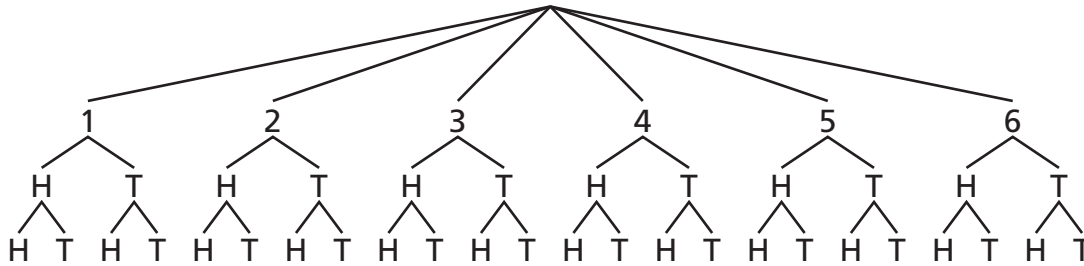## 12.5 Start Thinking

A die is rolled and then two coins are tossed. The possible outcomes are shown in the tree diagram below. How many outcomes are possible? What does each row in the tree diagram represent? What does each branch in the tree diagram represent? Describe two ways of determining the total number of outcomes from the tree diagram.
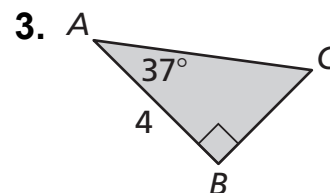

12.5 Warm Up
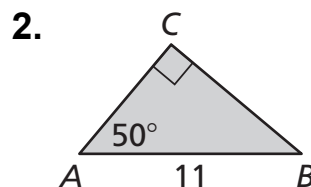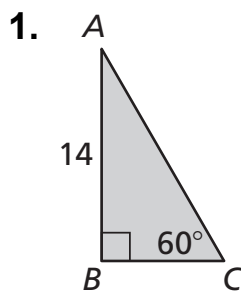
Count the number of different ways the letters can be arranged.

1. POP **2.** TAP **3.** NOON **4.** KEEP

12.5 Cumulative Review Warm Up

Solve △ABC. Round your answers to four decimal places.

1.

2.

3.

Name _____ Date _____

12.5 Practice A

In Exercises 1–3, find the number of ways that you can arrange (a) all of the letters and (b) 2 of the letters in the given word.

  1. HAT   **2.** PORT   **3.** CHURN

In Exercises 4–9, evaluate the expression.

  4. $_4P_3$ **5.** $_6P_2$ **6.** $_8P_1$

  7. $_5P_4$ **8.** $_9P_5$ **9.** $_{11}P_0$

10. Fifteen sailboats are racing in a regatta. In how many different ways can three sailboats finish first, second, and third?

11. Your bowling team and your friend's bowling team are in a league with 6 other teams. In tonight's competition, find the probability that your friend's team finishes first and your team finishes second.

In Exercises 12 and 13, count the possible combinations of _r_ letters chosen from the given list.

  12. H, I, J, K, L; $r = 3$ **13.** U, V, W, X, Y; $r = 2$

In Exercises 14–19, evaluate the expression.

  14. $_6C_1$ **15.** $_7C_5$ **16.** $_8C_8$

  17. $_9C_7$ **18.** $_{11}C_5$ **19.** $_{12}C_2$

20. You and your friends are ordering a 3-topping pizza. The pizzeria offers 8 different pizza toppings. How many combinations of 3 pizza toppings are possible?

In Exercises 21 and 22, tell whether the question can be answered using _permutations_ or _combinations_. Explain your reasoning. Then answer the question.

21. On a biology lab exam, there are 8 stations available. You must complete the labs at 6 of the 8 stations. In how many ways can you complete the exam?

22. Your committee is voting on their logo. There are 7 possible logos and you are to rank your top 3 logos. In how many ways can you rank your top 3 logos?

Name_____ Date_____

12.5 Practice B

In Exercises 1–3, find the number of ways that you can arrange (a) all of the letters and (b) 2 of the letters in the given word.

1. SMILE   2. POLITE   3. WONDERFUL

In Exercises 4–9, evaluate the expression.

4. $_6P_4$ 5. $_{12}P_1$ 6. $_{10}P_7$

7. $_{11}P_0$ 8. $_{25}P_2$ 9. $_{20}P_6$

10. You have textbooks for 7 different classes. In how many different ways can you arrange them together on your bookshelf?

