

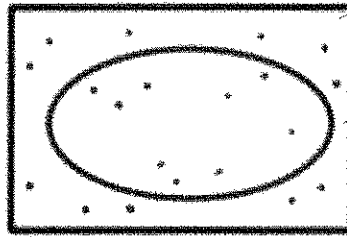
Name Monte Carlo quiz

Page 1

Where the random points that were generated in the rectangle region "landed" or "hit" the target are shown as PURPLE dots.

There are not a lot of dots.

It was decided twenty would be plenty.



The Monte Carlo method was used to estimate the area of the ellipse, i.e. area inside the RED oval.

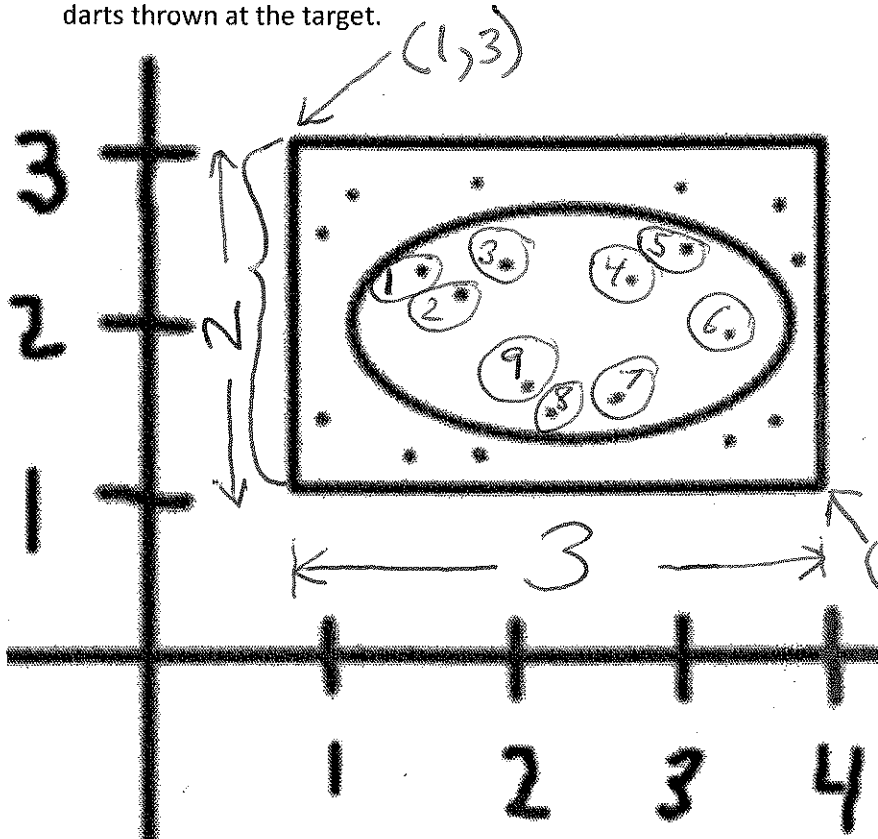
The rectangle that completely encloses the oval has corners at (1,3) and (4,1).

What is the area that the Monte Carlo simulation would calculate for the area of the OVAL?

Note: Show your work.

Also, nobody would ever do a Monte Carlo simulation and only throw 20 darts!

1. Calculate the area of the circle and show your work and process of arriving at your result. There were a total of 20 darts thrown at the target.



$$\begin{aligned} \text{Height} &= 2 = 3 - 1 \\ \text{Width} &= 3 = 4 - 1 \\ \text{Area of rectangle} &= 2 * 3 \\ &= 6 \text{ units} \end{aligned}$$

9 darts inside circle (oval)

$$\frac{9}{20} = 0.45 \text{ is proportion of darts landing in the area we want to know}$$

$$\frac{9}{20} * 2 * 3 = 0.45 * 6 = 2.7 \text{ units is estimate of area of the oval.}$$

page 2

What if we threw 100 darts and 41 landed inside the oval?

$$\text{Area of oval} = \frac{41}{100} * 2 * 3$$

$$= 0.41 * 6$$

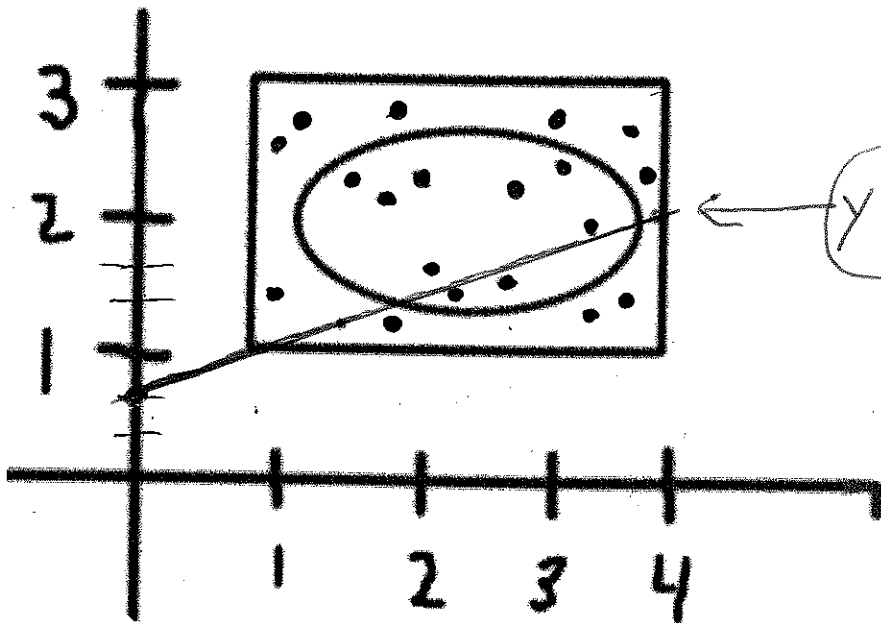
Monte Carlo simulation estimated area for the oval.

