Dr. Daniel Miller, Member and Chair
Student Learning in University Studies
May 17, 2006

**Student Learning in Quantitative Reasoning Courses Self-Study Report**

## I. Goals

Quantitative Reasoning (QR) is a required component for all Millikin students under MPSL. The QR goals specifically reflect the University goal of "Preparing students for democratic citizenship in a global environment".

To participate rationally in a world where discussions about everything from finance to the environment, from personal health to politics, are increasingly informed by mathematics, one must understand mathematical methods and concepts, their assumptions and implications. Thus, the learning goals.

1. Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.

2. Represent mathematical information symbolically, visually, numerically, and verbally.

3. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.

4. Recognize that mathematical and statistical methods have limits.

The table below lists the major QR course and their fulfillment of the QR goals.

Table 1

| | #1 | #2 | #3 | #4 |
|---|---|---|---|---|
| MA 112 | x | | x | |
| MA 114 | x | x | | |
| MA 120 | x | | | x |
| MA 125 | x | | x | |
| MA 140 | | x | x | |
| PH 110 | | x | | |
| SO/PS 201 | x | x | x | x |

## II. Snapshot

The departments of Mathematics, Behavioral Sciences, and Philosophy staff all QR courses for MPLS. From the fall of 2002 until the spring of 2006, 139 QR courses were taught. Of these 123 were in mathematics, 13 in Behavioral Sciences, and 3 in Philosophy. Additionally, the Mathematics Department staffs all of the developmental "*prerequisite*" mathematics courses.

The Philosophy Department's Critical Thinking: Logic (PH 213) course is the only Philosophy course that meets QR. The course is taught by Jo Ellen Jacobs, the chair of the department, and is generally offered once per academic year. The Behavioral Science course that meets QR requirements is Statistical Methods (PS 201). Prior to MPSL this course was also offered once per year but since the fall of 2003 it has increased enrollment to four sections per academic year. A major reason for this increase is that Statistical Methods is the only QR course that does not require a minimum competency mathematics placement score. James St. James, chair of behavior sciences, has agreed to change the prerequisite to that of all other QR course by spring 2007. This change to require a placement score of three or better for Statistical

Methods will assure that all Millikin University students have measurable meet minimal competency in QR.

The Statistical Methods course has been taught by a variety of faculty.

- Gordon Forbes: Fall 2002, Fall 2003-2 sections, Spring 2004-2 sections
- Rebecca Jobe: Fall 2004-2 sections, Spring 2005-2 sections
- Linda Collinsworth: Fall 2005-2 sections, Spring 2—6-2 sections

All members of the Mathematics Department are expected to teach QR courses. It has been an ongoing departmental goal to have full time faculty teach both the QR courses as well as the developmental mathematics courses. To this end, starting in the fall of 2006 Jim Rauff and Dan Miller will take the lead faculty roll for MA 100 and MA 106 respectively. Additionally, the department is anticipating performing a large-scale pedagogical study on the effectiveness of online verse tradition instruction in these courses. Historically the department has offered as least 3 sections of MA 100 and 4 sections of MA 106 each semester. Both of these developmental courses grew out of the MPSL promise to guarantee minimum competency in QR. To insure this level of performance, all students must take a placement exam to determine their placement into QR courses except for Statistical Methods as noted above.

The QR placement process begins with students taking the Compass mathematics placement exam, a computer adaptive test developed by ACT. The scores for this exam range from 1-5. A score of one indicated that the student has not achieved the 50 percentile of students whom have completed high school algebra one. A score of two indicates that the student has not achieved the 50 percentile of students whom have completed high school algebra two. Scores of 3 through 5 indicate that the student is ready for collegiate work and has met minimum competency. Upon completion of the placement exam the students are advised on what QR or developmental course to register for. A survey was completed in the Spring of 2006 to identify suggested course placement for QR for all majors offered at Millikin University (see attachment 1).

