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Development of the Minimum Competency Exam in Mathematics for the Hoquiam School District

John Daniel Descher

DEVELOPMENT OF THE MINIMUM COMPETENCY EXAM IN MATHEMATICS FOR THE HOQUIAM SCHOOL DISTRICT

A Project Report

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by

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Committee Chair B. Erickson

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Two competency exams (Test A and Test B) were constructed and field tested on high school students in the Hoquiam School District. Individual results were compared to respective Stanford Achievement Test scores. Statistical analyses were performed to investigate population differences. Results from Test A were compared to results from Test B. Also, differences between performances of juniors and seniors were analyzed. A further statistical analysis was performed to compare performances between boys and girls.

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Chapter 1

PROBLEM

Focus of the Study

Between 1972 and 1978 there was a significant overall decline in mathematics achievement which was particularly apparent in older high school students (Ward, 1979). During the same time frame, the results of the Ninth Annual Gallup Poll of the public's opinion toward the public schools showed that the nation's business community was dissatisfied with the unemployability of a large portion of high school youth (Gallup, 1977). Gallup (1977) also found a general decline in support for public education and a low esteem for public education and a low esteem for school officials. Baratz (1977) pointed out that the concern over poor student performance had led to the feeling that educators should set higher standards via testing.

This growing concern about educational quality and basic skills set off an explosion of interest in testing (Joseph Califano, 1977). In April of 1976, eight states required minimum competency testing (Baratz, 1977). By March of 1978, 25 more states had followed a similar

pattern, (Pipho, May, 1978) supporting Caliphano's (1977) view that "no single test is right for every school."

The editorial panel of Mathematics Teacher (February, 1977) endorsed the concerns of others by identifying the three parts of the problem:

> One of the most urgent problems facing mathematics education today is the challenge to define basic skills or minimum levels of competency in mathematics, to devise a curriculum that can ensure that students achieve this competency, and to construct evaluation instruments for assessing the established levels of competency. (Math Teacher, February, 1977, Volumne 70, Number 2)

The Euclid Conference of 1975 had previously concluded that the term "basic mathematics skills" is least useful when restricted to computing and most useful when given a broad interpretation (Taylor, 1978). By the end of 1977, the Basic Skills Task Force (of National Council of Supervisors of Mathematics) had itemized ten separate basic skills areas: problem solving; application to everyday situations; alertness to reasonableness of results; estimation and approximation; computation; geometry; measurement; interpretation of tables, graphs, and charts; using mathematics to predict; computer literacy (Forbes, 1978).

Statement of the Problem

The problem leading to the study was that the Hoquiam School District lacked any minimum expectency level in mathematics for its high school graduates. The problem

was further compounded with the absence of a tool by which students could be tested in reference to any standards.

Purpose of the Study

The purposes of the project were: (1) to write a collection of test items which reflected student learning objectives in mathematics at Hoquiam High School; (2) to administer two math competency tests constructed from those test items to eleventh and twelth grade students in 1979; (3) to determine whether there will be a difference in performance on the math competency tests between Juniors and Seniors; (4) to determine whether there will be a difference in performance on the math competency tests between girls and boys; (5) to determine whether the mean of both tests will be the same; (6) to determine how high of a correlation there will be between individual performances on the math competency tests with corresponding Stanford achievement test scores.

Definition of Terms

In order to clarify certain portions of this presentation, the following definitions are given:

Students. The term student shall refer to eleventh and twelth grade students at Hoquiam High School who have no identified learning disabilities.

Minimum Competency Test. Test which students are required to take with the results being used, in part, for high school graduation requirements.

Computation Problems. Computation problems are problems which involve two or more numbers given with one of four arithmetic operations.

One Step Problem. One step problems refer to word problems which require one arithmetic operation to solve.

Multiple Step Problems. Multiple step problems refer to word problems which require more than one arithmetic operation to solve.

Significance of the Project

The use of existing standardized norm-referenced tests in a minimum competency program would be inappropriate. Standardized tests contain items that half or more of the students will miss. Test items must be written so that most students will ultimately be able to answer correctly (Taylor, 1978). This project will satisfy Hoquiam's need for such an exam.

Also, the test results themselves will provide the school district with a measuring device that will allow us to evaluate our mathematics curriculum.

Limitation of the Project

This project resulted in an assessment of the competency level in mathematics of Hoquiam High School Juniors. The results should not be generalized to describe other populations.

Chapter 2

REVIEW OF LITERATURE

This review of literature covers a sampling of the literature as it relates to the problem of basic competency in mathematics for high school graduates. It also relates to testing practices in various parts of the United States with regard to minimum competency.

Controversy

Recent literature has documented the controversy concerned with minimum competency in both definition and measurement.

Pipho (1978) pointed out that in most instances professional educators have been responsible for setting the minimum requirements in skill areas that have been predetermined on the state level. The skill areas, if not taken to extremes, are legitimate and can be easily identified (Down, 1977). However, stipulating minimum requirements in those skill areas provides educators with a real dilemma. The system must operate from the assumption that at least 95 percent of the students can be taught the standards (Baratz, 1977). If the level of student competency cannot be raised to meet an

established minimum, is the minimum to be lowered to meet the level of the students (Brickell, 1978)?

Remediation through additional class time is likely to raise scores of low achievers on district-wide achievement tests (Ogden, 1979; Lerner, 1979). However, Anderson and Lesser (1978) pointed out that in Washington State where mandated testing is done at the fourth and eighth grade levels between $43 and $47 million will be required to fund remedial programs in mathematics alone.

There has also been concern for the future structure of the high school curriculum and teaching strategies. As of March, 1978, thirty-three states had passed legislation mandating specific standards for promotion within or graduation from public school systems. The remaining states had legislation pending or studies under way (Pipho, 1978). Minter, Watkins, and Matuszek (1978) expressed their uneasiness with three different questions regarding the effects of minimum competency testing. (1) Will it dictate a narrow curriculum aimed at the tests? (2) Will minimum competencies result in maximum goals for students as well as teachers? (3) What are the consequences of telling students that they are not competent?

