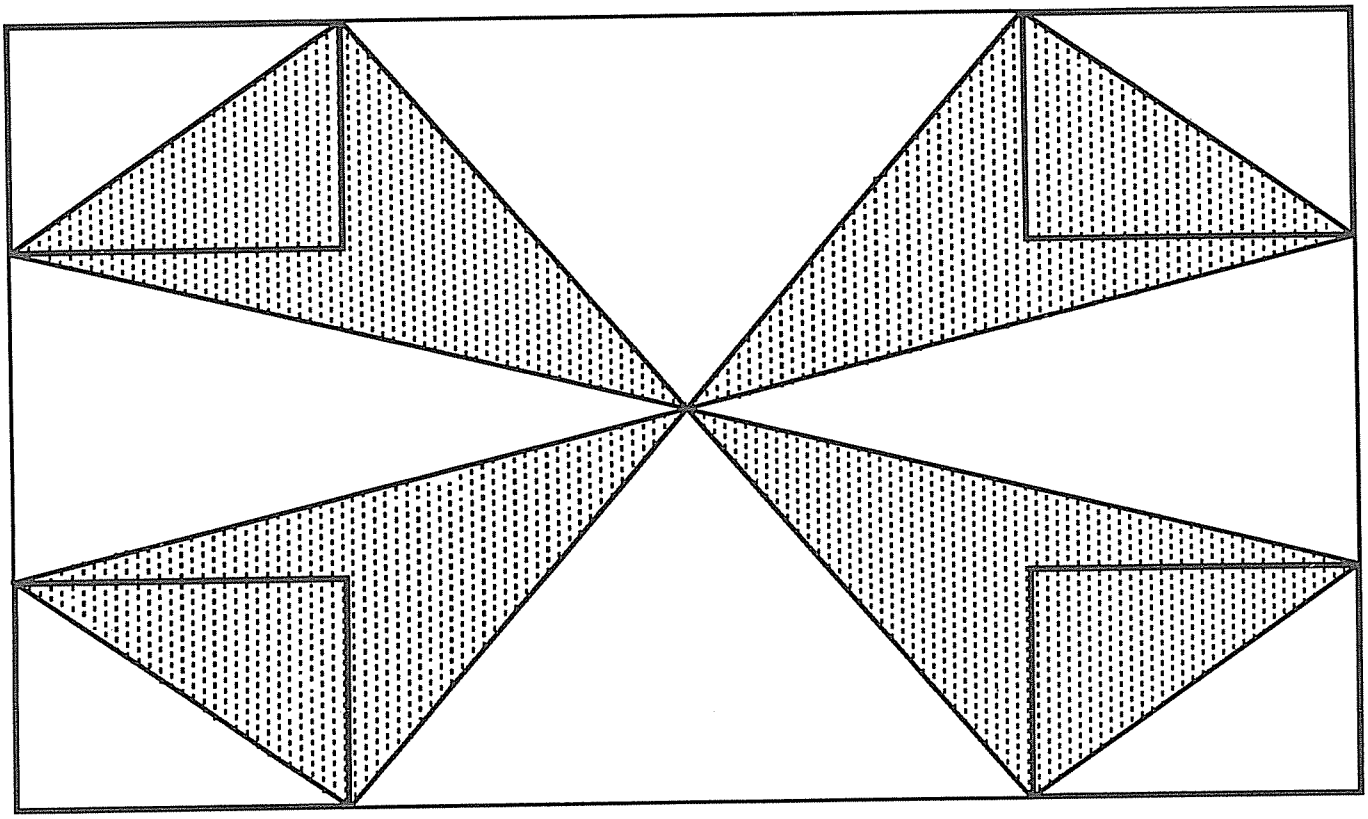
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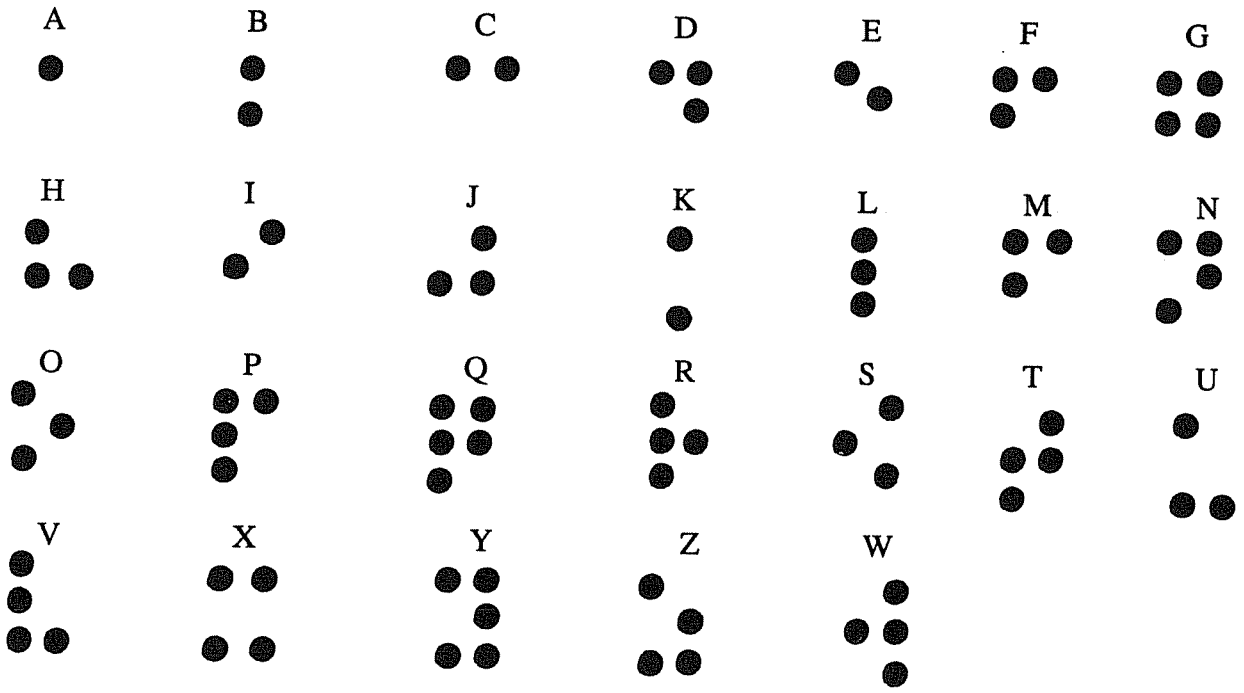
The Braille Alphabet