Proportion of "darts" landing inside the oval

Known area of the rectangle

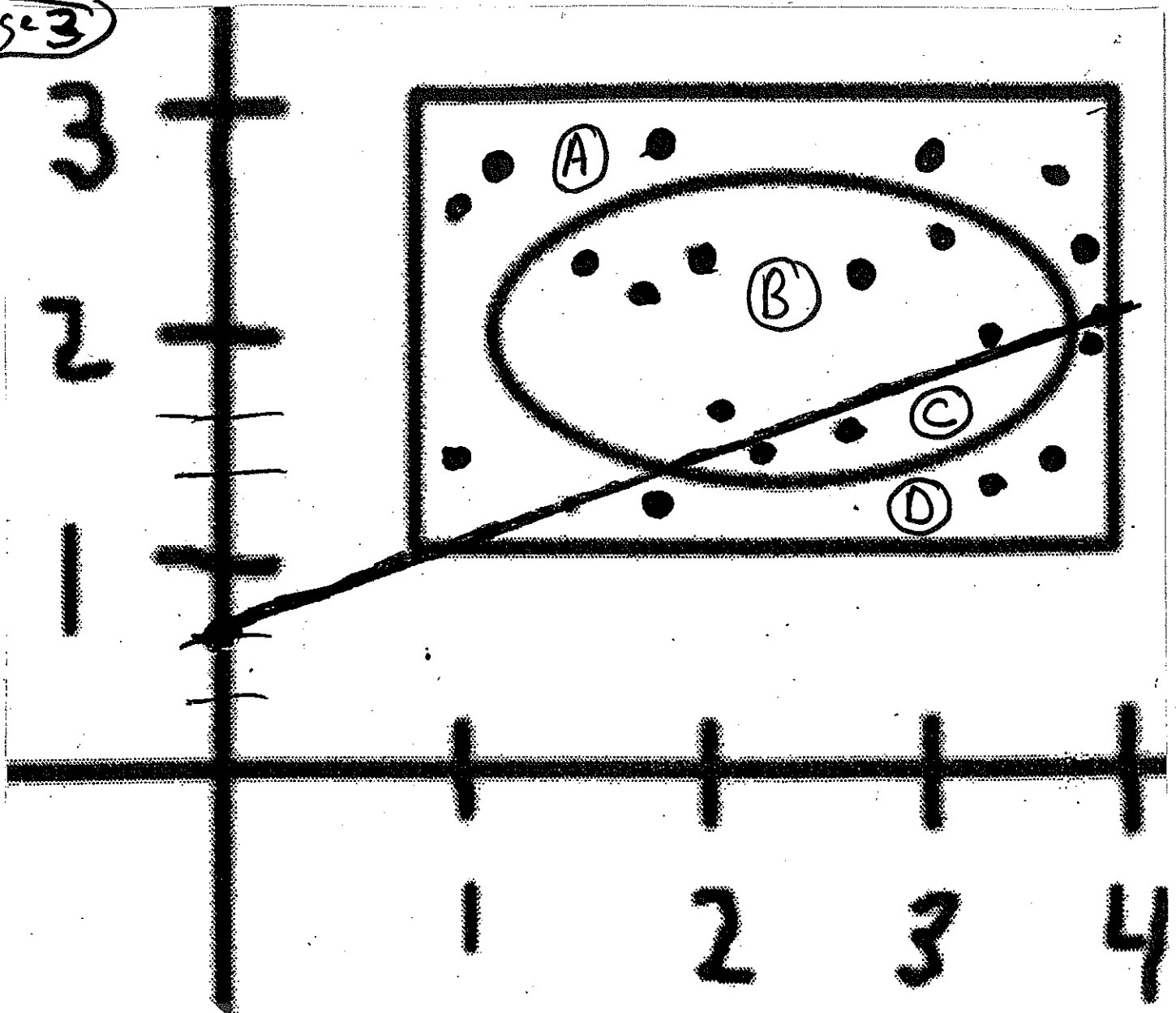
Add the line  $y = \frac{1}{3}x + \frac{2}{3}$

slope =  $\frac{1}{3}$   
intercept =  $\frac{2}{3}$



$$y = \frac{x}{3} + \frac{2}{3}$$

Estimate the 4 different areas



<u>Area</u>	<u>Darts</u>	<u>Proportion</u>	<u>Estimated area</u>
Ⓐ	7	$\frac{7}{20} = 0.35$	$0.35 * 6 = 2.1$
Ⓑ	7	$\frac{7}{20} = 0.35$	$0.35 * 6 = 2.1$
Ⓒ	2	$\frac{2}{20} = 0.1$	$0.1 * 6 = 0.6$
Ⓓ	4	$\frac{4}{20} = 0.2$	$0.2 * 6 = 1.2$
	<u>20 darts</u>	<u>1.0</u>	<u>6.0</u>