12.1	The Fundamental Counting Principle and Permutations
Objectives	1. Use the fundamental counting principle to count the number of ways an event can happen. 2. Use the permutations to count the number of ways an event can happen.
Fundamental Counting Principle	**Two Events** If one event can occur ***m*** ways and another event can occur ***n*** ways, then the number of ways both events can occur is:_____. **Three or More Events** The fundamental counting principle can be extended to three or more events. **Multiply** together all the ways the events can occur.
You are buying a sandwich. You have a choice of 5 meats, 5 cheeses, 3 dressings and 8 other toppings. How many different sandwiches with one meat, one cheese, one dressing, and one other topping can you choose?	
Ohio license plates are 3 letter followed by 4 digits. How many plates are possible if: **a. Letters and digits CAN be repeated.** **b. Letters and digits CANNOT be repeated.**	

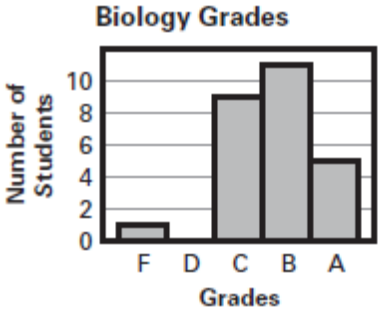
Permutations (Order is Important)	A permutation is an ordering of ***n*** objects. The number of permutations of n distinct objects is: $n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 3 \cdot 2 \cdot 1$
How many different ways can 5 people sit in a car that can seat 5 people? **How many different ways are there to seat 20 students in 20 desks?**	
Permutations of n objects taken r at a time. (Order is Important)	${}_nP_r = \frac{\boldsymbol{n}!}{(\boldsymbol{n}-\boldsymbol{r})!}$
How many different ways are there to seat 8 people into 5 seats? **There are 12 books on the Summer Reading List you want to read 5 of them. In how many different orders can you read 5 of them?**	

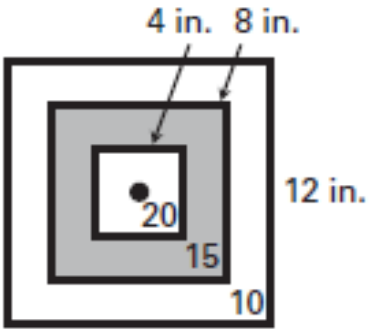
Permutations with Repetition.	The number of distinguishable permutations of n objects where one object is repeated q_1 times and another is repeated q_2 times and so on is: $$\frac{n!}{q_1! \cdot q_2! \cdot \ldots \cdot q_k!}$$
Find the number of distinguishable permutations of the letters in the following words.	MATHEMATICS ALGEBRA TENNESSEE

12.2	Combinations and Binomial Theorem
Objectives	1. Use combinations to count the number of ways an event can happen. 2. Use the binomial theorem to expand a binomial that is raised to a power.
Combinations (Order is NOT important)	**n** objects taken **r** at a time. $_nC_r = \frac{n!}{(n-r)!r!}$
Using Combinations with cards **How many different 5 card hands are possible from a standard deck?** **How many different 5 card hands are possible if all 5 cards are from the same suit?**	A standard deck of cards has: _____ cards, _____ suits, _____ cards of each suit, and _____ cards of each kind.

Multiplying or Adding Combinations	If finding the number of ways an Event A **AND** Event B can happen, _____. If finding the number of ways an Event A **OR** Event B can happen, _____.
You are taking a vacation. You can visit as many as 5 different cities and 7 different attractions. **a. Suppose you want to visit exactly 3 different cities *and* 4 different attractions. How many different trips are possible?** **b. Suppose you want to visit *at least* 8 locations (cities or attractions). How many different trips are possible?**	
Find the number of 5 card hands that contain 3 Aces and one other card that is NOT an Ace.	
An amusement park has 15 different rides. You want to ride at least 10 of them. How many different combinations of rides can you go on?	

Pascal's Triangle	
The Binomial Theorem	$(\boldsymbol{a}+\boldsymbol{b})^{\boldsymbol{n}}=$
Expand.	$(x+4)^3$ $(x-5)^4$ $(2x+3)^3$

12.3	An Introduction to Probability
Objectives	1. Find theoretical and experimental probabilities. 2. Find geometric probabilities.
Key Terms	Probability
Theoretical Probability	When all outcomes are equally likely , the theoretical probability that an Event A will occur is: $$P(A) = \frac{Number\ of\ outcomes\ in\ A}{Total\ number\ of\ outcomes}$$
You roll a six-sided die whose sides are numbered 1 through 6. Find the probability of: **a. rolling a three.** **b. rolling an even number.** **c. rolling a number greater than two.** **d. rolling a number greater than 0.**	
Experimental Probability	Finding the probability by conducting an experiment, survey or or looking at history.
The first exam grades of students in a biology class are shown in the bar graph. Find the probability of a randomly chosen student in the class received a B or better.	

