2016 - 2017 Academic Junior High Decathlon

Logic Study Guide

2017 Logic Study Guide created by Education Test Creators

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The Logic Quiz is a timed team event that tests problem-solving, inductive logic skills, and deductive reasoning. The Logic Quiz typically consists of 20 logic puzzles with a total value of 8,000 points. Point values for each question vary, depending upon the difficulty of the puzzle and the average time it takes to solve. The Logic Quiz lasts for one hour.

The Logic Study Guide gives directions to solve the most common logic puzzles used in the AJHD Logic Quiz. It is not a comprehensive guide. There are logic puzzles on the AJHD Logic Quiz that are not included in this guide. The Logic Study Guide is designed to familiarize your team with different processes and tools to use in solving logic puzzles.

The Logic Study Guide shows one method to solve each type of logic puzzle. However, there are multiple ways to solve logic puzzles. It is recommended that your team work on the logic practice puzzles together and share different methods and approaches in finding solutions. Brainstorming different ideas and approaches to solving problems builds teamwork, communication skills, organizational skills, and respect.

Keep in mind that the Logic Quiz is a timed test. It is important to find the answers to the logic puzzles as quickly as possible. The Logic Study Guide includes addition, multiplication, and division shortcuts to use for math-based logic. Try placing time limits for solving practice problems. The more puzzles you solve, the better your problem-solving skills will become.

Prior to the day of the competition, select at least one member of your team to serve as the Logic Captain. The Logic Captain is responsible for assigning logic puzzles to each decathlete to solve during the Logic Quiz, working with the Recorder to make sure a solution is found for each puzzle, and managing the team during the competition. A good Captain is not necessarily the decathlete with the strongest logic skills. The Captain needs to be a good time-manager, communicator, and organizer.

In addition, select one team member to be the Recorder. This person is responsible for filling out the master answer key that is scored at the completion of the Logic Quiz. The Recorder should have very neat handwriting, be detail-oriented, and communicate effectively with the Captain and team members. The Recorder works with the Logic Captain to keep track of the puzzles that have been solved and keep track of elapsed time during the Logic Quiz.

Two logic practice tests are include in the study guide. We recommend using these practice tests for mock Logic Quizzes. Print out a copy of the practice test for each member of the decathlon team. Print out a copy of the team Master Answer Sheet. Have the Recorder write the name of your school on the team Master Answer Sheet. Set a timer for one hour.

When the mock Logic Quiz begins, look through the entire practice test, taking note of the types and point values of each puzzle. Have the Logic Captain divide up the test puzzles amongst the team members. As puzzles are solved, give the solution to the Recorder. The Recorder writes the answer on the Master Answer Key. When time expires, turn in the Master Answer Key for scoring.

Here are some recommendations for improving your Logic Quiz score:

1. Do not pass the Master Answer Key to each decathlete to record answers. Too often, time is wasted when the Master Answer Key is misplaced. The Recorder is responsible for keeping track of the Master Answer Key and recording the solutions.

2. Always look through the entire test before beginning. Read the directions for each puzzle. Note the points for each puzzle.

3. Divide and conquer! Split up the puzzles and assign different puzzles to each decathlete to solve.

4. To calm nerves and boost team confidence, solve the easy puzzles first!

5. Puzzles with large point values (600 to 800 points) typically are time-consuming to solve. The Captain should delegate time-consuming puzzles to team members with the best logic skills. Don't delay in tackling these problems.

6. Inform the entire team when a puzzle is solved. Give the Recorder the solution to record on the Master Answer Key.

7. Keep track of the time. The Recorder and/or Captain should notify the team when half the time has elapsed. At the half-way mark, go over the puzzles that do not have a recorded answer and determine if a decathlete needs help from a teammate on the remaining puzzles. Reassign problems if a decathlete is stuck. Sometimes, a new perspective helps.

8. Repeat step #5 fifteen minutes before the end of the Logic Quiz.

9. Five minutes before the end of the Logic Quiz, turn in any new solutions to the Recorder. Also, write down any partial solutions to the puzzles on the Master Answer Key. (Sometimes, partial credit is awarded for partial solutions.)

10. One minute before the end of the Logic Quiz, write down whatever you have for any unsolved puzzles. You are not penalized for guessing!

11. Remember to relax, breathe deeply, and concentrate on your test. Don't become distracted by the other teams competing in the event.

12. If you need to clarify the directions for a puzzle, ask the test proctor for help.

13. Double check your work. Make sure every part of each answer is recorded accurately on the Master Answer Key.

14. Attempt to solve any tie-breaker questions, but only after solving the other problems on the test. Tie-breaker questions are only used to break ties in the individual test areas and do not count toward the overall team competition score unless a tie needs to be broken at the end of the competition.

Good luck, Decathletes!

- For access to the Quizlet.com classroom for the Logic Test, go to https://quizlet.com/ and click on the “Sign Up” tab to create your own account.

- Once you have set up your account, click on the “continue to free Quizlet” tab (in small letters located below the “Add superpowers to your account!” banner) to access the free version of the Quizlet.com classroom.

- Use the link below to go directly to the 2017 AJHD Logic Test classroom or type in 2017 AJHD Logic Test in the search field and click on the Classroom tab to locate the classroom.

  https://quizlet.com/class/3320101/

- Once you reach the 2017 AJHD Logic Test classroom, click on the “Request to Join” button. A message will be sent to Education Test Creators to add you to the classroom. Please note that it may take up to two days for your “Request to Join” to be approved and activated.

- In the classroom, you will find files to access for practice. Click on the title of the file to access the information.

- Note the icons at the top of the Quizlet page. Try out the different study aids by clicking on an icon.
  - Cards = flashcards
  - Learn = fill-in quizzes
  - Speller = pronounces word and asks for its spelling
  - Test = short-answer, multiple-choice, and true/false tests
  - Scatter = match terms to definitions
  - Race = game based on the terms

- For help with using the Quizlet.com site, click on your username in the upper right hand corner of the home page. Click on the “Help Center” tab on the dropdown menu.

Have fun and check for updates to the classroom!

1. **Read the entire problem, including the directions. <u>Do not skip this step!</u>**
2. Define what type of problem it is: Odds, probability, anagram, math problem, etc.
3. Define what answer(s) you need to find.

    Try underlining key words, quantities, and other information you need to solve the problem.

4. Assign variables for the unknown quantities. Use as few variables as possible. Write down what each variable represents.
5. Draw a diagram of the problem.
6. Are all the measurements in the same term?

    If not, convert the measurements into the same units.

7. Look for key words that describe mathematical operations, such as “more than”, ”less than”, “sum of”, or “difference”. Translate these terms into algebraic equations.
8. Are there any standard formulas that apply to the problem?

    Distance = rate x time

    Area of a rectangle = length x width

    $$\text{Work} = \frac{\textit{Person "A" time worked}}{\textit{Person "A" time to complete}} + \frac{\textit{Person "B" time worked}}{\textit{Person "B" time to complete}} = 1$$

9. If it is a math problem, solve the equation using mathematical rules of operation and algebra.
10. Sometimes, it is easier to solve a problem in the reverse order (left to right or bottom to top). If you are stuck without an answer, work the problem in reverse order.
11. Look for patterns.

    Sometimes, placing letters or numbers in a different order will reveal a pattern. Look for patterns in reverse order (left to right or bottom to top). If an anagram, list the letters in alphabetical order, then try to find common letter combinations.

12. Try brainstorming ideas on how to solve the problem.

    There are multiple ways to solve a problem. Discuss possible ways of approaching the problem with your teammates. Divide up the work and compare possible answers to reach a solution.

13. Double-check your work.

    Plug your answers back into the equation to determine if the answer is correct. Make sure you have answered every question. If a problem uses series of numbers or letters, make sure you have used all the numbers or letters.

Here are some tips on translating word problems into algebraic equations:

Algebraic Symbol	English Terms for Algebraic Symbols						
+	Add	Sum	In addition	More than	Increased	In excess	Greater
-	Subtract	Difference	Reduce	Less	Minus	Decreased by	
x	Multiply	Times	Percent	Product	Interest on		
÷	Divide	Quotient	Per				
=	Equal	Same as	Is	Will be	Result		
>	Greater than						
<	Less than						
≥	Greater than or equal to						
≤	Less than or equal to						
x^2	Square of (*x*)	Squared	To the second power				
x^3	Cube of (*x*)	Cubed	To the third power				

Examples of Translating English Words into Algebraic Expressions			
Eight more than y	*y* + 8	2 more than a number is 6	*x* + 2 = 6
A number added to 4	4 + *x*	The product of 5 times a number is 10	5*y* = *10*
The sum of *x* and *y*	*x* + *y*	One half a number is 5	$\frac{1}{2}x = 5, \frac{x}{2} = 5$
A number increased by 10	*x* + 10	Five times the sum of *y* and 5	5(*y* + 5)
A number minus 10	*x* - 10	Five times the difference of y and 5	5(*y* – 5)
The difference between x and 5	*x* - 5	The sum of two consecutive integers	*x* + (*x* + 1)
The difference between 5 and x	5 - *x*	The sum of two consecutive even integers or the sum of two odd integers	*x* + (*x* + 2)
Two times a number *y*	2*y*	The sum of 5*y* and 10 is equal to the product *y* and 15	5*y* + 10 = 15*y*
Twenty percent of x	0.20*x*	The product of the sum of *a* and 1 and the sum of *b* and 2	(*a* + 1)(b + 2)
X squared plus 5	$x^2 + 5$	5 less than *X* cubed	$x^3 - 5$
The product of x and y	*xy, x(y)*	The product of 3 and 5	3 x 5, 3•5, 3(5)
The quotient of x and 2	$\frac{x}{2}$	The quotient of 2 and x	$\frac{2}{x}$

Anagram: Rearrange the letters of a word or phrase to produce a new word or phrase, using all the original letters exactly once.

Example: An anagram for *orchestra* is *carthorse*.

Antonyms: Words that have opposite meanings. Example, *hot* and *cold*.

Cryptogram: A puzzle that consists of a short piece of coded message or text. A cryptogram is an example of a substitution cipher, in which each letter is replaced by a different letter, number or picture. To solve the puzzle, discover the original lettering.

Example: *vqmqmq* = *banana*, where *v* = *b*, *q* = *a*, and *m* = *n*.

Deduction puzzles: Also known as True/False problems, the solution of a deduction puzzle is reached by deciding if a premise is true or false based upon the evidence in the puzzle. Only use the information in the puzzle; do not relate the problem to "real-world" situations or experiences outside the scope of the problem. The solution must make all of the premises true.

Fibonacci sequence: A sequence of numbers in which each number is the sum of the two preceding numbers.

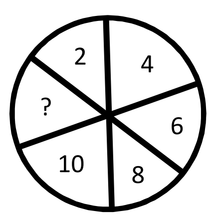
Example: 1, 1, 2, 3, 5, 8, 13, 21, ...