Faculty teaching MA 100 since Fall 2004

- Willard Brown: Adjunct Faculty, 6-sections
- Carol Sudduth: Adjunct Faculty, 5-sections
- Michael Fearheiley: Full Time Instructor, 1-section
- Jim Rauff: Tenured Faculty, 1-section

Faculty teaching MA 106 since Fall 2004

- Carol Sudduth: Adjunct Faculty, 3-sections
- James Daniel Foster: Full Time Instructor, 4-sections
- Michael Fearheiley: Full Time Instructor, 10-sections
- Charles Songer: Adjunct Faculty, 2-sections
- Daniel R. Miller: Tenured Faculty, 1-section
- Jim Rauff: Tenured Faculty, 1-section

For a complete list of faculty by section teaching developmental and QR course see attachment 2.

The Mathematics Department is currently undergoing dramatic changes. A facility position was lost when the Dean of Arts and Sciences was promoted from within the department. In the Spring of 2006 the department had two retirements. One was tenured and the other was a yearly contractual. The department replaced these two positions with tenure track hires. The department expects to obtain one additional tenure track line in the coming year to reduce the number of courses currently being taught by adjunct faculty.

## III. Learning Story

Quantitative Reasoning is the first part of MPLS incoming students learns about. In a letter received prior to summer registration they are informed that they will be required to take a mathematics placement exam (see attachment 3). Included in the letter is a description of the exam, the grading parameters, and a web address that included a content review. Additionally Dr. Daniel R. Miller's e-mail address is given so that if students do have additional questions they can contact him directly. Finally, they are informed that they can take the exam a maximum of three times.

Approximately half of the incoming students pass the exam on their first attempt. Those that do not pass are encouraged to test again during "first week" and about 20% of those retesting will pass at that time. The department performed a large-scale study on the placement process in 2005 and found it to have a highly positive predictive value. Since the inception of mandatory placement based on the Compass placement exam the percentage of students successfully completing developmental courses has greatly improved. Student success in QR courses after completing MA 106 was analyzed by comparing their MA 106 scores to their QR scores and to their compass scores. First we compared students' grades in MA 106 to their QR grades. The analysis showed statistically significant relationship between MA 106 grades and their latter QR grades, $p<.000$. This suggests that students that score well in MA 106 go on to perform well in their QA courses. This would indicate that the remediation has improved their mathematical abilities to that of students scoring 3 on their first attempt at the Compass exam. Table 11 indicates that if a student received a D/F in MA 106 they have a 42.9% likelihood of receiving a D/F in their QR course. A student who scores an A/B in MA 106 has a 47.6% likelihood of receiving an A/B in their QR course. (see Compass research).

After students receive either a three on the placement exam or complete the appropriate remediation course they can then register for a QR course. As the survey results showed there is generally little guidance given to students outside mathematics and business on which specific QR course would best prepare them for professional or personal success.

## IV. Assessment Methods

During the Fall 2005 every faculty member that was teaching a QR course was required to fill out a survey indicating which QR goals the course directly addressed. The results of this survey are given in table 1. The major assessment for QR will continue to be the Compass exam.

The types of artifacts that will be collected include:

- Syllabi from all QR courses
- Final exams from all QR course

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## V. Assessment Data

There will be continued assessment of the predictive value of the Compass exam. The major assessment project will address the effectiveness of alternative instructional methods for both developmental and QR courses.

Assessment data to be collected in the fall of 2006:

- Determine that 100% of all QR course syllabi contain references to the QR goals and indicate how they will be addressed within the course.
- Determine the effectiveness of alternative instructional methods for developmental courses.
- Determine the effectiveness of alternative instructional methods for QR courses.

## VI. Analysis

Goal 1 –

Goal 2 –

Goal 3 –

Since there is no data gathered at this point, no analysis is possible.

## VII. Plans

As outlined previously, the major plans for QR include changing the prerequisites for Statistical Methods so that there is uniformity in the prerequisites for all QR courses. Additionally, the department will support the continued research into the effectiveness of alternative delivery methods for QR and developmental course.

