

ADMINISTRATION DETAILS

1. Provide students with a general introduction to the test by explaining that the test consists of a number of problems involving reasoning or problem solving strategies that are useful in solving problems in a variety of areas. The test will provide information about how familiar students are with with these strategies. Explain that some of the items are quite difficult few students would be expected to get them all correct.
2. At the commencement of the test demonstrate the operation of a pendulum to the students. Items 3 and 4 concern investigations with pendulums.
Say: "When the pendulum is allowed to swing back and forth it takes an equal time for each swing. The weights at the end or the length of a pendulum can be changed."
3. Indicate when students should commence each item.
4. Students can work ahead but are not advised to do so.
5. At the conclusion to the test allow time for students to revise and/or complete items.
6. It is important that students understand the situations and the questions as best they can. For this reason you may need to read or rephrase certain questions and items of information for certain students. Care should be taken not to provide hints as to the correct solutions.

Suggested time:

- Items 1-6 3 minutes each.
Items 7-8 4 minutes each
Items 9-10 6 minutes each
Total time: 38 minutes.

Item 1

Form A

Orange Juice #1

Four large oranges are squeezed to make six glasses of juice. How much juice can be made from six oranges?

- a. 7 glasses
- b. 8 glasses
- c. 9 glasses
- d. 10 glasses
- e. other

Reason

- 1. The number of glasses compared to the number of oranges will always be in the ratio 3 to 2.
- 2. With more oranges, the difference will be less.
- 3. The difference in the numbers will always be two.
- 4. With four oranges the difference was 2. With six oranges the difference would be two more.
- 5. There is no way of predicting.

Item 2

Orange Juice #2

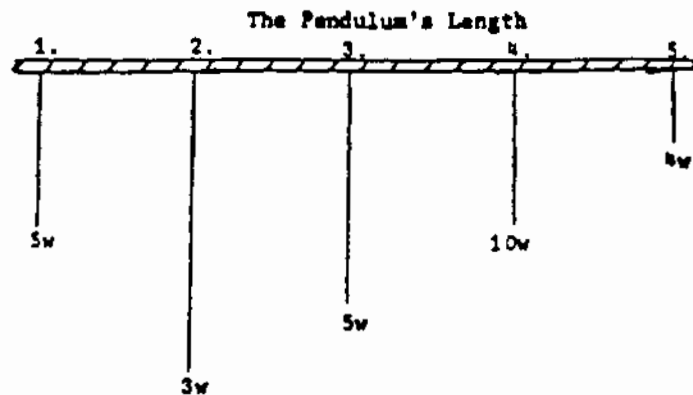
How many oranges are needed to make 13 glasses of juice?

- a. $6 \frac{1}{2}$ oranges
- b. $8 \frac{2}{3}$ oranges
- c. 9 oranges
- d. 11 oranges
- e. other

Reasons

- 1. The number of oranges compared to the number of glasses will always be in the ratio 2 to 3.
- 2. If there are seven more glasses, then five more oranges are needed.
- 3. The difference in the numbers will always be two.
- 4. The number of oranges will be half the number of glasses.
- 5. There is no way of predicting the number of oranges.

Item 3



Suppose you wanted to do an experiment to find out if changing the length of a pendulum changed the amount of time it takes to swing back and forth. Which pendulums would you use for the experiment?

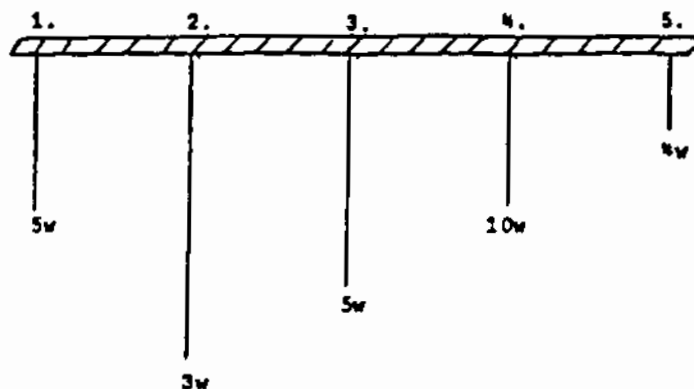
- a. 1 and 4
- b. 2 and 4
- c. 1 and 3
- d. 2 and 5
- e. all