You have all seen your students struggle at times with algebra. Many students cannot grasp how it is that letters are replaced by numbers and vice versa.

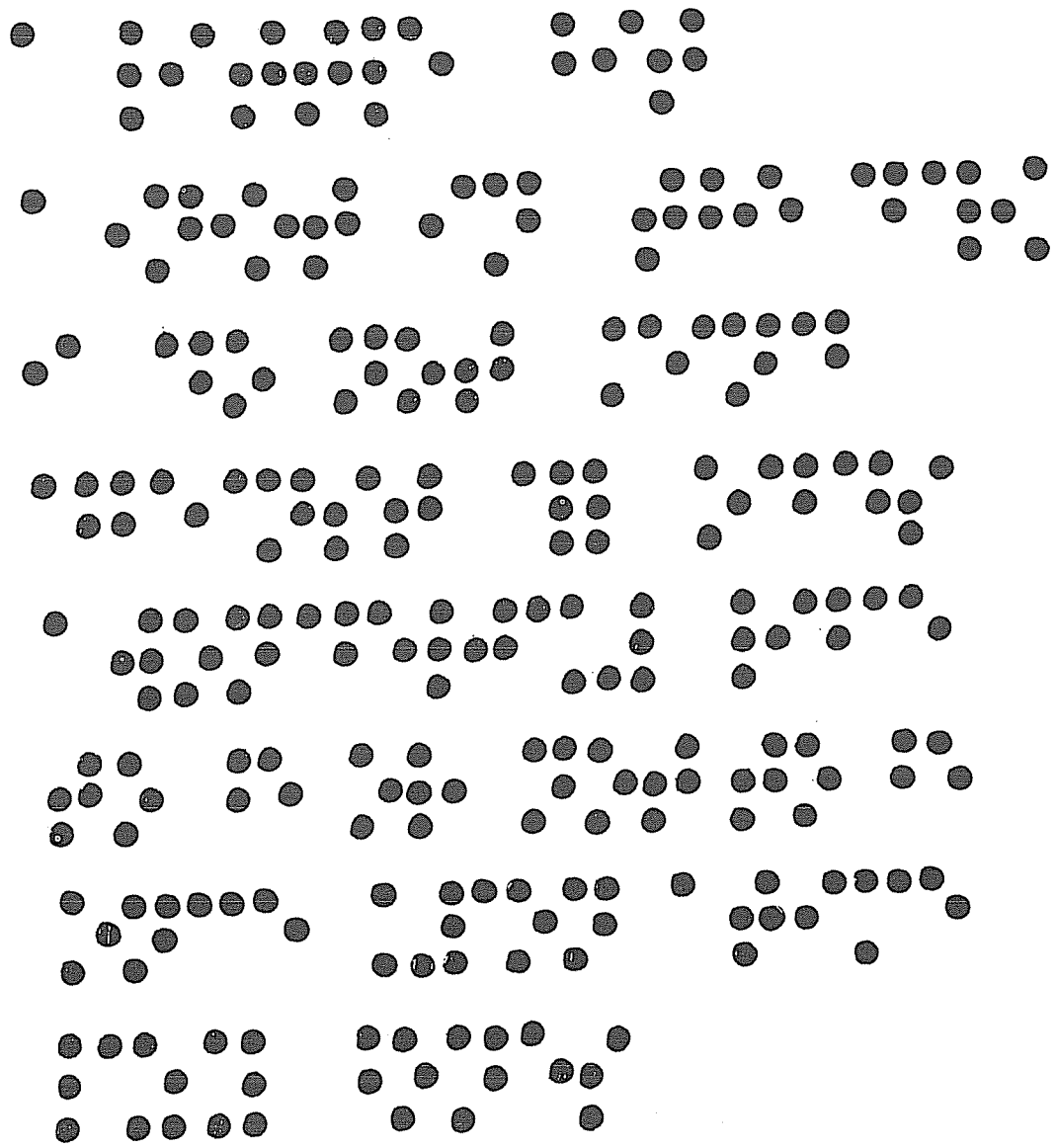
Try to imagine, just for a moment, that you are learning algebra without the benefit of sight. To simply learn to read, a blind person must first be able to intuitively work with algebra. The Braille alphabet, discussed below, is designed using algebraic skills.

The Braille alphabet enables the blind to read and to write as effectively as anyone else. The alphabet itself was developed by Louis Braille in 1829. As a youngster, he became frustrated with the large and bulky raised letters used for him to learn reading and writing skills. Later, while discussing the problem with Charles Barbier, Louis came up with the idea of reading by code. After a number of years of experimenting, he successfully developed the Braille code.

