

**Report on the Effectiveness of Mathnasium Learning Center Teaching
on Student Performance on Standards-based Mathematics Tests**

Report on 2008 Student Testing Data

prepared by

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Introduction

Mathnasium is a learning center which students may attend after school to boost their math skills. The center is highly specialized; teaching only math. The program is for students in grades 2 through 8 and high school. Students attend the center once or twice a week, for about an hour. Like a gym or health club, members pay a monthly fee and can drop-in anytime. The goal is to significantly increase a student's math skills, understanding of math concepts, and overall school performance, while building confidence and forging a positive attitude toward the subject.

The company has sought to determine the effectiveness of its program, and has commissioned several qualitative and quantitative studies since 2004.

This study was conducted in 2008, using the results of paired testing data for a cross-section of Mathnasium Center students. Using a single group non-experimental pre-posttest design, this study was to determine whether there exists a positive treatment effect on mathematics testing performance of elementary and middle school children as a result of their attending the Mathnasium teaching center for a period of approximately 6 months.

The Study

To see whether students' performance on tests of math skills are improving as a result of Mathnasium tutoring, two math tests were given to students, one at the beginning of the study period (pretest), and one at the end (posttest). The students who participated in this study are Mathnasium customers who also attend local elementary schools.

Students are placed at a specific learning level within the Mathnasium curriculum based on an initial interview at the Mathnasium Center, a review (if possible) of recent testing results from school, and whether or not they are able to pass a pre-test at the level one lower than their current grade. These data are used to place the student at the level where they begin the Mathnasium learning process. This is the level where the subject's pre-test and post-test are given.

The instruments used in this study are the Mathnasium 'Check-up Tests'. These tests have been aligned to math standards from all States in which Mathnasium operates, including the State where Mathnasium is headquartered, California. A sample test is included in the Appendix. The pre- and posttests are equivalent, containing the same level and number of questions and testing the same exact skills. The tests have been independently validated by an experienced credentialed mathematics teacher, showing that they test at grade-level and that the content is consistent with the California State standards.

Between the two tests, each student attended the Learning Center a few times per week for mathematics tutoring. The treatment period averages 3 months.

The design of this statistical study is a 'Single Group Pretest-Posttest Design' (Figure 1). This design compares the same group of participants before and after the program. The

purpose of the single group pretest-posttest design is to determine if participants improved after receiving the program. As is common with most any statistical work, there are limitations and threats to this design which are noted in the Conclusions and Recommendations section of this report.

Figure 1. Single Group Research Design based on Kerlinger (1973)

Students at the Mathnasium Learning Center form a single group. The group receives the treatment for a minimal period of three months. O represents the pretest and posttest.

O X O

The null hypothesis of this study is that attending the Learning Center will have no positive causal effect on posttest performance. A *t-test* comparing matched pairs of pre- and posttest results was used to statistically determine if there is a significant difference between the two test scores across the study population. A one-tailed test was used because the effect of the Mathnasium tutoring treatment was assumed to be positive.

Analysis

Once the pre and posttest data was collected, the data were entered into Microsoft Excel, and manipulated to combine and match student pairs of data. This information was then sorted by test level. The data was reviewed to determine which grades could serve as the subject of further statistical analysis. Several of the grade level statistics were deemed unreliable due to low sample size. Data for testing levels 1, 7, 8, and 9 were provided for this study but not included in analysis due to low sample sizes (≤ 10 students).