Thus far, in view of the controversy, neither the worst fears of the critics nor the highest hopes of the supporters have realized (Frahm and Covington, 1979). However, most authorities believe that minimum competency

testing is here to stay (Newsweek, May 28, 1979). Only time will tell of the effects it will have on the educational process.

Origins

In 1958 a survey conducted in the city of Denver revealed that most businessmen and industrialists viewed the high school diploma as a certificate of attendance and nothing more (Gillman, 1977). Responding to this consensus, the Denver public school system began requiring high school students to pass proficiency and review tests which were designed to have four parts: numerical, spelling, language, and reading (Beal, 1978).

The following two decades brought on a wave of concern in declining student competency and comprehension (Beckmann, 1978). Although results from the Iowa test of basic skills indicated that there were no significant gains or losses in achievement from 1970 to 1977 (Munday, 1979). The Stanford Achievement Test results showed an overall decline from 1965 to 1978 (Beckmann, 1978). Further, supporting the belief that student competency was on the decline were the results from the second assessment of mathematics conducted by the National Assessment of Educational Progress. This assessment showed an overall decline in mathematics achievement from 1973 to 1978. This decline was especially evident in older high school students.

In conjunction with this trend was pressure from outside the educational community. Oregon became the first state to mandate that students be required to pass minimum competency exams beginning in 1972 (Minter, Watkins, Matuszek, 1978).

Cohen and Haney (1978) cited three different possible causes for this trend of student accountability. The first one concerns the input-output concept of social organization. Schools, as well as hospitals and various government agencies, have become thought of as factories where raw materials are inputted and finished products are out-putted. Further reasoning is seen in the fact that "schooling" is quantitative and measurable whether it be in semesters, years, and/or test scores. Thirdly, we live in an age when there is a social climate of accountability and mistrust in various social agencies. Agencies are punished by removing or reducing funds if desired results are not quaranteed.

Beckmann (1978) cited five reasons for declining achievement scores in mathematics: (1) more unrest and relative permissiveness in schools; (2) less cohesion in families; (3) relatively more resistence and confrontation to authority throughout society; (4) growth of concern for social problems and a lessened concern for science; (5) increased athletics for boys and girls.

Basic competency programs have developed in response to a widespread concern by colleges, employers, and the

general public that students are not learning the fundamentals (Kenney, 1978). These programs will result in an increase in the amount of class time spent teaching and learning identified fundamentals (Lerner, 1979). This will place a needed increase in emphasis on cognitive development in our schools (Ebel, 1978).

Florida: A Case Study

As of May, 1979, no fewer than nineteen states required students to pass some form of a minimum competency test as part of their graduation requirements (Newsweek, May 28, 1979). One such state is Florida which passed legislation in 1975 to that effect. The new graduation requirements were set for the class of 1978 to 1979.

The state of Florida placed a ban on "social promotion" and requries students to pass two different exams, one in basic skills and the other in functional literacy, in addition to the minimum number of course credits as required by the local school districts (Pipho, 1978). This legislation came about as a result, in part, of media stories and editorials which expressed concern because students were being promoted and graduated from school without minimal reading, writing, and arithmetic skills (Fisher, 1978).

The basic skills portion did not prove to be the major hurdle of the program. Students found the most difficulty in passing the functional literacy portion of

the new requirement. The functional literacy portion focused on practical problems and tasks in twenty-four skill areas, thirteen in math, and eleven in communications. Students would be expected to pass this portion within four tries (Fisher, 1978).

The State Department of Education enlisted the assistance of the Educational Testing Service of Princeton, New Jersey (Fremer, 1978). Field tests were constructed for the functional literacy portion of the exam. A success level of 70 percent was set as passing criterion and the exams were administered in the Spring of 1977 to students in five Florida counties on an experimental basis. An analysis of the results caused officials to expect a twenty-four percent to thirty-three percent failure rate (Fisher, 1978).

The functional literacy test was administered to Florida's eleventh grade students in October of 1977. The results showed failure rates of thirty-five percent and ten percent in mathematics and communications respectively (Glass, 1978).

The State Legislation appropriated $10 million in 1977 for a compensatory education program. This money was distributed to local districts on the basis of failure rates (Fisher, 1978). In 1978 this figure was increased to $26.5 million. The remediation program resulted in increases in performance and by October of 1978 it was

estimated that between eighty percent and ninety percent had passed both portions of the exam (Turlington, 1979).

Turlington (1979) pointed out that the improvement was the result of (1) the state's compensatory effort; (2) increased diligence on the part of students and teachers; and (3) a generally improved atmosphere in the schools. He further indicated that evidence suggested that the testing program had no effect on drop out rates.

A minor setback hit the Florida program when in the summer of 1979, a Federal District Court ruled that diplomas were to be awarded to those who flunked the literacy test but were otherwise qualified to graduate. Although the court upheld the testing requirement in general, it ruled that the program was imposed too hastily and that students should be told before their sophomore year of such requirements (Time Magazine, July 30, 1979).

Summary

The review on related literature has revealed that (1) American society is dissatisfied with the level of competency that is achieved by many of our high school graduates. (2) States' governments are responding to this pressure by legislating additional graduation requriements which relate to performance on minimum competency tests. (3) The legalities of such programs have been supported by the Federal Court. (4) The legalities of the method of implementation of such programs has been outlined.

(5) The minimum competency test results help educators channel those students in need of compensatory education into programs that are designed to help them overcome their deficiencies. (6) The preliminary results indicate that a well-planned and financially-supported program can survive and be a success.