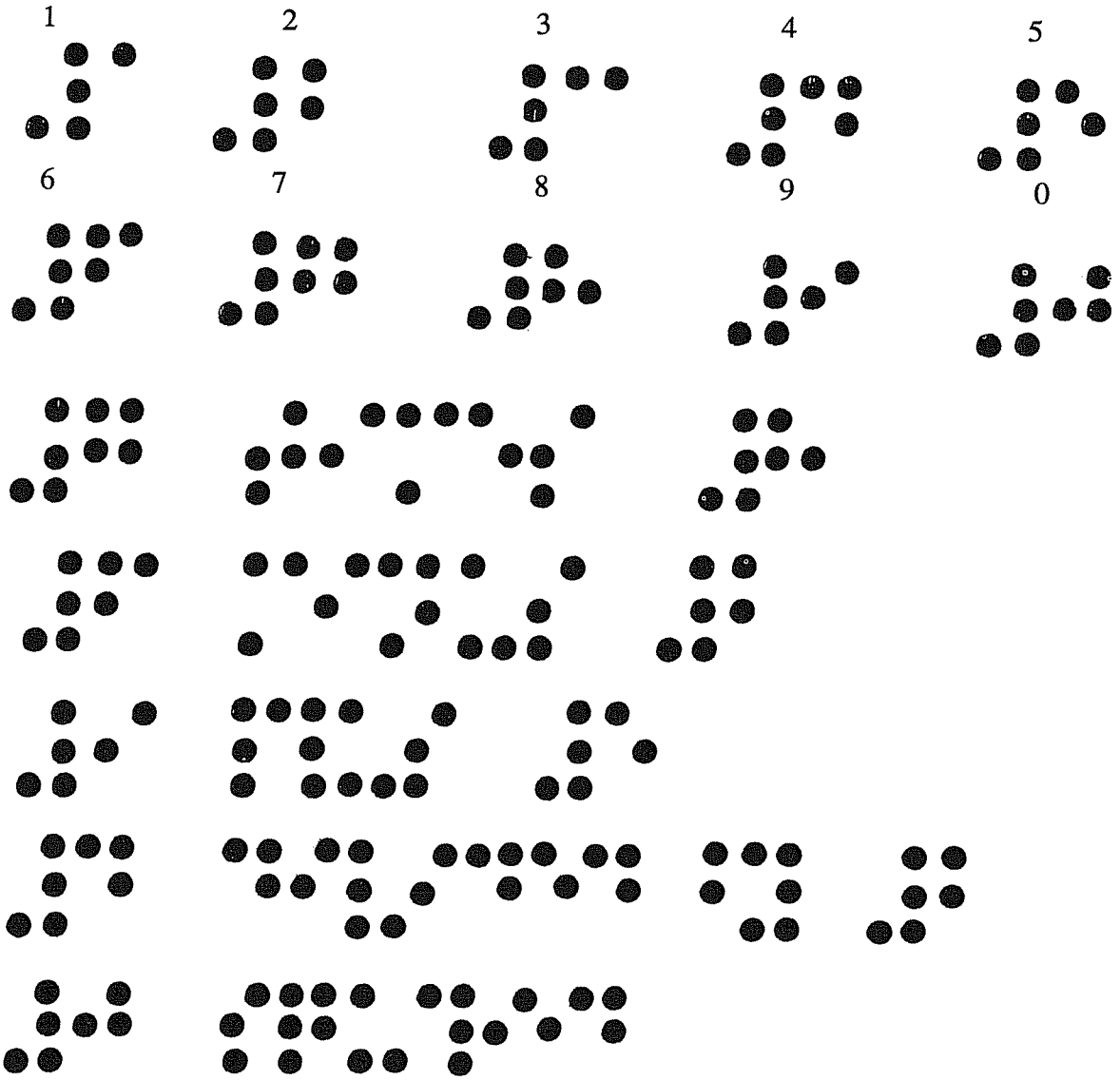
The code itself is based upon the 3 x 2 matrix. The braille "cell" is comprised of six dots placed in a certain order throughout the matrix. Depending upon where the dots are placed, the reader can determine what letter is represented. The alphabet is shown below.



Use the braille alphabet from the previous page to interpret each of the following. What does each sentence represent? A blank line is left between each sentence.



The Braille alphabet is extended to represent numbers. Use the alphabet and the numbers represented below to find the value of each expression.



For your more advanced students, have them look for the pattern that is used to represent letters and numbers using the Braille alphabet.