Homonym or homophone: Words that share the same pronunciation but have different meanings. For example, *tail* and *tale* are homonyms/homophones.

Logic wheel: A type of pattern problem that uses a circle divided into segments. Each segment contains a term of the pattern. To solve, find the missing term that is depicted by the question mark.

Example:

Answer: **?** = 0 or 12



Ordering: Placing numbers or figures in order: first, second, third, fourth, etc.

Oxymoron: A figure of speech that combines contradictory terms. Example, *giant shrimp* or *sweet sorrow.*

Palindrome: A word, phrase, or list of symbols that read the same from left to right and from right to left.

Example: *Madam, I'm, Adam*.

Pascal's triangle: A pattern in the shape of a triangle. The sum of the numbers in each row is twice the sum of the numbers in the previous row. The sum of the numbers in a row (*n)* is represented by 2^n.

```
                  1
               1     1
            1     2     1
         1     3     3     1
      1     4     6     4     1
   1     5    10    10     5     1
1     6    15    20    15     6     1
```

Row 1	2^0
Row 2	2^1
Row 3	2^2
Row 4	2^3
Row 5	2^4
Row 6	2^5
Row 7	2^6

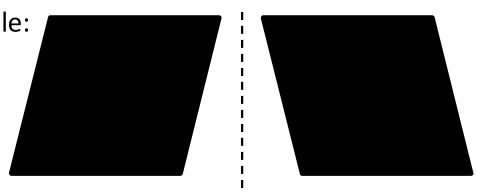
Patterns: A list of numbers or figures that follow a certain sequence. Patterns often follow mathematical progressions or equations.

Pictogram or rebus: A puzzle that used pictures, letters, or symbols to represent words or phrases.

Example:  C U (I see you.)

Reflection: The mirror image of an object. To form the mirror image, flip the figure over a line of reflection. Reflections are often found in pattern problems.

Example:



Riddle: A puzzling question posed as a problem to be solved or guessed.

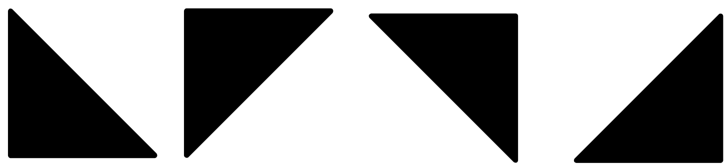
Example: *What is greater than God, more evil than the devil, the poor have it, the rich need it, and if you eat it, you will die?* Answer: *Nothing.*

Roman numerals:

Roman Numeral	Equivalent
I	1
V	5
X	10
L	50
C	100
D	500
M	1,000

Rotation: An object that turns around a fixed point. In pattern problems, objects often rotate a consistent amount, for example, 45° to the right or clockwise. To rotate a figure, select the point of rotation, then move the object around the point.

Example: The triangle rotates 90° to the right.



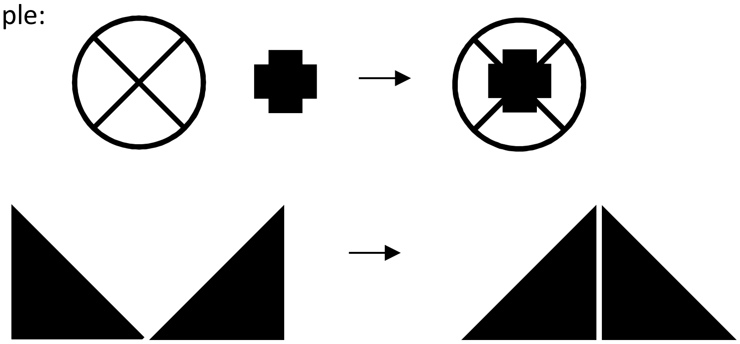
Sudoku: A placement puzzle. The standard Sudoku is a 9 x 9 grid, consisting of 9 - 3 x 3 boxes. To solve a Sudoku, place the digits from 1 through 9 into each column, row, and 3 x 3 box without repeating a number. Sudoku puzzles may vary in size. The digits that are used are determined by the size of the grid. For instance, a 4 x 4 grid uses the digits 1 through 4, and a 6 x 6 grid uses the digits 1 through 6.

Synonyms: Words that have the same meaning. Example, *tiny* and *small*.

Tangrams: Tangrams use geometric shapes that are combined to form different figures. Tangram puzzles will often ask if a particular figure may be formed (for instance, a square from two triangles), how many of a particular shape are in a figure, or if the surface areas of two or more figures are the same.

Translation: A figure moves along a straight line. In pattern problems, translation is used to overlap figures or to create different figures with the same area.

Example:



Word ladder: A beginning word and an end word are given. To solve the puzzle, change one letter in each successive word until the end word is formed. The challenge is to use the least number of words to change the beginning word into the end word.

Example: Change *cold* to *warm.*

Cold → *Cord* → *Card* → *Ward* → *Warm*

Wordoku: A Sudoku that uses letters instead of numbers.

Finding the odds

Odds are used to describe the chance of an event occurring. The odds are the ratios that compare the number of ways the event can occur with the number of ways the event cannot occur.

The odds in favor - the ratio of the number of ways that an outcome can occur compared to how many ways it cannot occur.

Odds in favor = Number of successes: Number of failures

The odds against - the ratio of the number of ways that an outcome cannot occur compared to how many ways it can occur.

Odds against = Number of failures: Number of successes

Example:

A jewelry box contains 5 white pearl, 2 gold rings, and 6 silver rings. What are the odds of drawing a white pearl from the jewelry box?

Number of successes = 5

Number of failures = 2 + 6 = 8

Numbers of ways to draw a white pearl: number of ways to draw another piece of jewelry.

5:8

The odds are 5:8

Probability is a type of ratio where we compare how many times an outcome can occur compared to all possible outcomes.

$$\text{Probability} = \frac{\text{number of wanted outcomes}}{\text{number of possible outcomes}}$$

Example:

What is the probability of rolling a 6 when you roll 1 die?

A die has 6 sides, one side contains the number 6. So, there is 1 wanted outcome in 6 possible outcomes.

$$\frac{1}{6}$$

Number of 6's on 1 die (numerator)

Number sides on 1 die. (denominator)

Independent events: Two events are independent when the outcome of the first event does not influence the outcome of the second event.

When we determine the probability of two independent events, we multiply the probability of the first event *P*(*X)* by the probability of the second event *P(Y)*.

$$P(X \text{ and } Y) = P(X) \bullet P(Y)$$

Example:

If a person rolls two dice, what is the probability of getting two 4s?

The probability of rolling a 4 on one die is 1/6

The probability of rolling 4s on both dice is:

$$P(X \text{ and } Y) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

Dependent events: Two events are dependent when the outcome of the first event influences the outcome of the second event. The probability of two dependent events is the product of the probability of X and the probability of Y **AFTER** X occurs.

P(X and Y) = P(X) • P(Y after X)

Example:

What is the probability for you to choose two red cards in a deck of cards?

A deck of cards has 26 black and 26 red cards. The probability of choosing a red card randomly is:

$$P(X) = \frac{26}{52} = \frac{1}{2}$$

One red card has been removed from the deck, therefore the probability of choosing a second red card from the deck is now:

$$P(Y \text{ after } X) = \frac{25}{51}$$

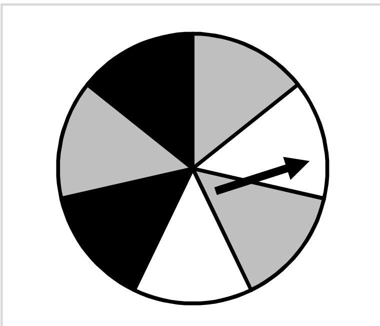
The probability of choosing two red cards in a deck of cards is:

$$P(X \text{ and } Y) = \frac{1}{2} \cdot \frac{25}{51} = \frac{25}{102}$$

Mutually exclusive events: Two events are mutually exclusive when the events cannot happen at the same time. The probability that one of the mutually exclusive events occur is the sum of their individual probabilities.

P(X or Y) = P(X) + P(Y)

An example of two mutually exclusive events is a wheel of fortune.



What is the probability that the wheel stops at black or grey?

P(black or grey) = P(black) + P(grey)

P(black) = $\frac{2}{7}$

P(grey) = $\frac{3}{7}$

Inclusive events: Two events are inclusive when the events can happen at the same time.

To find the probability of an inclusive event, first add the probabilities of the individual events and then subtract the probability of the two events happening at the same time.

P(X or Y) = P(X) + P(Y) – P(X and Y)

Example:

What is the probability of drawing a black card or a ten in a deck of cards?

There are 4 tens in a deck of cards P(10) = $\frac{4}{52}$

There are 26 black cards P(black) = $\frac{26}{52}$

There are 2 black tens P(black and 10) = $\frac{2}{52}$

$$P(\text{black or ten}) = \frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} = \frac{7}{13}$$

Number patterns are a list of numbers or figures that follow a certain sequence. Patterns often follow mathematical progressions or equations.

Here are a few quick tips to help solve number patterns or sequences:

1. Are the numbers in the sequence increasing or decreasing?

    If the numbers are increasing, see if the difference between successive terms use addition or multiplication.

    If the numbers are decreasing, see if the difference between successive terms use subtraction or division.

2. Are the numbers in the sequence increasing gradually or rapidly?

    If the numbers are increasing rapidly, the sequence may be using exponents, such as squares or cubes.

    If the numbers are increasing rapidly, look for multiples.

    If the numbers are increasing gradually, compare the difference between each successive term. Does a pattern appear?

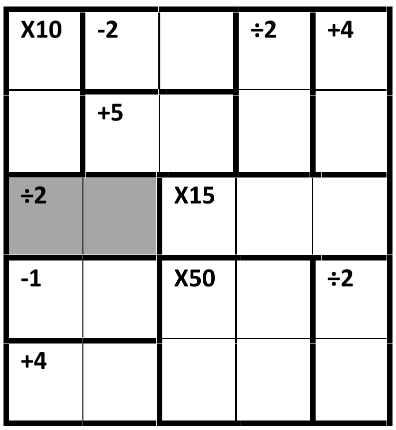
Here are some examples of number sequences:

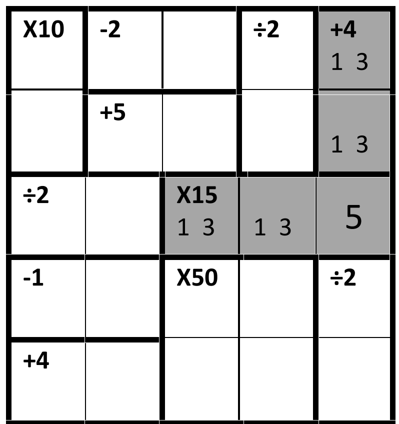
3, 5, 7, 9, 11, 13	What is the pattern? Odd numbers
2, 4, 6, 8, 10, 12	What is the pattern? Even numbers
1, 2, 3, 5, 8, 13, 21, 34	What is the pattern? Fibonacci sequence **
3, 9, 27, 81, 243, 729	What is the pattern? Exponents of 3; 3^x
5, 10, 15, 20, 25, 30, 35	What is the pattern? Multiples of 5
6, 11, 16, 21, 26, 31, 36	What is the pattern? (Multiples of 5) + 1; $5x + 1$

****Fibonacci sequence:** A sequence of numbers in which each number is the sum of the two preceding numbers. Example: 1, 1, 2, 3, 5, 8, 13, 21, ...