Chapter 3

PROCEDURE

The basic procedural objectives were: (1) to attain administrative advice, input, and support in laying a foundation for competency-based mathematics instruction; (2) to use test results to help identify weaknesses in the high school mathematics curriculum; (3) to specify and implement new high school graduation requirements for the Hoquiam High School graduating class of 1981, and to relate those requirements to student performance on a math competency test.

Prior to 1977, there was a general feeling in the Hoquiam School District that many of our high school graduates lacked essential computational and problem-solving skills. An informal series of interviews of local businessmen and community leaders revealed that the same lack of confidence existed with the community.

In the Spring of 1977 a committee consisting of the Hoquiam School District's Curriculum Coordinator, Hoquiam High School's Principal, and one of Hoquiam High School's Mathematics Teachers was formed. It was the determination of this committee that those students who lacked certain mathematical skills would be required

to pass an additional credit in mathematics (one semester course) for high school graduation. Further, it was decided that a math competency test would be written and administered to all eleventh grade students in order to determine which students would be required to pass an additional course in mathematics. It was decided that these students would be identified by their membership in the two lowest stanines determined by the test results. The new graduation requirement was to begin with the graduating class of 1981.

The gears for the production of the math competency test were put into motion. Another informal series of interviews was conducted within the community to help identify those mathematical skills which were encountered most often in everyday life.

It was the consensus of those interviewed that the skills fell into three areas in addition to mastery of the four basic operations with whole numbers, fractions, and decimals. The first was in consumer mathematics, including computation of sales tax and percentage problems as well as an understanding of and ability to compute small consumer loans. The second category related to employee skills. These includec clock arithmetic, computation of wages, and the ability to interpret individual payroll statements. The third area of skills involved mathematics in the home and in personal life. Computation of automobile mileage, and understanding of deductible insurance,

checkbook arithmetic, and measurement were cited as the most important skills in this category. The committee added the ability to read and interpret graphs and tables as an additional skill area encountered often enough in everyday life to warrant inclusion on the math competency test.

Instrumentation

From the four skill categories, 150 test items were written. The committee analyzed and inspected each of the items. Problems which were ambiguous were discarded. In addition, multiple step problems which required the performance of more than five arithmetic computations were removed. This resulted in two math competency tests, Form A and Form B, each containing thirty-five similar items.

Field Test

These two exams were field tested in the Spring of 1979 on both eleventh and twelth grade students at Hoquiam High School. The two different forms were distributed at random to both classes. They were administered in a power setting in order to allow students ample time to demonstrate their abilities. The results were used in order to identify the percentage needed for a passing score under the assumption that the lower two stanines were not to pass.

In the Spring of 1980 the two forms were administered to the eleventh grade students at Hoquiam High School under the new graduation requirements. The manner of administration was the same. However, students were given three opportunities to pass one of the two exams. The tests were administered once every two weeks until all students had either passed one of the tests or failed three times.

Chapter 4

RESULTS OF THE STUDY

In the Spring of 1979 the two forms of the Math Competency Exams were field tested on the Junior class (class of 1980) and on the Senior class (class of 1979). Each class was randomly divided into two groups, one group was given Form A and the other was given Form B. The results of each student's performance were recorded and statistical analyses were performed to answer four questions: (1) Is there a difference in performance on the two tests between the Junior class and the Senior class? (3) Is there a difference in performance between Junior boys and Junior girls? (4) How high is the correlation coefficient between Junior scores on the Math Competency Exams and their corresponding scores on the Stanford Achievement test which had previously been administered in the Spring of their Sophomore year (Spring, 1978)?

Juniors and Seniors

A one-way analysis of variance was performed on the results of Test A between the Juniors and the Seniors. The same analysis was performed on the results of Test B. between the Juniors and Seniors. The null hypothesis on

each was, that there would be no difference in the mean score of the Juniors and of the Seniors. The level of significance was set at .05.

With regard to the results of the Test A analysis, the mean score of the Seniors was 68.4 and that of the Juniors was 67.3. In spite of this, the null hypothesis was retained as the F ratio was calculated to be only 0.059, which fell short of the needed 3.93 for rejection.

Findings in the analysis of Test B results showed a similar pattern. Here the mean score of the Seniors was 67.7 while the Junior mean was computed at 66.5. The F ratio, calculated at 0.178, was larger than the corresponding F from Test A. However, it fell short of the 3.93 needed for rejection of the null hypothesis. (See Appendix B)

Mean Score of Test A and Test B

A one-way analysis of variance was also performed to determine whether there was a difference in the means of Test A and Test B. The null hypothesis was that there was no difference between the means of the two Junior groups that were administered the tests.

The mean score of Test A was 67.3 and that of Test B was 66.5. The F ratio was calculated at 0.07, falling short of the required 3.92 needed for rejection. The null hypothesis of both sets having the same mean was retained. (See Appendix C)

Boys and Girls

A final one-way analysis of variance was performed on the results of Test A and Test B with the Junior boys and Junior girls. The null hypothesis was that there would be no difference in the means of the four groups. The level of significance was set at .05.

The F ratio was calculated at 0.484. Here again, the null hypothesis was retained as the F statistic fell far below the tabled value of 2.68. (Appendix D)

Correlation with Stanford Achievement Test Scores

The Pearson Product Moment Correlation Coefficient was used to find the relationship between the results of Test A and Test B with corresponding scores on the Stanford Achievement Test which was given to the Junior class in the Spring of 1978. The respective coefficients for Test A and Test B were calculated at +0.82 and +0.85. (See Appendix E)

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of the Math Competency testing programs have led this writer to four basic conclusions: (1) Students are not discriminated against because of the test they take. (2) Male and female students do equally well on tests and appear to master equivalent skills in basic mathematics. (3) The correlation with the Stanford Achievement Test is at an acceptable level. A perfect correlation was not expected because of the time lapse between the two testing dates. The Stanford Achievement Test measures achievement while the Math Competency Test measures aptitude. (4) Juniors and Seniors, in general, do not differ significantly in the demonstration of basic skills. This has been measured without consideration of whether or not Seniors were enrolled in a mathematics class at the time of testing.