Table 1. Statistical results

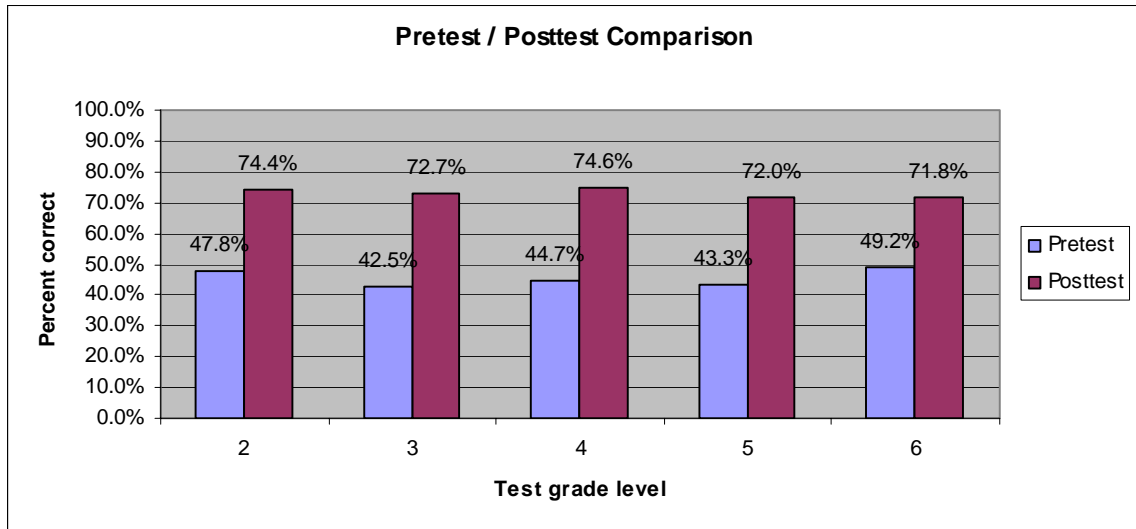
		Mean	Variance	n	Pearson <i>r</i>	df	t Stat	P(T<=t) one-tail	t Critical one-tail (at .05)
Grade 2	Pretest	48%	0.0134	34	0.65	33	-15.1	1.01E-16	1.69
	Posttest	74%	0.0160	34					
Grade 3	Pretest	43%	0.0239	33	0.61	32	-12.7	2.54E-14	1.69
	Posttest	73%	0.0245	33					
Grade 4	Pretest	45%	0.0342	42	0.78	41	-15.7	3.25E-19	1.68
	Posttest	75%	0.0362	42					
Grade 5	Pretest	43%	0.0309	30	0.73	29	-10.3	1.68E-11	1.70
	Posttest	72%	0.0494	30					
Grade 6	Pretest	49%	0.0581	16	0.77	15	-5.8	1.71E-05	1.75
	Posttest	72%	0.0359	16					

The *t-test* analysis was performed on the data collected for test levels 2 through 6. The calculations were run using the Data Analysis Add-in statistical functionality within Microsoft Excel. The paired samples were found to correlate highly. A statistically significant difference in the testing scores between pre- and posttest is shown at the 95% confidence level (Table 1).

Conclusion and Recommendations

The statistical results show a positive treatment effect across all grades analyzed. The improvement in mean scores between pre and post-tests across all grades analyzed ranges from 23 to 30%. The students performed significantly better on a math posttest after receiving instruction through the learning center.

Figure 2. A graphical comparison of mean pre- and posttest results.



While these results show a positive treatment effect, there are a number of threats to the statistical results. The study is not experimental in design, and could benefit from a more controlled environment and time frame. This research is designed to supplement other studies to determine the effectiveness of the Learning Center. As such, this study was easier to implement and less expensive study than experimental, or quasi-experimental designs. But, this design has inherent limitations, namely participants may improve over time without intervention of any kind, and these changes can be mistakenly attributed to the program under evaluation. This design could not indicate whether the program solely caused improvement in participants; as there is no way to distinguish between changes over time due to other factors and effects specific to the program.

It is recommended that a larger scale, qualitative, experimental study be considered within a controlled environment and time frame. A very sound approach to an experiment would be to have two groups, one which is a 'control', or group that does not receive the treatment, and the other which is 'experimental' or 'treatment', the group which uses the software. The purpose of control is to reduce and bias. Size of sample was very small in this study, and it is recommended that the center conduct additional studies using larger numbers of students. To produce reliable statistics, the minimum size of the groups ought to be a minimum of 20 subjects per group; of course, the larger the group, the better.

Another threat, and difference from previous studies for Mathnasium, is the length of the student treatment effect. This study has the average length of time between pre and post-test as about 6-7 months, which certainly overlaps time when students are attending regular math classes in school. In previous reports prepared by for Mathnasium, the treatment times were closer to 3-4 months, or took place over a summer break. Certainly having the treatment period over a summer school break would reduce the influence on student improvement that caused by school math classes.

While there are limitations to the statistical results in this study, there are important strengths. The most important change between this study and previous testing data analysis reports is that the amount of data for this report, specifically the student sample size for each testing level, has increased dramatically from previous reports.

When the statistical significance shown by the data is coupled with qualitative feedback from parents that Center attendees demonstrate more enthusiasm towards learning math, and their children's grades improved, the results of this study are very positive.

