

Mathematics Proficiency

Headline

Average mathematics scale scores have increased steadily since 1990, and in 2007 were the highest ever for both fourth and eighth graders. (See [Figure 1](#)) Additionally, scores in all percentiles (10th, 25th, 50th, 75th, and 90th) were higher in 2007 than in any other assessment year for both fourth and eighth graders.

Importance

Competence in mathematics is essential for functioning in everyday life, as well as for success in our increasingly technological workplace. Students who take higher level mathematics and science courses which require strong fundamental skills in mathematics are more likely to attend and to complete college.¹ One study of high school females found that math scores of those who eventually dropped out of high school were lower than those who eventually graduated from high school.²

The importance of mathematics extends beyond the academic domain. Young people who transition to adulthood with limited mathematics skills are likely to find it difficult to function in society. Basic arithmetic skills are required for everyday computations and sometimes for job applications.³ Competence in mathematics skills is related to higher levels of employability.^{4,5} Analyses find that, since 1976, the influence of high school students' mathematics skills on earnings later in life has grown continuously.⁶

Trends

Between 1990 and 2007, average mathematics scale scores rose from 213 to 240 for fourth graders and from 263 to 281 for eighth graders. (See [Figure 1](#)) Math proficiency scores for twelfth graders also rose between 1990 and 2000 from 294 to 300.⁷ (See [Table 3](#)) In 2005, a new mathematics framework was developed for twelfth grade students on a 0 to 300 scale, instead of the 0 to 500 scale which was used in previous years. The average score for all twelfth grade students in 2005 was 150 out of 300. (See [Table 3](#)) Although different scoring was used, a special study found that there was a probable increase in math ability for twelfth grade students from 2000 to 2005.⁸

Additional information on the special study is available at:
<http://new.humrro.org/finalreports/NAEP12mathrends.pdf>

Differences by Race and Ethnicity

Scores have been rising for all race and ethnicity groups, although white students continue to outscore their black, Hispanic, and American Indian peers. These gaps are more prominent in grade eight than in grade four. ([See Table 1](#))

In 2007, Asian students had higher math proficiency scores than white, black, and Hispanic students at all age levels. For example, among eighth grade students, Asian students had an average scale score of 297, compared with 291 for white students, 265 for Hispanic students, and 260 for black students. ([See Figure 2](#))

Differences by Parental Education

Children of parents with high levels of education have higher math proficiency scores than do other children. In 2007, eighth graders whose parents had graduated college had an average score 29 points higher than students whose parents had not finished high school, and 22 points higher than students whose parents had a high school degree only. In 2005, twelfth grade students whose parents graduated college had an average scale score of 161, compared to 138 for students of parents with a high school degree and 130 for students of parents with less than a high school degree. ([See Table 3](#))

Differences by Gender

Male and female students in the fourth and eighth grades had similar mathematics scores, in 2007 (241 and 239, respectively among fourth graders; 282 and 280, respectively among eighth graders). ([See Table 1](#) and [Table 2](#)) Scores in 2005 for male and female twelfth graders are also similar (151 versus 149, respectively). ([See Table 3](#))

State and Local Estimates

2007 mathematics estimates for 4th and 8th graders by region are available at: http://nationsreportcard.gov/math_2007/m0037.asp

2007 mathematics estimates for 4th and 8th graders for states participating in NAEP are available at: http://nationsreportcard.gov/math_2007/m0001.asp

2007 state estimates for 4th graders who scored below the basic math level are available at http://www.aecf.org/kidscount/sld/compare_results.jsp?i=530

2007 state estimates for 4th graders who scored at or above the proficient math level are available at http://www.aecf.org/kidscount/sld/compare_results.jsp?i=540

2007 state estimates for 8th graders who scored below the basic math level are available at http://www.aecf.org/kidscount/sld/compare_results.jsp?i=610

2007 state estimates for 8th graders who scored at or above the proficient math level are available at http://www.aecf.org/kidscount/sld/compare_results.jsp?i=620

