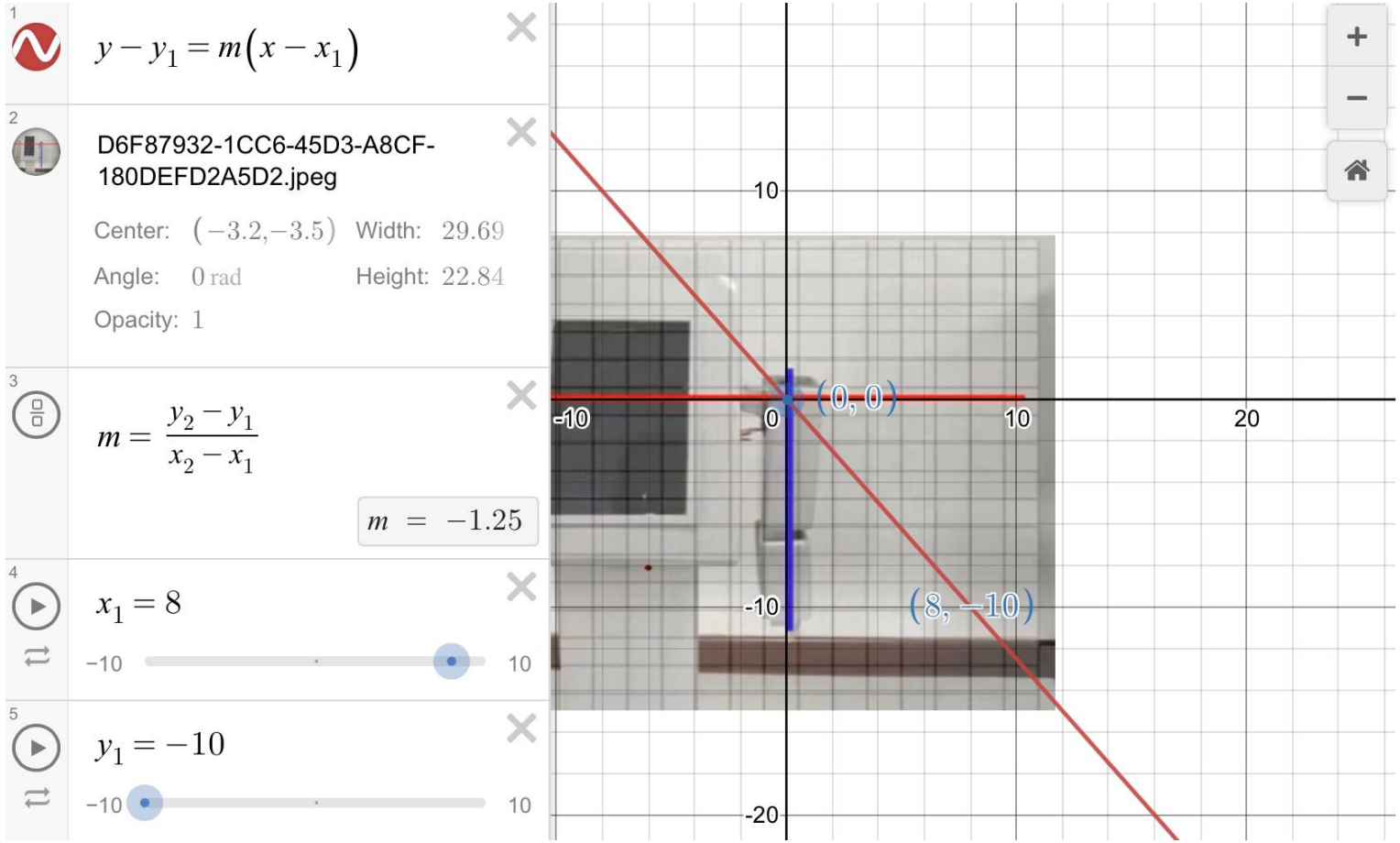
The Graphs


$y - y_1 = m(x - x_1)$
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -2.5$
$x_1 = 4$
−10 10
$y_1 = -10$
−10 10
20
10
-10
0
10
20
-10
-20
(0, 0)
(4, −10)