Recommendations

The new program of Math Competency testing at Hoquiam High School has resulted in both needs concerning test items and possibilities relating to curriculum evaluation.

A "bank" of test items should be constructed and maintained according to various skill categories. Each time the tests are administered, two unique tests should be constructed from this bank. This writer recommends that the test items and the skill categories be reviewed every two years to reassess the content. Current trends in mathematical needs indicate that mathematics used in day-to-day life today may become antiquated in the future.

Further, it is recommended that student results from this testing program be used to evaluate Hoquiam High School's mathematics curriculum. The fact that there was no significant difference in performance between Juniors and Seniors raises questions which need to be answered. Do students who take more classes in mathematics perform better on the Math Competency Test? Which courses of study produce the most competent students?

Finally, the Math Competency Test should be administered to a group of incoming Freshmen and administered again to the same group in their Junior year. A statistical analysis of these results would further enhance our ability to evaluate the quality of the mathematics curriculum at Hoquiam High School.

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APPENDIX A

MATH COMPETENCY TESTS

1) 609
528
+867

A) 2024
B) 2004
C) 1984
D) 2005
E) none of these

2) John has $392.27 in his checking account. He writes a check for $198.52 and then deposits $65.00. What is his new balance?

A) $258.75
B) $655.79
C) $525.79
D) $128.75
E) none of these

3) 8040
-5473

A) 2667
B) 3567
C) 3677
D) 1667
E) none of these

4) One gallon of paint will cover 240 square feet. How many one gallon cans of paint must you buy to paint four walls each measuring 10 x 14 feet?

A) 2 gallons
B) 3 gallons
C) 4 gallons
D) 5 gallons
E) none of these

5) 3 3/4 ÷ 4 1/2 = /

A) 2/3

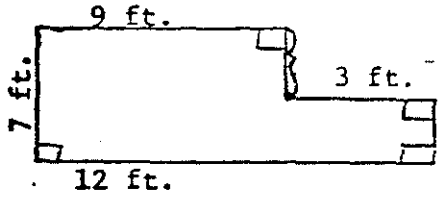
B) 5/6

C) 12 1/2

D) 1 1/5

E) none of these

6) What is the total area of this figure?



A) 38 square feet
B) 75 square feet
C) 81 square feet
D) 108 square feet
E) none of these

7) 16% of 25 = ☐

A) 400
B) 40
C) .40
D) 4.00
E) none of these

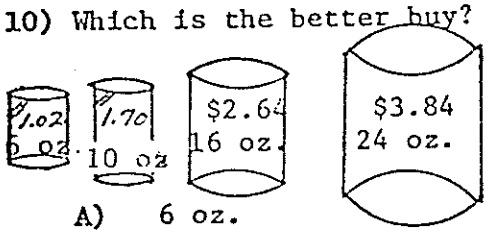
8) There is a 5.4% sales tax in Washington state. What is the sales tax on a $3,500 car?

A) $18.90
B) $189.00
C) $648.00
D) $15.43
E) none of these

9) 7.6
x .47

A) 35.72
B) 3.572
C) 357.2
D) 25.72
E) none of these

10) Which is the better buy?



A) 6 oz.
B) 10 oz.
C) 16 oz.
D) 24 oz.
E) none of these

11) 4/5 - 1/3 = ☐

A) 3/2
B) 5/8
C) 7/15
D) 17/15
E) none of these

12) Joe owns a $50 deductible auto insurance policy. If $523.19 worth of damage is done to his car in an auto accident, how much will Joe's insurance company pay.

A) $50
B) $473.19
C) $573.19
D) $523.19
E) none of these

JANUARY, 1979

	HIGH WATER	A. M. h. m.	ft.	P. M. h. m.	ft.
1	Mon	2:12	9.0	1:50	10.0
2	Tue	3:01	9.2	2:45	9.4
3	Wed	3:51	9.2	3:44	8.8
4	Thur	4:42	9.2	4:47	8.1
5	Fri	5:34	9.3	5:56	7.6
6	Sat	6:28	9.3	7:11	7.2
7	Sun	7:20	9.4	8:20	7.1
8	Mon	8:14	9.4	9:24	7.2
9	Tue	9:04	9.5	10:24	7.5
10	Wed	9:50	9.5	11:19	7.6
11	Thur	10:35	9.6	11:59	7.9
12	Fri	11:15	9.5	....	..
13	Sat	12:38	8.1	11:55	9.4
14	Sun	1:13	8.1	12:31	9.2
15	Mon	1:45	8.2	1:06	9.1
16	Tue	2:16	8.2	1:41	8.8
17	Wed	2:49	8.3	2:20	8.5
18	Thur	3:22	8.4	3:02	8.1
19	Fri	3:59	8.5	3:51	7.6
20	Sat	4:41	8.6	4:47	7.2
21	Sun	5:28	8.7	5:59	7.0
22	Mon	6:21	8.9	7:10	6.8
23	Tue	7:18	9.2	8:22	7.0
24	Wed	8:17	9.4	9:28	7.3
25	Thur	9:13	9.8	10:28	7.8
26	Fri	10:09	10.2	11:23	8.3
27	Sat	11:03	10.4	....	..
28	Sun	12:15	8.7	11:57	10.4
29	Mon	1:04	9.2	12:49	10.2
30	Tue	1:49	9.4	1:41	9.9
31	Wed	2:34	9.5	2:34	9.3