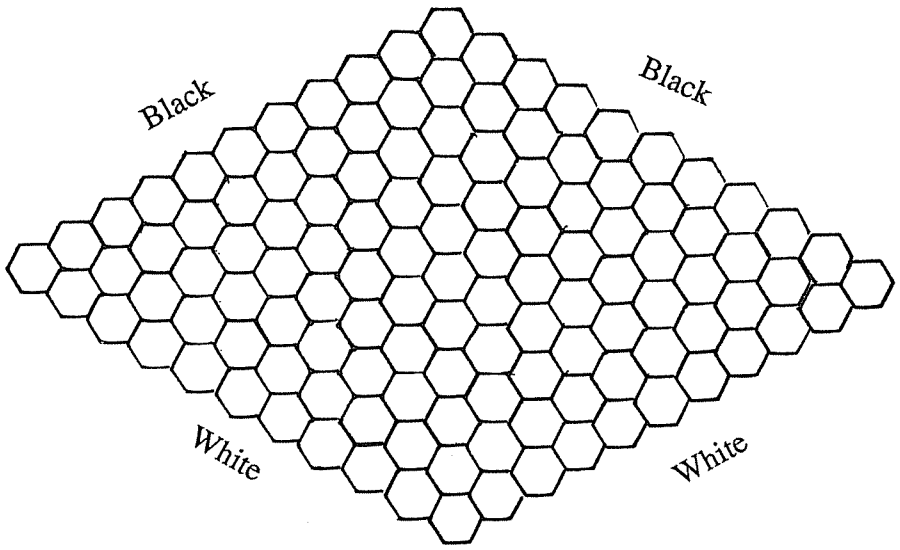
Hex

No, we are not going to put a hex on you. Rather, we are introducing a game that was first presented by Piet Hain, in 1949. Try playing the game with a friend. The rules of the game, and the board, are shown below.

Rules

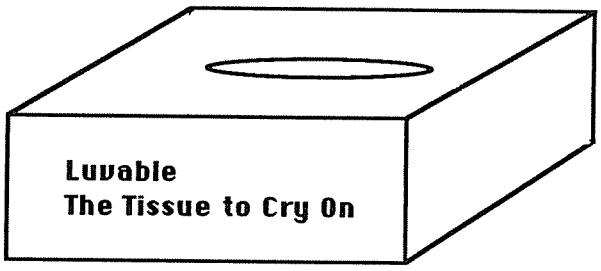
1. Each player alternates colouring a single hexagon.
2. The object of the game is to find a path from the black side of the board to the white, for Player 1, and from the white side of the board to the black for Player 2.
3. The winner finds a path that is not broken. A path is one where you move from one hexagon to another by simply crossing a line.
   - You cannot 'jump' a hexagon.
   - You must cross the 'middle' barrier with 11 hexagons in the column.

Middle Barrier



Math in the Bathroom

You have probably told your students that thay can find mathematics everywhere in their own familiar world. Have you ever thought about how much mathematics can be found in the bathroom?



Look at the tissue box shown to the right. How thick do you think each tissue is? Follow the steps shown below to find out.

Step 1 Measure the height of the tissue box.

Step 2 Find the number of tissues in the box you are measuring.

Step 3 Divide the number in Step 1 by the number in Step 2. How thick is each tissue?

Now try the following problems. Each problem relates to what you could find in your bathroom.

1. (a) Develop a plan to find the surface area covered by the tissues in a box.
   (b) Use your plan. What is the area covered by all the tissues?
   (c) Use your results in (b). Is the area covered by the tissues greater than the area covered by all pages of your local newspaper? Give reasons for your answer.

2. Look at any roll of toilet paper.
   (a) What is the area covered by each sheet?
   (b) How many sheets are on a roll?
   (c) What area is covered by all the sheets?
   (d) Use your results in (c). Is this area greater than the area covered by all pages of your local newspaper? Give reasons for your answer.

3. Use your roll of toilet paper in Question 2.
   (a) What shape is formed by the roll?
   (b) What is the thickness of each sheet?
   (c) What is the surface area of the roll of toilet paper before it is ever used?

4. Use your toilet roll.
   (a) Find the volume of the toilet roll.
   (b) Interpret your result in (a). Do you think that the toilet roll can absorb the volume of water calculated in (a)? Give reasons for your answer.

5. Look at the tube that holds the sheets of paper. The spiral on the outside of the tube is called a "helix".
   (a) Why is it called a helix? (Use your library if necessary.)
   (b) Calculate the surface area of the tube.
   (c) Cut the tube along the helix and flatten the tube. What shape is the result?
   (d) Use your observations in (c). Make a tube for toilet paper that has twice the surface area of the tube in (b).

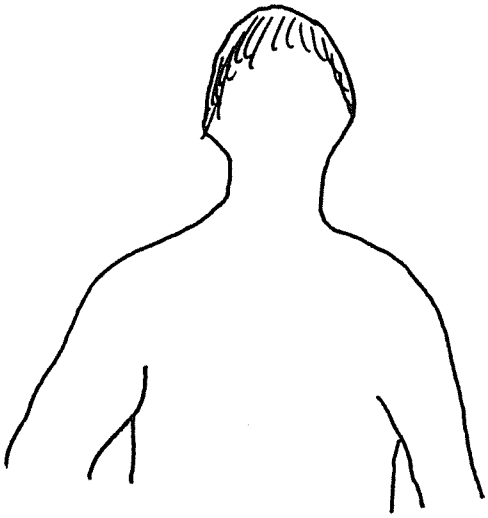
6. Chances are that, at some point, you will find yourself in a bathroom. Did you know that about 70% of your body mass consists of water? This fact, along with the knowledge that 1 L of water has a mass of 1 kg, can be used to find your volume. Use the steps shown below.
   (a) Use a bathroom scale to find your mass.
   (b) The mass of your body is also the number of litres of water in your body. Write your mass in cubic centimtres. (Remember: 1 millilitre = 1 cubic centimetre.)
   (c) Interpret your result in (b). What is your volume in cubic centimetres?

7. Look at the sink in your bathroom.
   (a) Develop a plan to find the volume of water that can fill your sink. (What assumptions do you need to make about a full sink?)
   (b) Use your plan in (a). What is the volume of water that can be held by your sink?

8. Look at the tub in your bathroom.
   (a) Develop a plan to find the volume of water that can fill your tub. (What assumptions do you need to make about a full tub?)
   (b) Use your plan in (a). What is the volume of water that can be held by your tub?