## Executive Summary

Student Learning in Quantitative Reasoning Courses Self-Study Report

Quantitative Reasoning (QR) is a required component for all Millikin students under MPSL. The QR goals specifically reflect the University goal of "Preparing students for democratic citizenship in a global environment".

To participate rationally in a world where discussions about everything from finance to the environment, from personal health to politics, are increasingly informed by mathematics, one must understand mathematical methods and concepts, their assumptions and implications. Thus, the learning goals.

1. Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.

2. Represent mathematical information symbolically, visually, numerically, and verbally.

3. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.

4. Recognize that mathematical and statistical methods have limits.

The departments of Mathematics, Behavioral Sciences, and Philosophy staff all QR courses for MPLS. From the fall of 2002 until the spring of 2006, 139 QR courses were taught. Of these 123 were in mathematics, 13 in Behavioral Sciences, and 3 in Philosophy. Additionally, the Mathematics Department staffs all of the developmental "*prerequisite*" mathematics courses.

QR is currently involved in two major initiatives. First to change the prerequisite for Statistical Methods taught through Behavioral Sciences to a placement score of three so that it matches all other QR courses. This would also provide measurable proof of minimum QR competency for all Millikin University students. Second is to provide support for a large-scale research project through the Mathematics Department looking at the effectiveness of alternative instruction methods for developmental and QR course.

Attachment 1

**Mathematics Placement Advising**

Proctors,

The information outlines below is designed to assist you in advising students after they have completed the placement exam. Students should be advised to consult their advisor for the most up to date information in their major.

1) All students will have a maximum of three attempts at the placement exam. Our research indicated that after three attempts the predictive validity of the exam dropped sharply. The limiting of retakes moves us into line with ACT recommendations for the exam. However, we will continue to be the only university that I know of that allows for more than two attempts at the exam. The process will now be that students will take the placement exam at O & R and then will have the option to retake the exam up to twice prior to the end of the first week of the fall semester.

2) All incoming students with AP mathematics or statistics credit (score 3 or above) or CLEP mathematics credit will be exempt from the exam. Likewise, all students that have transferred a QR course from an accredited institution will be exempt. Finally, students with a Math ACT score of 25 or better or a SAT I Math score 570 or better will also be exempt. All of these exceptions require documentation to the register.

3) The Compass exam will no longer be used as a final exam in MA 100 or 106. Students will progress by earning a "C" or better in these courses.

The mathematics department on an individual basis will handle students needing special testing arrangements such as late transfers or disabilities.

Interpreting placement scores:

| Placement Score | Action |
|---|---|
| 1 | Enroll in MA 100 (first developmental course, it does not count as a QR course but does count as a general elective) |
| 2 | Enroll in MA 106 (second developmental course, it does not count as a QR course but does count as a general elective) |
| 3 | Enroll in any QR course (see major recommendations below) |
| 4 | Enroll in any QR course (see major recommendations below) |
| 5 | Enroll in any QR course (see major recommendations below) |

Additional scores:

A score of 6-8 may appear on students' records. These scores indicate that the students do not need to take the placement exam based on the exceptions outlines in general information # 2 above.

Exception:

The QR course taught through Behavioral Science, PS 201, does not require a 3+ on the placement exam. However there are other prerequisites for this course. It is anticipated that by Spring 07 this course will also require a placement code of three or above.

Department: **Mathematics and Computer Science**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Mathematics | MA 140 | | |
| Mathematics Education | MA 140 | | |
| Computer Science | MA 208 | MA 140 | |

Department: **Political Science**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Political Science | | MA 120 MA 125 | Any QR |

Department: **Nursing**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Nursing | MA 120 or PS/SO 201 | | |

Department: **Physics**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Physics | MA 140 | | |

Department: **Biology**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Biology | | MA 114 or MA 140 | Any QR |

Department: **Chemistry**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Chemistry | | MA 140 | Any QR |

Department: **English**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| English Lit. | | | Any QR |
| Writing | | MA 120 or PS/SO 201 | Any QR |
| Education | | | Any QR |