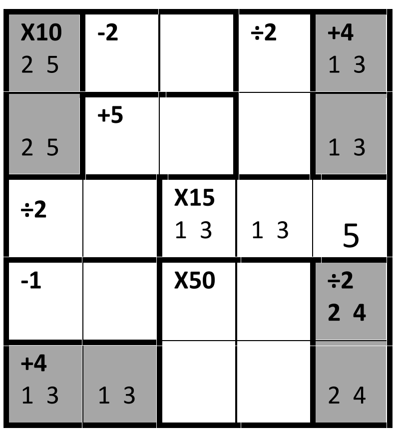
In this example of a KenKen puzzle, the digits 1 through 5 appear exactly once in each row and column. Within the puzzle, the grid is divided into different shapes, shown by heavy outlines. Within each heavily outlined shape, use the indicated math operator (addition, subtraction, multiplication, or division) to reach the result indicated next to the math operator.

A digit may appear more than once in an outlined shape as long as the digit does not appear in the same row or column. The digits in each outline do not have to follow math orders of operation. For example, in the outlined shape highlighted in the KenKen with the operator of ÷2, the digits may be written from left to right as 2 and 4 or 4 and 2.

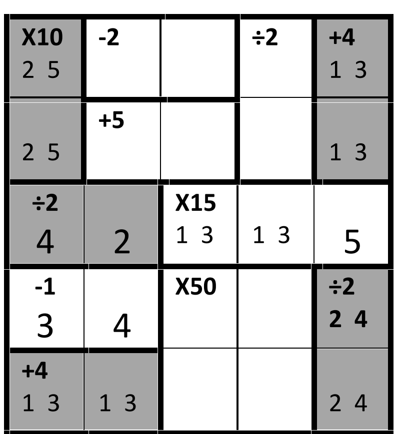




Begin with the outlined shapes that only have one set of possible digits. For instance, the rectangle with (+4) in the upper right corner of the KenKen may only be solved by the digits 1 and 3. The only digits that solve the math operator for the three-box rectangle (x15) used the digits 1, 3, and 5. By process of elimination, 5 is the digit for the last box in row three.

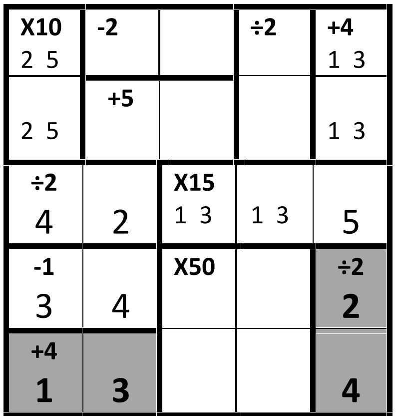


The only possible digits for the rectangle in the upper right corner of the puzzle (x10) are 2 and 5. The only possible digits in the lower left corner are 1 and 3. The only remaining digits in column 5, in the bottom two boxes of the rectangle with (÷2) are 2 and 4. The third box in the second column is 2.

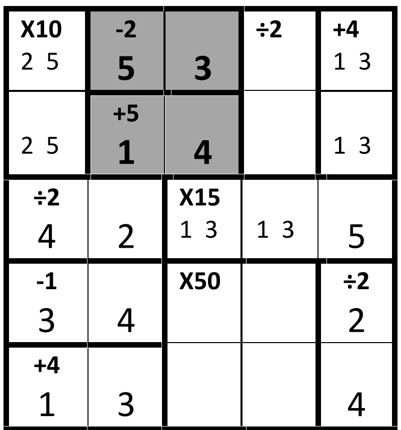


The only remaining digits in row 3, in the first two boxes that make up the rectangle with (÷2) are 2 and 4. Because the digits 2 and 5 are the only possible digits for the rectangle in the upper two boxes of column 1, the digit 4 is the only possibility for the first box in row 3. By process of elimination, the second box in row 3 is 2.

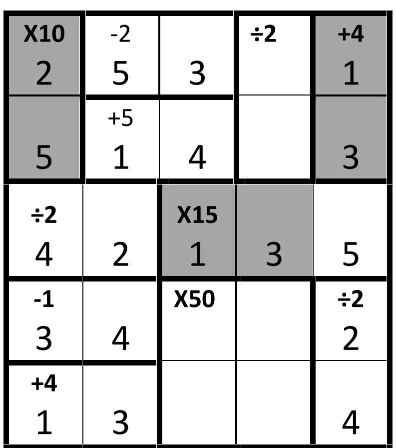
In the first box of row four, the possible digits are 1 and 3. The math operation indicated for the rectangle formed by the first and second box is (-1). Since the digit 2 has already been used in column 2, the only combination of digits that results in a difference of 1 is 3 and 4. By process of elimination, 3 is the digit in the first box of row four and 4 is the digit in the second box of row four.



Because the digit 3 is used in the fourth box of column 1, the digit 1 is the only possibility for the fifth box in the column. Because the digit 4 is used in the first box in row four, the only possibility for the last box in row four is 2. The only possibility for the last box in row 5 is the digit 4.

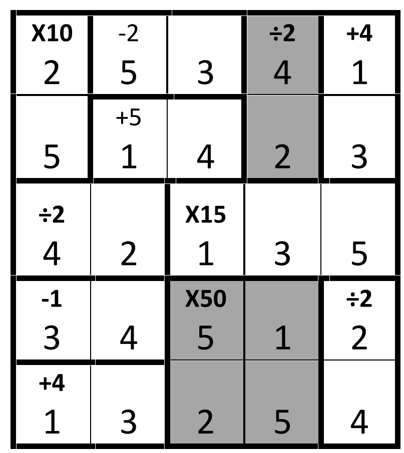


In the second column, the only digits remaining are 1 and 5. By process of elimination, the digit in the second box in the second column is 1. The first box in the second column is 5. To solve for the rectangle (-2) consisting of the second and third box in row 1, the digit in the third box is 3. To solve for the rectangle (+5) consisting of the second and third box in row 2, the digit in the third box is 4.



Use the process of elimination to finish the puzzle.

Here is the final solution.



KenKen puzzles vary in size and layout. Always check on the digits used for each puzzle. For example, a KenKen puzzle with an 8 x 8 grid uses the digits 1 through 8.

Once you have an answer, double check that each digit is only used once in each row and column. Also, check your math!

Sudoku Example

3					1
4			3		6
1		5			
				3	
		2		1	
		3	6		4

3					1
4			**3**		6
1		5			
				3	
		2		1	**?**
		3	6		4

3					1
4			3		6
1		5			
				3	
		2	**?**	1	**3**
		3	6	**?**	4

Sudoku & Wordoku Puzzles

To solve a Sudoku puzzle, fill in each box with the digits 1 through 6. Each digit will appear exactly once in each box, column, and row.

Here are some hints to help you solve the puzzle.

First, look for squares in the puzzle that can only have one possible digit. The easiest way to find these squares is to look for a box that has a lot of numbers already filled out. In the sample to the left, look at the bottom right hand box. It already has three digits filled out. The missing digits in this box are 2, 3, and 5. If we look at the digits in column four and the last row, we see that there are already 3's present in the column and row. The only square the digit 3 may occupy in the box is the square with the question mark.

The remaining digits that are missing from the box are 2 and 5. The fifth row already has a 2. Therefore, 2 belongs in the square in the sixth row and, by process of elimination, 5 belongs in the square in the fifth row.

Now, let's look at the top right hand box. The missing digits in this box are 2, 4, and 5. There is already a 2 in the fifth column. By process of elimination, the 2 belongs in the square with the question mark.

3			**?**		1
4			3		6
1		5			
				3	
		2	**5**	1	**3**
		3	6	**2**	4

Can you find where 4 and 5 belong in the upper right hand box? Try solving the rest of this puzzle using the process of elimination.

3			**2**	**?**	1
4			3	**?**	6
1		5			
				3	
		2	**5**	1	**3**
		3	6	**2**	4

Sudoku Example

3	**5**	**6**	**2**	**4**	1
4	**2**	**1**	3	**5**	6
1	**3**	5	**4**	**6**	**2**
2	**6**	**4**	**1**	3	**5**
6	**4**	2	**5**	1	**3**
5	**1**	3	6	**2**	4

Here is the solution to the Sudoku Example.

Wordoku puzzles are the same as Sudoku puzzles, except that Wordoku puzzles use letters from words instead of numbers. Each letter in the word may only be used exactly once in each column, row, and box.

In this Wordoku puzzle, the word that is used is **MOVIES.**

Wordoku Example

M					
S			O		M
		S		I	
I		E	M		O
		M	V		
	O				E

→

M		O			
S			O		M
O	M	S		I	
I		E	M	S	O
		M	V	O	
	O			M	E

→

M		O			
S			O		M
O	M	S		I	
I		E	M	S	O
E		M	V	O	
V	O			M	E

↓

M		O			S
S			O		M
O	M	S		I	
I		E	M	S	O
E	S	M	V	O	I
V	O	I	S	M	E

←

M		O		V	S
S		V	O		M
O	M	S		I	V
I	V	E	M	S	O
E	S	M	V	O	I
V	O	I	S	M	E

←

M	E	O	I	V	S
S	I	V	O	E	M
O	M	S	E	I	V
I	V	E	M	S	O
E	S	M	V	O	I
V	O	I	S	M	E

Here is the solution to Wordoku Example

Addition Shortcuts

In puzzles using only the digits 1 through 9, look for sums that are made up of only one or two possible combinations of addends.