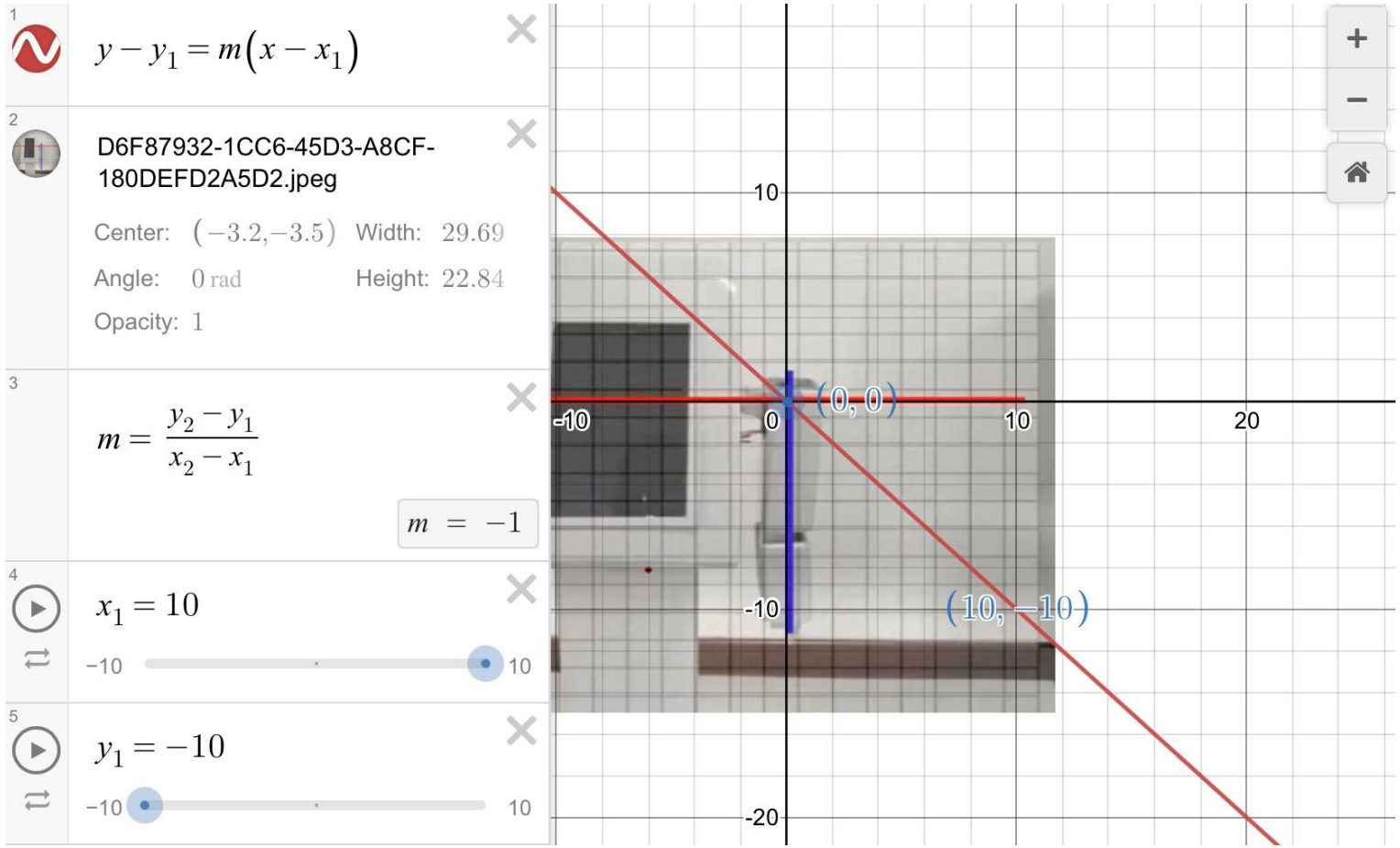
The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -1.66666666667$
4
$x_1 = 6$
−10 10
5
$y_1 = -10$
−10 10
10
-10
0
10
20
-10
-20
$(0, 0)$
$(6, -10)$