Appendix A: References

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Appendix B: Compiled test data used in this study

Grade Level	1st Checkup #	Pre Test Date	Pre Test Score		Post Test Date	Post Test Score		Total Hours Attended	Days
1	40	11/06/2006	65	65%	04/24/2007	100	100%	24	169
1	40	08/27/2007	18	18%	03/18/2008	55	55%	29	204
1	40	08/22/2006	23	23%	08/14/2007	83	83%	51	357
1	40	03/20/2007	10	10%	01/24/2008	73	73%	44	310
1	40	10/16/2006	20	20%	08/01/2007	58	58%	41	289
1	40	07/12/2007	13	13%	01/17/2008	58	58%	27	189
1	40	01/03/2007	55	55%	11/03/2007	95	95%	43	304
1	40	11/11/2006	8	8%	08/30/2007	58	58%	41	292
1	40	02/28/2007	25	25%	09/27/2007	53	53%	30	211
1	40	12/22/2007	55	55%	05/27/2008	80	80%	22	157
1	40	10/24/2007	13	13%	05/06/2008	68	68%	27	195
2	57	07/03/2007	49	49%	02/06/2008	70	70%	31	218
2	57	09/25/2007	46	46%	03/18/2008	68	68%	25	175
2	57	10/03/2007	63	63%	04/08/2008	75	75%	26	188
2	57	10/27/2007	32	32%	05/19/2008	56	56%	29	205
2	57	09/13/2007	49	49%	02/08/2008	75	75%	21	148
2	57	09/20/2007	51	51%	03/29/2008	82	82%	27	191
2	57	09/29/2007	40	40%	03/11/2008	88	88%	23	164
2	57	05/09/2007	32	32%	11/01/2007	58	58%	25	176
2	57	01/29/2007	47	47%	08/20/2007	82	82%	29	203
2	57	06/14/2007	54	54%	12/27/2007	70	70%	28	196
2	57	08/29/2006	32	32%	08/28/2007	56	56%	52	364
2	57	02/21/2007	39	39%	01/23/2008	49	49%	48	336
2	57	03/16/2007	54	54%	01/29/2008	82	82%	45	319
2	57	07/20/2006	53	53%	04/19/2007	91	91%	39	273
2	57	10/04/2007	42	42%	06/09/2008	82	82%	35	249
2	57	06/26/2007	61	61%	02/05/2008	72	72%	32	224
2	57	08/09/2007	51	51%	01/06/2008	81	81%	21	150
2	57	02/08/2007	39	39%	07/25/2007	65	65%	23	167
2	57	04/02/2007	51	51%	09/18/2007	75	75%	24	169
2	57	08/09/2007	32	32%	05/20/2008	70	70%	40	285
2	57	09/05/2007	63	63%	05/02/2008	100	100%	34	240
2	57	11/27/2007	42	42%	05/20/2008	77	77%	25	175
2	57	01/07/2008	68	68%	06/07/2008	74	74%	21	152
2	57	11/07/2006	58	58%	09/24/2007	100	100%	45	321
2	57	10/23/2006	65	65%	04/18/2007	96	96%	25	177
2	57	09/21/2007	51	51%	03/03/2008	67	67%	23	164
2	57	06/12/2007	60	60%	04/10/2008	89	89%	43	303
2	57	09/17/2007	63	63%	05/07/2008	82	82%	33	233
2	57	11/05/2007	30	30%	04/29/2008	61	61%	25	176
2	57	03/26/2007	37	37%	12/12/2007	63	63%	37	261
2	57	03/08/2007	63	63%	09/11/2007	75	75%	26	187
2	57	08/31/2007	30	30%	03/03/2008	72	72%	26	185
2	57	11/26/2007	40	40%	05/21/2008	67	67%	25	177
2	57	10/24/2007	37	37%	04/24/2008	58	58%	26	183