Sum	Addends											
+ 3	1	2										
+ 4	1	3										
+ 5	1	4	or	2	3							
+ 6	1	2	3									
+ 7	1	2	4									
+ 8	1	2	5	or	1	3	4					
+10	1	2	3	4								
+11	1	2	3	5								
+15	6	9	or	7	8							
+16	7	9										
+17	8	9										
+ 22	5	8	9									
+23	6	8	9									
+24	7	8	9									
+29	5	7	8	9								
+30	6	7	8	9								
+ 36	1	2	3	4	5	6	7	8				
+ 37	1	2	3	4	5	6	7	9				
+38	1	2	3	4	5	6	8	9				
+ 39	1	2	3	4	5	7	8	9				
+ 40	1	2	3	4	6	7	8	9				
+ 41	1	2	3	5	6	7	8	9				
+ 42	1	2	4	5	6	7	8	9				
+ 43	1	3	4	5	6	7	8	9				
+ 44	2	3	4	5	6	7	8	9				
+ 45	1	2	3	4	5	6	7	8	9			

Multiplication Shortcuts

For puzzles that use multiplication and only the digits 1 through 9, factor the product to find the digits to use in the puzzle. Remember that any number multiplied by 1 is equal to the number being multiplied.

x 2	1 2						
x 3	1 3						
x4	1 4						
x 5	1 5						
x 6	1 6	or	2 3				
x 7	1 7						
x 8	1 8	or	2 4	or	1 2 4		
x 9	1 9						
x 10	2 5	or	1 2 5				
x 12	2 6	or	3 4	or	1 2 6	or	1 3 4
x 14	2 7	or	1 2 7				
x15	3 5	or	1 3 5				
x 16	2 8	or	1 2 8				
x 18	2 9	or	3 6	or	1 2 9	or	1 3 6
x 20	4 5	or	1 4 5				
x 21	3 7	or	1 3 7				
x 24	3 8	or	4 6	or	1 3 8	or	1 4 6
x27	3 9	or	1 3 9				
x 28	4 7	or	1 4 7				
x 30	5 6	or	2 3 5	or	1 5 6	or	1 2 3 5
x 35	5 7	or	1 5 7				
x 36	2 3 6	or	1 2 3 6				
x 40	5 8	or	2 4 5	or	1 5 8	or	1 2 4 5
x 42	2 3 7	or	1 2 3 7				
x 45	5 9	or	1 5 9				
x 48	2 3 8	or	1 2 3 8				

Division Shortcuts

÷ 2	All even numbers are divisible by 2.
÷ 3	The sum of the digits is divisible by 3.
÷ 4	The number formed by the last two digits is divisible by 4.
÷ 5	The last digit is 0 or 5.
÷ 6	The number is divisible by 2 and by 3.
÷ 9	The sum of the digits is divisible by 9.

MATH ORDER OF OPERATIONS

PEMDAS

The order of operations is the order in which a mathematical expression is solved.

First, solve terms within

Parantheses, then

Exponents, then

Multiplication or **D**ivision - in order from left to right, then

Addition or **S**ubtraction in order from left to right.

Word ladders are great practice for learning word patterns. These puzzles also challenge us to find more than one solution to a problem.

If you become stuck, try working the puzzle from the bottom word to the top word. Sometimes approaching a puzzle from a different direction (bottom to top, right to left, center to edges, last to first) will provide clues to the answer that are not obvious from a traditional approach (first to last, top to bottom, left to right).

Change the top word into the bottom word in each column by changing only one letter at a time to form a new word. Do not change the order of the letters. Proper names, slang and foreign words are not allowed. Use the first box to write your own solution for each word ladder. Sample solutions are given for each word ladder. How many ways can you find to change the top word into the bottom?

Gift	**Gift**		**Gift**		**Gift**
	Lift		Rift		Gilt
	Life	or	Rife	or	Gile
	Live		Life		Give
Love	**Love**		Live		Live
			Love		**Love**

Cold	**Cold**		**Cold**		**Cold**
	Fold		Cord		Bold
	Ford		Ford		Bald
	Word	or	Form	or	Bard
	Ward		Worm		Ward
Warm	**Warm**		**Warm**		**Warm**

Cryptograms are substitution codes. Each letter in the cryptogram stands for another letter in the alphabet. No letter represents itself or more than one letter. Here are some hints to help you break the code:

1-letter words:

A or I

Most common letters in words:

A, E, S, and T

Common 2-letter words:

Am	An	As	At	Be
By	Do	Go	He	If
In	Is	It	Me	My
No	Of	On	Or	So
To	Up	Us	We	

Common 3-letter words:

All	And	Any	Are	Ask	But
Buy	Can	For	Get	Got	
Had	Has	How	Its	Let	May
Not	New	Off	Our	Ran	Run
Saw	Say	The	Too	Was	Way
Who	You				

Most common double letters:

BB, CC, DD, EE, FF, GG, LL, MM, NN, OO, PP, RR, SS, TT, & ZZ

Most common 2-letter combinations:

CH, CR, ED, ES, LY, SH, ST, TH, TR, WH

Words with Apostrophes:

He'd	He'll	He's	I'd	I'm	I'll	It's
She'd	She'll	She's	We'd	We'll	We're	
You'd	You'll	You're	They'd	They'll	They're	Wouldn't
Can't	Don't	Won't	Isn't	Wasn't	Couldn't	Shouldn't

Words that begin sentences ending in a question mark (?):

Who	How
What	When
Where	Can
Why	May

Letter combinations for the ending of long words:

-est	-ence	-ance	-ing	-ness
-less	-tion	-cion		

Conjunctions - often first word after a comma:

and, or, but, for, nor, yet, so

Hints to solve cryptograms:

Look for single letters. Words that are single letters may only be -a or -i.
Then, look for words with two letters.
The first word of a sentence is often a noun, pronoun, or an article followed by a noun. Verbs are often the second or third word in a sentence.
Look for words that have apostrophes. Letter(s) after apostrophes are -s, -t, -ll, -ld, or -re.
Also look for sentences that end in a question mark.
Look for words that appear more than once in the cryptogram. If the words that repeat are short, try "the", "and", "are", "was", "you" or "but".
Conjunctions are often the first word after a comma - the most common are "and", "or", and "but".
Once you solve the code for a letter, write the solution above each of those letters in the cryptogram.

Rebus or pictogram puzzles are puzzles that use pictures, symbols, words and letters to represent a common word, phrase, or saying. Here is a summary of some hints to solve rebus or pictogram puzzles.

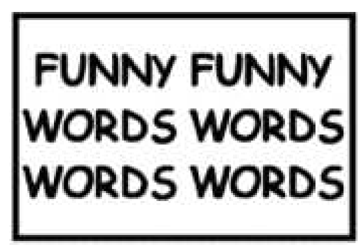
POSITION
The location of the words and symbols in relation to both the rectangle containing the puzzle and to the other words and symbols contained in the puzzle may give a clue to the solution. In this example, **ROB** is found in the middle of the word **HOOD**. The solution is **Robin Hood**.

HIGHLIGHTING
Arrows, underlining, or bold letters may be used to draw attention to some part of the puzzle. This is a clue that the part of the puzzle that is highlighted is part of the solution. In this example, the arrow points to the first **AID**, and thus the answer is **first aid**.

DIRECTION
When a word is written in any direction other than the usual left-to-right orientation, it is generally relevant to the solution. This example illustrates the phrase **get up and go**.

SIZE
Unusually large or small words or symbols are used to represent size, such as big, large, giant, small, wide, tiny, and so forth. This example represents **big deal**.

NUMBER
The number or frequency of a word or symbol may represent part of the solution. This example shows **2 FUNNY** and **4 WORDS**. The answer is **too funny for words**.



COLOR
If a word or symbol is printed in a color other than black, the color may be important in solving the puzzle. In this example, **HERRING** is in red. The solution for this example is **a red herring**.

STYLE
The style of the letters in a word is sometimes important in finding the answer to the puzzle. The shape of letters may represent tall, short, fat, thin, slanted, etc. The letters in this example give a clue to finding the answer of **fat chance**.

SOUND
Sometimes rebus puzzles use the sounds that are represented by symbols as a hint. The sound may not always be exact, but it will always be close to the sound of the word in the answer. In this example, the **C's** represent the word seas and the position of the word **Travel** plays a part in the soluction. The answer is **overseas travel**.

TRAVEL
CCCCC

The letters in each vertical column belong in the empty boxes immediately below the letters. The black boxes show the separation between words. When the letters are arranged in the correct boxes in each column, a quote from a famous person will appear. Each letter in each vertical column is used only once.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	■	E	■	■	■	■	■	A	■	■	■	C	■	■	■	C	■	■	■	C	H	E (X)	■
	A	N	D	A	D	■	A	E	D	■	■	E	■	B	H	E	H	S	■	E	H	E (X)	■
	L	O	H	A	D	J	A	N	E	L	H	E	E	R	I	E	S	T	H	H	L	E (X)	E
	W	O	R	D	I	O	E	R	L	S	I	N	H	T	L	O	S	U	H	O	O	E	S
	W	T	R	L	T	N	R	S	U	T	W	T	H	Y	M	S	T	W	R	T	R	L	Y
1			■						■					■					■				
2					■						■							■				E	■
3				■			■				■				■							E	
4	■					■				■			■				■					E	■
5						■				■			■						■				

In dropdown puzzles, look for columns with a lot of the same letters. For example, look at column 22. Based on common endings for words, assign an “E” to the words in rows 2, 3, and 4. Once you use a letter, mark it off with an “X”

Look for letter combinations that form only one word. For example, “the” is the only word that may be formed using the letters in columns 14, 15, and 16 for the fourth word in row four. Next, consider the first, third and fourth words in row three. Can you find the three-letter combinations for these words? As you use each letter, continue to cross it off from the column to begin eliminating possible word choices.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
■	■	E	■	■	■	■	■	~~A~~	■	■	■	C	■	■	■	C	■	■	■	C	H	~~E~~	■
■	~~A~~	~~N~~	~~D~~	A	D	■	A	E	D	■	■	E	■	B	~~H~~	~~E~~	H	S	■	E	H	~~E~~	■
■	L	O	H	A	D	J	A	N	E	~~L~~	H	E	E	R	I	E	S	T	H	H	L	~~E~~	E
■	W	O	R	D	I	O	E	R	~~L~~	S	I	N	~~H~~	~~T~~	L	O	S	U	H	O	O	E	S
■	W	T	R	L	T	N	R	S	U	T	W	~~T~~	H	~~Y~~	M	S	T	W	R	T	R	L	Y
1			■						■					■					■				
2					■						■							■				E	■
3	A	N	D	■			■	A	L	L	■	T	H	Y	■							E	
4	■					■				■			■	T	H	E	■					E	■
5						■				■			■						■				

Continue to look for letter combinations that make only one possible word. At this point, consider words under columns where letters have been eliminated. For instance consider the first and third word in row 1 and the first word in row 5.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
■	■	~~E~~	■	■	■	■	■	~~A~~	■	■	■	C	■	■	■	C	■	■	■	C	H	~~E~~	■
■	~~A~~	~~N~~	~~D~~	A	~~D~~	■	A	E	D	■	■	~~E~~	■	B	~~H~~	~~E~~	H	S	■	E	H	~~E~~	■
■	~~L~~	~~O~~	H	A	D	J	A	N	E	~~L~~	~~H~~	E	~~E~~	R	I	E	S	T	H	H	L	~~E~~	E
■	~~W~~	O	~~R~~	D	I	O	E	R	~~L~~	~~S~~	I	N	~~H~~	~~T~~	L	O	S	U	H	O	O	E	S
■	~~W~~	T	R	~~L~~	T	N	R	S	U	~~T~~	W	~~T~~	~~H~~	~~Y~~	M	S	T	W	R	T	R	L	Y
1	W	E	■						■	T	H	E	E	■					■				
2	L				■					S	■		H					■				E	■
3	A	N	D	■			■	A	L	L	■	T	H	Y	■							E	
4	■					■				■			■	T	H	E	■					E	■
5	W	O	R	L	D	■				■			■						■				