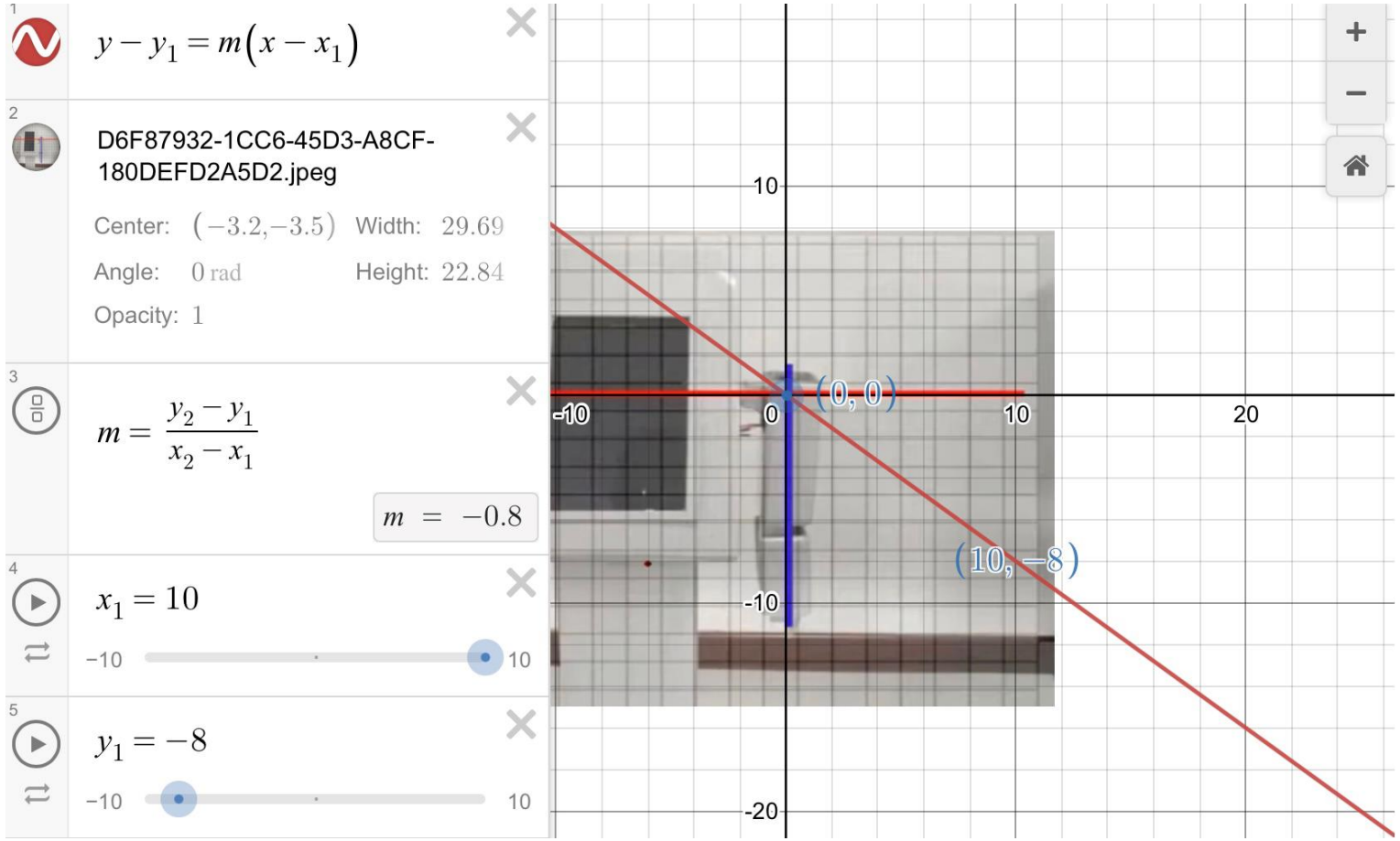
The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -1.25$
4
$x_1 = 8$
−10 10
5
$y_1 = -10$
−10 10
10
-10
-20
-10
0
10
20
$(0, 0)$
$(8, -10)$

