## Quantitative Skills \& Reasoning - Math 1001

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## Math 1001 Test 3

Population size: 25
Median: 67
Minimum: 14
Maximum: 99
First quartile: 50
Third quartile: $\mathbf{8 6 . 5}$
Interquartile Range: $\mathbf{3 6 . 5}$ Outliers: none


## A function is a relationship between two quantities

where every input has only one output.

Find the equation for the linear function that passes through the points $(-3,7)$ and $(3,3)$. Answers must use whole numbers and/or fractions, not decimals.

Carl has already stuffed 14 envelopes, and will continue to stuff 7 envelopes per minute. Find a linear function $E$ that represents the total number of envelopes Carl will have stuffed in $t$ minutes, assuming he doesn't take any breaks.

Determine if the function is linear, exponential, or neither.
The population of a town is decreasing at a rate of $1.5 \%$ per year.

## Linear Exponential Neither $0^{8}$ Exponentia

Fill in the blanks. Enter the vertex and intercepts as ordered pairs, aka points. Standard Form: $y=x^{2}-4 x+3$

- 1. Does the parabola open up or down? Up Down $\sigma^{6}$ Up
- 2. Equation of the Axis of Symmetry: $\quad$ os $x=2$
- 3. Vertex $(x, y)=\square \sigma^{s}(2,-1)$
- 4. $y$-intercept $(x, y)=$
$\sigma^{8}(0,3)$

An object is fired from a cannon. Its height after $t$ seconds is given by the function $h(t)=-16 t^{2}+256 t+100$ feet. How high was the object after 5 seconds?

The object was $\square 0^{6} 980$ feet high.

Find all zeros of the function: $q(x)=x^{2}-14 x+33$.


Determine whether the following equation represents an exponential growth or exponential decay.
$y=144 \cdot(0.63)^{x}$
exponential decay

- exponential growth
$\sigma^{6}$ exponential decay $\times$


## A vehicle purchased for $\$ 27500$ depreciates at a constant rate of $6 \%$ per year. Determine the approximate value of the vehicle 12 years after purchase. <br> Round to the nearest whole number.

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13088
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## Definitions

- The result of an experiment is called an outcome.
- An event is any particular outcome or group of outcomes.
- A simple event is an event that cannot be broken down further.
- The sample space is the set of all possible simple events.


## Definitions

- Given that all outcomes are equally likely, we can compute the probability of an event $E$ using this formula:

$$
P(E)=\frac{\text { Number of outcomes corresponding to the event } E}{\text { Total number of equal likely outcomes }}
$$

## Definitions

- The complement of an event is the event " $E$ does not happen." The notation $\bar{E}$ is used for the complement of event $E$.
- We can compute the probability of the complement using
- $P(\bar{E})=1-P(E)$. Notice also that $P(E)=1-P(\bar{E})$.


## Definitions

- Odds is the ratio of the probability that a particular event will occur to the probability that it will not occur. We always express odds in simplest form.

The odds for an event $E$ is the ratio of $\mathrm{P}(E)$ to $\mathrm{P}($ not $E)$.

The odds against an event $E$ is the ratio of $\mathrm{P}($ not $E)$ to $\mathrm{P}(E)$.

## Definitions

- Independent Events
- Events $A$ and $B$ are independent events if the probability of Event $B$ occurring is the same whether or not Event $A$ occurs.

Formula ( $\mathrm{P}(A$ and $B)$ for independent events)
If events $A$ and $B$ are independent, then the probability of both $A$ and $B$ occurring is

$$
\mathrm{P}(A \text { and } B)=\mathrm{P}(A) \cdot \mathrm{P}(B)
$$

- where $P(A$ and $B)$ is the probability of events $A$ and $B$ both occurring, $P(A)$ is the probability of event $A$ occurring, and $P(B)$ is the probability of event $B$ occurring.


## Probability of Either Event

Formula ( $\mathrm{P}(A$ or $B)$ )

- The probability of either $A$ or $B$ occurring (or both) is

$$
P(A \text { or } B)=P(A)+P(B)-P(A \text { and } B) .
$$

Note: Two events are mutually exclusive if they do not share any common outcomes.

## Example

In your drawer you have 10 pairs of socks, 6 of which are white, and 7 tee shirts, 3 of which are white. If you reach in and randomly grab a pair of socks and a tee shirt, what is the probability at least one is white? Let A Event be drawing a white sock and B Event be drawing a white tee shirt

$$
\begin{array}{ll}
P(A)=\frac{6}{10} & P(B)=\frac{3}{7} \\
& P(A \text { or } B)=P(A)+P(B)-P(A) P(B) \\
& =\frac{6}{10}+\frac{3}{7}-\frac{6}{10} \frac{3}{7}=\frac{72}{70}-\frac{18}{70}=\frac{54}{70}=\frac{27}{35}
\end{array}
$$

## Conditional Probability for Dependent Events

- Independent Events
- Events $A$ and $B$ are dependent events if the probability of Event $B$ is affected by Event $A$ occurring.