◐-1st Qtr 5 ◑-Last Qtr 21

●-Full Moon 13 ○-New Moon 28

JANUARY, 1979

	LOW WATER	A. M. h. m.	ft.	P. M. h. m.	ft.
1	Mon	8:19	2.7	8:49	-0.7
2	Tue	9:10	2.6	9:36	-0.2
3	Wed	10:09	2.5	10:26	0.6
4	Thur	11:03	2.5	11:17	1.3
5	Fri	12:05	2.4	....	..
6	Sat	12:10	2.1	1:08	2.2
7	Sun	1:09	2.7	2:10	1.8
8	Mon	2:08	3.1	3:11	1.3
9	Tue	3:07	3.3	4:04	0.9
10	Wed	4:01	3.4	4:52	0.6
11	Thur	4:52	3.3	5:36	0.3
12	Fri	5:40	3.3	6:17	0.2
13	Sat	6:23	3.2	6:57	0.2
14	Sun	7:05	3.1	7:34	0.2
15	Mon	7:46	3.1	8:11	0.5
16	Tue	8:27	3.2	8:47	0.8
17	Wed	9:06	3.2	9:23	1.2
18	Thur	9:49	3.1	9:58	1.7
19	Fri	10:37	3.0	10:34	2.3
20	Sat	11:26	2.9	11:16	3.3
21	Sun	....	..	12:27	2.6
22	Mon	12:13	3.3	1:31	2.2
23	Tue	1:22	3.6	2:33	1.5
24	Wed	2:31	3.8	3:32	0.8
25	Thur	3:37	3.6	4:28	0.1
26	Fri	4:36	3.3	5:20	-0.6
27	Sat	5:31	2.9	6:10	-1.0
28	Sun	6:21	2.4	6:56	-1.2
29	Mon	7:11	2.0	7:42	-1.0
30	Tue	8:02	1.7	8:27	-0.6
31	Wed	8:53	1.6	9:12	0.1

MINUS TIDES ARE SHOWN IN HEAVIER TYPE

Tables are in Standard Time

Refer to tables above for #13, #14

13) What time was the morning low tide on Jan. 24, 1979?

A) 2:31 a.m.
B) 9:28 p.m.
C) 8:17 a.m.
D) 3:32 p.m.
E) none of these

14) On how many days during the month were the low tides less than minus two feet?

A) seven
B) one
C) six
D) twelve
E) none of these

15) 12% of 1500= ☐

A) 180
B) 1.80
C) 18.00
D) .18
E) none of these

16) This is a stub from Bill's paycheck.

Weekly Salary	Deductions	
	F.I.C.A.	Federal withholding
#210	#17.00	#43.17

What is his take-home pay?

A) $210.00
B) $149.83
C) $277.17
D) $ 60.17
E) none of these

17) 12.22 - 6.843 = ☐

A) 5.377
B) 53.77
C) 53.79
D) 5.379
E) none of these

18) To the closest tenth of a cent, what is the cost per ounce of a one pound can of juice selling for $1.49?

A) 9.4¢
B) 11.5¢
C) 9.3¢
D) 11.6¢
E) none of these

19) 164
x39

A) 2596
B) 2496
C) 2486
D) 1486
E) none of these

20) How many feet of fence are required to enclose a rectangular lot which measures 50 x 125 feet?

A) 350 feet
B) 6250 feet
C) 175 feet
D) 250 feet
E) none of these

21) 3 2/3 x 4 1/2 = /7

A) 12 1/3

B) 7 1/3

C) 15 1/2

D) 16 1/2

E) none of these

22) How long does it take to drive 165 miles at an average speed of 55 M.P.H.?

A) 20 minutes
B) 2 hours
C) 3 hours
D) 4 hours
E) none of these

23) 75% of 28 = /7

A) 21.00
B) 210
C) 2.10
D) 210.0
E) none of these

24) Maggie sells real estate. Her salary is $100 per week plus 1% commission on all property which she sells. Last week she sold a house for $37,500. What was her total salary for last week:

A) $100
B) $375
C) $475
D) $275
E) none of these

25) 49) 75852

A) 1538
B) 1539 r41
C) 1549 r41
D) 1548
E) none of these

26) What is the cost of 37 feet of wire which sells for 23¢ per foot?

A) $ 8.51
B) $ .85
C) $851
D) $160.87
E) none of these

27) Last month Maria drove her car 765 miles. Her car got 17 miles per gallon of gas last month. How many gallons of gas did her car use?

A) 130
B) 405
C) 40.5
D) 45
E) none of these

30) $.5\overline{)3.555}$

A) 71.11
B) .711
C) 7.11
D) 711
E) none of these

28) $1.007 + 938 + 2.600 = \overline{/\ /}$

A) 45.45
B) 454.5
C) 4.545
D) 4545
E) none of these

31) A frozen spaghetti dinner which serves one person costs $1.09. The ingredients to make the same dinner at home which serves four people costs $2.40. How much money is saved by making a homemade dinner rather than buying four frozen dinners?

A) $4.36
B) $1.96
C) $5.24
D) There is no savings
E) none of these

29) Susan falls asleep at 10:30 p.m. She wakes up at 5:45 a.m. the next morning. How long did she sleep?

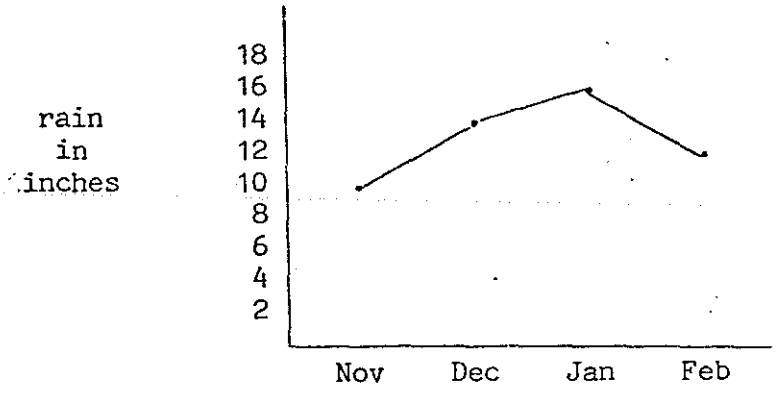
A) 5 hrs. 45 minutes
B) 6 hrs. 45 minutes
C) 7 hrs. 15 minutes
D) 7 hrs. 45 minutes
E) none of these

32) $5/6 + 1/12 = \overline{/\ /}$

A) 1/3
B) 11/12
C) 4/12
D) 6/18
E) none of these

32

1978-1979
Rainfall in Grays Harbor



Use for #33, #34

33) What was the rainfall in Grays Harbor during January?