2007 estimates for 4th and 8th graders in 11 large urban districts participating in NAEP are available at http://nationsreportcard.gov/tuda_math_2007/m0001.asp

International Estimates

International estimates for eighth grade mathematics proficiency from the *Trends in International Mathematics and Science Study (TIMSS) 2003* report are available at: <http://nces.ed.gov/pubs2005/2005005.pdf>

Fourth grade assessments from TIMSS are available at: <http://nces.ed.gov/pubs2005/2005005.pdf>

Twelfth grade assessments from TIMSS are available at: <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98049>

International comparisons of mathematics literacy from the Organization for Economic Cooperation and Development's (OECD) Program for International Student Assessment (PISA) for 15 year olds in 2006 are available in the *Performance of U.S. 15-Year-Old Students in Science and Mathematics Literacy in an International Context* report at <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008016>

National Goals

The No Child Left Behind Act, signed into law in January 2002, requires states to set performance standards for multiple subjects, including mathematics, and requires that each state measure students' progress in mathematics and reading every year from grades 3 to 8, and at least once in grades 10 to 12. Each state is expected to make adequate yearly progress toward meeting standards, and all children are expected to meet or exceed minimum proficiency standards, as defined by the state, within twelve years (by 2014).

For more information visit: <http://www.ed.gov/nclb/methods/math/math.html>

Definition

Mathematics proficiency is defined as performance on the National Assessment of Educational Progress (NAEP) main assessment and is measured by average scale scores. Scale scores range from 0 to 500, with a standard deviation of 100. In 2005, a new mathematics framework was adopted for twelfth graders and the scale scores range from 0 to 300.

Data Sources

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. National Assessment of Educational Progress Reading and Mathematics Assessments (NAEP), 2007, 2005, 2003, 2000, 1996, 1992, and 1990 Mathematics Assessments. Accessed through the NAEP data tool at <http://nces.ed.gov/nationsreportcard/nde/criteria.asp>

Raw Data Source

National Assessment of Educational Progress Mathematics Assessments
<http://nces.ed.gov/nationsreportcard/>

Approximate Date of Next Update

2009

¹ Adelman, C. (1999). *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment*. Washington, DC: Office of Education Research and Improvement, U.S. Department of Education. Available at: <http://www.ed.gov/pubs/Toolbox/index.html>

² Tyler, John H., Murnane, Richard J., and Willett, John B. (2002). "Who Benefits from a GED? Evidence for females from *High School and Beyond*." *Economics of Education Review* 22: 237-247.

³ Kirsch, I., Jungeblut, A., Jenkins, L. & Kolstad, A. (1993). *Adult Literacy in America: A First Look at the Findings of the National Adult Literacy Survey*. Washington, DC: National Center for Education Statistics. [On-line]. Available: <http://nces.ed.gov/pubs93/93275.pdf>

⁴ Riley, R.W. (1998). "The State of Mathematics Education: Building a Strong Foundation for the 21st Century." Speech given at the Conference of the American Mathematical Society and the Mathematical Association of America, January 8, 1998.

⁵ Murnane, Richard J., Willett, John B., Braatz, M. Jay, and Duhaldeborde, Yves. (2001). "Do Different dimensions of male high school students' skills predict labor market success a decade later? Evidence from the NLSY." *Economics of Education Review* 20: 311-320.

