#

Algebra 2/Trig
Unit 7 Notes Packet

Name:
Date:
Period:

Sequences and Series AND Probability and Data Analysis

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(9) Page 705 - 706 #15 - 51 Column and #55, 56, 57 skipping #23, 27

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You can think of a **sequence** as a function whose domain is a set of consecutive integers. If a domain is not specified, it is understood that the domain starts with 1.

Finite sequences are ones that end.

Infinite sequences continue without stopping.

When the terms of a sequence are added, the resulting expression is a **series**. A series can either be infinite or finite.

You can use **summation notation** (aka sigma notation) to write a series

11.2 Arithmetic Sequences and Series (stress applications) (I/4)

In an **arithmetic sequence,** the difference between consecutive terms is constant. The constant difference is called the **common difference** and is denoted by *d.*

(E1.) Decide whether each set is arithmetic.

(a) -3, 1, 5, 9, 13, …

(b) 2, 5, 10, 17, 26,…

(P1.) Decide whether each set is arithmetic.

(a) -10, -6, -2, 0, 2, 6, 10,…

(b) 5, 11, 17, 23, 29,…

The nth term of an arithmetic sequence with first term a_1 and common difference d is given by:

$$a_n = a_1 + (n-1)d$$

Key:

a_1 - 1st term in the series or sequence

a_n - nth term in the series or sequence

n - location of a term in a series or sequence

d - common difference

r - common ratio

S_n - sum of the 1st to the nth term of a series

Σ- summation notation

*****To write a rule for the nth term in an arithmetic sequence, you must find a_1 and d.*****

(E2.) (a) Write a rule for the nth term of the sequence 50, 44, 38, 32,…

(b) Then find a_{20}

(P2.) (a) Write a rule for the nth term of the sequence 32, 47, 62, 77,…

(b) Then find a_{12}

(E3.) One term of an arithmetic sequence is $a_{13} = 30$. The common difference is $d = \frac{3}{2}$. Write a rule for the nth term.

(P3.) One term of an arithmetic sequence is a_8=50. The common difference is $d = .25$. Write a rule for the nth term.

(E4.) Two terms of an arithmetic sequence are $a_6 = 10$ and $a_{21} = 55$.

(a) Write a rule for the *n*th term.

(b) Find the value of n for which $a_n = 40$

(P4.) Two terms of an arithmetic sequence are $a_5 = 10$ and $a_{30} = 110$.

(a) Write a rule for the nth term.

(b) Write the value for n for which $a_n = -2$

The expression formed by adding the terms of an arithmetic sequence is called an arithmetic series. The sum of the first *n* terms of an arithmetic sequence is denoted by S_n.

The Sum of a Finite Arithmetic Series

The sum of the first *n* terms of an arithmetic series is: $S_n = n(\frac{a_1+a_n}{2})$

In words, S_n is the mean of the first *n*th terms, multiplied by the number of terms.

(E5.) Consider the arithmetic series 4 + 7 + 10 + 13 + 16 + 19 + … Find the sum of the first 30 terms.

(P5.) Consider the arithmetic series 20 + 18 + 16 +14 +…Find the sum of the first 25 terms.

(E6.) The first row of a concert hall has 25 seats, and each row after the first one has one more seat than the row before it. There are 32 rows of seats.

(a) Write a rule for the number of seats in the nth row

(b) Thirty-five students from a class want to sit in the same row. How close to the front can they sit?

(P6.) A construction company is laying a natural gas pipeline. Several sections of pipe have been laid in a pile at the construction site. There are 12 sections of pipe in the bottom row of the pile. Each row has one less pipe than the row below it. There are 8 rows of pipe.

(a) Write a rule for the number of pipe sections in the nth row.

(b) Which row has 6 pipe sections?

(E7.) Refer to (E6.) Information about a concert hall.

(a) What is the total number of seats in the concert hall?

(b) Suppose 12 more rows of seats are built (where each row has one more seat than the row before it). How many additional seats will the concert hall have?

(P7.) Use the information about the pipe sections in (P6).

(a) What is the total number of pipe sections in the pile?

(b) Suppose three more rows of pipe are added to the pile. How many additional pipe sections will the pile have?