3	57	06/10/2007	58	58%	02/26/2008	63	63%	37	261
3	57	02/13/2007	35	35%	10/30/2007	82	82%	37	259
3	57	05/22/2007	12	12%	05/11/2008	65	65%	50	355
3	57	10/17/2007	25	25%	05/21/2008	37	37%	31	217
3	57	01/30/2007	28	28%	11/30/2007	56	56%	43	304
3	57	07/27/2007	28	28%	01/02/2008	46	46%	22	159
3	57	07/14/2007	46	46%	01/08/2008	77	77%	25	178
3	57	07/05/2007	35	35%	01/15/2008	82	82%	27	194
3	57	08/22/2007	35	35%	02/28/2008	89	89%	27	190
3	57	11/01/2007	44	44%	05/22/2008	93	93%	29	203
3	57	10/25/2007	28	28%	04/10/2008	39	39%	24	168
3	57	11/15/2006	28	28%	05/21/2007	79	79%	26	187
3	57	02/14/2007	35	35%	08/01/2007	63	63%	24	168
3	57	12/04/2007	42	42%	05/28/2008	61	61%	25	176
3	57	06/23/2007	70	70%	03/18/2008	89	89%	38	269
3	57	07/20/2006	54	54%	04/30/2007	88	88%	40	284
3	57	11/01/2007	47	47%	03/31/2008	93	93%	21	151
3	57	04/23/2007	32	32%	10/02/2007	60	60%	23	162
3	57	07/19/2007	58	58%	05/20/2008	81	81%	43	306
3	57	05/17/2007	49	49%	11/16/2007	82	82%	26	183
3	57	05/31/2007	37	37%	03/25/2008	75	75%	42	299
3	57	06/02/2007	56	56%	01/24/2008	79	79%	33	236
3	57	08/01/2007	42	42%	02/19/2008	77	77%	28	202
3	57	09/17/2007	30	30%	02/25/2008	68	68%	23	161
3	57	10/17/2007	21	21%	05/20/2008	51	51%	30	216
3	57	12/03/2007	77	77%	05/27/2008	84	84%	25	176
3	57	09/01/2006	51	51%	05/09/2007	95	95%	35	250
3	57	10/13/2006	40	40%	04/23/2007	72	72%	27	192
3	57	06/07/2007	28	28%	03/25/2008	54	54%	41	292
3	57	08/22/2007	63	63%	04/03/2008	81	81%	32	225
3	57	12/05/2007	51	51%	05/08/2008	70	70%	22	155
3	57	09/19/2007	44	44%	02/27/2008	79	79%	23	161
3	57	04/10/2007	74	74%	01/07/2008	89	89%	38	272
4	82	10/18/2007	65	65%	05/14/2008	98	98%	29	209
4	82	05/02/2007	68	68%	06/12/2008	79	79%	58	407
4	82	04/25/2007	55	55%	10/30/2007	82	82%	26	188
4	82	10/23/2007	38	38%	05/30/2008	94	94%	31	220
4	82	08/25/2007	68	68%	05/17/2008	85	85%	38	266
4	82	09/21/2007	61	61%	04/19/2008	95	95%	30	211
4	82	03/05/2007	18	18%	09/20/2007	79	79%	28	199
4	82	07/16/2007	67	67%	01/13/2008	89	89%	25	181
4	82	05/23/2007	38	38%	01/24/2008	54	54%	35	246
4	82	01/11/2007	21	21%	07/23/2007	66	66%	27	193
4	82	03/14/2007	72	72%	11/08/2007	87	87%	34	239
4	82	03/15/2007	35	35%	01/05/2008	88	88%	42	296
4	82	02/14/2007	59	59%	11/27/2007	85	85%	40	286
4	82	10/11/2007	50	50%	04/09/2008	87	87%	25	181
4	82	08/02/2007	50	50%	01/08/2008	88	88%	22	159
4	82	08/07/2007	23	23%	04/09/2008	48	48%	35	246
4	82	09/01/2007	24	24%	03/24/2008	77	77%	29	205