Columns 1, 10 and 13 have only one letter left. Fill in the remaining box in each column.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		E						A				C				C				C	H	E	
	A	N	D	A	D		A	E	D			E		B	H	E	H	S		E	H	E	
	L	O	H	A	D	J	A	N	E	L	H	E	E	R	I	E	S	T	H	H	L	E	E
	W	O	R	D	I	O	E	R	L	S	I	N	H	T	L	O	S	U	H	O	O	E	S
	W	T	R	L	T	N	R	S	U	T	W	T	H	Y	M	S	T	W	R	T	R	L	Y
1	W	E		A						T	H	E	E										
2	L	O	R	D						S		C	H	R	I	S	T					E	
3	A	N	D					A	L	L		T	H	Y								E	
4		T	H	A	T									T	H	E						E	
5	W	O	R	L	D									B									

Continue to look for letter combinations that make only one possible word. Look at the first and third words in row 2 and the first word in row 4. After filling in the words, one letter remains in both column 4 and column 14. Fill in the remaining boxes in the column.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		E						A				C				C				C	H	E	
	A	N	D	A	D		A	E	D			E		B	H	E	H	S		E	H	E	
	L	O	H	A	D	J	A	N	E	L	H	E	E	R	I	E	S	T	H	H	L	E	E
	W	O	R	D	I	O	E	R	L	S	I	N	H	T	L	O	S	U	H	O	O	E	S
	W	T	R	L	T	N	R	S	U	T	W	T	H	Y	M	S	T	W	R	T	R	L	Y
1	W	E		A	D	O	R	E		T	H	E	E		M								
2	L	O	R	D		J	E	S	U	S		C	H	R	I	S	T					E	
3	A	N	D		I	N		A	L	L		T	H	Y								E	
4		T	H	A	T		A							T	H	E						E	
5	W	O	R	L	D		A							B	L								

At this point, look for clues from the words surrounding incomplete words, such as the second words in rows 1 and 2. After filling in the words, one letter remains in both columns 5 and 6. Fill in the remaining boxes in each column. Two of the same letter, "A", remain in column 7. Fill in the blank boxes in column 7 with the letter A. Then proceed to the remaining two letters in column 15. The letter M must be the first letter in the fourth word in row 1 because it cannot be the second letter in the fourth word in row 5 (there are no words that begin with BM).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
■	■	~~E~~	■	■	■	■	■	~~A~~	■	■	■	~~C~~	■	■	■	C	■	■	■	C	H	~~E~~	■
■	~~A~~	~~N~~	~~D~~	~~A~~	~~D~~	■	~~A~~	~~E~~	D	■	■	~~E~~	■	~~B~~	~~H~~	~~E~~	H	S	■	E	H	~~E~~	■
■	~~L~~	~~O~~	~~H~~	~~A~~	~~D~~	~~J~~	~~A~~	N	E	~~L~~	~~H~~	E	~~E~~	~~R~~	~~I~~	E	S	T	H	H	L	~~E~~	E
■	~~W~~	~~O~~	~~R~~	~~D~~	~~I~~	~~O~~	~~E~~	R	~~L~~	~~S~~	I	N	~~H~~	~~T~~	~~L~~	O	S	U	H	O	O	E	S
■	~~W~~	~~T~~	~~R~~	~~L~~	~~T~~	~~N~~	~~R~~	~~S~~	~~U~~	~~T~~	W	~~T~~	~~H~~	~~Y~~	~~M~~	~~S~~	~~T~~	W	R	T	R	L	Y
1	W	E	■	A	D	O	R	E	■	T	H	E	E	■	M	O	S	T	■				
2	L	O	R	D	■	J	E	S	U	S	■	C	H	R	I	S	T	■				E	■
3	A	N	D	■	I	N	■	A	L	L	■	T	H	Y	■	C	H					E	
4	■	T	H	A	T	■	A	R N	E D	■	I W	N E	■	T	H	E	■					E	■
5	W	O	R	L	D	■	A	R N	E D	■	I W	N E	■	B	L	E	S	S	■				

The fourth words in rows 1 and 5 may be determined from the remaining letters and the completed words in the quote. After the used letters are crossed off, only one letter remains in columns 16 and 17. Fill in the remaining letter in each column in the blank boxes.

If more than one possibility exists, make a note of the possible words on the puzzle. For example, the third words in rows 4 and 5 may be either “IN” or “WE”. The second words in rows 4 and 5 may be either “ARE” or “AND”. Read the completed words in the quote to determine the answer.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
■	■	~~E~~	■	■	■	■	■	~~A~~	■	■	■	~~C~~	■	■	■	~~C~~	■	■	■	C	H	~~E~~	■
■	~~A~~	~~N~~	~~D~~	~~A~~	~~D~~	■	~~A~~	~~E~~	~~D~~	■	■	~~E~~	■	~~B~~	~~H~~	~~E~~	~~H~~	~~S~~	■	E	H	~~E~~	■
■	~~L~~	~~O~~	~~H~~	~~A~~	~~D~~	~~J~~	~~A~~	~~N~~	~~E~~	~~L~~	~~H~~	~~E~~	~~E~~	~~R~~	~~I~~	~~E~~	~~S~~	~~T~~	H	H	L	~~E~~	E
■	~~W~~	~~O~~	~~R~~	~~D~~	~~I~~	~~O~~	~~E~~	~~R~~	~~L~~	~~S~~	~~I~~	~~N~~	~~H~~	~~T~~	~~L~~	~~O~~	~~S~~	U	H	O	O	E	S
■	~~W~~	~~T~~	~~R~~	~~L~~	~~T~~	~~N~~	~~R~~	~~S~~	~~U~~	~~T~~	~~W~~	~~T~~	~~H~~	~~Y~~	~~M~~	~~S~~	~~T~~	W	R	T	R	L	Y
1	W	E	■	A	D	O	R	E	■	T	H	E	E	■	M	O	S	T	■				
2	L	O	R	D	■	J	E	S	U	S	■	C	H	R	I	S	T	■				E	■
3	A	N	D	■	I	N	■	A	L	L	■	T	H	Y	■	C	H	U				E	
4	■	T	H	A	T	■	A	R	E	■	I	N	■	T	H	E	■	W				E	■
5	W	O	R	L	D	■	A	N	D	■	W	E	■	B	L	E	S	S	■				

There are two letters remaining in column 18. The letter W must be the first letter in the fifth word in row 4 because it cannot be the third letter in the fifth word in row 3 (there are no words that begin with CHW).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
■	■	~~E~~	■	■	■	■	■	~~A~~	■	■	■	~~C~~	■	■	■	~~C~~	■	■	■	C	H	~~E~~	■
■	~~A~~	~~N~~	~~D~~	~~A~~	~~D~~	■	~~A~~	~~E~~	~~D~~	■	■	~~E~~	■	~~B~~	~~H~~	~~E~~	~~H~~	~~S~~	■	E	H	~~E~~	■
■	~~L~~	~~O~~	~~H~~	~~A~~	~~D~~	~~J~~	~~A~~	~~N~~	~~E~~	~~L~~	~~H~~	~~E~~	~~E~~	~~R~~	~~I~~	~~E~~	~~S~~	~~T~~	H	H	L	~~E~~	E
■	~~W~~	~~O~~	~~R~~	~~D~~	~~I~~	~~O~~	~~E~~	~~R~~	~~L~~	~~S~~	~~I~~	~~N~~	~~H~~	~~T~~	~~L~~	~~O~~	~~S~~	~~U~~	H	O	O	E	S
■	~~W~~	~~T~~	~~R~~	~~L~~	~~T~~	~~N~~	~~R~~	~~S~~	~~U~~	~~T~~	~~W~~	~~T~~	~~H~~	~~Y~~	~~M~~	~~S~~	~~T~~	~~W~~	R	T	R	L	Y
1	W	E	■	A	D	O	R	E	■	T	H	E	E	■	M	O	S	T	■	H	O	L	Y
2	L	O	R	D	■	J	E	S	U	S	■	C	H	R	I	S	T	■	H			E	■
3	A	N	D	■	I	N	■	A	L	L	■	T	H	Y	■	C	H	U	R	C	H	E	S
4	■	T	H	A	T	■	A	R	E	■	I	N	■	T	H	E	■	W	H			E	■
5	W	O	R	L	D	■	A	N	D	■	W	E	■	B	L	E	S	S	■				

The fifth word in row 3 is our next stop. Look at the letters in column 19. The only letter in this column that fits in the fifth word in row 3 is the letter R. The remaining letters in column 19 are the same letter (H). Fill in the letters H in the blank boxes remaining in column 19.

The last words in rows 1 and 3 may be determined by the context of the words in the quote. Given the emerging religious theme of the quote and the remaining letters in the puzzle, the last word in row 1 is probably "holy" and the last word in row 3 is probably "churches". Fill in the blank boxes and cross out the corresponding letters.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
■	■	~~E~~	■	■	■	■	■	~~A~~	■	■	■	~~C~~	■	■	■	~~C~~	■	■	■	~~C~~	~~H~~	~~E~~	■
■	~~A~~	~~N~~	~~D~~	~~A~~	~~D~~	■	~~A~~	~~E~~	~~D~~	■	■	~~E~~	■	~~B~~	~~H~~	~~E~~	~~H~~	~~S~~	■	E	H	~~E~~	■
■	~~L~~	~~O~~	~~H~~	~~A~~	~~D~~	~~J~~	~~A~~	~~N~~	~~E~~	~~L~~	~~H~~	~~E~~	~~E~~	~~R~~	~~I~~	~~E~~	~~S~~	~~T~~	~~H~~	~~H~~	L	~~E~~	E
■	~~W~~	~~O~~	~~R~~	~~D~~	~~I~~	~~O~~	~~E~~	~~R~~	~~L~~	~~S~~	~~I~~	~~N~~	~~H~~	~~T~~	~~L~~	~~O~~	~~S~~	~~U~~	~~H~~	O	~~O~~	E	~~S~~
■	~~W~~	~~T~~	~~R~~	~~L~~	~~T~~	~~N~~	~~R~~	~~S~~	~~U~~	~~T~~	~~W~~	~~T~~	~~H~~	~~Y~~	~~M~~	~~S~~	~~T~~	~~W~~	~~R~~	T	R	L	~~Y~~
1	W	E	■	A	D	O	R	E	■	T	H	E	E	■	M	O	S	T	■	H	O	L	Y
2	L	O	R	D	■	J	E	S	U	S	■	C	H	R	I	S	T	■	H	E		E	■
3	A	N	D	■	I	N	■	A	L	L	■	T	H	Y	■	C	H	U	R	C	H	E	S
4	■	T	H	A	T	■	A	R	E	■	I	N	■	T	H	E	■	W	H	O	L	E	■
5	W	O	R	L	D	■	A	N	D	■	W	E	■	B	L	E	S	S	■	T			

For the last word in row 4, there are two words that may be formed with the remaining letters, "where" and "whole". However, the word "whole" is the only choice that is grammatically correct. Of the remaining letters in column 19, "E" must be used for the last word in row 2 because "T" does not work. Therefore, the last word in row 5 begins with the letter "T".

