

1.6 Probability

The Probability of an event is a ratio that tells how likely it is that an event will take place.

Probability is expressed as a percent (0% through 100%) or as a real number (0 through 1)

The probability of an impossible event is 0 or 0%

The probability of a certain event is 1 or 100%

When you gather data from observations, you can calculate an Experimental probability. Each observation is called an experiment or a trial. Is calculated when the actual situation or problem is performed as an experiment.

$$P(\text{event}) = \frac{\text{number of times the event occurs}}{\text{number of trials}}$$

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The odds of an event occurring is the ratio of the number of ways the event can occur to the number of ways the event cannot occur.

Odds = number of successes : number of failures

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If a sample space has n equally likely outcomes and an event A occurs in m of these outcomes then the Theoretical probability of an event A is $P(A) = \frac{m}{n}$. Theoretical probability is the probability that is calculated using math formulas.

$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

Theoretical probability is what we expect to happen, where experimental probability is what actually happens when we try it out. The probability is still calculated the same way, using the number of possible ways an outcome can occur divided by the total number of outcomes. As more trials are conducted, the experimental probability generally gets closer to the theoretical probability.

Page 2

John collects stamps from different countries. He has five from Canada, two from France, one for Russia, four from Great Britain, and one from Germany. If he accidentally loses one stamp, what is the probability that it is a stamp from Canada? From Russia?

$$P(C) = \frac{5}{13}$$

$$P(R) = \frac{1}{13}$$

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Grace has a collection of jerseys from college campuses that she has visited. Two come from colleges in Michigan, three from California one from Ohio, one from Washington, and three from New York. What is the probability that she will grab one from Michigan? From New York? What are the odds she will grab one from California?

$$P(MI) = \frac{2}{10} = \frac{1}{5} = 20\%$$

$$P(NY) = \frac{3}{10} = 30\%$$

$$\text{odds}(A) = 3:7$$

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A player hit the bull's eye on circular dartboard 8 times out of 25. Find the experimental probability that the player hit the bull's eye.

$$P(\text{be}) = \frac{8}{25} = 32\%$$

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A basketball player has made 32 free throws in 50 tries. What is the experimental probability of her making a free throw?

$$P(\text{make}) = \frac{32}{50} = 64\%$$

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Brown is a dominant eye color for human beings. If a father and mother each carry a gene for brown eyes, and a gene for blue eyes, what is the probability of their child having blue eyes?

Having brown eyes?

	B	b
B	BB	Bb
b	Bb	bb

$$P(\text{blue}) = \frac{1}{4} = 25\%$$

$$P(\text{brown}) = \frac{3}{4} = 75\%$$

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The door prize at a party with 25 people is given by writing the numbers 1 through 25 on the bottom of the paper plates. A) What is the probability that you have the winning plate? B) What are the odds of winning the prize? C) What are the odds of **not** winning the plate?

$$P(\text{win}) = \frac{1}{25} = 4\%$$

$$\text{odds (win)} = 1:24$$

$$\text{odds (losing)} = 24:1$$

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Find the theoretical probability and odds of each outcome if a die is rolled.

	Probability	Odds
The # 1	$\frac{1}{6}$	1:5
A # less than 3	$\frac{2}{6} = \frac{1}{3}$	2:4
An odd #	$\frac{3}{6} = \frac{1}{2}$	3:3
A # greater than 6	$\frac{0}{6}$	0:6
An even # less than 6	$\frac{2}{6} = \frac{1}{3}$	2:4
A # greater than 0	$\frac{6}{6} = 1$	6:0
A multiple of 3	$\frac{2}{6} = \frac{1}{3}$	2:4

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The probability that Jim will make his next free throw is 75%. Find the odds that he will not make his next free throw.

$$P(\text{make}) = 75\% = \frac{75}{100} = \frac{3}{4}$$

$$\text{odds (miss)} = 1:3$$

Page 10

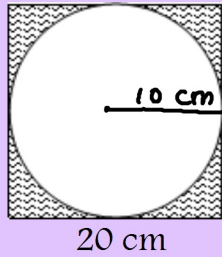
Sometimes you can use area to find theoretical probability.

If the points of a region represent equally-likely outcomes, then you can find probability by comparing areas.

$$P(\text{event}) = \frac{\text{Area of favorable region}}{\text{area of entire region}}$$

Page 12

A circle is inscribed in a square target with 20cm sides. Find the probability that a dart landing randomly within the square does not land within the circle.



$$A_{\square} = 20^2 = 400$$

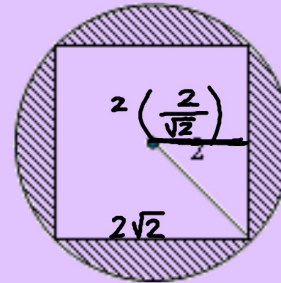
$$A_{\circ} = \pi r^2 = \pi(10)^2 = 100\pi$$

$$P(\text{shade}) = \frac{400 - 100\pi}{400}$$

$$\approx 21.5\%$$

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Find the probability that a random point is within the shaded area.



$$A_{\circ} - A_{\square}$$

$$A_{\circ} = \pi r^2 = 4\pi$$

$$A_{\square} = (2\sqrt{2})^2 = 4 \cdot 2 = 8$$

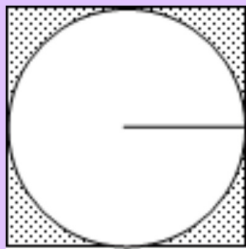
$$P = \frac{4\pi - 8}{4\pi}$$

$$\cdot 36$$

$$\frac{4}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$$

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Find the probability that a random point is within the shaded area.



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homework:

page 42 # 2-26 even, skip #22

27-37 and worksheet

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