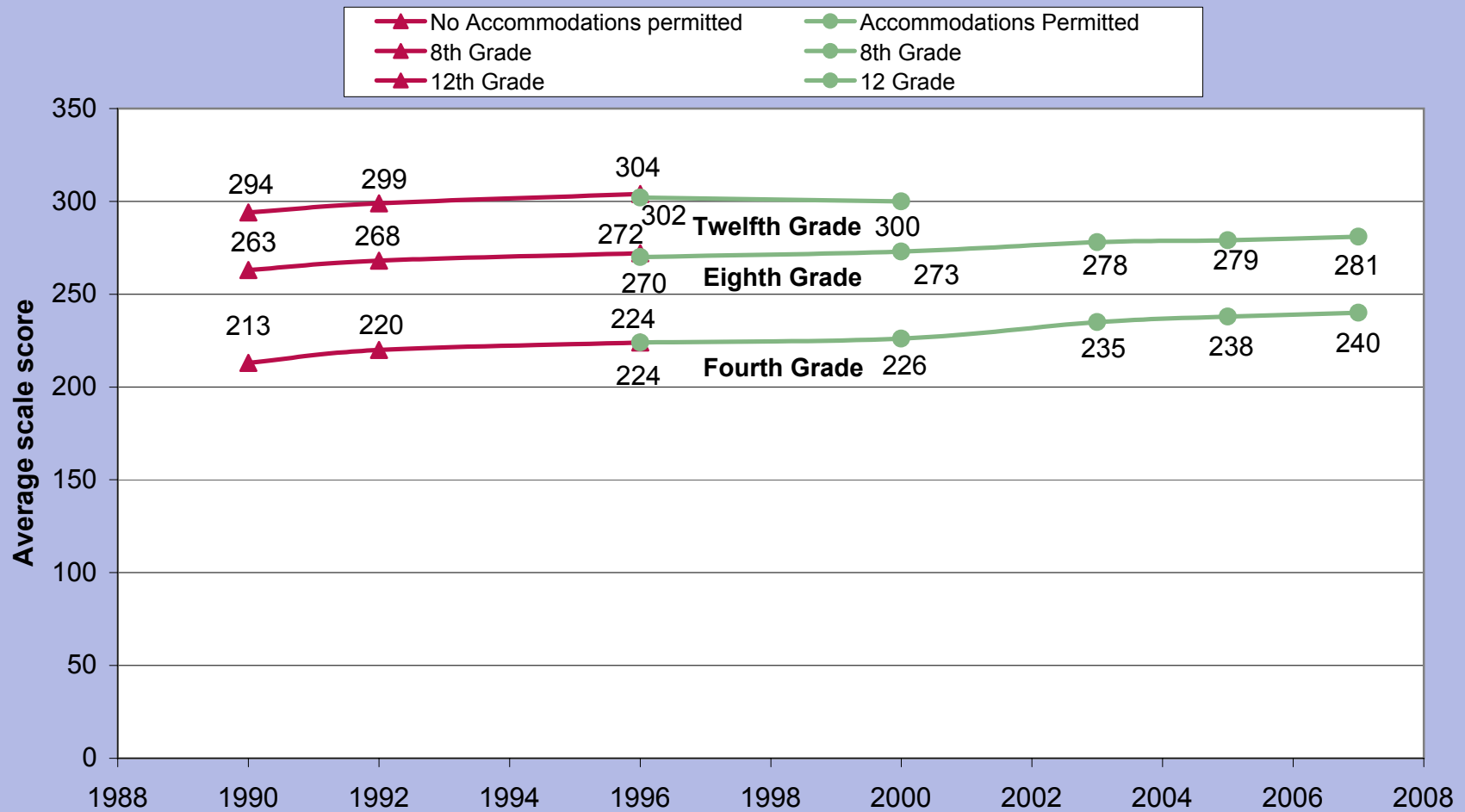
⁶ Murnane, R., Willett, J., and Levy, F. (1995). "The growing importance of cognitive skills in wage determination." *The Review of Economics and Statistics*, 77(2): 251-266.

⁷ In 1996, NAEP started allowing testing accommodations for students with disabilities and for limited English proficient students. Accommodations may include extra time, one-on-one administration, use of magnifying equipment, translation of assessments, or the use of bilingual dictionaries and are determined by state and district policies. Beginning in 2002, all NAEP assessments allow accommodations.