Reason

1. The longest pendulum should be tested against the shortest pendulum.
2. All pendulums need to be tested against one another.
3. As the length is increased the number of washers should be decreased.
4. The pendulums should be the same length but the number of washers should be different.
5. The pendulums should be different lengths but the number of washers should be the same.

Item 4

The Pendulum's Weight



Suppose you wanted to do an experiment to find out if changing the weight on the end of the string changed the amount of time the pendulum takes to swing back and forth. Which pendulums would you use for the experiment?

- a. 1 and 4
- b. 2 and 4
- c. 1 and 3
- d. 2 and 5
- e. all

Reason

1. The heaviest weight should be compared to the lightest weight.
2. All pendulums need to be tested against one another.
3. As the number of washers is increased the pendulum should be shortened.
4. The number of washers should be different but the pendulums should be the same length.
5. The number of washers should be the same but the pendulums should be different lengths.

Item 5

The Vegetable Seeds

A gardener bought a package containing 3 squash seeds and 3 bean seeds. If just one seed is selected from the package what are the chances that it is a bean seed?

- a. 1 out of 2
- b. 1 out of 3
- c. 1 out of 4
- d. 1 out of 6
- e. 4 out of 6

Reasons

1. Four selections are needed because the three squash seeds could have been chosen in a row.
2. There are six seeds from which one bean seed must be chosen.
3. One bean seed needs to be selected from a total of three.
4. One half of the seeds are bean seeds.
5. In addition to a bean seed, three squash seeds could be selected from a total of six.

Item 6

The Flower Seeds

A gardener bought a package of 21 mixed seeds. The package contents listed:

3 short red flowers
4 short yellow flowers
5 short orange flowers
4 tall red flowers
2 tall yellow flowers
3 tall orange flowers.

If just one seed is planted, what are the chances that the plant that grows will have red flowers?

- a. 1 out of 2
- b. 1 out of 3
- c. 1 out of 7
- d. 1 out of 21
- e. other

Reason

1. One seed has to be chosen from among those that grow red, yellow or orange flowers.
2. $\frac{1}{4}$ of the short and $\frac{4}{9}$ of the tall are red.
3. It does not matter whether a tall or a short is picked. One red seed needs to be picked from a total of seven red seeds.
4. One red seed must be selected from a total of 21 seeds.
5. Seven of the twenty one seeds will produce red flowers.