Formula ( $\mathrm{P}(A$ and $B)$ for dependent events)
If events $A$ and $B$ are dependent, then the probability of both $A$ and $B$ occurring is

$$
\mathrm{P}(A \text { and } B)=\mathrm{P}(A) \cdot \mathrm{P}(B \mid A)
$$

## Definitions

- Fundamental Counting Principle

If there are $m$ items in one category and $n$ items in another category, then the total number of available choices is $m^{*} n$.

This principle can be extended to more than two categories as well.

## Definitions

The factorial of a non-negative integer $n$, is the product of all positive integers less than or equal to $n$.

$$
\frac{\text { Notation }}{n!=n \cdot(n-1) \cdot(n-2) \cdots 3 \cdot 2 \cdot 1}
$$

Note: 0 ! = 1

## Example

$5!=5 * 4 * 3 * 2 * 1=120$

## Definitions

## Combinations

We say that there are ${ }_{\mathrm{n}} \mathrm{C}_{\mathrm{r}}$ combinations of size $r$ that may be selected from among $n$ choices without replacement when order doesn't matter.

$$
{ }_{\mathrm{n}} \mathrm{C}_{\mathrm{r}}=\frac{n!}{(n-r)!r!}
$$

## Example

The United States Senate Appropriations Committee consists of 29 members; the Defense Subcommittee of the Appropriations Committee consists of 19 members. Disregarding party affiliation or any special seats on the Subcommittee, how many different 19-member subcommittees may be chosen from among the 29 Senators on the Appropriations Committee?

$$
{ }_{29} C_{19}=\frac{29!}{10!19!}=20,030,010
$$

## Probability Using Permutations and Combinations

## Example

In a certain state's lottery, 48 balls numbered 1 through 48 are placed in a machine and six of them are drawn at random. If the six numbers drawn match the numbers that a player had chosen, the player wins $\$ 1,000,000$. In this lottery, the order the numbers are drawn in doesn't matter. Compute the probability that you win the million-dollar prize if you purchase a single lottery ticket.

Number of ways to pick 6 of $48={ }_{48} C_{6}=12,271,512$

$$
\text { Probability }=\frac{1}{12,271,512}=.0000000815
$$

## Find the indicated probability. Round your answer to 6 decimal places when necessary.

1) Two fair 6 -sided dice are rolled. What is the probability that the sum of the two numbers on the dice is greater than 10 ?
2) Two fair 6-sided dice are rolled. What is the probability that the sum of the two numbers on the dice is not greater than 10 ?
3) Two fair 6-sided dice are rolled. What are the odds of the sum of the two numbers on the 1) $\qquad$
4) $\qquad$
5) $\qquad$ dice is greater than 10
6) Which of the following could not possibly be probabilities?
A. -0.44
B. $\frac{13}{7}$
C. 0
D. 0.43
A) A and B
B) A and D
C) A, B, and C
D) A and C
E) B and C
7) Which of the following events has a probability of 0 ?

A: The sun will shine all day on January 1st in Portland, Oregon
B: I will win the lottery if I buy one ticket
C: Tomorrow will be Monday if today is Saturday
A) C only
B) A and C
C) B and C
D) All of them
E) A only
9) A group of people were asked if they had attended college. 200 responded "yes", and 350 responded
9) $\qquad$ "no".
Find the probability that if a person is chosen at random, they attended college.

Find the indicated probability. Round your answer to 6 decimal places when necessary.
10) Two marbles are drawn without replacement from a box with 3 white, 2 green, 2 red, and 1 blue marble. Find the probability that both marbles are white.
A) $\frac{3}{8}$
B) $\frac{9}{56}$
C) $\frac{3}{32}$
D) $\frac{3}{28}$

Find the indicated probability.
11) The following table show the results of a clinical trial for an allergy drug.

|  | Allergy <br> drug | Placebo | Control <br> (no treatment) | Total |
| :--- | :---: | :---: | :---: | :---: |
| Improvement | 145 | 85 | 41 | 271 |
| No improvement | 55 | 115 | 59 | 229 |
| Total | 200 | 200 | 100 | 500 |

What is the probability that a randomly selected person received no treatment or improved? Round your answer to the nearest thousandth when necessary.

What is the probability of Improvement given that patient got the Allergy drug? $\qquad$

What is the probability of Improvement given that patient got Placebo? $\qquad$

What is the probability of Improvement given that patient got no treatment? $\qquad$
15) How many different 4-topping pizzas can be made if there are 13 individual toppings to choose from? Assume that no topping is used more than once and that the order of the toppings on the pizza is unimportant.
16) There are 5 members on a board of directors. If they must elect a chairperson, a secretary, and a treasurer, how many different slates of candidates are possible?
15) $\qquad$
16) $\qquad$
$\qquad$
14) A poker hand consists of 5 cards dealt from an ordinary deck of 52 playing cards. How
14) $\qquad$ many different hands are there consisting of four hearts and one spade?