4	82	02/13/2007	50	50%	07/16/2007	78	78%	21	153
4	82	09/14/2006	67	67%	05/24/2007	94	94%	36	252
4	82	01/25/2007	52	52%	08/14/2007	94	94%	28	201
4	82	04/18/2007	56	56%	11/15/2007	70	70%	30	211
4	82	10/30/2007	59	59%	05/18/2008	79	79%	28	201
4	82	06/20/2007	32	32%	04/20/2008	54	54%	43	305
4	82	12/03/2007	61	61%	05/22/2008	93	93%	24	171
4	82	01/23/2007	27	27%	03/12/2008	63	63%	59	414
4	82	07/31/2007	43	43%	02/28/2008	56	56%	30	212
4	82	03/29/2007	11	11%	05/28/2008	30	30%	60	426
4	82	05/29/2007	24	24%	02/20/2008	65	65%	38	267
4	82	05/03/2007	35	35%	05/28/2008	50	50%	55	391
4	82	03/21/2007	60	60%	05/01/2008	94	94%	58	407
4	82	09/06/2007	70	70%	04/10/2008	93	93%	31	217
4	82	07/19/2007	17	17%	03/06/2008	34	34%	33	231
4	82	01/15/2008	55	55%	06/11/2008	88	88%	21	148
4	82	08/08/2007	18	18%	04/08/2008	48	48%	34	244
4	82	10/02/2007	22	22%	04/21/2008	55	55%	28	202
4	82	10/30/2007	41	41%	04/21/2008	67	67%	24	174
4	82	11/05/2007	60	60%	04/16/2008	87	87%	23	163
4	82	01/30/2007	24	24%	08/08/2007	37	37%	27	190
4	82	02/28/2007	63	63%	07/31/2007	100	100%	21	153
4	82	10/11/2007	30	30%	04/10/2008	65	65%	26	182
4	82	10/10/2007	63	63%	04/02/2008	91	91%	25	175
4	82	10/24/2007	24	24%	04/10/2008	65	65%	24	169
5	91	07/28/2007	55	55%	01/20/2008	69	69%	25	176
5	91	07/30/2007	56	56%	01/28/2008	77	77%	26	182
5	91	08/16/2007	35	35%	05/07/2008	89	89%	37	265
5	91	08/29/2007	11	11%	04/08/2008	34	34%	31	223
5	91	03/12/2007	47	47%	11/15/2007	95	95%	35	248
5	91	12/06/2007	48	48%	06/04/2008	73	73%	25	181
5	91	06/18/2007	9	9%	12/18/2007	43	43%	26	183
5	91	12/05/2007	14	14%	04/30/2008	12	12%	21	147
5	91	11/30/2007	56	56%	04/26/2008	87	87%	21	148
5	91	01/22/2007	48	48%	08/22/2007	54	54%	30	212
5	91	04/02/2007	44	44%	06/04/2008	84	84%	61	429
5	91	06/12/2007	43	43%	12/05/2007	99	99%	25	176
5	91	07/25/2007	46	46%	06/11/2008	79	79%	46	322
5	91	12/11/2007	25	25%	05/23/2008	43	43%	23	164
5	91	08/18/2007	62	62%	06/11/2008	87	87%	42	298
5	91	06/20/2007	73	73%	03/06/2008	98	98%	37	260
5	91	11/01/2007	65	65%	04/25/2008	81	81%	25	176
5	91	09/13/2006	36	36%	12/06/2007	70	70%	64	449
5	91	08/04/2007	65	65%	02/09/2008	98	98%	27	189
5	91	07/03/2007	41	41%	01/29/2008	90	90%	30	210
5	91	05/27/2007	52	52%	05/07/2008	64	64%	49	346
5	91	12/10/2007	24	24%	05/14/2008	40	40%	22	156
5	91	08/21/2006	53	53%	07/25/2007	82	82%	48	338
5	91	08/30/2007	34	34%	02/21/2008	64	64%	25	175
5	91	03/13/2007	53	53%	08/22/2007	80	80%	23	162

5	91	11/20/2007	66	66%	05/15/2008	62	62%	25	177
5	91	08/18/2007	45	45%	06/07/2008	89	89%	42	294
5	91	09/10/2007	8	8%	03/31/2008	42	42%	29	203
5	91	05/24/2007	54	54%	02/27/2008	98	98%	39	279
5	91	01/08/2008	32	32%	06/12/2008	76	76%	22	156
6	96	03/01/2007	65	65%	08/11/2007	59	59%	23	163
6	96	08/21/2007	68	68%	06/07/2008	69	69%	41	291
6	96	03/01/2007	66	66%	11/27/2007	93	93%	38	271
6	96	05/11/2007	61	61%	11/29/2007	96	96%	28	202
6	96	10/03/2007	67	67%	03/11/2008	95	95%	22	160
6	96	11/30/2007	41	41%	04/29/2008	72	72%	21	151
6	96	08/15/2007	75	75%	03/27/2008	100	100%	32	225
6	96	08/29/2005	2	2%	09/12/2006	45	45%	54	379
6	96	04/30/2007	43	43%	01/24/2008	71	71%	38	269
6	96	09/08/2006	28	28%	04/22/2008	60	60%	84	592
6	96	08/08/2007	33	33%	05/15/2008	53	53%	40	281
6	96	07/02/2007	19	19%	11/26/2007	40	40%	21	147
6	96	05/29/2007	58	58%	01/29/2008	90	90%	35	245
6	96	02/17/2007	94	94%	10/24/2007	81	81%	35	249
6	96	04/11/2007	24	24%	10/22/2007	59	59%	27	194
6	96	09/01/2007	43	43%	06/04/2008	65	65%	39	277
7	137	05/06/2007	33	33%	11/28/2007	60	60%	29	206
7	137	11/30/2007	51	51%	05/01/2008	67	67%	21	153
7	137	11/29/2007	54	54%	05/14/2008	72	72%	23	167
7	137	05/30/2007	72	72%	03/19/2008	90	90%	42	294
7	137	02/05/2007	59	59%	11/15/2007	89	89%	40	283
7	137	07/17/2007	28	28%	03/08/2008	58	58%	33	235
7	137	10/04/2007	26	26%	04/08/2008	44	44%	26	187
7	137	08/17/2007	61	61%	02/21/2008	71	71%	26	188
7	137	07/19/2007	29	29%	02/19/2008	52	52%	30	215
7	137	04/18/2007	59	59%	01/08/2008	84	84%	37	265
7	137	11/24/2007	29	29%	06/02/2008	54	54%	27	191
7	137	10/04/2007	80	80%	04/29/2008	98	98%	29	208
8	66	11/14/2007	50	50%	04/09/2008	61	61%	21	147
8	66	07/14/2007	38	38%	01/16/2008	52	52%	26	186
8	66	09/04/2007	32	32%	02/24/2008	71	71%	24	173
8	66	10/03/2007	8	8%	05/21/2008	50	50%	33	231
8	66	08/13/2007	11	11%	06/07/2008	80	80%	42	299
8	66	09/10/2007	3	3%	03/20/2008	77	77%	27	192
9	81	07/24/2007	38	38%	03/11/2008	75	75%	33	231
9	81	10/01/2007	12	12%	02/25/2008	25	25%	21	147
9	81	08/13/2007	36	36%	04/30/2008	56	56%	37	261
9	81	10/10/2007	6	6%	06/03/2008	15	15%	33	237
9	81	10/17/2007	28	28%	05/27/2008	35	35%	31	223