(E8.) Find the sum of the series

$$\sum_{i=1}^{10} (2+i)$$

(P8.) Find the sum of the series

$$\sum_{i=1}^{15} 3-i$$

In a geometric sequence, the ratio of any term to the previous term is constant. This constant ratio is called the common ratio and is denoted by *r.*

(E1.) Decide whether each sequence is geometric.

(a) 1, 2, 6, 24, 120,…

(b) 81, 27, 9, 3, 1,…

(P1.) Decide whether each sequence is geometric.

(a) 4, -8, 16, -32,…

(b) 3, 9, -27, -81, -243,…

<u>Rule for a Geometric Sequence</u>

The *n*th term of a geometric sequence with the first term a_1 and common ratio, *r*, is given by:

$$a_n = a_1(r)^{(n-1)}$$

(E2.) (a) Write a rule for the *n*th term of the sequence -8, -12, -18, -27,…

(b) Find a_8

(P2.) (a) Write a rule for the *n*th term of the sequence 5, 2, 0.8, 0.32.

(b) Find a_8

(E3.) One term of a geometric sequence is $a_3 = 5$. The common ratio is $r = 2$. Write a rule for the *n*th term.

(P3.) One term of a geometric sequence is $a_4 = 3$. The common ratio is $r = 3$. Write a rule for the *n*th term.

(E4.) Two terms of a geometric sequence are $a_2 = 45$ and $a_5 = -1215$. Find a rule for the *n*th term.

(P4.) Two terms of a geometric sequence are $a_2 = -4$ and $a_6 = -1024$. Find a rule for the *n*th term.

The expression formed by adding the terms of a geometric sequence is called a geometric series. As with an arithmetic series, the sum of the first *n* terms of a geometric series is denoted by S_n.

<u>The Sum of a Finite Geometric Series with Common Ratio $r \neq 1$ is:</u>

$$s_n = a_1\left(\frac{1 - r^n}{1 - r}\right)$$

(E5.) Consider the geometric series 1 + 5 + 25 + 125 + 625 +… Find the sum of the first 10 terms.

(P5.) Consider the geometric series $4 + 2 + 1 + \frac{1}{2} + \ldots$ Find the sum of the first 10 terms.

(E6.) In 1990 the average monthly bill for cellular telephone service in the United States was $80.90. From 1990 through 1997, the average monthly bill decreased by about 8.6% per year. *Source: Statistical Abstract of the United States.*

(a) Write a rule for the average monthly cellular telephone bill a_n (in dollars) in terms of the year. Let $n = 1$ represent 1990.

(b) What was the average monthly cellular telephone bill in 1993?

(P6.) You buy a new car for $25,000. The value of the car decreases by 16% each year? Write a rule for the average yearly value of the car a_n (in dollars) in terms of the year. Let n = the current year.

(E7.) Use the model for the average monthly cellular telephone bill in (E6.) On average, what did a person pay for cellular telephone service during 1990 - 1997?

(P7.) Suppose your computer system loses one-fifth of its value at the end of the first year. At the end of the second year, it loses one-fifth of the remaining four-fifths of its value, and so on. If you paid $2700 for the computer, what is its average value at the end of each year during the 5 years you own it?

(E8.) Find the sum of the series

$$\sum_{i=1}^{10} 2(2)^{i-1}$$

(P8.) Find the sum of the series

$$\sum_{i=1}^{12} 3(4)^{i-1}$$

When dealing with the occurrence of more than one event or activity, it is important to be able to quickly determine how many possible outcomes exist.

For example, if ice cream sundaes come in 5 flavors with 4 possible toppings, how many different sundaes can be made with one flavor of ice cream and one topping?

Rather than list the entire sample space with all possible combinations of ice cream and toppings, we may simply multiply: 5 • 4 = 20 possible sundaes. This simple multiplication process is known as the Counting Principle.

The Fundamental Counting Principle: If there are **a** ways for one activity to occur, and **b** ways for a second activity to occur, then there are **a • b** ways for both to occur.

The fundamental counting principal can be extended to three or more events. For example, if three events can occur in m, n, and p ways, then the number of ways that all three events can occur is $m \cdot n \cdot p$.