A) 12 inches
B) 18 inches
C) 10 inches
D) 13 inches
E) none of these

34) Of the four months shown, which one had the most rain?

A) Nov.
B) Dec.
C) Jan.
D) Feb.
E) Cannot be read from graph

35) John will pay $500.00 for a new TV set if he pays cash. He can make time payments for 12 months at $42.50. How much money will John save if he pays cash?

A) $100.00
B) $ 4.95
C) $ 10.00
D) $ 32.50
E) none of these

1) 1.007 + 938 + 2.600 = [ ]

A) 45.45
B) 454.5
C) 4.545
D) 4545
E) none of these

2) A normal work week is 40 hours. Dick receives 1½ times his normal wage if he works over 40 hours. Last week Dick worked 47 hours. His normal wage is $5.00 per hour. What was Dick's total wage last week?

A) 52.50
B) 200.00
C) 252.50
D) 352.50
E) None of these

3) 12% of 150 = [ ]

A) 180
B) 1.80
C) 18.00
D) .18
E) none of these

4) One gallon of paint will cover 220 square feet. How many one gallon cans of paint must you buy to paint six walls each measuring 10 feet by 20 feet?

A) 5
B) 6
C) 7
D) 8
E) none of these

5) 64
x39

A) 2596
B) 2496
C) 2486
D) 1486
E) none of these

6) A 12 ounce package of rice sells for $1.59. An 18 ounce package of the same rice sells for $2.49. Which is cheaper per ounce?

A) The twelve oz. package
B) The eighteen oz. package
C) Both the same
D) There is not enough information given to determine which is the better buy
E) none of these

7) 609
528
+867

A) 2024
B) 2004
C) 1984
D) 2005
E) none of these

10) Jane has a balance of $237.15 in her checking account. She deposits $149.55 and then cashed a check for $262.93. What is her new balance?

A) $123.77
B) $350.93
C) $500.48
D) $175.33
E) none of these

8) Linda's weekly pay is $250. The following deductions are withheld from her paycheck: Federal income tax, $42.32; Medical insurance, $ 3.50; FICA $12.75. What is Linda's weekly take home pay?

A) $291.38
B) $308.62
C) $191.38
D) $204.13
E) none of these

11) 12.22 - 6.843 = / /

A) 5.377
B) 53.77
C) 53.79
D) 5.379
E) none of these

9) 5/6 + 1/12 = / /

A) 1/3

B) 11/12

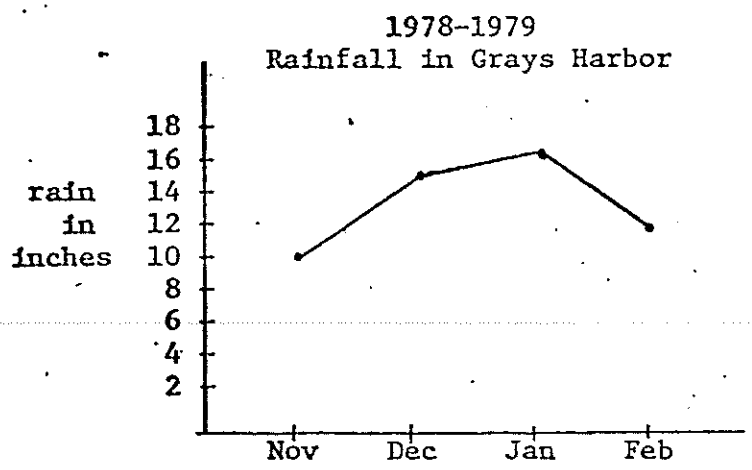
C) 4/12

D) 6/18

E) none of these

12) Find the total thickness of two pieces of wood that are glued together. One piece is 1 7/16 inches thick and the other is 1 3/8 inches thick.

A) 2 5/8 inches
B) 2 5/12 inches
C) 2 13/16 inches
D) 3 1/4 inches
E) none of these



Use for 13 and 14

13) What was the rainfall in Grays Harbor during December?

A) 12 inches
B) 18 inches
C) 10 inches
D) 13 inches
E) none of these

14) Of the four months shown, which one had the least rain?

A) Nov.
B) Dec.
C) Jan.
D) Feb.
E) Cannot be read from graph.

15) 7.6
x .47

A) 35.72
B) 3.572
C) 357.2
D) 25.72
E) none of these

16) What is the total cost of a stereo system which has a down payment of $175.00 and 18 monthly payments of $42.50?

A) $590.00
B) $940.00
C) $413.19
D) $3192.50
E) none of these

17) 4/5 - 1/3 = ▭

A) 3/2
B) 5/8
C) 7/15
D) 17/15
E) none of these

18) A 10% annual inflation rate means:

A) Your money is worth 10% more every year.
B) Your money is worth 10% less every year.
C) People are buying 10% more every year.
D) Wages increase by 10% a year.
E) none of these

19) 8040
-5473

A) 2667
B) 3567
C) 3677
D) 1667
E) none of these

20) Jim bought a pair of socks for $3.98. If there is a 5.4% sales tax added to the price, how much will Jim's change be from a $10 bill.