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		~~E~~						~~A~~				~~C~~				~~C~~				~~C~~	~~H~~	~~E~~	
	~~A~~	~~N~~	~~D~~	~~A~~	~~D~~		~~A~~	~~E~~	~~D~~			~~E~~		~~B~~	~~H~~	~~E~~	~~H~~	~~S~~		~~E~~	H	~~E~~	
	~~L~~	~~O~~	~~H~~	~~A~~	~~D~~	~~J~~	~~A~~	~~N~~	~~E~~	~~L~~	~~H~~	~~E~~	~~E~~	~~R~~	~~I~~	~~E~~	~~S~~	~~T~~	~~H~~	~~H~~	~~L~~	~~E~~	E
	~~W~~	~~O~~	~~R~~	~~D~~	~~I~~	~~O~~	~~E~~	~~R~~	~~L~~	~~S~~	~~I~~	~~N~~	~~H~~	~~T~~	~~L~~	~~O~~	~~S~~	~~U~~	~~H~~	~~O~~	~~O~~	E	~~S~~
	~~W~~	~~T~~	~~R~~	~~L~~	~~T~~	~~N~~	~~R~~	~~S~~	~~U~~	~~T~~	~~W~~	~~T~~	~~H~~	~~Y~~	~~M~~	~~S~~	~~T~~	~~W~~	~~R~~	~~T~~	R	L	~~Y~~
1	W	E		A	D	O	R	E		T	H	E	E		M	O	S	T		H	O	L	Y
2	L	O	R	D		J	E	S	U	S		C	H	R	I	S	T		H	E	R	E	
3	A	N	D		I	N		A	L	L		T	H	Y		C	H	U	R	C	H	E	S
4		T	H	A	T		A	R	E		I	N		T	H	E		W	H	O	L	E	
5	W	O	R	L	D		A	N	D		W	E		B	L	E	S	S		T	H	E	E

There is only one letter left in column 23, which is the last letter in the fifth word in row 5. The letter R in column 21 must be used for the fourth word in row 2. The remaining letters finish the last word in row 5.

Finally, read the completed quote to make sure your answer is grammatically correct. It is also a good idea to double check the letters in your answer to make sure that you have used each letter in each column.

W	E		A	D	O	R	E		T	H	E	E		M	O	S	T		H	O	L	Y
L	O	R	D		J	E	S	U	S		C	H	R	I	S	T		H	E	R	E	
A	N	D		I	N		A	L	L		T	H	Y		C	H	U	R	C	H	E	S
	T	H	A	T		A	R	E		I	N		T	H	E		W	H	O	L	E	
W	O	R	L	D		A	N	D		W	E		B	L	E	S	S		T	H	E	E

Logic grid problems use grids to organize the information given in the problem and to narrow down the possible solutions. All the information that is required to solve the problem is given in the introduction and clues provided with the logic problem. To use a logic grid, place an "x" in a box when a premise cannot be true. Place a "•" in a box for a correct answer.

Sample Logic Problem

The Squirrel family is collecting nuts to store for winter. Using only the clues below, match each member of the Squirrel family with the type and quantity of the nuts they gathered. Note: Each member of the Squirrel family collected only one kind of nut and each collected a different quantity of nuts.

1. Roger Squirrel collected one pound fewer nuts than the squirrel that collected walnuts.
2. Sammy Squirrel collected the pecans.
3. Petunia Squirrel collected eight pounds of nuts.
4. The four nuts are the nuts that Roger Squirrel collected, the nine pounds of nuts, the seven pounds of nuts, and the almonds.

		Types of Nuts				Squirrel Family			
		Acorns	Almonds	Pecans	Walnuts	Olivia	Petunia	Sammy	Roger
Quantity of Nuts	6 lbs.				X				
	7 lbs.								
	8lbs.								
	9 lbs.								X
Squirrel Family	Olivia								
	Petunia								
	Sammy								
	Roger				X				

Clue #1: <u>Roger Squirrel</u> collected <u>one pound fewer nuts</u> than the squirrel that collected <u>walnuts</u>.

From this clue, we can determine that Roger did not collect 9 lbs. of nuts, and Roger did not collect walnuts. Mark an "x" in the box that is the intersection of Roger and 9lbs., and an "x" in the box for Roger and walnuts.

We can also determine that 6 lbs. is not the quantity of walnuts, because there is at least one quantity of nuts (gathered by Roger) that is less. Mark an "x" in the box at the intersection of walnuts and 6 lbs.

		Types of Nuts				Squirrel Family			
		Acorns	**Almonds**	**Pecans**	**Walnuts**	**Olivia**	**Petunia**	**Sammy**	**Roger**
Quantity of Nuts	**6 lbs.**				X				
	7 lbs.								
	8lbs.								
	9 lbs.								X
Squirrel Family	**Olivia**			X					
	Petunia			X					
	Sammy	X	X	•	X				
	Roger			X	X				

Clue # 2: <u>Sammy</u> Squirrel collected the pecans.

Place a "•" in the box at the intersection of pecans and Sammy.

Since Sammy collected the pecans, place an "x" in the column for pecans for Olivia, Petunia and Roger. Place an "x" in Sammy's row for acorns, almonds, and walnuts.

Note: Once a "•" has been added to a grid, "x" out the remaining boxes in the row and column in the section which the "•" appears.

		Types of Nuts				Squirrel Family			
		Acorns	**Almonds**	**Pecans**	**Walnuts**	**Olivia**	**Petunia**	**Sammy**	**Roger**
Quantity of Nuts	**6 lbs.**				X		X		
	7 lbs.						X		
	8lbs.					X	•	X	X
	9 lbs.						X		X
Squirrel Family	**Olivia**			X					
	Petunia			X					
	Sammy	X	X	•	X				
	Roger			X	X				

Clue #3: <u>Petunia</u> Squirrel collected <u>eight pounds</u> of nuts.

Place a "•" in the box at the intersection of 8lbs. and Petunia.

"X" out the remaining boxes in the row and column in the section which the "•" appears.

		Types of Nuts				Squirrel Family			
		Acorns	Almonds	Pecans	Walnuts	Olivia	Petunia	Sammy	Roger
Quantity of Nuts	6 lbs.				X	X	X	X	•
	7 lbs.		X				X		X
	8lbs.					X	•	X	X
	9 lbs.		X				X		X
Squirrel Family	Olivia	X		X					
	Petunia	X		X					
	Sammy	X	X	•	X				
	Roger	•	X	X	X				

Clue #4: The four nuts are the nuts that Roger Squirrel collected, the nine pounds of nuts, the seven pounds of nuts, and the almonds.

In this clue, each of the underlined items refers to a different nut.

Begin with Roger Squirrel. We can determine that Roger did not collect 9 lbs., 7 lbs., or almonds. Place an "x" in each of these boxes for Roger. The only available boxes left are shaded in gray. Place a "•" in the shaded boxes. "X" out the remaining boxes in the row and column in the section which the "•" appears.

We can also determine that neither the 9 lbs. nor the 7 lbs. of nuts were almonds. Place an "x" in these boxes for almonds.

		Types of Nuts				Squirrel Family			
		Acorns	Almonds	Pecans	Walnuts	Olivia	Petunia	Sammy	Roger
Quantity of Nuts	6 lbs.				X	X	X	X	•
	7 lbs.		X				X		X
	8lbs.					X	•	X	X
	9 lbs.		X				X		X
Squirrel Family	Olivia	X	X	X	•				
	Petunia	X	•	X	X				
	Sammy	X	X	•	X				
	Roger	•	X	X	X				

Let's look at the boxes on the grid for Olivia.

We can determine that Olivia gathered either 7lbs. or 9 lbs. of nuts. We also know that almonds are not 7 lbs. or 9 lbs. Therefore, Olivia did not gather almonds. Mark an "x" in the box for Olivia and almonds.

Olivia gathered walnuts and Petunia gathered almonds. Place a "•" in the shaded boxes and "x" in the remaining box in the section.

		Types of Nuts				Squirrel Family			
		Acorns	Almonds	Pecans	Walnuts	Olivia	Petunia	Sammy	Roger
Quantity of Nuts	6 lbs.	•	X	X	X	X	X	X	•
	7 lbs.	X	X				X		X
	8lbs.	X	•	X	X	X	•	X	X
	9 lbs.	X	X				X		X
Squirrel Family	Olivia	X	X	X	•				
	Petunia	X	•	X	X				
	Sammy	X	X	•	X				
	Roger	•	X	X	X				

We know that Petunia gathered 8 lbs. of nuts. Petunia gathered almonds and the almonds weigh 8 lbs. Mark a "•" in the box for almonds and 8 lbs.

From the process of elimination, we know that Roger collected 6 lbs. of acorns. Mark a "•" in the box where acorns and 6 lbs. intersect.

"X" out the remaining boxes in the rows and columns in the section in which the "•" appear.

		Types of Nuts				Squirrel Family			
		Acorns	Almonds	Pecans	Walnuts	Olivia	Petunia	Sammy	Roger
Quantity of Nuts	6 lbs.	•	X	X	X	X	X	X	•
	7 lbs.	X	X	X	•		X		X
	8lbs.	X	•	X	X	X	•	X	X
	9 lbs.	X	X	•	X		X		X
Squirrel Family	Olivia	X	X	X	•				
	Petunia	X	•	X	X				
	Sammy	X	X	•	X				
	Roger	•	X	X	X				

Now, let's go back to:

Clue #1: <u>Roger Squirrel</u> collected <u>one pound fewer nuts</u> than the squirrel that collected <u>walnuts</u>.

We know that Roger collected 6 lbs. of nuts. Therefore, the walnuts weigh 7 lbs. Mark a "•" for 7 lbs. and walnuts.

"X" out the remaining boxes in the rows and columns in the section which the "•" appear.

The only remaining box for almonds is 9 lbs. Mark a "•" in the box.

You have solved the problem!

Solution:
Olivia, Walnuts, 7 lbs.
Petunia, Almonds, 8 lbs.
Sammy, Pecans, 9 lbs.
Roger, Acorns, 6 lbs.

Here are some more hints on solving logic grid problems:

- **Read the entire problem, including the directions, before beginning.**
  Sometimes clues are included in the directions.

- **Underline the important information in each clue.**
  In the sample problem, we underlined nuts, weights, and the names of the squirrels.

- **When you find an answer, mark a "•" in the corresponding box, then "X" out the remaining boxes in the row and column in the section which the "•" appears**.