For instance, if three events can occur in 2, 5, and 7 ways, then all three events can occur in

$$2 \cdot 5 \cdot 7 = 70\ ways.$$

(E1.) Police use photographs of various facial features to help witnesses identify suspects. One basice identification kit contains 195 hairlines, 99 eyes and eyebrows, 89 noses, 105 mouths, and 74 chins and cheeks.

(a) The developer of the identification kit claims that it can produce billions of different faces. Is this claim correct?

(b) A witness can clearly remember the hairline and the eyes and eyebrows of a suspect. How many different faces can be produced with this information?

(P1.) In a high school there are 273 freshman, 291 sophomores, 252 juniors and 237 seniors. In how many different ways can a committee of 1 freshman, 1 sophomore, 1 junior and 1 senior be chosen?

(E2.) The standard configuration for a New York license plate is 3 digits followed by 3 letters.

(a) How many different license plates are possible if digits and letters can be repeated?

(b) How many different license plates are possible if digits and letters cannot be repeated?

(P2.) A multiple choice test has 10 questions with 4 answer choices for each question. In how many different ways could you complete the test?

A permutation is an arrangement of objects in specific order.

The order of the arrangement is important!!

Consider, four students walking toward their school entrance. How many different ways could they arrange themselves in this side-by-side pattern?

1,2,3,4	2,1,3,4	3,2,1,4	4,2,3,1
1,2,4,3	2,1,4,3	3,2,4,1	4,2,1,3
1,3,2,4	2,3,1,4	3,1,2,4	4,3,2,1
1,3,4,2	2,3,4,1	3,1,4,2	4,3,1,2
1,4,2,3	2,4,1,3	3,4,2,1	4,1,2,3
1,4,3,2	2,4,3,1	3,4,1,2	4,1,3,2

The number of different arrangements is 24 or $4! = 4 \cdot 3 \cdot 2 \cdot 1$. There are 24 different arrangements, or permutations, of the four students walking side-by-side.

The notation for a permutation:

$${}_nP_r$$

n is the **total** number of objects

r is the number of objects chosen (want)

The formula for a permutation:

$${}_nP_r = \underbrace{n(n-1)(n-2)\ldots}_{r \text{ factors}}$$

OR

The formula for a permutation:

$${}_nP_r = \frac{n!}{(n-r)!}$$

(Remember that $0! = 1$.)

(Note: if $n = r$, as it did with the students walking side-by-side, then ${}_nP_r = n!$ for either formula.)

(E3.) Twelve skiers are competing in the final round of the Olympic freestyle skiing aerial competition.

(a) In how many different ways can the skiers finish the competition? (Assume there are no ties.)

(b) In how many different ways can 3 of the skiers finish first, second and third to win the gold, silver and bronze medals?

(P3.) You have homework assignments from 5 different classes to complete this weekend.

(a) In how many different ways can you complete the assignments?

(b) In how many different ways can you choose 2 of the assignments to complete first and last?

(E4.) You are considering 10 different colleges. Before you decide to apply to the colleges, you want to visit some or all of them. In how many orders can you visit:

(a) 6 of the colleges?

(b) all 10 colleges?

(P4.) There are 12 books on the summer reading list. You want to read some or all of them. In how many different orders can you read:

(a) 4 of the books?

(b) all 12 of the books?

(E5.) Find the number of distinguishable permutations in

(a) OHIO

(b) MISSISSIPPI

(P5.) Find the number of distinguishable permutations of the letters in

(a) SUMMER

(b) WATERFALL

12.2 Combinations (I/1)

A combination is a selection of *r* objects from a group of *n* objects where the order is not important. For instance, in most card games the order in which your cards are dealt is NOT important.

$$\boxed{{}_nC_r = \binom{n}{r} = \frac{{}_nP_r}{r!} = \frac{n!}{r!(n-r)!}}$$

For instance, the number of combinations of 2 objects taken from a group of 5 objects is ${}_5C_2 = \frac{5!}{3!\cdot 2!} = 10$

(E1.) A standard deck of 52 playing cards has 4 suits with 13 different cards in each suit.

(a) If the order in which the cards are dealt is not important, how many different 5 card hands are possible?