⁸ Diaz, T.E., Le, H. A., & Wise, L.L. (2006). NAEP-QA FY06 special study: 12th grade math trend estimates. Washington, DC: U.S. Department of Education, National Center for Education Statistics Available at: <http://new.humrro.org/finalreports/NAEP12mathrends.pdf>

Figure 1

Average Scale Score in Mathematics of Fourth, Eighth, and Twelfth Grade Students, 1990-2007



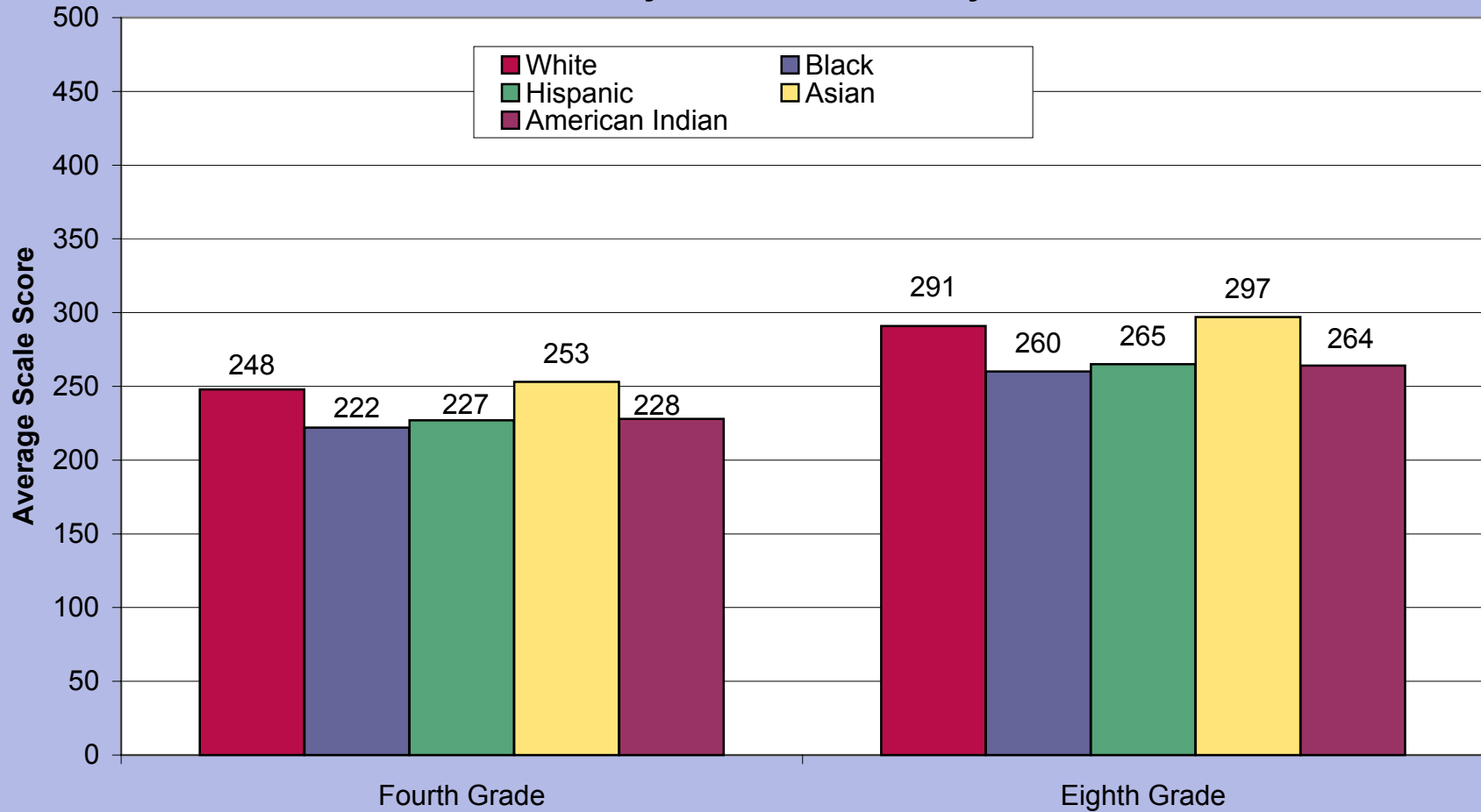
Note: In 2005, a new mathematics framework was developed for twelfth grade scores on a 0 to 300 scale, instead of the 0 to 500 scale which was used in previous years, therefore, scores are incomparable.