9. (a) Do you prefer to take bath or a shower?
   (b) Predict which you think uses more water - a bath or a shower?
   (c) Check your porediction in (b) using your library. Which uses more?
   (d) Use your answer in (c). Write a short paragraph to explain why is this so?

Math in Your Body



Your body is a system of about 200 bones and 100 joints that make a rather complex system of props, pulleys and levers. This skeleton is needed to ensure that you not only breathe and are able to move, but also to ensure that you do not collapse in heap on the ground.

There are many facts about your body of which you are probably unaware. By answering the questions that follow, find out as many interesting facts as you can. Use your library to investigate many of these, as well as other, facts about your body.

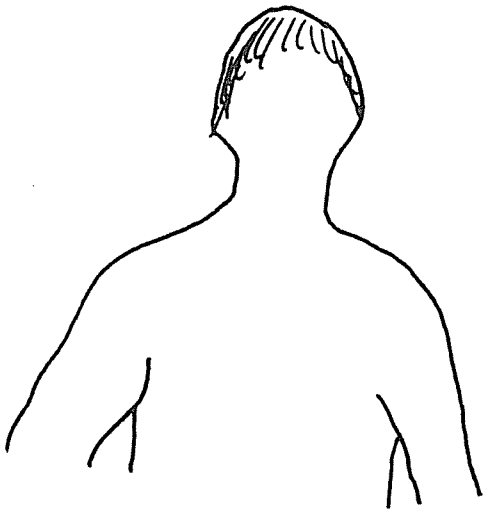
1. Work with a friend. One of you will have to keep track of the time.
   (a) How many times can you blink your eyes in one minute?
   (b) How many times can you blink you eyes in one second?
   (c) Did you known that the fastest human muscle can make your eyelids blink about 5 times each second? How fast are you?

2. (a) Predict how many times you think your heart will beat in a life time.
   (b) Measure your heart beat at rest.
   (c) How many times will your heart beat in a day? in a year? in 70 years?
   (d) How accurate was your prediction in (a)?

3. Use your library.
   (a) What is the distance around the equator of the earth?
   (b) How far would you travel if you walked around the earth 2.5 times? What assumptions do you make in solving this question?
   (c) Interpret your answer in (b). If you laid all the blood vessels in your body end to end, how many kilometres would they stretch?

4. There are about 100 000 hairs on your body. Each hair is strong enough to lift about a 0.2 kg mass.
   (a) Use a scale. Find your mass.
   (b) How many hairs would it take to lift your mass?
   (c) Do you think there are enough hairs on your head to left all the people in your class? Give reasons for your answer.

5. When you perform any physical activity, you will perspire.
   (a) In what activities will you perspire the most?
   (b) Evaluate this expression.
   200 000 x 7 + (314 462 - 2231 x 2 + 1 290 000).
   (c) Each sweat gland averages a length of 0.16 mm. Use your expression in (b). How many kilometres will your sweat glands stretch if they are laid end to end?



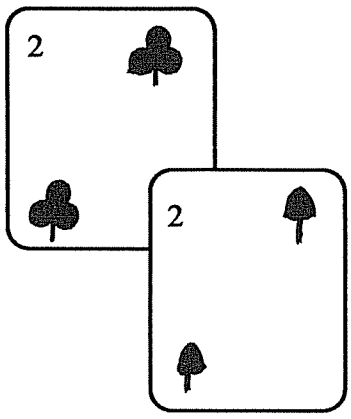
6. Work with a friend.
   (a) Pace off a distance of 100 m.
   (b) Run the 100 m as fast as you can. Your friend will time you.
   (c) Use your results in (b). What is your speed in kilometres per hour?
   (d) The electrical impulses in the nerves of your body travel at a speed of about 400 km/h. In the time it takes you to run 100 m, how far has one electrical impulse travelled?

7. (a) Predict how long you think you spend with your eyes shut each day.
   (b) For how many hours did you sleep last night?
   (c) Stand in front of a mirror. How many times do you blink in one minute.
   (d) On average, each time you blink you will have your eyes shut for 0.03 s. Use your answer in (c). For how many hours will your eyes be shut each day? How accurate was your prediction?

8. Try this experiment.
   (a) Fill a glass about three quarters full of water.
   (b) Sprinkle some black pepper onto the surface of the water.
   (c) Swirl the glass. What do you noitce about the black pepper?
   (d) What conclusion can you draw about the water in the glass?

   The result that you saw in Question 8 can be applied to your ears. There is a fluid in the ear canal that is used to detect and regulate your balance. As you turn your head from one side to the other, your ear canal will move, but the fluid stay still. Use your library. How does this help you maintain your balance?

Card Tricks



Card tricks have provided amusement and fascination for many people over many years. The following shows you two card tricks. They were first presented by Martin Gardner in his book Mathematical Puzzles and Diversions. Martin Gardner, being a magician himself, presented many tricks that worked because of the mathematics involved. After you have tried these two tricks, you may wish to read some of his publications. They will give you many more ideas that you can use with your students.

- Follow the steps given to verify that they work.
- Try them on a friend.
- Then, verify mathematically why they work.

Steps

1. From a well-shuffled deck of cards, have a friend select three cards. Place them face down on a table.

2. Have your friend shuffle the remaining cards and give them back to you.

3. Look at the fourth card from the bottom of the deck. Remove its counter part from the deck. For example, if the fourth card is a 3 of heart, select the 3 of diamonds. If the fourth card is the 7 of spades, select the 7 of clubs.