Item 7

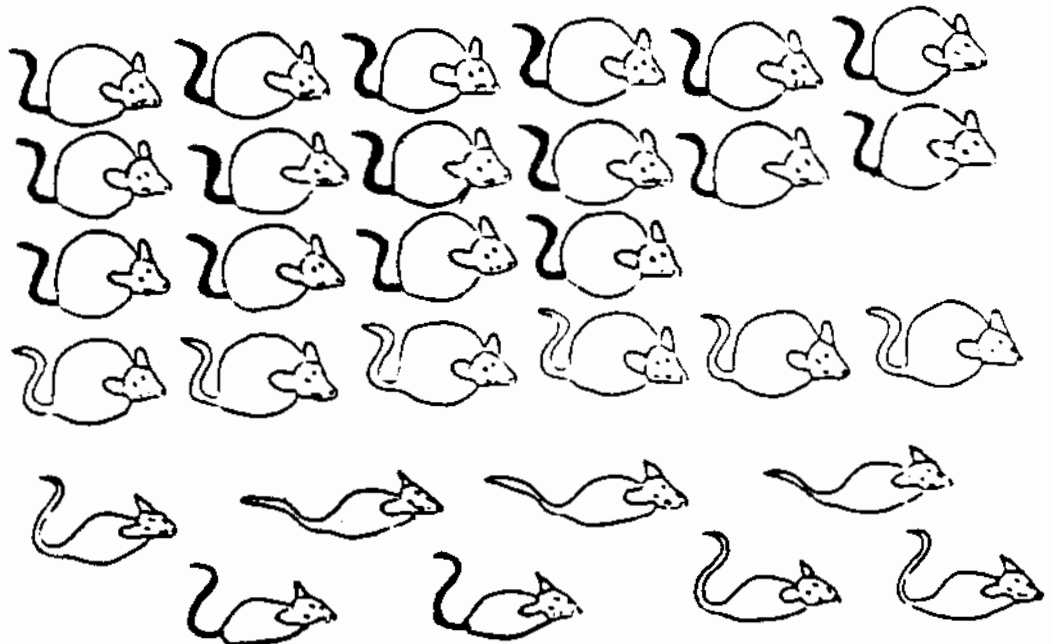
The Mice

The mice shown represent a sample of mice captured from a part of a field. Are fat mice more likely to have black tails and thin mice more likely to have white tails?

- a. Yes
- b. No

Reason

1. 8/11 of the fat mice have black tails and 3/4 of the thin mice have white tails.
2. Some of the fat mice have white tails and some of the thin mice have white tails.
3. 18 mice out of 30 have black tails and 12 have white tails.
4. Not all of the fat mice have black tails and not all of the thin mice have white tails.
5. 6/12 of the white tailed mice are fat.



Item 8

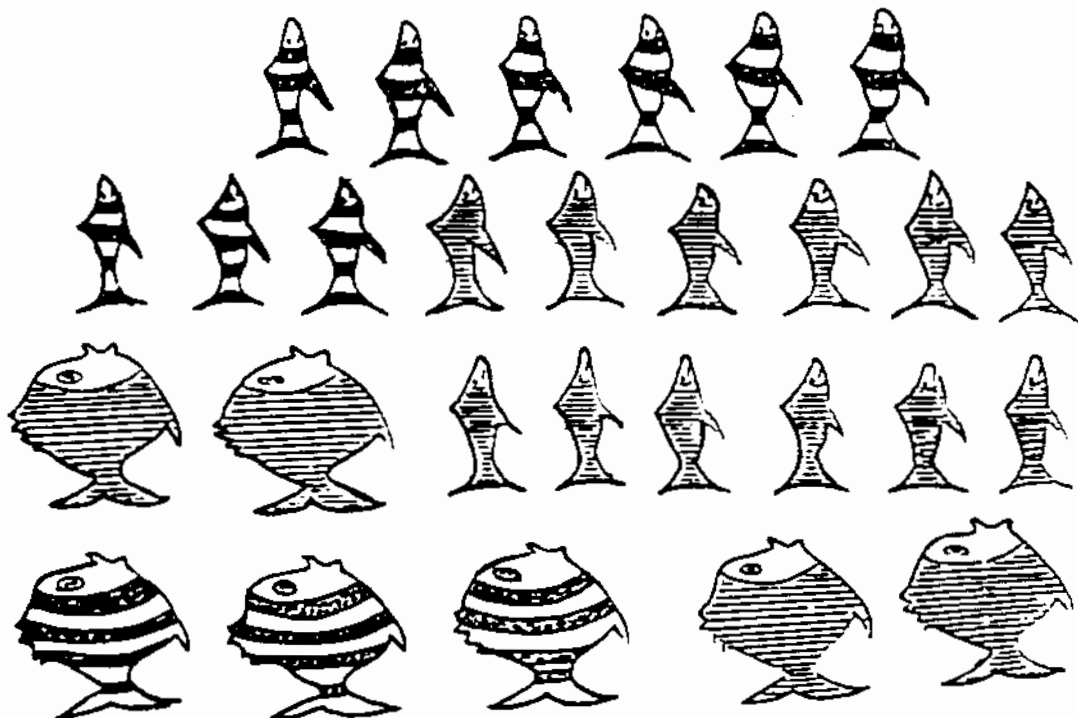
The Fish

Are fat fish more likely to have broad stripes than thin fish?