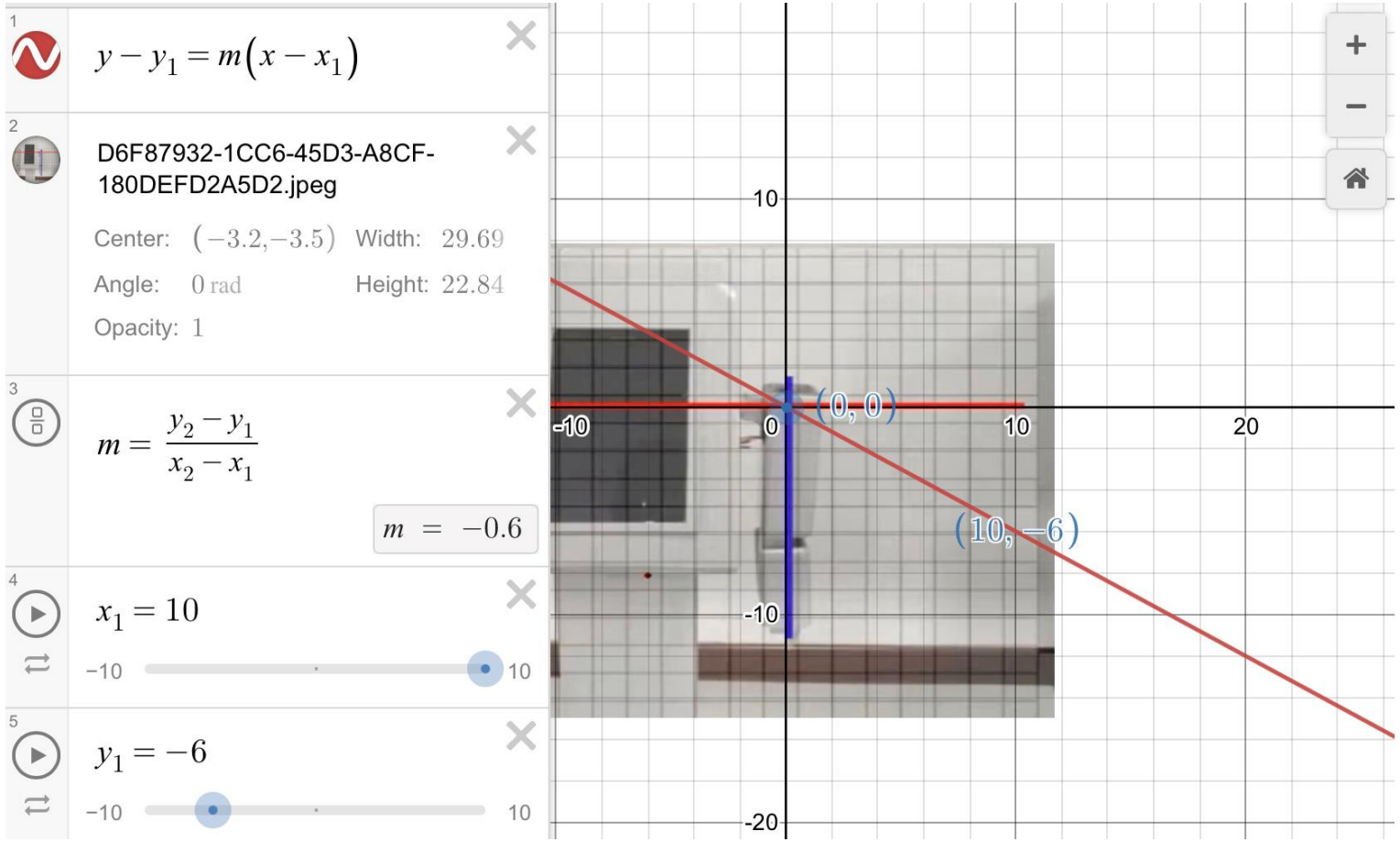
The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -1$
4
$x_1 = 10$
−10 10
5
$y_1 = -10$
−10 10
10
-10
-20
-10
0
10
20
$(0, 0)$
$(10, -10)$