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. *National Assessment of Educational Progress Mathematics Assessments (NAEP), 2007, 2005, 2003, 2000, 1996, 1992, and 1990 Mathematics Assessments*. Access through the NAEP data tool at <http://nces.ed.gov/nationsreportcard/naepdata/search.asp>.



Figure 2

Average Scale Score in Mathematics for Fourth and Eighth Grade Students, by Race and Ethnicity, 2007

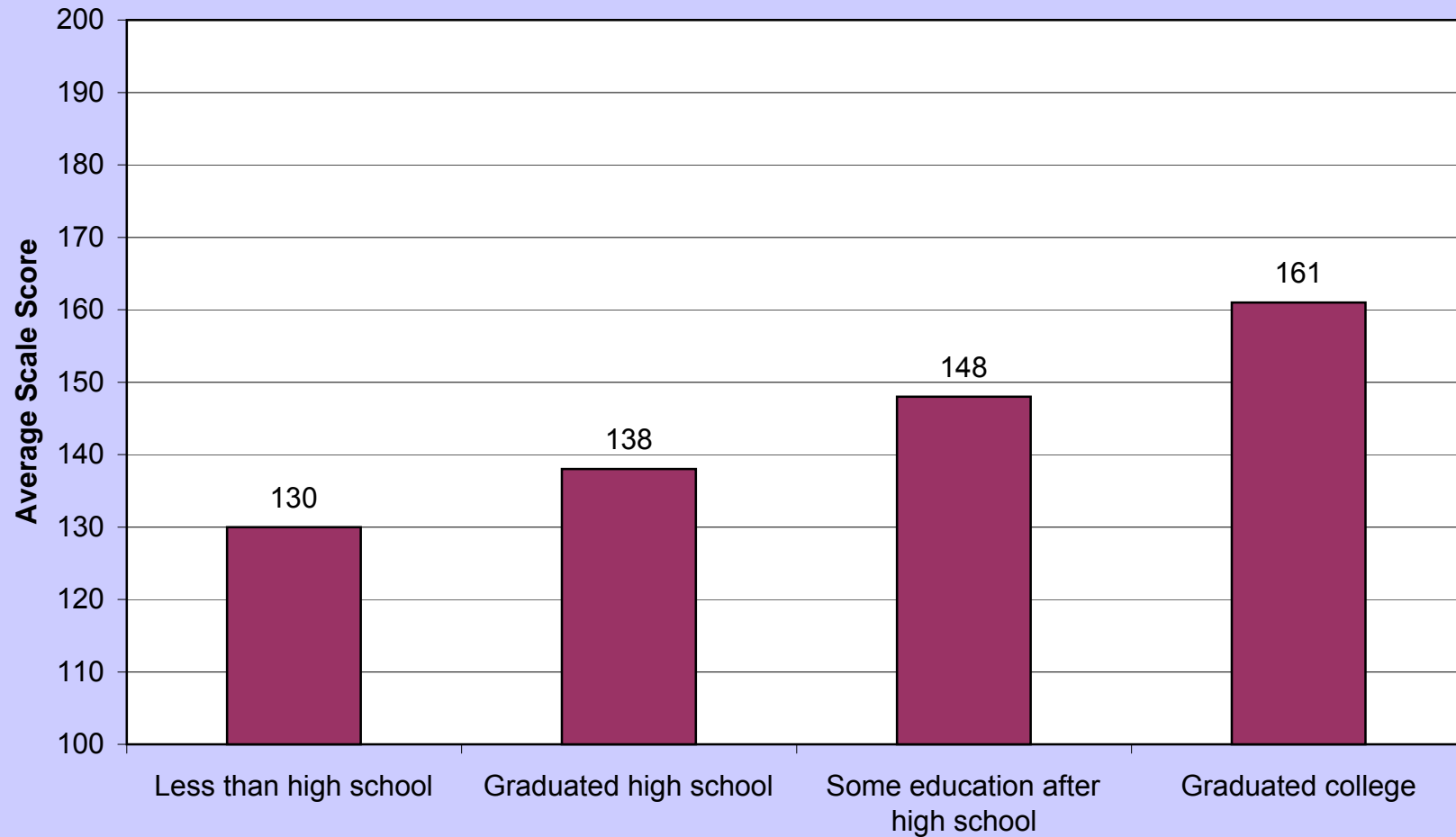


Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. *National Assessment of Educational Progress Mathematics Assessments (NAEP), 2007 Mathematics Assessments*. Accessed through the NAEP data tool at <http://nces.ed.gov/nationsreportcard/naepdata/search.asp>.



Figure 3

Average Scale Score of Twelfth Grade Students by Parent's Education, 2005



Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. National Assessment of Educational Progress Mathematics Assessments (NAEP), 2005 Mathematics Assessments. Accessed through the NAEP data tool at <http://nces.ed.gov/nationsreportcard/nde/criteria.asp>



Table 1

National Mathematics Scores³ Among Students in Grade 4

	1990	1992	1996	1996	2000	2003	2005	2007
	No Accommodations permitted ¹			Accommodations Permitted ¹				
Total	213	220	224	224	226	235	238	240
Gender								
Male	214	221	226	224	227	236	239	241
Female	213	219	222	223	224	233	237	239
Race/Ethnicity ²								
White	220	227	232	231	234	243	246	248
Black	188	193	199	198	203	216	220	222
Hispanic	200	202	205	207	208	222	226	227
Asian/Pacific Islander	*	231	226	229	*	246	251	253
American Indian	*	*	*	*	*	223	226	228
Free/Reduced-Price School Lunch Program Eligibility								
Eligible	-	-	207	207	208	222	225	227
Not eligible	-	-	231	232	235	244	248	249
Information not available	-	-	233	231	237	241	244	246
Type of School								
Public	212	219	222	222	224	234	237	239
Nonpublic	224	228	237	235	238	244		246
Type of Location								
Central City	-	214	218	218	220	229	233	
Urban fringe/ large town	-	226	229	227	230	238	241	
Rural/ small town	-	218	222	226	226	236	238	
Percentile								
10 th	171	177	182	182	184	197	200	202
25 th	193	199	204	203	205	216	220	222
50 th	214	221	226	225	227	236	239	242
75 th	235	242	246	245	248	255	258	260
90 th	253	259	262	262	265	270	273	275