A) $5.81
B) $5.48
C) $6.23
D) $6.81
E) none of these

JANUARY, 1979

	HIGH WATER	A. M. h. m.	ft.	P. M. h. m.	ft.
1	Mon	2:12	9.0	1:50	10.0
2	Tue	3:01	9.2	2:45	9.4
3	Wed	3:51	9.2	3:44	8.8
4	Thur	4:42	9.2	4:47	8.1
5	Fri	5:34	9.3	5:56	7.6
6	Sat	6:28	9.3	7:11	7.2
7	Sun	7:20	9.4	8:20	7.1
8	Mon	8:14	9.4	9:24	7.2
9	Tue	9:04	9.5	10:24	7.5
10	Wed	9:50	9.5	11:19	7.6
11	Thur	10:35	9.6	11:59	7.9
12	Fri	11:15	9.5	. . . .	. .
13	Sat	12:38	8.1	11:55	9.4
14	Sun	1:13	8.1	12:31	9.2
15	Mon	1:45	8.2	1:06	9.1
16	Tue	2:16	8.2	1:41	8.8
17	Wed	2:49	8.3	2:20	8.5
18	Thur	3:22	8.4	3:02	8.1
19	Fri	3:59	8.5	3:51	7.6
20	Sat	4:41	8.6	4:47	7.2
21	Sun	5:28	8.7	5:59	7.0
22	Mon	6:21	8.9	7:10	6.8
23	Tue	7:18	9.2	8:22	7.0
24	Wed	8:17	9.4	9:28	7.3
25	Thur	9:13	9.8	10:28	7.8
26	Fri	10:09	10.2	11:23	8.3
27	Sat	11:03	10.4	. . . .	. .
28	Sun	12:15	8.7	11:57	10.4
29	Mon	1:04	9.2	12:49	10.2
30	Tue	1:49	9.4	1:41	9.9
31	Wed	2:34	9.5	2:34	9.3

◐-1st Qtr 5 ◑-Last Qtr 21
●-Full Moon 13 ○-New Moon 28

JANUARY, 1979

	LOW WATER	A. M. h. m.	ft.	P. M. h. m.	ft.
1	Mon	8:19	2.7	8:49	-0.7
2	Tue	9:10	2.6	9:36	-0.2
3	Wed	10:09	2.5	10:26	0.6
4	Thur	11:03	2.5	11:17	1.3
5	Fri	12:05	2.4	. . . .	. .
6	Sat	12:10	2.1	1:08	2.2
7	Sun	1:09	2.7	2:10	1.8
8	Mon	2:08	3.1	3:11	1.3
9	Tue	3:07	3.3	4:04	0.9
10	Wed	4:01	3.4	4:52	0.6
11	Thur	4:52	3.3	5:36	0.3
12	Fri	5:40	3.3	6:17	0.2
13	Sat	6:23	3.2	6:57	0.2
14	Sun	7:05	3.1	7:31	0.2
15	Mon	7:45	3.1	8:11	0.5
16	Tue	8:27	3.2	8:47	0.8
17	Wed	9:05	3.2	9:23	1.2
18	Thur	9:49	3.1	9:58	1.7
19	Fri	10:37	3.0	10:34	2.3
20	Sat	11:25	2.9	11:16	3.3
21	Sun	. . . . .	. .	12:27	2.6
22	Mon	12:13	3.3	1:31	2.2
23	Tue	1:22	3.6	2:33	1.5
24	Wed	2:31	3.8	3:32	0.8
25	Thur	3:37	3.6	4:26	0.1
26	Fri	4:36	3.3	5:20	-0.6
27	Sat	5:31	2.9	6:10	-1.0
28	Sun	6:21	2.4	6:56	-1.2
29	Mon	7:11	2.0	7:42	-1.0
30	Tue	8:02	1.7	8:27	-0.6
31	Wed	8:53	1.6	9:12	0.1

MINUS TIDES ARE SHOWN IN HEAVIER TYPE

Tables are in Standard Time

Refer to tables above for #21, #22

21) What time was the morning high tide on Jan. 24, 1979?

A) 2:31 a.m.
B) 9:28 p.m.
C) 8:17 a.m.
D) 3:32 p.m.
E) none of these

22) On how many days during the month were the low tides less than minus one foot?

A) seven
B) one
C) six
D) twelve
E) none of these

23) 3 3/4 - 4 1/2 = ___

A) 2/3

B) 5/6

C) 12 1/2

D) 1 1/5

E) none of these

24) A car is driven 245 miles on 14 gallons of gas. How many miles does it travel on one gallon of gas?

A) 17
B) 17.5
C) 16.5
D) 18.5
E) none of these

25) 16% of 25 = ___

A) 400
B) 40
C) .40
D) 4.00
E) none of these

26) Gasoline costs 78.8¢ per gallon. What is the cost of 12.5 gallons?

A) $985
B) $ 6.30
C) $ 15.86
D) $ 9.85
E) none of these

27) $49\overline{)75852}$

A) 1538
B) 1539 r41
C) 1549 r41
D) 1548
E) none of these

28) Find the average of the following numbers: 9, 23, 45, 13, 20

A) 21
B) 21.5
C) 22
D) 550
E) none of these

) $.5\overline{)\ 3.555}$

A) 71.11
B) 711
C) 7.11
D) 711
E) none of these

30) Mary waited 6 hrs. and 10 minutes before her bus arrived. The bus arrived at 4:30 p.m. At what time did Mary begin waiting for the bus?

A) 9:20 a.m.
B) 10:40 a.m.
C) 11:20 a.m.
D) 10:20 a.m.
E) none of these

31) 75% of 28 = /_/

A) 21.00
B) 210
C) 2.10
D) 210.0
E) none of these

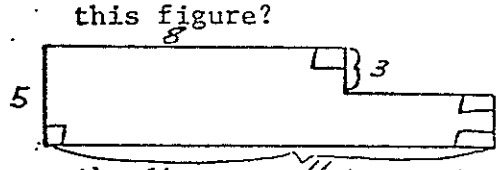
32) There is a 5.4% sales tax in the State of Washington. A shirt costs $12.98 plus tax. What is the total cost of the shirt?