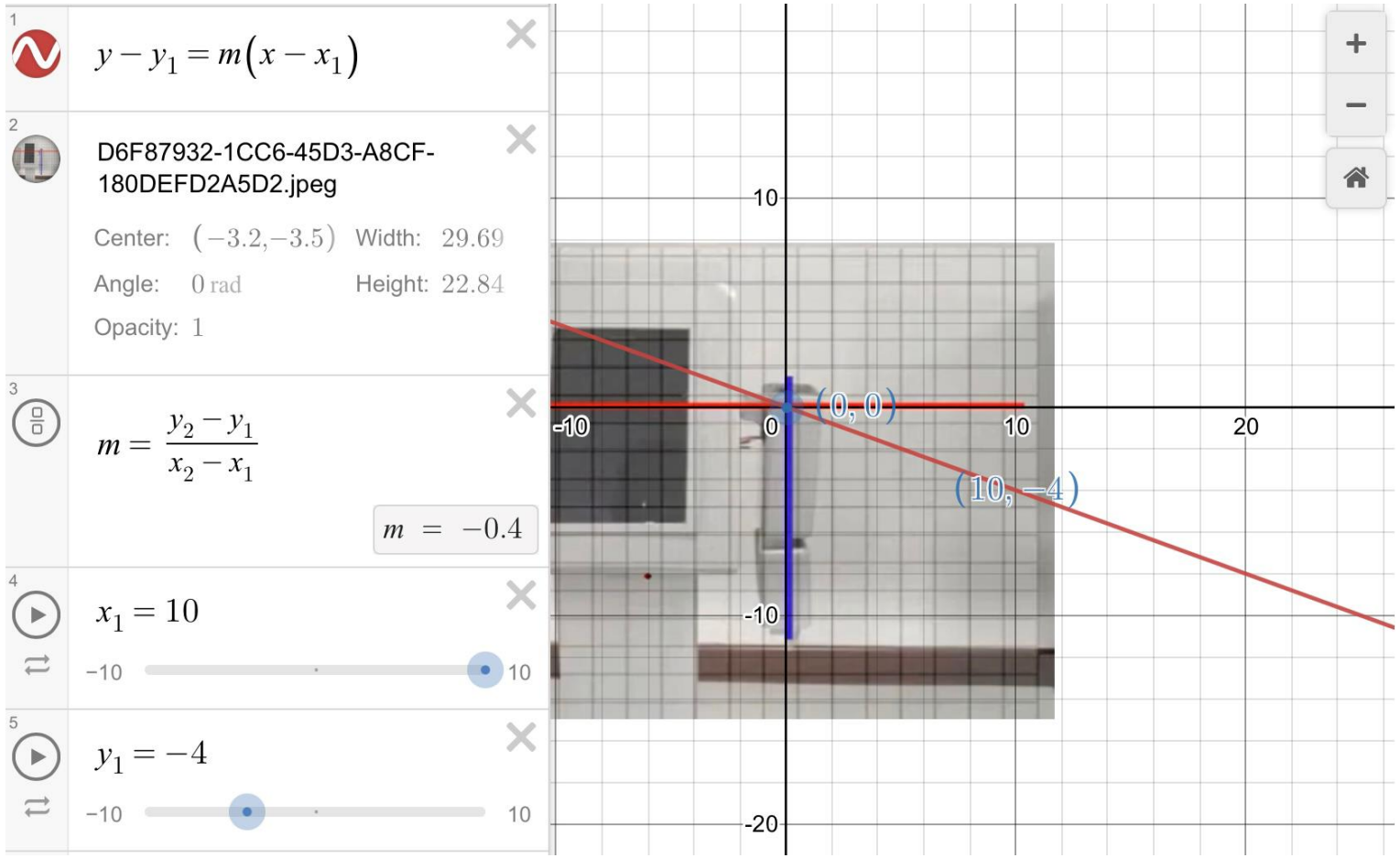
The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -0.8$
4
$x_1 = 10$
−10 10
5
$y_1 = -8$
−10 10
10
-10
-20
-10
0
10
20
$(0, 0)$
$(10, -8)$