Standard 52-Card Deck

K ♠	K ♣	K ♦	K ♥
Q ♠	Q ♣	Q ♦	Q ♥
J ♠	J ♣	J ♦	J ♥
10 ♠	10 ♣	10 ♦	10 ♥
9 ♠	9 ♣	9 ♦	9 ♥
8 ♠	8 ♣	8 ♦	8 ♥
7 ♠	7 ♣	7 ♦	7 ♥
6 ♠	6 ♣	6 ♦	6 ♥
5 ♠	5 ♣	5 ♦	5 ♥
4 ♠	4 ♣	4 ♦	4 ♥
3 ♠	3 ♣	3 ♦	3 ♥
2 ♠	2 ♣	2 ♦	2 ♥
A ♠	A ♣	A ♦	A ♥

(b) In how many of these hands are all five cards of the same suit?

(P1.) Using the standard deck mentioned above,

(a) If the order is not important, how many different 7 card hands are possible?

(b) How many of these hands have all 7 cards of the same suit?

IMPORTANT NOTE:

(1) When finding the number of ways both an event A ***AND*** an event B can occur, you need to multiply.

(2) When finding the number of ways that an event A ***OR*** an event B can occur, you add instead.

(E2.) A restaurant serves omelets that ban be ordered with any of the ingredients shown.

(a) Suppose you want *exactly* 2 vegetarian ingredients and 1 meat ingredient in your omelet. How many different types of omelets can you order?

Omelets $3.00
(plus $.50 for each ingredient)

Vegetarian	Meat
green pepper	ham
red pepper	bacon
onion	sausage
mushroom	steak
tomato	
cheese	

(b) Suppose you can afford *at most* 3 ingredients in your omelet. How many different types of omelets can you order?

(P2.) 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 types of trips are possible?

Counting problems that include phrases like "at least" or "at most" are sometimes easier to solve by subtracting possibilities you do not want from the total number of possibilities.

(E3.) A theater is staging a series of twelve different plays. You want to attend *at least* 3 of the plays. How many different combinations of plays can you attend?

(P3.) A restaurant offers 6 salad toppings. On a deluxe salad, you can have up to 4 toppings. How many different combinations of toppings can you have?

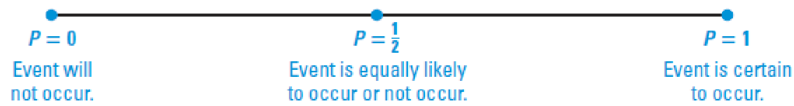
One of the stumbling blocks that students face when dealing with permutations and combinations is knowing whether the problem requires a combination or a permutation. Here are some examples of when each is applicable. Notice, in permutations, the order IS important and in combinations, the order is NOT important.

Permutation versus	**Combination**
1. Picking a team captain, pitcher, and shortstop from a group.	**1.** Picking three team members from a group.
2. Picking your favorite two colors, in order, from a color brochure.	**2.** Picking two colors from a color brochure.
3. Picking first, second and third place winners.	**3.** Picking three winners.

<u>****Some Key Words For Permutations: Arrange, Order, Line up****</u>

<u>****Some Key Words For Combinations: Select, Group, Choose****</u>

The probability of an event is a number between 0 and 1 that indicates the likelihood that an event will occur. An event that is certain to occur has a probability of 1. An event that cannot occur has a probability of 0. An event that is equally likely to occur or not occur has a probability of $\frac{1}{2}$.



Theoretical probability is based on knowing all of the equally likely outcomes of an experiment.

Probability of an Event

The probability of an event when all the outcomes are equally likely is:

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

Sample Space is also another word used for the number of all possible outcomes.

A probability that is based on repeated trials of an experiment is called an experimental probability. Each trial in which the event occurs is a success.

Experimental Probability

The experimental probability of an event is:

$$P(\text{event}) = \frac{\text{Number of successes}}{\text{Number of trials}}$$

(E1.) You roll a six-sided die whose sides are numbered from 1 through 6.

(a) Find the probability of rolling a 4

(b) Find the probability of rolling an odd number

(c) Find the probability of rolling a number less than 7

(P1.) A spinner has 8 equal-size sectors numbered from 1 to 8.