A) $13.86
B) $14.58
C) $13.68
D) $16.38
E) none of these

33) 3 2/3 x 4 1/2 = /_/

A) 12 1/3
B) 7 1/3
C) 15 1/2
D) 16 1/2
E) none of these

34) What is the total area of this figure?



A) 64 square units
B) 32 square units
C) 55 square units
D) 46 square units
E) none of these

35) To the closest tenth of a cent, what is the cost per ounce of a one-pound can of juice selling for $1.29?

A) 8.0¢
B) 80.7¢
C) 8.1¢
D) 12.4¢
E) none of these

APPENDIX B

JUNIOR AND SENIOR COMPARISON

TEST A SCORES

Juniors (Class of 1980)		Seniors (Class of 1979)	
83	66	69	77
94	60	97	83
97	46	74	37
89	74	94	46
83	66	74	71
74	60	96	97
77	57	71	43
80	51	43	57
91	63	86	60
94	66	66	86
97	77	23	71
83	77	80	97
86	63	77	60
83	46	86	60
91	63	74	74
86	49	43	74
77	77	51	80
66	66	86	71
83	69	69	57
66	49	63	31
63	49	60	80
66	66	34	77
80	60	71	
60	63	71	
86	31	43	
71	37	91	
46	29	57	
71	29	51	
63	37	83	
69	37	80	

Sum of Squares Between:	18.521
Mean Squares Between:	18.521
Sum of Squares Within:	34635.907
Mean Square Wtihin:	314.872
Sum of Squares Total:	34654.428

Degrees of Freedom: 1,110

TEST B SCORES

Juniors (Class of 1980)		Seniors (Class of 1979)	
86	69	49	80
91	57	34	86
97	77	63	63
94	71	40	74
94	66	60	49
86	71	69	71
86	60	94	89
74	63	66	83
89	77	66	54
63	60	77	46
86	57	86	74
69	57	60	80
89	60	83	83
71	57	43	86
71	60	86	51
66	63	77	49
71	34	71	57
71	57	77	89
69	69	77	80
74	57	63	74
71	57	74	57
69	63	60	51
74	49	49	
63	45	86	
71	37	89	
66	34	49	
66	40	74	
74	49	49	
60	31	74	
66		51	

Sum of Squares Between:	41.294
Mean Squares Between:	41.294
Sum of Squares Within:	25216.976
Mean Square Within:	231.348
Sum of Squares Total:	25258.270

Degrees of Freedom: 1,109

APPENDIX C

TEST A AND TEST B COMPARISON

JUNIORS

(Class of 1980)

83	66	86	69
94	60	91	57
97	46	97	77
89	74	94	71
83	66	94	66
74	60	86	71
77	57	86	60
80	51	74	63
91	63	89	77
94	66	63	60
97	77	86	57
83	77	69	57
86	63	89	60
83	46	71	57
91	63	71	60
86	49	66	63
77	77	71	34
66	66	71	57
83	69	69	69
66	49	74	57
63	49	71	57
66	66	69	63
80	60	74	49
60	63	63	45
86	31	71	37
71	47	66	34
46	29	66	40
71	29	74	49
63	37	60	31
69	37	66	

Sum of Squares Between:	18.637
Mean Squares Between:	18.637
Sum of Squares Within:	31203.346
Mean Square Within:	266.695
Sum of Squares Total:	31221.983

Degrees of Freedom: 1,117

APPENDIX D

COMPARISON OF GIRLS AND BOYS

JUNIORS

(Class of 1980)

Test A		Test B	
Girls	Boys	Girls	Boys
83	94	86	91
97	83	94	97
89	74	94	86
77	80	86	74
97	91	63	89
86	94	86	71
86	83	69	66
66	83	89	71
66	91	71	71
66	77	69	71
80	83	74	66
60	63	71	60
86	71	69	69
71	46	74	77
63	74	63	71
69	66	66	60
66	60	74	77
60	51	66	57
46	63	57	57
57	63	71	60
63	49	66	63
66	66	63	34
77	69	60	57
77	49	57	69
46	60	60	57
77	63	57	63
49	29	49	45
66		40	37
31		31	34
37			49
29			
37			
37			

Sum of Squares Between:	389.478
Mean Squares Between:	129.826
Sum of Squares Within:	30832.504
Mean Square Within:	268.109
Sum of Squares Total:	31221.983

Degrees of Freedom: 3,115

APPENDIX E

COMPARISON WITH STANFORD ACHIEVEMENT TEST

JUNIORS

(Class of 1980)

Test A	SAT	Test A	SAT
83	100	66	79
94	98	60	79
97	98	46	79
89	96	74	79
83	96	66	79
74	96	60	77
77	94	57	77
80	94	51	77
91	94	63	77
94	92	66	75
97	92	77	75
83	92	77	75
86	90	63	73
83	90	46	73
91	90	63	71
86	90	49	71
77	90	77	71
66	90	66	69
83	90	69	69
66	88	49	69
63	88	49	67
66	85	66	67
80	85	60	63
60	85	63	60
86	85	31	54
71	83	37	54
46	81	29	50
71	81	29	44
63	81	37	42
69	81	37	35

JUNIORS

(Class of 1980)

Test A	SAT	Test A	SAT
86	100	69	81
91	100	57	81
97	100	77	81
94	100	71	81
94	98	66	79
86	98	71	79
86	98	60	79
74	98	63	79
89	96	77	77
63	96	60	75
86	96	57	75
69	94	57	75
89	94	60	73
71	94	57	71
71	92	60	69
66	92	63	69
71	90	34	67
71	88	57	67
69	88	69	67
74	88	57	65
71	85	57	65
69	85	63	63
74	85	49	60
63	83	45	77
71	83	37	56
66	81	34	56
66	81	40	48
74	81	49	46
60	81	31	44
66	81		