4. Have your friend turn over the three cards. Each card is given values as follows.
   Ace - 1, Two - 2, Three - 3, ..., Ten - 10, Jack - 11, Queen - 12, King - 13

5. Have your friend start placing cards on each of the three selected cards until 15 is reached. For example, if the card is a Jack, then the Jack represents 11 and four cards are turned over to represent 12, 13, 14 and 15.

6. Repeat Step 5 for all three cards. Then, find the sum of the numbers that have been represented by the three cards. Count out this many cards from the deck.

7. Once you have completed Step 6, announce that the next card in the deck and the card that you removed earlier will be the same number and the same colour.

How is this done?

Here is another card trick you can try. You have probably solved problems that use the same skills used in this card trick.

- Follow the steps to try the card trick.
- Solve the problem shown below.
- Then try to explain why the trick works.

Steps

1. Give a full deck of cards to a friend.

2. Have your friend shuffle the deck thoroughly. Then select 20 cards from the deck.

3. Turn these cards face up and return them to the deck.

4. Your friend then shuffles the deck once again so that the cards that are turned face up are spread randomly throughout the deck.

5. Now have your friend count out the top 20 cards from the deck and hand them to you. You now announce that, with your eyes shut, you will turn over enough cards in the pile just handed to you so that there are exactly the same number of cards in the pile you are holding as the pile your friend is holding.

6. Without looking at the deck, simply turn the pile in your hands over.

7. Now count out the cards that are face up. There is exactly the same number of cards face up in each pile.

To try and determine how this problem works, solve the following problem that you may have seen before.

Colin (whose little wife calls the chinless wonder) has two beakers, each with 100 mL of liquid in them. One beaker contains a red dye solution while the other beaker contains a green die solution. Fifty millilitres of the green die solution are placed in the red die solution. The new solution is then mixed. From this new solution, 50 mL are taken and placed back into the green die solution. Which beaker has the most green die solution in it? Give reasons for your answer.

Spatial Sense

To solve many problems, you will have your students look for patterns. It is through this search for patterns, that students often develop their sense of the space around them. In 1977, Hoffer suggested "seven visual perception abilities" that students use to help develop their sense of the space around them. The seven are as follows.

- Eye-motor coordination
- Figure-ground perception
- Perceptual constancy
- Position-in-space perception
- Perception of spatial relationships
- Visual discrimination
- Visual memory

Much has been written over the years about all seven abilities. In fact, originally, Brennan, Jackson and Reeve (1972) suggested that there were nine "visual perception abilites". At this point, it is not possible to go into all of the perception abilites described. However, one of the abilities is summarized below. On the next 3 pages, you will find activities and problems that can be solved to help develop this one ability. To help your students develop the skill, have them work in small groups to complete each activity.

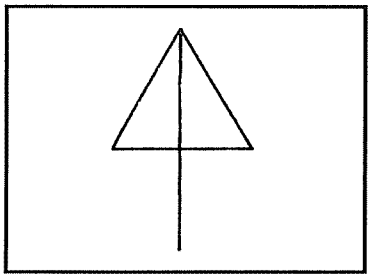
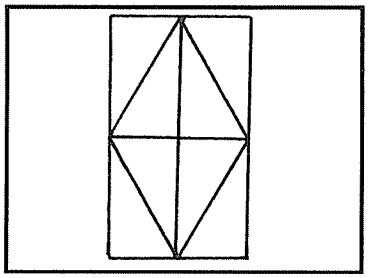
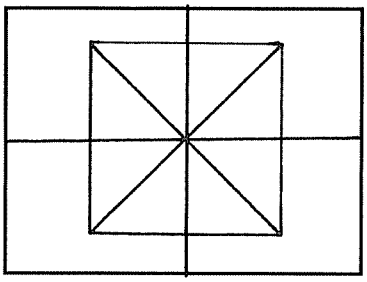
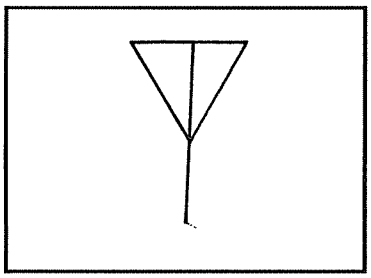
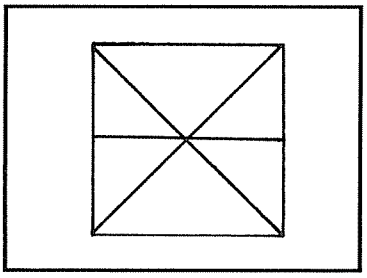
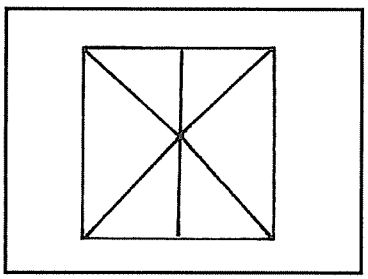
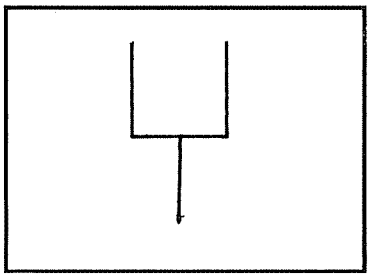
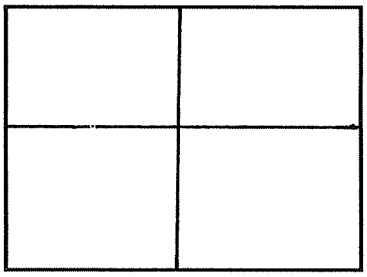
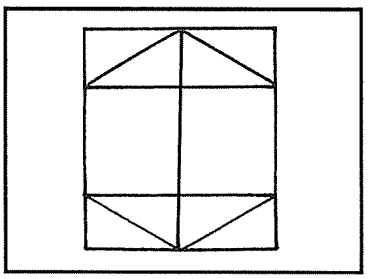
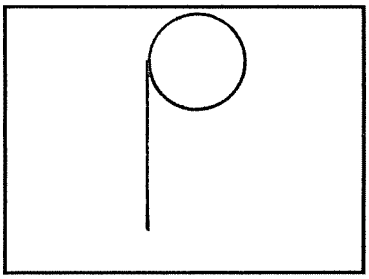
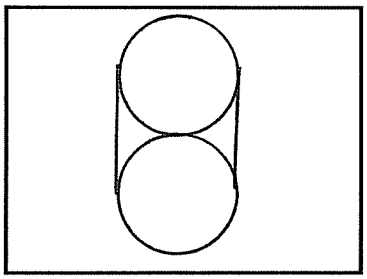
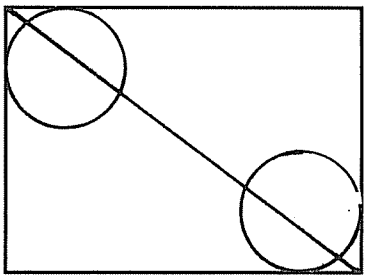
Figure-ground perception