(a) Find the probability of spinning a 6

(b) Find the probability of spinning a number greater than 5

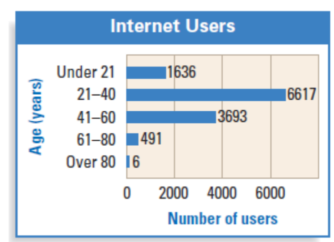
(E2.) You have a CD that has 8 songs in your CD player. You set the player to play the songs at random. The player plays all 8 songs without repeating any song.

(a) What is the probability that the songs are played in the same order they are listed on the CD?

(b) You have 4 favorite songs on the CD. What is the probability that 2 of your favorite songs are played first, in any order?

(P2.) There are 9 students on the math team. You draw their names one by one to determine the order in which they answer questions at a math meet. What is the probability that 3 of the 5 seniors the the team will be chosen last, in any order?

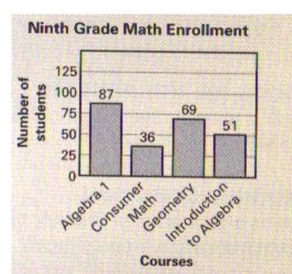
(E3.) In 1998 a survey asked Internet users for their ages. The results are shown in the bar graph. Find the experimental probability that a randomly selected Internet use is



(a) at most 20 years old

(b) at least 41 years old

(P3.) Ninth graders must enroll in one math class. The enrollments of ninth grade students during the previous year are shown in the bar graph. Find the probability that a randomly chosen student from this year's ninth grade class in enrolled in



(a) Consumer Math

(b) Algebra 1 or Introduction to Algebra

Odds When all outcomes are equally likely, the ratio of the number of favorable outcomes to the number of unfavorable outcomes is called the **odds in favor** of an event. The ratio of the number of unfavorable outcomes to the number of favorable outcomes is called the **odds against** an event.

$$\text{Odds in favor} = \frac{\text{Number of favorable outcomes}}{\text{Number of unfavorable outcomes}}$$

$$\text{Odds against} = \frac{\text{Number of unfavorable outcomes}}{\text{Number of favorable outcomes}}$$

(E4.) You randomly choose an integer from 0 through 9. What are the odds that the integer is 4 or more?

(P4.) You randomly choose a letter from the word SUMMER. What are the odds that the letter is a vowel?

(E5.) The probability that a randomly chosen household has a cat is 0.27. *Source: American Veterinary Medical Association.* What are the odds

(a) that a household has a cat?

(b) that a household does NOT have a cat?

(P5.) The probability that a randomly chosen 4 digit security code contains at least one zero is 0.34. What are the odds that a 4 digit security code contains at least one zero?

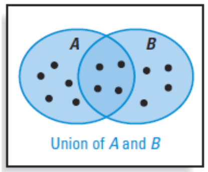
Probabilities of Unions and Intersections

VOCABULARY

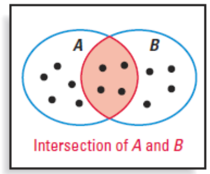
Compound event The union or intersection of two events

Mutually exclusive events Events *A* and *B* are mutually exclusive if the intersection of *A* and *B* is empty.

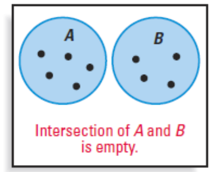
Complement The complement of event *A*, denoted *A′*, consists of all outcomes that are not in *A*.



Union of *A* and *B*



Intersection of *A* and *B*

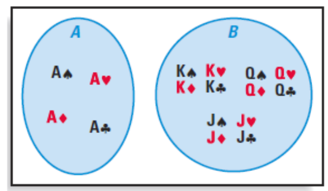


Intersection of *A* and *B* is empty.