- a. Yes
- b. No

Reason

1. Some fat fish have broad stripes and some have narrow stripes.
2. $\frac{3}{7}$ of the fat fish have broad stripes.
3. $\frac{12}{28}$ are broad striped and $\frac{16}{28}$ are narrow striped.
4. $\frac{3}{7}$ of the fat fish have broad stripes and $\frac{9}{21}$ of the thin fish have broad stripes.
5. Some fish with broad stripes are thin and some are fat.



Item 9

The Student Council

Three students from grades 10, 11, and 12 were elected to the student council. A three-member committee is to be formed with one person from each grade. All possible combinations must be considered before a decision can be made. Two possible combinations are Tom, Jerry, and Dan (TJD) and Sally, Anne, and Martha (SAM). List all other possible combinations in the spaces provided.

More spaces are provided on the Answer Sheet than you will need.

STUDENT COUNCIL

<u>Grade 10</u>	<u>Grade 11</u>	<u>Grade 12</u>
Tom (T)	Jerry (J)	Dan (D)
Sally (S)	Anne (A)	Martha (M)
Bill (B)	Connie (C)	Gwen (G)

Item 10

The Shopping Center

In a new Shopping Center, 4 store locations are going to be opened on the ground level.

A BARBER SHOP (B), a DISCOUNT STORE (D), a GROCERY STORE (G), and a COFFEE SHOP (C) want to move in there. Each one of the stores can choose any one of four locations. One way that the stores could occupy the 4 locations is BDGC. List all other possible ways that the stores can occupy the 4 locations.

More spaces are provided on the Answer Sheet than you will need.

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Test of Logical Thinking Form A

The answers to the Test of Logical Thinking (Form A) are:

1. C 1

2. C 1

3. C 5

4. A 4

5. A 4

6. B 0

7. A 1

8. C 4

9. 12 combinations

10. 14 combinations

THE TEST OF LOGICAL THINKING: INTERPRETING RESULTS

The Test of Logical Thinking (TOLT) provides a measure of formal reasoning ability. Five reasoning types are assessed on the TOLT: proportional reasoning; controlling variables; probabilistic reasoning; correlational reasoning; and combinatorial reasoning. Two test items assess each type of reasoning. A total score of 10 can be obtained on the TOLT. Research has indicated that pupils who are able to figure out items such as these are usually capable of advanced mathematics and scientific achievement.

Scores on the TOLT can be used in a variety of ways. Several examples are described below.

1. Three mathematics groups were formed using scores of 0,1 for the lower group; 2 for the middle group; and greater than or equal to 3 for the advanced group. The scores happened to provide approximately equal sized groups in the class concerned. From a theoretical viewpoint 0,1 represents pupils at a *concrete* developmental level; 2 represents pupils at a *transitional* stage of development; and three or more represents pupils capable of using *formal* reasoning to solve problems.
2. Scores on the TOLT were used to identify pupils who were not working to capacity. For example, one boy who had scored 10 on the TOLT was in the bottom year 7 mathematics group. Incidentally, very few adults are able to score 10 on the TOLT.
3. TOLT scores have been used as a basis for identifying pupils for the gifted program in a number of schools.
4. Perhaps the greatest advantage of having a measure of pupil formal reasoning ability is that challenging problems can be planned for the most able and remedial programs can be planned for less able pupils. Teachers are better able to plan work that is at an appropriate cognitive level for individual learners.

Please let me know if you would like more information on the TOLT or have any questions. If you would like to assess reasoning ability of other classes I'll be glad to provide assistance.

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27/7/81