**Algebra 2 1.6 Probability Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Probability** – how likely to occur an event is.

The probability of an event is always between 0 – 1 (0% - 100%)

always

never

$$1$$

100%

0

0%

**Experimental Probability**

 Experimental probability of an event: $P\left(Event\right)=\frac{number of time the event occurs}{total number of trials}$

Ex: A dart player hits the bull’s eye on a dart board 8 times out of 50. Find the experimental probability that he player hits the bull’s eye.

 $P\left(Bull^{'}s Eye\right)= \frac{8}{50}= \frac{4}{25}$ or $0.16$ or $16\%$

Classroom Exercise:

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |

**Simulation** – when actual trials are difficult (or very expensive) to conduct you can find experimental probability using a *simulation* – which is a model of the event.

Ex: To simulate taking a 5-question True/False test that you guess at each answer.

 Flip a coin 5 times: Head = correct answer

 Tail = incorrect answer

 Using a random digit table: even digit = correct answer

 odd digit = incorrect answer

TABLE 1 - RANDOM DIGITS

11164 36318 75061 37674 26320 75100 10431 20418 19228 91792 21215 91791 76831 58678 87054 31687 93205

43685 19732 08468 10438 44482 66558 37649 08882 90870 12462 41810 01806 02977 36792 26236 33266 66583

60881 97395 20461 36742 02852 50564 73944 04773 12032 51414 82384 38370 00249 80709 72605 67497 49563

12872 14063 93104 78483 72717 68714 18048 25005 04151 64208 48237 41701 73117 33242 42314 83049 21933

92813 04763 51486 72875 38605 29341 80749 80151 33835 52602 79147 08868 99756 26360 64516 17971 48478

 Out of 20 trials:

 Find the probability of getting at least 3 out of 5 correct.

 Find the probability of getting all 5 answers correct.

**Probability Simulator**

 Application on the TI-84 that can simulate coin tosses, dice rolls, random numbers, etc.

**Theoretical Probability**

Sample space: *n* outcomes

If a sample space has *n* equally likely outcomes and event *A* occurs in *m* of these outcomes the theoretical probability of A is:

Event A: *m* outcomes

 $P\left(A\right)=\frac{m}{n}$

Ex: Find the theoretical probability of rolling a multiple of 3 with a number cube (die).

Sample Space

2

3

1

 $P\left(multiple of 3\right)= $

4

5

6

Ex: Brown is a dominant eye color for humans. If a father and mother each carry a gene for brown and a gene for blue, what is the probability that they have a child with blue eyes?

 B = Brown eye gene BB = child with Brown eyes

 b = blue eye gene Bb = child with Brown eyes

 bb = child with blue eyes

Gene from Mother

|  |  |  |
| --- | --- | --- |
|  | B | b |
| B | BB | Bb |
| b | Bb | bb |

Gene from Father

 $P\left(child with blue eyes\right)= $

 Find the probability that this couple has a child with brown eyes.

**Venn Diagrams**

Ex: out of a group of 100 students: 31 students drink coffee

 42 students drink energy drinks

 16 students drink both coffee and energy drinks

E

C

What is the probability that a randomly selected student drinks both coffee and energy drinks?

What is the probability that a randomly selected student does not drink coffee and does not drink energy drinks?

What is the probability that a randomly selected student drinks coffee, but doesn’t drink energy drinks?

**Algebra 2 9.7 Probability of Multiple Events Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Dependent Events** – when the outcome of one event affects the outcome of a second event.

**Independent Events** – when the outcome of one event does not affect the outcome of a second event.

Ex: Classify each pair of events as dependent or independent.

1. Spin a spinner. Then select a marble from a bag that contains marbles of different colors.
2. Select a marble from a bag that contains marbles of two colors. Put that marble aside and then select a second marble from the bag.
3. Roll a die twice.
4. Select a marble from a bag that contains marbles of two colors. Put that marble back in the bag and select a second marble from the bag.

**Probability of Independent Events**

 If *A* and *B* are independent events the $P\left(A and B\right)=P\left(A\right) ∙P\left(B\right)$

Ex: Events A and B are independent events

 $P\left(A\right)=0.3$ Find the probability of both *A* and *B* occurring

 $P\left(B\right)=0.5$

Ex: A box contains 20 red marbles and 30 blue marbles. A second box contains 10 white marbles and 47 black marbles. If you choose one marble from each box without looking, what is the probability that you get a blue marble and a black marble?

 Independent Events? $P\left(Blue and Black\right)=$

 Find the probability that you select a red marble and a white marble.

 Find the probability that you select a red marble and a green marble

**Mutually Exclusive Events – two events that cannot happen at the same time**

Ex: Rolling a 5 or a 3 with a single roll of a die

Ex: Rolling an odd number or a number less than 3 with a single roll of a die

**Probability of *A* or *B***

 If *A* and *B* are Mutually Exclusive events

 $P\left(A or B\right)=P\left(A\right)+P\left(B\right)$

 If *A* and *B* are not Mutually Exclusive events

 $P\left(A or B\right)=P\left(A\right)+P\left(B\right)-P\left(A and B\right)$

Ex: At a restaurant, customers get a choice of one of four vegetables with their main course. About 33% choose green beans and about 28% choose spinach.

 What is the probability that a customer will choose green beans or spinach?

Ex: A spinner has 20 equal-sized sections numbered from 1 – 20. You spin the spinner. What is the probability that the number you spin will be a multiple of 2 or a multiple of 3?

**Venn Diagrams and Tree Diagrams**

Sample

Space

 Sample Space – all possible elements

*A*

 *A* – all possible elements in *A*

 not *A*

*A*

 Mutually Exclusive Events Not Mutually Exclusive Events

*A*

*B*

*A*

*B*

 *A* and *B*

 Mutually Exclusive Not Mutually Exclusive

*A*

*B*

*A*

*B*

 *A* or *B*

 Mutually Exclusive Not Mutually Exclusive

*A*

*B*

*A*

*B*

**Tree Diagrams**

Ex: Gender of children in a family of two children

 Sample Space

 What is the probability that the family has one male and one female?

 What is the probability that the family has only males?

 What is the probability that he family has only females?

 What do all of the probabilities add up to?

**The sum of the probabilities of all possible choices is always equal to 1 (100%).**