PROBABILITY OF COMPOUND EVENTS

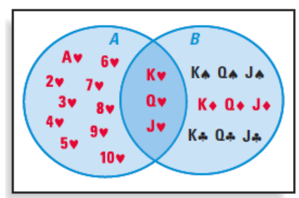
If *A* and *B* are two events, then the probability of *A* or *B* is:
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

If *A* and *B* are mutually exclusive, then the probability of *A* or *B* is: $P(A \text{ or } B) = P(A) + P(B)$



(E1.) A card is randomly selected from a standard deck of 52 cards. What is the probability that it is an ace *or* a face card? (MEE)

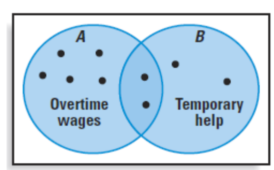
(P1.) One six sided die is rolled. What is the probability of rolling a multiple of 3 or 5? (MEE)



(E2.) A card is randomly selected from a standard deck of 52 cards. What is the probability that the card is a heart *or* a face card?(NMEE)

(P2.) One six sided die is rolled. What is the probability of rolling a multiple of 3 or a multiple of 2? (NMEE)

(E3.) Last year a company paid overtime wages *or* hired temporary help during 9 months. Overtime wages were paid during 7 months and temporary help was hired during 4 months. At the end of the year, an auditor examines the accounting records and randomly selects one month to check the company's payroll. What is the probability that the auditor will select a month in which the company paid overtime wages *and* hired temporary help?



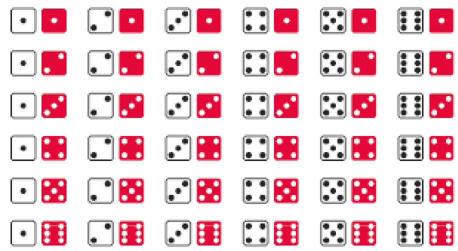
(P3.) In a poll of high school juniors, 6 out of 15 students took a French class and 11 out of 15 took a math class. Fourteen out of 15 students took French or math. What is the probability that a student took both French and math?

The probability of the complement of an event is one minus the probability of the event.

Complement:

$$P(A') = 1 - P(A)$$

(E4.) When two six sided dice are tossed, there are 36 possible outcomes as shown. Find the probability of the given event.



(a) The sum is NOT 8

(b) The sum is greater than or equal to 4

(P4.) A card is randomly selected from a standard deck of 52 cards. Fin the probability of the given event.

(a) The card is NOT a king

(b) The card is NOT an ace or a jack

(E5.) Four houses in a neighborhood have the same model of garage door opener. Each opener has 4096 possible transmitter codes. What is the probability that at least two of the four houses have the same code?

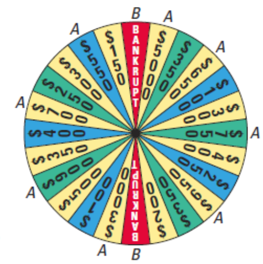
(P5.) One high school requires students to complete 30 hours of community service to graduate. There are 156 different community service options to choose from. What is the probability that in a group of 5 students, at least 2 of them will be going the same community service?

Two events are said to be **independent** if the result of the second event is not affected by the result of the first event.

If A and B are independent events, the probability of **both** events occurring is the product of the probabilities of the individual events

If A and B are **independent** events,
$P(\text{A and B}) = P(\text{A}) \cdot P(\text{B})$.

(E1.) You are playing a game that involves spinning the money wheel shown. During your turn you get to spin the wheel twice. What is the probability that you get more than $500 on your first spin and then go bankrupt on your second spin?



(P1.) A game machine claims that 1 in every 15 people win. What is the probability that you win twice in a row?

(E2.) During the 1997 baseball season, the Florida marlins won 5 out of 7 home games and 3 out of 7 away games against the San Francisco Giants. During the 1997 National League Division Series with the Giants, the Marlins played the first two games at home and the third game away. The Marlins won all three games. Estimate the probability of this happening.

(P2.) In a survey 9 out 11 men and 4 out of 7 women said they were satisfied with a product. If the next three customers are 2 women and a man, what is the probability that they will all be satisfied?

(E3.) You collect hockey trading cards. For one team there are 25 different cards in the set, and you have all of them except for the starting goalie card. To try and get this card, you buy 8 packs of 5 cards each. All cards are in a pack are different and each of the cards is equally likely to be in a given pack. Find the probability that you will get at least one starting goalie card.

(P3.) Refer to the survey is (P2.). If 4 men are the next customers, what is the probability that at least one of them is NOT satisfied with the product?