Simply stated, figure-ground perception is the ability to "distinguish between the foreground from the background". This can be done in three of the following ways.

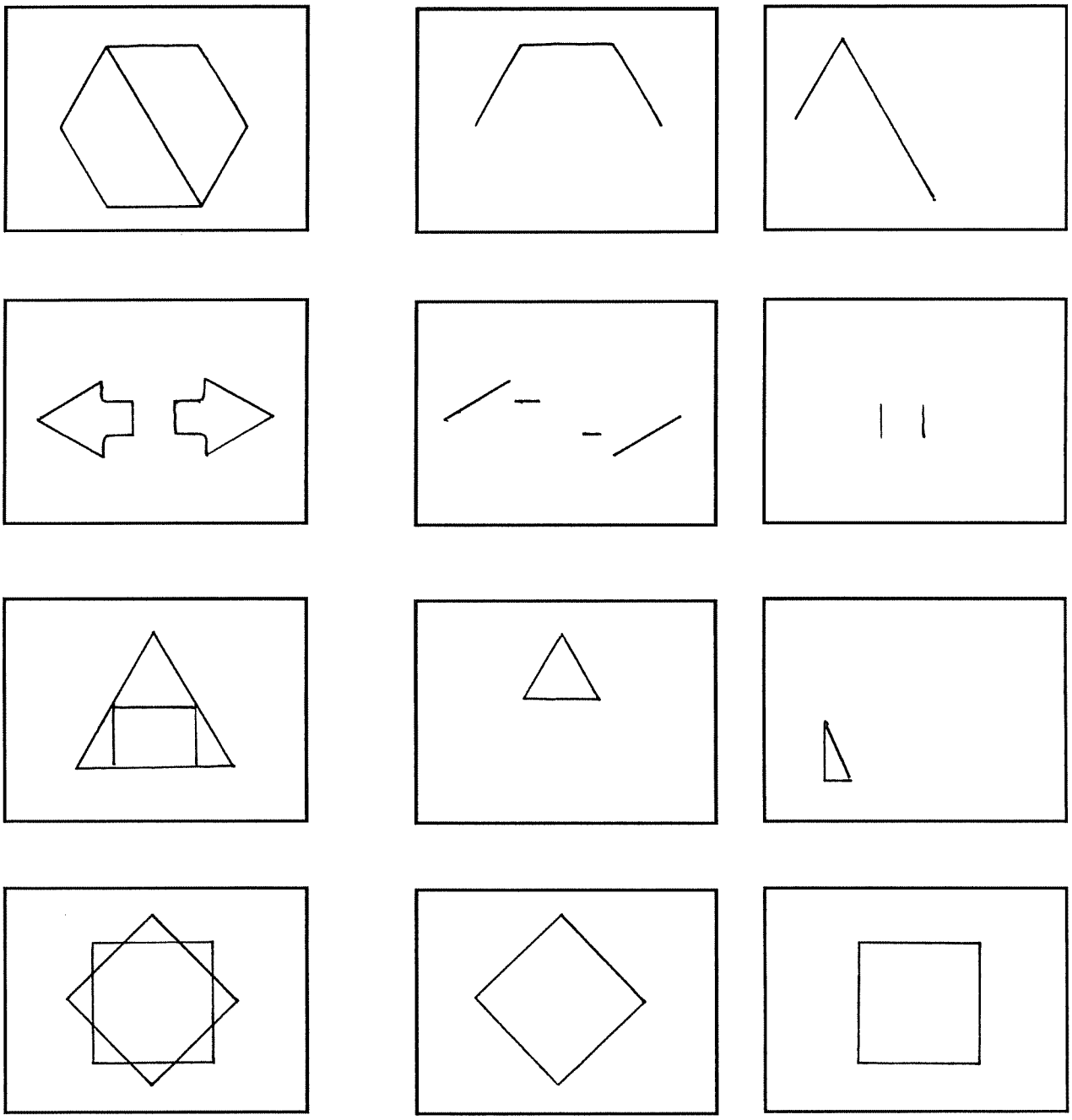
- Identify a figure in a diagram where more than one figure can be seen.
- Complete a given figure from a partial figure.
- Complete a figure from its parts.