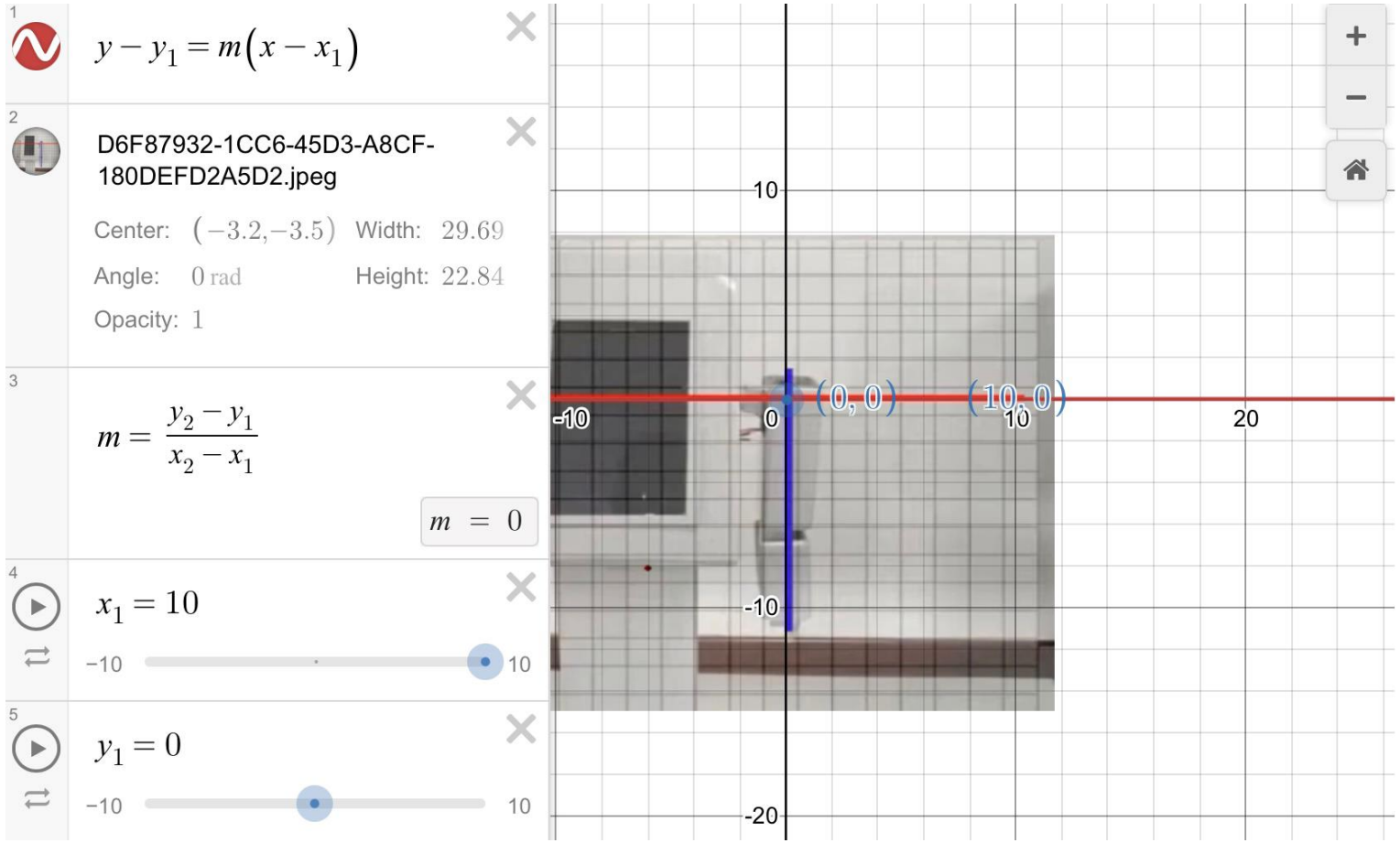
The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -0.6$
4
$x_1 = 10$
−10 10
5
$y_1 = -6$
−10 10
10
-10
-20
-10
0
10
20
$(0, 0)$
$(10, -6)$

The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = -0.4$
4
$x_1 = 10$
−10 10
5
$y_1 = -4$
−10 10
10
-10
-20
-10
0
10
20
(0, 0)
(10, −4)

The Graphs


1
$y - y_1 = m(x - x_1)$
2
D6F87932-1CC6-45D3-A8CF-180DEFD2A5D2.jpeg
Center: $(-3.2, -3.5)$ Width: 29.69
Angle: 0 rad Height: 22.84
Opacity: 1
3
$m = \frac{y_2 - y_1}{x_2 - x_1}$
$m = 0$
4
$x_1 = 10$
−10 10
5
$y_1 = 0$
−10 10
10
-10
-20
-10
0
10
20
(0, 0)
(10, 0)

The Conclusion

the safety space is the slop of the liner Eq.

The domine of the slop is between -2.5 and 0

The perves domine is the appropriate space that the arm should reach