11. You make wristbands for Team Spirit Week. Each wristband has a bead containing a letter of the word COLTS. You randomly draw one of the 8 beads from a cup. Find the probability that COLTS is spelled correctly when you draw the beads.

In Exercises 12 and 13, count the possible combinations of r letters chosen from the given list.

12. P, Q, R, S, T, U; $r = 2$ 13. G, H, I, J, K, L; $r = 4$

In Exercises 14–19, evaluate the expression.

14. $_9C_1$ 15. $_7C_7$ 16. $_{10}C_4$

17. $_{13}C_7$ 18. $_{14}C_8$ 19. $_{25}C_5$

In Exercises 20 and 21, tell whether the question can be answered using *permutations* or *combinations*. Explain your reasoning. Then answer the question.

20. Ninety-five tri-athletes are competing in a triathlon. In how many ways can 3 tri-athletes finish in first, second, and third place?

21. Your band director is choosing 6 seniors to represent your band at the Band Convention. There are 44 seniors in the band. In how many groupings can the band director choose 6 seniors?

Name _____ Date _____

12.5 Enrichment and Extension

Permutations and Combinations

As you learned, a *permutation* is an arrangement of objects in a specific order. Sometimes there are also other conditions that must be satisfied. In such cases, you should deal with the special conditions first.

Example: Using the letters in the word *square*, how many 6-letter arrangements with no repetitions are possible if vowels and consonants alternate, beginning with a vowel?

Of the 6 letters in the word, 3 are vowels (u, a, e) and 3 are consonants (s, q, r).

Beginning with a vowel, every other slot is to be filled by a vowel. There are 3 such slots and 3 vowels to be arranged in them.

$\underline{\ 3\ } \times \underline{\ \ \ } \times \underline{\ 2\ } \times \underline{\ \ \ } \times \underline{\ 1\ } \times \underline{\ \ \ }$

The remaining 3 slots have 3 consonants to be arranged in them.

$\underline{\ 3\ } \times \underline{\ 3\ } \times \underline{\ 2\ } \times \underline{\ 2\ } \times \underline{\ 1\ } \times \underline{\ 1\ }$

Multiply to determine the total number of arrangements.

There are 36 possible arrangements.

The girls Amy, Ann, and Doris and the boys Al, Aaron, Bob, and Roy are in a nursery group. Determine the number of ways the children can be arranged in a line with the following conditions.

 1. A girl is always at the head of the line.

 2. Roy is always at the head of the line.

 3. A child whose name begins with A is always at the head of the line.

 4. A child whose name begins with A is always at the head and the rear of the line.

The diamond suit from a standard deck of 52 playing cards is removed from the deck, shuffled, and laid out in a row. Determine the number of possible arrangements.

 5. The first card is the ace.   **6.** The first card is a face card.

Use the digits 0, 1, 2, 3, 4 without repetition. Determine the number of ways to form each arrangement.

 7. 3-digit numerals whose values are at least 100.

 8. 4-digit numerals whose values are at least 1000 and less than 4000.

 9. 4-digit numerals whose values are at least 2000 and less than 3000.

Name_____ Date_____

12.5 Puzzle Time

Why Was The Pantry So Good At Telling The Future?

Write the letter of each answer in the box containing the exercise number.

Evaluate the expression.

1. $_3P_1$

2. $_7P_3$

3. $_{10}P_4$

4. $_{21}P_4$

5. $_9P_6$

6. $_{11}P_8$

7. $_{15}P_3$

8. $_6P_6$

9. $_5C_2$

10. $_{30}C_{28}$

11. $_{15}C_9$

12. $_8C_4$

13. $_{19}C_{14}$

14. $_8C_8$

15. $_{44}C_{41}$

16. $_9C_4$

17. $_{28}C_{25}$

18. $_{20}C_{15}$

19. A row contains five empty desks. How many different ways could five students sit in the desks in the row?

20. Sixteen students are competing in the 100-yard dash. In how many different ways can the students finish first, second, and third?

Answers

E. 60,480	**T.** 435
I. 3	**K.** 5040
W. 6,652,800	**O.** 15,504
H. 720	**A.** 10
W. 5005	**A.** 70
R. 120	**T.** 210
S. 11,628	**I.** 1
T. 3276	**N.** 143,640
N. 13,244	**S.** 126
W. 2730	**E.** 3360

1	2		3	4	5	6		7	8	9	10		11	12	13	

14	15		16	17	18	19	20