Department: **Behavioral Science**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Psychology | PS/SO 201 | | |
| Sociology | PS/SO 201 | | |
| Human Services | PS/SO 201 | | |

Department: **Education**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Elementary | | MA 112 | Any QR |
| Early Childhood | | MA 112 | Any QR |

Department: **Communication**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Communication | | | Any QR |

Department: **Art**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| All Majors | | | Any QR |

Department: **Exercise Science**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| | | MA 120 MA 125 | Any QR |

Department: **History**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| All Majors | | | Any QR |

Department: **Modern Language**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| All Majors | | | Any QR |

Department: **Music**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Music Business | | MA 120 | Any QR |
| All Others | | | Any QR |

Department: **Philosophy**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| Philosophy | PH 213 | | |

Department: **Theater and Dance**

| Majors | Required Math course(s) | Recommended Math Course(s) | Acceptable Course(s) |
|---|---|---|---|
| All Majors | | | Any QR |

Attachment 2

Developmental and QR Mathematics Courses Fall 02 – Spring 06

| Developmental and QR Mathematics Courses Fall 02 |
|---|
| Basic Algebra - 10455 - MA 100 - 01 |
| Instructors: Carol L Sudduth (P) |
| Basic Algebra - 10456 - MA 100 - 02 |
| Instructors: Carol L Sudduth (P) |
| Basic Algebra - 11510 - MA 100 - 03 |
| Instructors: Carol L Sudduth (P) |
| Intermediate Algebra - 10780 - MA 106 - 03 |
| Instructors: Charles Larry Songer (P) |
| Intermediate Algebra - 11071 - MA 106 - 04 |
| Instructors: Charles Larry Songer (P) |
| Intermediate Algebra - 11511 - MA 106 - 05 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 11514 - MA 106 - 06 |
| Instructors: Carolyn V Likins (P) |
| College Algebra - 10461 - MA 110 - 02 |
| Instructors: Daniel Miller (P) |
| College Algebra - 10874 - MA 110 - 03 |
| Instructors: James Daniel Foster (P) |
| Math Content for Elem Teacher - 10460 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Math Content for Elem Teacher - 10462 - MA 112 - 02 |
| Instructors: Daniel Miller (P) |
| Elem Prob and Statistics - 11294 - MA 120 - 06 |
| Instructors: Charles Larry Songer (P) |
| Math in the World - 11497 - MA 125 - 01 |
| Instructors: Delene R Perley (P) |

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|---|
| Math in the World - 11498 - MA 125 - 02 |
| Instructors: Delene R Perley (P) |
| Calculus I - 10781 - MA 140 - 03 |
| Instructors: Michael L Fearheiley (P) |
| VIII. Statistical Meth.- Behav. Sci. - 10007 - PS 201 – 02 |
| Instructors: Gordon B Forbes (P) |
| Developmental and QR Mathematics Courses SP 03 |
| Intermediate Algebra - 30521 - MA 106 - 01 |
| Instructors: Carol L Sudduth (P) |
| Intermediate Algebra - 31075 - MA 106 - 02 |
| Instructors: Carolyn V Likins (P) |
| College Algebra - 30526 - MA 110 - 01 |
| Instructors: Daniel Miller (P) |
| College Algebra - 32219 - MA 110 - 04 |
| Instructors: James Daniel Foster (P) |
| Math Content for Elem Teacher - 32023 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Trigonometry - 32024 - MA 115 - 01 |
| Instructors: Charles Larry Songer (P), Carolyn V Likins |
| Elem Prob and Statistics - 30525 - MA 120 - 03 |
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 30532 - MA 120 - 04 |
| Instructors: Charles Larry Songer (P) |
| Mathematics in the World - 32030 - MA 125 - 01 |
| Instructors: Delene R Perley (P) |
| Calculus I - 32220 - MA 140 - 02 |
| Instructors: James V Rauff (P) |
| Developmental and QR Mathematics Courses Fall 03 |