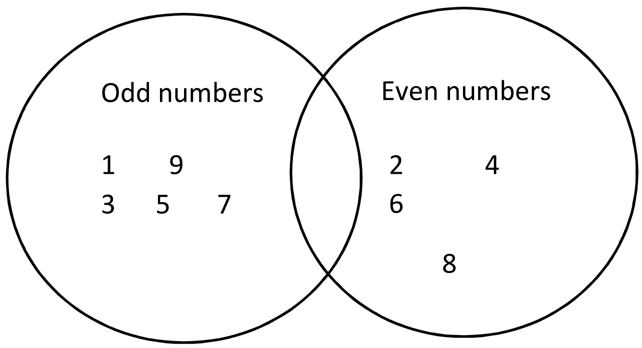
- **Study the logic grid to determine if you can find an answer through the process of elimination.**
  In the sample problem, we used the process of elimination to determine that Olivia gathered walnuts.

- **If you reach the end of the clues and do not have a solution, return to beginning of the list of clues and continue through the clues until a solution is found.**
  In the sample problem, we returned to Clue #1 to finish the logic grid.

Venn diagrams are used for word problems involving different groups and subsets of groups. In a Venn diagram with two circles, each circle represents a particular group. The sections of each circle that overlap define the members that belong to both groups.

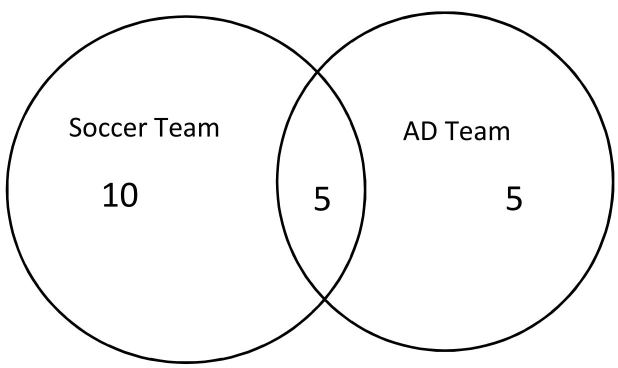
Here are some examples:

In the numbers from 1 through 10, how many numbers are even, and how many numbers are odd?



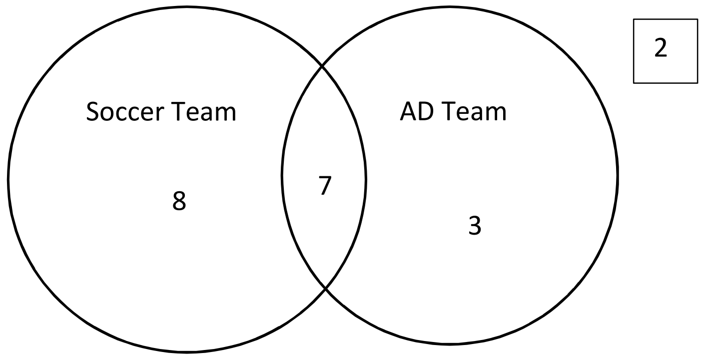
There are 5 odd numbers and 5 even numbers. No numbers belong to both groups.

Out of a class of 20 students, 5 students are on the Academic Decathlon (AD) team and the soccer team. If there are 15 students on the soccer team and 10 students on the AD team, how many students are only on the soccer team? How many students are only on the Academic Decathlon team?



The total number of students is 20. The number of students who are on both the AD team and the soccer team is 5. Write a 5 in the overlapping section of the circles. The total number on the soccer team is 15, including the five students who are on both teams. The number of students who are <u>only</u> on the soccer team is 15 – 5 = 10. The total number of students who are on the AD team is 10. The number of students who are <u>only</u> on the AD team is 10 – 5 = 5.

Out of a class of 20 students, 2 students do not participate on the AD team or the soccer team. If there are 15 students on the soccer team and 10 students on the AD team, how many students are on both the soccer team and the AD team? How many students are only on the Academic Decathlon team? How many students are only on the soccer team?



In this example, the 2 students who do not participate on a team are eliminated from the problem. Write a 2 outside of the circles to represent these students. That leaves a total of 18 students who participate on teams. Add the members of the soccer team and the AD team together to determine the total number of students on each team <u>and</u> the students who participate on both teams: 15 +10 = 25.

Subtract 25 from 18 to find the number of students who participate on both teams: 25 – 18 = 7. Write this number in the overlapping section of the circles.

Subtract 7 from the total number of students who play on the soccer team to find the number of students who play <u>only</u> on the soccer team: 15 -7 = 8. Write 8 in the circle to represent the number of students who <u>only</u> play soccer.

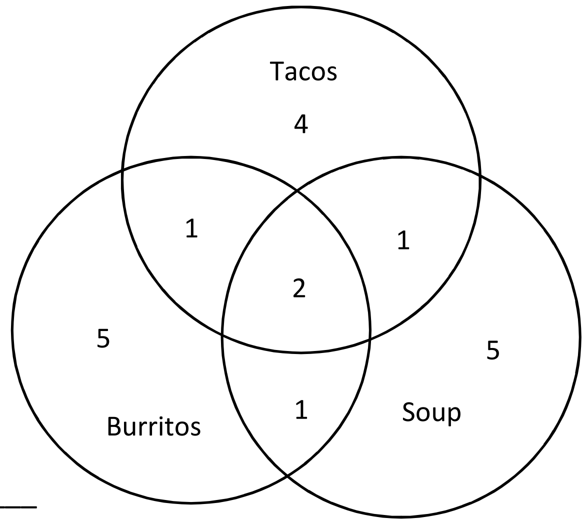
Subtract 7 from the total number of students who are on the AD team to find the number of students who <u>only</u> belong to the AD team: 10 – 7 = 3. Write 3 in the circle to represent the number of students who are <u>only</u> on the AD team.

Students who are on both the soccer and AD team: 7
Students who are only on the soccer team: 8
Students who are only on the AD team: 3

Check your answer: 7 + 8 + 3 = 18

Here is an example of a Venn diagram that uses three circles. As in the previous examples, each circle represents a group. The sections of each circle that overlap define the members that belong to both groups. The center that is overlapped by all three circles define the members that belong to all three groups.

The children who eat lunch at St. Pat's School have the choice of three items for lunch: tacos, burritos, and soup. Using the Venn diagram, answer the questions below:



How many children eat tacos only? ______
How many children eat burritos only? ______
How many children eat both tacos and burritos, but not soup? ______
How many children eat both burritos and soup, but not tacos? ______
How many children eat tacos, burritos, and soup? ______
How many children eat lunch? _________

Answers:

How many children eat tacos only? 4
How many children eat burritos only? 5
How many children eat both tacos and burritos, but not soup? 1
How many children eat both burritos and soup, but not tacos? 1
How many children eat tacos, burritos, and soup? 2
How many children eat lunch? 19

Mrs. Baker, the first grade teacher, has discovered that the cookies for the class party are missing. She suspects that one of three students, Chuck, Carl, or John, is responsible for the missing cookies. Mrs. Baker also knows that one of the students always lies when she asks him a question. Mrs. Baker asks each student in turn who stole the cookies.

Chuck said, "John stole the cookies."

John said, "Carl stole the cookies."

Carl said, "I didn't steal the cookies."

Without knowing the name of the student who is lying, can you find the thief from their responses?

Answer: John is the liar and the thief.

We know that only one of the responses is a lie (or false).

Student	Response
Chuck	False
Carl	True
John	False

If Chuck is lying, then the responses from John and Carl must both be true. Chuck cannot be the liar, because the statements from John and Carl cannot both be true. So we know that Chuck is not the liar and his statement is true.

Student	Response
Chuck	True
Carl	True
John	False

If Chuck's statement is true, then we know that John is the liar and the thief.

Student	Response
Chuck	False
Carl	False
John	True

As a check, let's assume that John is telling the truth. In this case, we end up with two false statements or lies. This is not a solution.

Student	Response
Chuck	False
Carl	True
John	False

As a final check, let's assume that Carl is the liar. In this case, Carl would be the thief. However, this would make Chuck's response a lie. This is also not a solution.

Studying logic fallacies allows a person to recognize common pitfalls in arguments and to identify errors in reasoning, thus avoiding both in practice. Below is a list of common logic fallacies.

Affirming the Consequent *- if A, then B; B, therefore A (A is the antecedent and B is the consequent)*

> Example: People who are Catholic attend church on Sundays. The Lee family attends church on Sundays. Therefore, the Lees are Catholic.

Appeal to Hypocrisy *- countering a charge with a charge*

> Example: How can you accuse me of stealing a donut? You take food from the cafeteria all the time!

Slippery Slope *-discrediting a proposition by arguing that its acceptance will lead to a series of undesirable consequences. The slippery slope fallacy assumes all consequences are inevitable.*

> Example: Voting for Paul Blank will lead to increases in property taxes, a slowdown in the economy, and loss of jobs in the area.

Appeal to the Bandwagon *(Argumentum ad populum) - A proposition is claimed to be true or good solely because many people believe it to be true or good.*

> Example: Everyone knows that Notre Dame will win the football game this weekend.

Groupthink *- substituting pride of membership in a group for reason or deliberation in arriving at a position on an issue.*

> Example: I am a member of the Republican Party. I vote for the Republican candidates in every election.

Scapegoating *- blaming a certain group or an individual for the problems of others.*

> Example: All of the problems in our national legislature are the doing of the Democratic Party and its inability to send a clear message to its party members on what needs to be done to pass important legislation.

Ad Hominem *- A person's character is attacked instead of the person's arguments.*

> Example: He is a convicted felon. You can't believe a thing he says. I don't believe he is innocent of this crime, despite the evidence.

Faulty Cause/Effect *- A happened, then B happened, therefore A caused B.*

> Example: The apple fell off the tree. The tree died. Therefore the apple falling off the tree caused the tree to die.

False Dilemma or Black and White Fallacy *- limiting possibilities to only two alternatives, even though other alternatives exist*

Example: I thought you were a good person, but you weren't in church yesterday.

Two Wrongs Make a Right *- Wrongful behavior on someone else's part does not change wrongful behavior on your part into justified or rightful behavior.*

Example: I don't know why I'm in trouble. Jenny hit me with the ball. So, I hit her back.

Appeal to Fear *- playing on the fears of an audience by bringing up possible unpleasant consequences if the proposition is adopted*

Example: If Mr. Blank is elected as mayor, we will have more taxes, lose our jobs, and the city will suffer.

Cherry-picking *- a form of generalization in which individual cases that confirm a position are pointed out while ignoring a significant number of cases that contradict the position.*

Example: Benjamin and Sydney like chocolate ice cream, but Jennifer and Truman like bubble gum ice cream. I like bubble gum ice cream, too. Bubble gum ice cream must be the most popular flavor at the ice cream parlor.

Composition *- A whole must have an attribute because its parts have that attribute.*

Example: Jeremy has one arm, two eyes, and five fingers. Jeremy is an American. Americans must all have one arm, two eyes, and five fingers.

Division *- A part must have an attribute because the whole to which it belongs has that attribute.*

Example: Humans have hair. Bobby is human. Therefore, Bobby has hair.
(In fact, Bobby is bald. Therefore, the statement is false.)