*- Indicates data not available

*Sample size was insufficient to permit reliable estimates.

¹In 1996, NAEP started allowing testing accommodations for students with disabilities and for limited English proficient students. Accommodations may include extra time, one-on-one administration, use of magnifying equipment, translation of assessments, or the use of bilingual dictionaries, as determined by state and district policies.

²Note that none of the race groups include Hispanics of those races.

³Scale scores range from 0 to 500, with a standard deviation of 100.

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress Mathematics Assessments (NAEP), 2007, 2005, 2003, 2000, 1996, 1992, and 1990 Mathematics Assessments through the NAEP data tool at <http://nces.ed.gov/nationsreportcard/nde/criteria.asp>

Table 2

National Mathematics Scores³ Among Students in Grade 8

	1990	1992	1996	1996	2000	2003	2005	2007
	No Accommodations permitted			Accommodations Permitted				
Total	263	268	272	270	273	278	279	281
Gender								
Male	263	268	272	271	274	278	280	282
Female	262	269	272	269	272	277	278	280
Race/Ethnicity ²								
White	270	277	281	281	284	288	289	291
Black	237	237	242	240	244	252	255	260
Hispanic	246	249	251	251	253	259	262	265
Asian/Pacific Islander	*	290	*	*	288	291	295	297
American Indian	*	*	*	*	*	263	264	264
Program Eligibility								
Eligible	-	-	252	250	253	259	262	265
Not eligible	-	-	280	277	283	287	288	291
Information not available	-	-	280	285	276	285	289	291
Parent's Education								
Did not finish high school	242	249	254	250	253	257	259	263
Graduated high school	255	257	261	260	261	267	267	270
Some education after high school	267	271	279	277	277	280	280	283
Graduated college	274	281	282	281	286	288	290	292
Unknown	241	252	254	252	254	259	260	263
Type of School								
Public	262	267	271	269	272	276	278	280
Nonpublic	271	281	284	285	286	292		293
Type of Location								
Central City	-	262	265	261	266	271	273	
Urban fringe/ large town	-	275	275	275	277	281	283	
Rural/ small town	-	267	276	274	275	279	279	
Percentile								
10 th	215	221	224	221	223	230	231	235
25 th	239	243	248	245	249	254	255	258
50 th	264	269	273	273	275	279	280	283
75 th	288	294	298	297	300	303	304	306
90 th	307	315	317	316	320	323	324	327