Appendix C: Statistical Results from Excel

Grade 2

t-Test: Paired Two Sample for Means

	<i>Variable</i> 1	<i>Variable</i> 2
Mean	0.477647	0.743529
Variance	0.013382	0.015969
Observations	34	34
Pearson Correlation	0.64568	
Hypothesized Mean Difference	0	
df	33	
t Stat	15.14901	
P(T<=t) one-tail	1.01E-16	
t Critical one-tail	1.69236	
P(T<=t) two-tail	2.03E-16	
t Critical two-tail	2.034515	

Grade 3

t-Test: Paired Two Sample for Means

	<i>Variable</i> 1	<i>Variable</i> 2
Mean	0.425152	0.72697
Variance	0.023926	0.024491
Observations	33	33
Pearson Correlation	0.613749	
Hypothesized Mean Difference	0	
df	32	
t Stat	-12.6779	
P(T<=t) one-tail	2.54E-14	
t Critical one-tail	1.693889	
P(T<=t) two-tail	5.08E-14	
t Critical two-tail	2.036933	

Grade 4

t-Test: Paired Two Sample for Means

	<i>Variable</i> 1	<i>Variable</i> 2
Mean	0.446667	0.745476
Variance	0.034169	0.036167
Observations	42	42
Pearson Correlation	0.783225	
Hypothesized Mean Difference	0	
df	41	
t Stat	-15.6715	
P(T<=t) one-tail	3.25E-19	
t Critical one-tail	1.682878	
P(T<=t) two-tail	6.5E-19	
t Critical two-tail	2.019541	

Grade 5

t-Test: Paired Two Sample for Means

	<i>Variable</i> 1	<i>Variable</i> 2
Mean	0.433333	0.719667
Variance	0.030926	0.049424
Observations	30	30
Pearson Correlation	0.731118	
Hypothesized Mean Difference	0	
df	29	
t Stat	-10.3003	
P(T<=t) one-tail	1.68E-11	
t Critical one-tail	1.699127	
P(T<=t) two-tail	3.36E-11	
t Critical two-tail	2.04523	

Grade 6

t-Test: Paired Two Sample for Means

	<i>Variable</i> 1	<i>Variable</i> 2
Mean	0.491875	0.7175
Variance	0.05815	0.035927
Observations	16	16
Pearson Correlation	0.765421	
Hypothesized Mean Difference	0	
df	15	
t Stat	-5.81276	
P(T<=t) one-tail	1.71E-05	
t Critical one-tail	1.75305	
P(T<=t) two-tail	3.42E-05	
t Critical two-tail	2.13145	