Each of the next three pages gives you activities that you can try with your students. Each page is devoted to one of the ways to "distinguish foreground from background". In order to keep your students on track, make copies of each of the next three pages and distribute them. It will be much easier than having your students trace the figures themselves.

On this page, you will identify figures from a given figure. In the box to the left, a figure is shown. Use a red marker to trace the figure in the 2 boxes to the right.

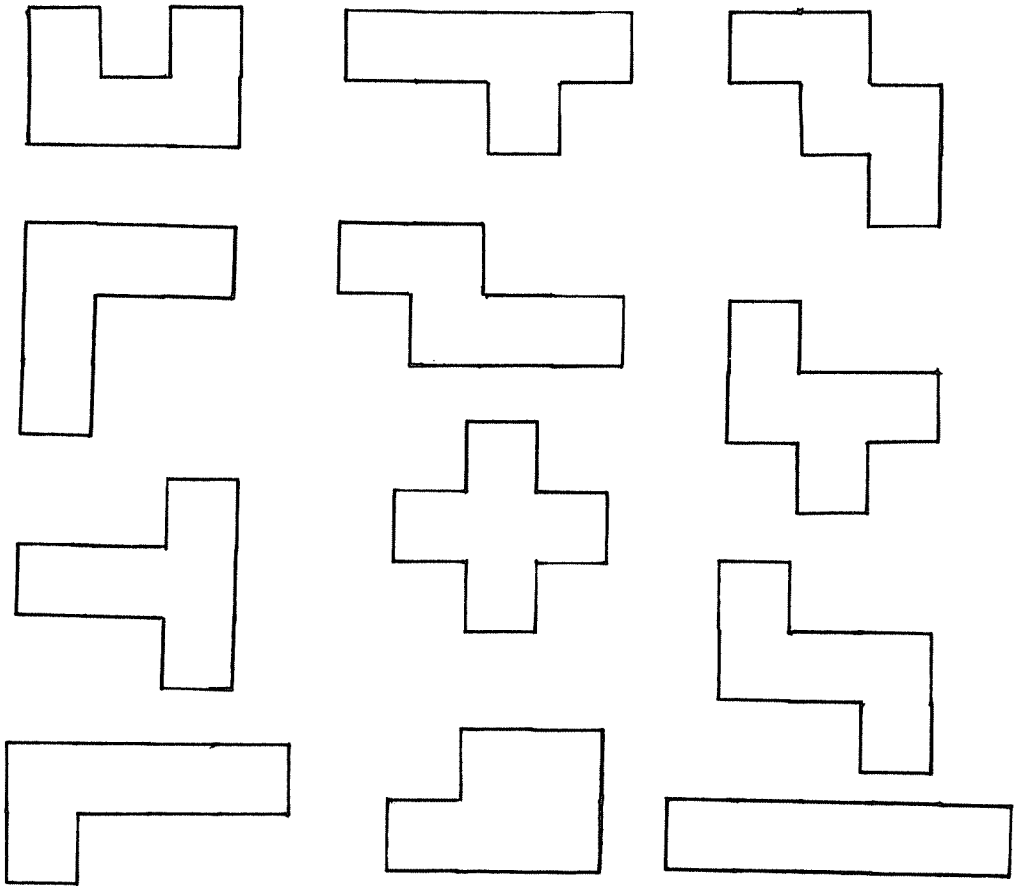













On this page, you will complete the figure given. In the box to the left, a figure is shown. Use a red pen to complete the figure in each box to the right.



The following uses the twelve pentominoes to create figures. The twelve pentominoes are shown below. Cut out the twelve pentominoes and use them to create the following figures.

- 4 different rectangles, each with an area of 60 square units.
- 2 different rectangles, each with an area of 30 square units.
- 1 square with an area of 25 square units.
- A shape of your own. Then, verbally describe the shape to a friend in the class. Have your friend use the pentominoes to construct your shape.



Blame it on the Rain

We are not discussing the popular song being played on many radio stations this summer. rather, we are going to think about other broadcasts made on all radio stations.

How many times have you listened to the weather forecast played on your favorite radio station and heard the following prediction?

"There is a 50% chance of rain today."

Did you think that the weather forecaster was only guessing and that the "odds" were 50-50 that it was going to rain?

In fact, this forecast is interpreted to mean that about 50% of the listening areas is going to be wet at some point throughout the day. For example, if the broadcast signal covers an area of about 250 square kilometres, then about 125 square kilometres are going to get wet.

Pick a radio station in your area. Find out how many square kilometres are covered by the broadcast signal. Use the broadcast area to interpret each of the following weather predictions.

1. "There is only a 10% chance of rain today.

2. "There is a 90% chance of precipitation today.

3. "There is a 70% chance of snow today."

4. "A thunderstorm watch is in effect. There is a 80% chance that damaging hail stones will fall in the surrounding areas."

5. Listen to your favorite radio station for a week.
   - Interpret what is meant by the weather forecast.
   - Record what the weather was like in your area and in the surrounding area.
   - How accurate was the weather forecast in your area? in the surrounding area?

6. Now use your library.
   - Find the Farmer's Almanac.
   - Check the weather forecasts for each day in the Farmer's Almanac.
   - How is the weather forecast in the Alamanac like the one given by your radio station? How is it different?
   - Over the course of one week, which was the more accurate forecast? Give reasons for your answer.
   - Which do you feel is the more accurate forecast? Give reasons for your answer.