If the result of one event **IS** affected by the result of another event, the events are said to be **dependent.**

If A and B are dependent events, the probability of both events occurring is the product of the probability of the first event and the probability of the second event once the first event has occurred.

If A and B are **dependent** events,
and A occurs first,
$P(\text{A and B}) = P(\text{A}) \bullet P(\text{B,once A has occurred})$
... and is written as ...
$P(\text{A and B}) = P(\text{A}) \bullet P(\text{B}|\text{A})$

(E4.) The table shows the number of endangered and threatened animal species in the United States as of November 30, 1998. Find

(a) the probability that a listed animal is a reptile

Source: United States Fish and Wildlife Service

	Mammals	Birds	Reptiles	Amphibians	Other
Endangered	59	75	14	9	198
Threatened	8	15	21	7	69

(b) the probability that an endangered animal is a reptile

(P4.) The table shows the camp attendance for three age groups of students in one town. Find

Age	Attended Camp	No Camp
5–7	45	117
8–10	94	62
11–13	81	79

(a) the probability that a listed student attended camp

(b) the probability that a child in the 8-10 group from the town did not attend camp

(E5.) You randomly select two cards from a standard 52-card deck. What is the probability that the first card is not a face card (a king, queen or jack) and the second card is a face card if

(a) you replace the first card before selecting the second card

(b) you do NOT replace the first card

(P5.) You randomly select two cards from a standard 52-card deck. Find the probability that the first card is a diamond and the second card is red if

(a) you replace the first card before selecting the second card

(b) you do NOT replace the first card

(E6.) You and two friends go to a restaurant to order a sandwich. The menu has 10 types of sandwiches and each of you is equally likely to order any type. What is the probability that each of you orders a different type?

(P6.) Three children have a choice of 12 summer camps that they can attend. If they each randomly choose which camp to attend, what is the probability that they attended all different camps?

(E1).

Data can sometimes be modeled by a function. Drawing a scatter plot of the data can help you recognize the type of function that best models the data. You can then use one of the regression features on a graphing calculator to find and graph an equation of the best-fitting model.

Use a graphing calculator to draw a scatter plot of the data. Then tell whether a *linear*, *quadratic*, or *exponential* function would best model the data.

a. Average total cost y of a year of college, where $x = 3$ represents 1993:

x	3	4	5	6	7	8	9	10
y	7931	8306	8800	9206	9588	10,076	10,444	10,876

b. Number of customers y in a restaurant each hour, where $x = 3$ represents 3 P.M.:

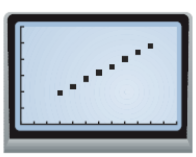
x	3	4	5	6	7	8	9	10
y	15	30	40	50	45	42	31	18

c. Population y of bacteria in a petri dish after x hours:

x	1	2	3	4	5	6
y	3	15	35	80	300	740

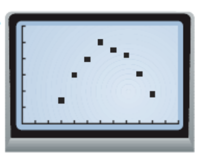
SOLUTION

a.



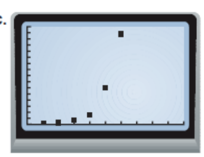
The points lie nearly in a straight line. This suggests a linear model.

b.



The points show a parabolic trend. This suggests a quadratic model.

c.



The points lie in a curve that seems to have an asymptote. This suggests an exponential model.

(E2.) Find and graph an equation of the best-fitting model for each data set in Example 1.

a.

The linear regression equation is $y = 423x + 6660$.

b.

The quadratic regression equation is $y = -2.55x^2 + 33.5x - 62.7$.

c.

The exponential regression equation is $y = 1.31 \cdot 2.91^x$.

(E3.) Use the models in parts (a) and (b) of Example 2.

a. Predict the average total cost of a year of college in 2007.

b. Predict the number of customers in the restaurant at 6:30 P.M.

The **correction coefficient** r for a set of paired data is a measure of how well a linear function models the data. If all of the graphed data pairs lie exactly on a line with a positive slope, the correlation coefficient is 1. If all of the graphed data pairs lie exactly on a line with a negative slope, the correlation coefficient is –1. If the graphed data pairs tend not to lie on any line, the correlation coefficient is close to 0.

(E4.) Estimate the correlation coefficient for the data.