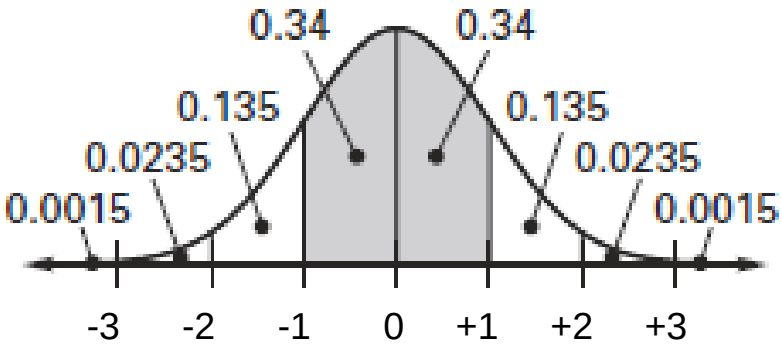
Geometric Probability	Probabilities that are found by calculating the ratio of two lengths, areas, or volumes.
Find the probability that a dart thrown at the given square target will score: **a. 20 points** **b. 15 points**	

12.4	Probabilities of Compound Events
Objectives	1. Find probabilities of unions and intersections of two events. 2. Use complements to find the probabilities of an event.
Probability of Compound Events	If A and B are two events, then the probability of **A or B** is: $$\boldsymbol{P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)}$$ If A and B are two **mutually exclusive events**, then the probability of **A or B** is: $$\boldsymbol{P(A\ or\ B) = P(A) + P(B)}$$
A card is randomly selected from a deck of cards. What is the probability that the card is a 5 or a face card?	
A card is randomly selected from a deck of cards. What is the probability that the card is a diamond or a face card?	
A and B are mutually exclusive. Find P(A or B), when P(A)=0.5 and P(B)=0.3.	
Find P(A or B), when P(A)=0.5, P(B)=0.4 and P(A and B)=0.3.	
Find P(A and B), when P(A)=0.7, P(B)=0.2 and P(A or B)=0.8.	

Using Complements to Find Probability	The Event A' (read as "A prime") is called the complement of event A, consisting in all outcomes not in A. $$\boldsymbol{P(A') = 1 - P(A)}$$
Find P(A') if P(A)= 2/3. **Find P(A') if P(A)= 25%.** **Find P(A') if P(A)= 0.7.**	
Four high school friends will all be attending the same university next year. There are 14 dormitories on campus. Find the probability that at least 2 of the friends will be in the same dorm.	

12.5	Probability of Independent and Dependent Events
Objectives	1. Find the probability of independent events. 2. Find the probability of dependent events.
Key Terms	Independent Dependent Events Conditional Probability
Probability of Independent Events	If A and B are **independent** events, then the probability that both A and B occur is $P(A \text{ and } B) = P(A) \cdot P(B)$.
You have a spinner with the numbers 1-5 on it. **What is the probability that you get a 2 on the first spin and a 4 on the second spin?** **What is the probability that you spin the spinner twice and get a 5 both time?** **What is the probability that you will NOT spin a 2 in one spin?**	

Probability of Dependent Events	If A and B are **dependent** events, then the probability that both A and B occur is P(A and B) = P(A) · P(B|A)
A and B are dependent events. Find P(A and B) given that P(A)=0.1 and P(B|A)=0.8.	
You randomly select two cards from a standard 52 card deck. Find the probability the probability the first card is a diamond and the second card is red. **a. You replace the first card before choosing the second card.** **b. You do NOT replace the first card.**	
You and a friend go to a restaurant and order a sandwich. The menu has 10 types of sandwiches which you both are equally likely to choose. What is the probability that each of you order a different sandwich?	

12.7	**Normal Distributions**
Objectives	1. Calculate probabilities using normal distributions. 2. Use normal distributions to approximate binomial distributions.
Key Term	Normal Curve
Areas Under a Normal Curve	The **mean** $\overline{x}$ and the standard **deviation σ** of a normal distribution determine the following areas. • The total area under the curve is 1. • 68% of the area lies within 1 standard deviation of the mean. • 95% of the area lies within 2 standard deviations of the mean. • 99.7% of the data lies within 3 standard deviations of the mean. 
The verbal section on the SAT exam is normally distributed with a mean of 507 and a standard deviation of 111. What is the probability that a randomly chosen test taker will score between 507 and 729?	
If you randomly choose 5 test takers, what is the probability that all five score at least 618?	