Appeal to Ignorance *- a proposition is true because there is no evidence against it or a proposition is false because there is no evidence for it.*

Example: Alien life forms exist in our solar system.

<u>Appeal to Authority</u> *– believing that something is true because an expert says that the statement is true. (X says that Y is true. X is an expert. Therefore, Y is true.)*

Example: Prior to 1492, European sailors believed that the Earth was flat. The queen of Spain accepted this premise, because the extensive travels of the sailors made them experts (at the time) in geography.

<u>Guilt by Association</u> *- because two things share a property, they are the same. Guilt is automatically assumed because of a relationship with an unsavory group.*

Example: Jamie cheated on his English exam. Tiffany is Jamie's best friend. Tiffany probably cheated on the English exam, too.

<u>Red Herring/Obfuscation</u> *– when a person brings a topic into a conversation that distracts from the original point, especially if the new topic is introduced in order to distract.*

Example:

Reporter: "Mr. President, has there been progress in reforming the guidelines for granting visas to foreign students?

President: "I am happy to report that our country is the safest country in the world and we have many foreign students who come to this country to earn college and graduate degrees.

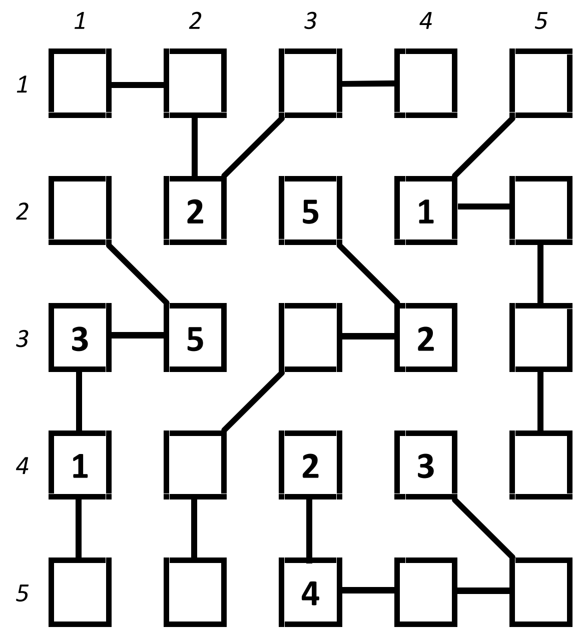
Square Routes

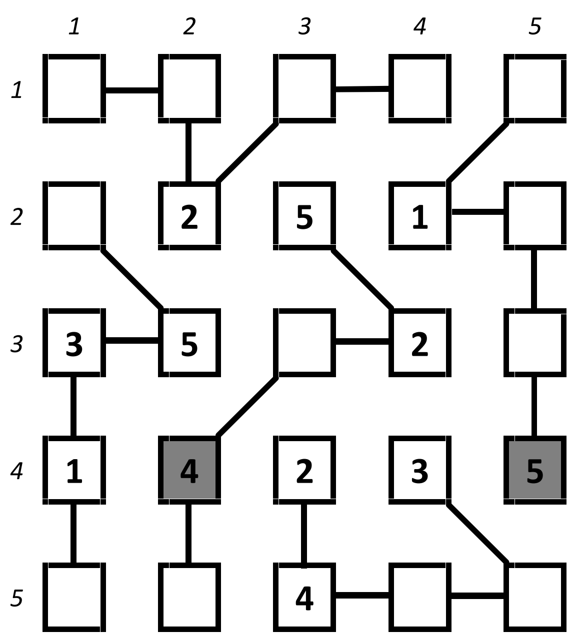
Fill in the empty squares so that all the digits from 1 to 5 appear exactly once in each row, column, and series of squares connected by lines (pathways).

As in a Sudoku puzzle, the best way to begin this puzzle is to use the numbers provided in the puzzle to determine where certain numbers must go through the process of elimination.

Here is an example, worked out step-by-step, to show you the method of solving square routes puzzles:

(Note: In the instructions for solving the puzzle, column numbers and rows are listed in italics.)





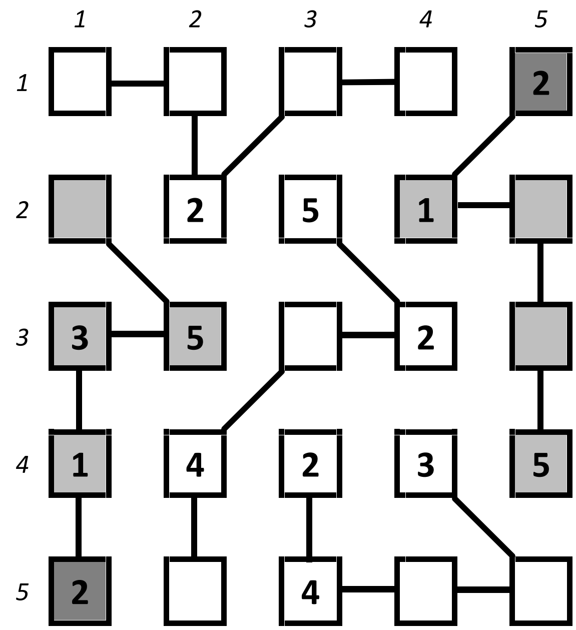
Step 1:

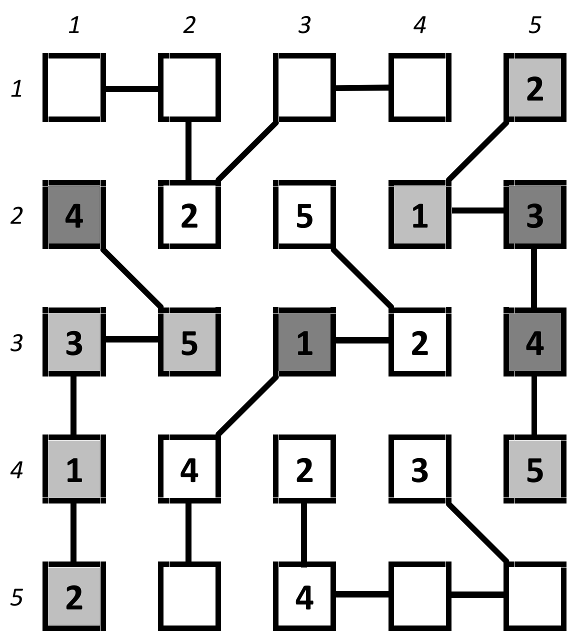
Look at the empty square in column *2*, row *4*.

The only possible number for this square is **4**, because the numbers 1, 2, and 3 are already included in row *4* and the number 5 is already in column *2.* To complete row *4*, place a **5** in the remaining square (row *4,* column *5*).

Step 2:

Now look at the two shaded pathways. There is a 2 already located in rows *2, 3,* and *4.* The only possible number in each pathway for the squares in row *5*, column *1* and row *1*, column *5* is **2**.

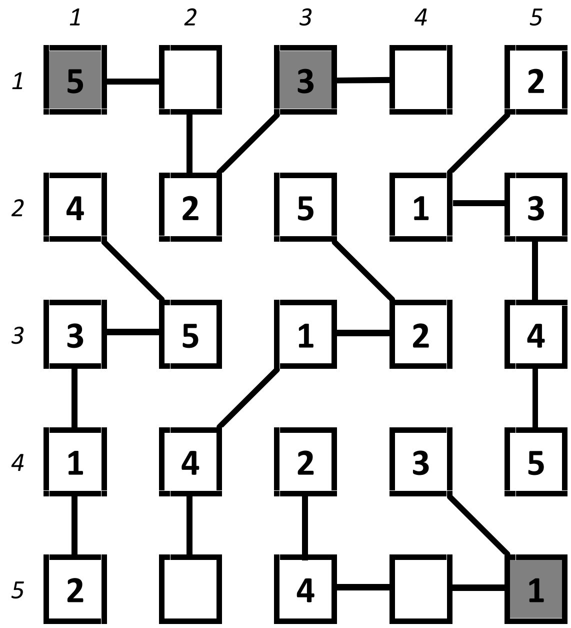




Step 3:

In row *3,* the only missing numbers are 1 and 4. A 4 is already in column *3.* Therefore, the only possible number for the square at row *3,* column *3 is* **1.** The remaining square in row *3*, column *5* is **4.**

It is now possible to complete the shaded pathways by placing a **4** in the empty square at row *2,* column *1* and a **3** in the empty square at row *2*, column *5.*



Step 4:

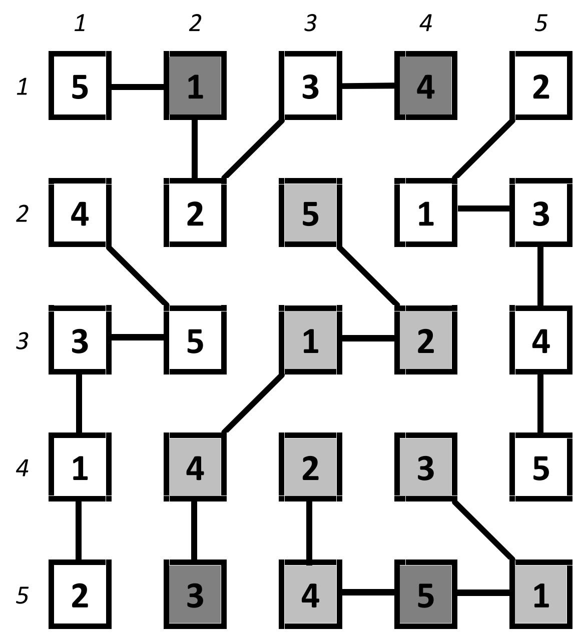
Columns *1, 3,* and *5* each have one empty square remaining. Complete the columns by placing a **5** in the square at row *1*, column *1,* placing a **3** in the square at row *1,* column *3*, and placing a **1** in the square at row *5*, column *5.*

Step 5:

The shaded pathways each have one empty square. Complete the shaded pathways by entering a **3** in the square at row *5,* column *2* and a **5** in the square at row *5*, column *4.*

Two empty squares remain in row *1.* The only missing number in column *2* is **1.** Fill in a **1** in the square at row *1*, column *2.* The only missing number in column *4* is **4.** Fill in a **4** in the square at row *1*, column *4* to complete the puzzle.

Note: This is just one method for solving a square routes puzzle. There are other methods and starting points to reach a solution.



Star Grids

In a star grid, numbered squares indicate how many stars are placed in squares immediately next to the numbered square. Adjacent squares include squares to the right, left, above, below, and diagonal of the numbered square. There is never more than one star in a square and not all the squares contain stars. Here is an example:

Example:

	5	
1		**2**

Solution:

2	★	
★	**5**	★
	★	★
1		**2**

Here is a practice star grid. Based on the numbered squares on the banner below, draw a star in each squares where a star is missing.

	3							
			2		**3**			
	5							**2**
			1		**3**		**3**	
2								
		1				**3**		
				1				