Appendix D. Sample of Mathnasium Internal Pretests used in this Study

Page 1 of 6

• Math Checkup #5 •

Show all work – neatly

DATE _____	1) $7,349 + 321 + 6 + 75 = \underline{\hspace{2cm}}$	2) $\begin{array}{r} 4,423 \\ 5,576 \\ 1,917 \\ + 8,082 \\ \hline \end{array}$	
GRADE _____	3) $\begin{array}{r} 3,482 \\ - 724 \\ \hline \end{array}$	4) $\begin{array}{r} 70,000 \\ - 9,123 \\ \hline \end{array}$	5) $\begin{array}{r} 63,905 \\ - 5,348 \\ \hline \end{array}$
NAME _____	6) $\begin{array}{r} 896 \\ \times 87 \\ \hline \end{array}$	7) $\begin{array}{r} 2,753 \\ \times 524 \\ \hline \end{array}$	8) $\begin{array}{r} 45,000 \\ \times 20,000 \\ \hline \end{array}$
	9) $9 \overline{) 7,290}$	10) $16 \overline{) 51,232}$	11) $79 \overline{) 53,205}$

12) $3.24 + 7.2 =$ _____ 13) $3.69 + 7.2 + 3 =$ _____

14) $18.79 - 3.2 =$ _____ 15) $8 - 1.75 =$ _____

16)
$$\begin{array}{r} 3.42 \\ \times 1.1 \\ \hline \end{array}$$

17)
$$\begin{array}{r} 0.25 \\ \times 0.25 \\ \hline \end{array}$$

18) $1.2 \overline{) 1.56}$

19) $0.25 \overline{) 875}$

Write your answers in simplified form.

20) $\frac{3}{8} + \frac{3}{8} =$ _____ 21) $2\frac{3}{8} + \frac{5}{6} =$ _____

22) $7 - 4\frac{3}{8} =$ _____ 23) $8\frac{2}{3} - 2\frac{3}{4} =$ _____

24) $\frac{8}{9} \times \frac{3}{4} =$ _____ 25) $4\frac{4}{5} \times \frac{1}{2} =$ _____

26) $\frac{8}{9} \div \frac{2}{3} =$ _____ 27) $3\frac{9}{10} \div \frac{3}{5} =$ _____

Draw a rectangle below. Label the length $12\frac{1}{2}$ feet and the width 2 feet.

28) Find the PERIMETER of the rectangle. _____

29) Find the AREA of the rectangle. _____

30) Write the number in words: 87,654,321

31) Write the number in words: 5.234

32) 25% of 20 = _____

33) 8% of 300 = _____

34) 16% of 225 = _____

35) 12% of 130 = _____

36) 10% of the apples in a barrel were rotten. The barrel contained a total of 120 apples. How many apples were *not* rotten? _____

A bag contains 5 red M&Ms, 4 green M&Ms, and 3 blue M&Ms.

37) What is the ratio of blue M&Ms to green M&Ms? _____

38) What is the ratio of green M&Ms to red M&Ms? _____

39) What part of the M&Ms are red? _____

- 40) 3,000 pounds of sand is used to fill sandboxes. 1,000 pounds was used to fill the big sandbox, and the rest was used to fill four equal-size sandboxes. How much sand was put in each of the smaller sandboxes?
- _____

- 41) Martha and George take turns baby-sitting. Martha works for 4 hours and George works for 2 hours. They are paid a total of \$24.00.

How should they share the money so that each person gets a fair share?

Martha = _____ **George** = _____

42) $7 + ^{-}3 =$ _____

43) $^{-}9 + 7 =$ _____

44) $^{-}8 + ^{-}7 =$ _____

45) $^{-}1 + 2 + ^{-}7 + ^{-}2 =$ _____

46) $4 - 7 =$ _____

47) $^{-}3 - ^{-}7 =$ _____

48) $^{-}5 + \underline{\hspace{1cm}} = ^{-}2$

49) $^{-}4 - \underline{\hspace{1cm}} = 9$

50) Round to the nearest *thousand*: 1,237,421: _____

51) Round to the nearest *hundredth*: 24.3472: _____

52) Round to the nearest *tenth*: 129.9521: _____

53) What is the *sum* of 10 and 2? _____

54) What is the *product* of 10 and 2? _____

55) What is the *quotient* of 10 and 2? _____

56) What is the *difference* of 10 and 2? _____

Define in your own words:

57) DENOMINATOR _____

58) MULTIPLE _____

59) FACTOR _____

What is the next number in the pattern:

60) 0, 1, 3, 6, 10, 15, _____ 61) 0, 1, 1, 2, 3, 5, 8, 13, _____

List *all* the factors of:

62) 12 _____ 63) 60 _____

What is the **GCF** (Greatest Common Factor) of:

64) 18 and 24 GCF = _____ 65) 75 and 125 GCF = _____

What is the **LCM** (Least Common Multiple) of:

66) 6 and 8 LCM = _____ 67) 10 and 12 LCM = _____

A bag contains 10 red marbles, 8 white marbles, and 6 blue marbles. If one marble is picked from the bag, what is the probability that the marble will be:

68) a blue marble _____? 69) *not* a white marble _____?