"-" Indicates data not available

*Sample size was insufficient to permit reliable estimates.

¹In 1996, NAEP started allowing testing accommodations for students with disabilities and for limited English proficient students. Accommodations may include extra time, one-on-one administration, use of magnifying equipment, translation of assessments, or the use of bilingual dictionaries and are determined by state and district policies. Beginning in 2002, all NAEP assessments allow accommodations.

²Note that none of the race groups include Hispanics of those races.

³Scale scores range from 0 to 500, with a standard deviation of 100.

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. National Assessment of Educational Progress Mathematics Assessments (NAEP), 2007, 2005, 2003, 2000, 1996, 1992, and 1990 Mathematics Assessments processed through the NAEP data tool at <http://nces.ed.gov/nationsreportcard/nde/criteria.asp>

Table 3

National Mathematics Scores³ Among Students in Grade 12

	1990	1992	1996	1996	2000	2005**
	<u>No Accommodations permitted¹</u>			<u>Accommodations Permitted¹</u>		
Total	294	299	304	302	300	150
Gender						
Male	297	301	305	303	302	151
Female	291	298	303	300	299	149
Race/Ethnicity²						
White	300	305	311	309	307	157
Black	268	275	280	275	273	127
Hispanic	276	286	287	284	282	133
Asian/Pacific Islander	311	312	312	305	315	163
American Indian	-	-	284*	-	294*	134
Free/Reduced-Price School Lunch Program Eligibility						
Eligible	-	-	281	280	279	132
Not eligible	-	-	307	306	304	155
Information not available	-	-	308	303	303	162
Parent's Education						
Did not finish high school	272	278	282	280	278	130
Graduated high school	283	288	294	290	287	138
Some education after high school	297	299	302	302	299	148
Graduated college	306	311	314	313	312	161
Unknown	269	277	275	269	274	123
Type of School						
Public	294	297	303	301	300	149
Nonpublic	300	314	314	310	315	-
Type of Location						
Central City	-	296	301	297	297	147
Urban fringe/ large town	-	303	309	305	303	154
Rural/ small town	-	297	301	302	298	148
Percentile						
10th	247	254	261	257	254	105
25th	270	276	282	279	276	127
50th	296	301	305	302	301	151
75th	319	324	327	326	325	174
90th	339	343	345	344	346	194

"-" Indicates data not available

*The nature of the sample does not allow accurate determination of the variability of the statistic

**In 2005, a new mathematics framework was developed on a 0 to 300 scale, instead of the 0 to 500 scale which was used in previous years, therefore, scores are incomparable.

¹In 1996, NAEP started allowing testing accommodations for students with disabilities and for limited English proficient students. Accommodations may include extra time, one-on-one administration, use of magnifying equipment, translation of assessments, or the use of bilingual dictionaries and are determined by state and district policies.

²Note that none of the race groups include Hispanics of those races.

³Scale scores range from 0 to 500, with a standard deviation of 100.

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. *National Assessment of Educational Progress Mathematics Assessments (NAEP), 2005, 2003, 2000, 1996, 1992, and 1990 Mathematics Assessments*. Accessed through the NAEP data tool at

<http://nces.ed.gov/nationsreportcard/nde/criteria.asp>