70) A furlong is one-eighth ($\frac{1}{8}$) of a mile. What part of a mile is 6 furlongs? _____

Papa bear ate half of the pie. Mama bear ate half of what was left. Baby bear ate half of what was left.

71) What fractional part of the pie was left for Goldilocks? _____

72) What fractional part of the pie did Mama bear get? _____

73) Name five numbers between $\frac{1}{4}$ and $\frac{3}{4}$: _____, _____, _____, _____, _____

74) Circle the fraction with the *greatest* value: $\frac{12}{13}$, $\frac{19}{20}$, $\frac{3}{7}$, $\frac{77}{99}$

75) Arrange in order from *smallest* to *largest*: 0, 1, $\frac{1}{2}$, $\frac{5}{12}$, $\frac{5}{8}$

_____, _____, _____, _____, _____

76) $\frac{3}{4}$ of 20 = _____

77) $\frac{5}{8}$ of 24 = _____

78) $\frac{1}{5}$ of _____ = 7

79) $\frac{3}{5}$ of _____ = 9

80) half of 20 = _____

81) half of 30 = _____

82) half of 100 = _____

83) half of 150 = _____

84) half of 7 = _____

85) half of 21 = _____

86) half of 99 = _____

87) half of $7\frac{1}{2}$ = _____

88) half of _____ = 8

89) half of _____ = $4\frac{1}{2}$

90) half of _____ = $24\frac{1}{2}$

91) half of _____ = $5\frac{3}{4}$

Appendix E. Sample Test Alignment to California State Standards

Grade 5, Test PT5A

2a	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
2b	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
3a	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
3b	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
—	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
4a	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
4b	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
4c	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
5a	Number Sense	2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.
5b	Number Sense	2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.
5c	Number Sense	2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.
6a	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
6b	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
6c	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
7a	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
7b	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
7c	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
9a	Number Sense	2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.
9b	Number Sense	2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.
9c	Number Sense	2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.
10a	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
10b	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
11a	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
11b	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
14a	Measurement and Geometry	1.1 Derive and use the formula for the area of a triangle and of a parallelogram by comparing it with the formula for the area of a rectangle (i.e., two of the same triangles make a parallelogram with twice the area; a parallelogram is compared with a rectangle of the same area by cutting and pasting a right triangle on the parallelogram).
14b	Measurement and Geometry	1.1 Derive and use the formula for the area of a triangle and of a parallelogram by comparing it with the formula for the area of a rectangle (i.e., two of the same triangles make a parallelogram with twice the area; a parallelogram is compared with a rectangle of the same area by cutting and pasting a right triangle on the parallelogram).
15a	Number Sense	1.1 Estimate, round, and manipulate very large (e.g., millions) and very small (e.g., thousandths) numbers.
15b	Number Sense	1.1 Estimate, round, and manipulate very large (e.g., millions) and very small (e.g., thousandths) numbers.
16a	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
16b	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
16c	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.

16d	Number Sense	2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.
18a	Statistics, Data Analysis, and Probability	1.3 Use fractions and percentages to compare data sets of different sizes.
18b	Statistics, Data Analysis, and Probability	1.3 Use fractions and percentages to compare data sets of different sizes.
18c	Statistics, Data Analysis, and Probability	1.3 Use fractions and percentages to compare data sets of different sizes.
21a	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21b	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21c	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21d	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21e	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21f	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21g	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
21h	Number Sense	2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.
22a	Number Sense	1.1 Estimate, round, and manipulate very large (e.g., millions) and very small (e.g., thousandths) numbers.
22b	Number Sense	1.1 Estimate, round, and manipulate very large (e.g., millions) and very small (e.g., thousandths) numbers.
22c	Number Sense	1.1 Estimate, round, and manipulate very large (e.g., millions) and very small (e.g., thousandths) numbers.
25a	Mathematical Reasoning	1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
25b	Mathematical Reasoning	1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
26a	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
26b	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
27a	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
27b	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
28a	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
28b	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
29a	Number Sense	2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.
29b	Statistics, Data Analysis, and Probability	1.3 Use fractions and percentages to compare data sets of different sizes.
30	Statistics, Data Analysis, and Probability	1.3 Use fractions and percentages to compare data sets of different sizes.