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|---|
| Intermediate Algebra - 30521 - MA 106 - 01 |
| Instructors: Carol L Sudduth (P) |
| Intermediate Algebra - 31075 - MA 106 - 02 |
| Instructors: Carol L Sudduth (P) |
| College Algebra - 30526 - MA 110 - 01 |
| Instructors: Daniel Miller (P) |
| College Algebra - 32219 - MA 110 - 04 |
| Instructors: James Daniel Foster (P) |
| Math Content for Elem Teacher - 32023 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Trigonometry - 32024 - MA 115 - 01 |
| Instructors: Charles Larry Songer (P), Carolyn V Likins |
| Elem Prob and Statistics - 30525 - MA 120 - 03 |
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 30532 - MA 120 - 04 |
| Instructors: Charles Larry Songer (P) |
| Mathematics in the World - 32030 - MA 125 - 01 |
| Instructors: Delene R Perley (P) |
| Calculus I - 32220 - MA 140 - 02 |
| Instructors: James V Rauff (P) |
| Statistical Meth.- Behav. Sci. - 10006 - PS 201 - 01 |
| Instructors: Gordon B Forbes (P) |
| Statistical Meth.- Behav. Sci. - 10007 - PS 201 - 02 |
| Instructors: Gordon B Forbes (P) |
| Developmental and QR Mathematics Courses SP 04 |
| Basic Algebra - 30539 - MA 100 - 01 |
| Instructors: Willard A Brown (P) |

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| Basic Algebra - 32863 - MA 100 - 02 |
| Instructors: Willard A Brown (P) |
| Intermediate Algebra - 30521 - MA 106 - 01 |
| Instructors: Carol L Sudduth (P) |
| Intermediate Algebra - 31075 - MA 106 - 02 |
| Instructors: James Daniel Foster (P) |
| Intermediate Algebra - 32020 - MA 106 - 03 |
| Instructors: James Daniel Foster (P) |
| College Algebra - 30527 - MA 110 - 02 |
| Instructors: Daniel Miller (P) |
| College Algebra - 30535 - MA 110 - 03 |
| Instructors: Daniel Miller (P) |
| College Algebra - 32790 - MA 110 - 04 |
| Instructors: James Daniel Foster (P) |
| Math Content for Elem Teacher - 32023 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Trigonometry - 32714 - MA 115 - 01 |
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 30528 - MA 120 - 01 |
| Instructors: Carolyn V Likins (P) |
| Instructors: Carolyn V Likins (P) |
| Elem Prob and Statistics - 30524 - MA 120 - 02 |
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 30525 - MA 120 - 03 |
| Instructors: Carolyn V Likins (P) |
| Elem Prob and Statistics - 30532 - MA 120 - 04 |
| Instructors: Michael L Fearheiley (P) |

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| Elem Prob and Statistics - 32028 - MA 120 - 05 |
| Instructors: Charles Larry Songer (P) |
| Math in the World - 32596 - MA 125 - 01 |
| Instructors: Carol L Sudduth (P) |
| Calculus I - 30530 - MA 140 - 01 |
| Instructors: Randal S Beck (P) |
| Critical Thinking: Logic - 32594 - PH 213 - 01 |
| Instructors: Jo Ellen Jacobs (P) |
| Statistical Meth.in Behav.Sci. - 30481 - PS 201 - 01 |
| Instructors: Gordon B Forbes (P) |
| Statistical Meth.in Behav.Sci. - 31981 - PS 201 - 02 |
| Instructors: Gordon B Forbes (P) |
| Developmental and QR Mathematics Courses Fall 04 |
| Basic Algebra - 10455 - MA 100 - 01 |
| Instructors: Carol L Sudduth (P) |
| Basic Algebra - 10456 - MA 100 - 02 |
| Instructors: Willard A Brown (P) |
| Basic Algebra - 11510 - MA 100 - 03 |
| Instructors: Willard A Brown (P) |
| Basic Algebra - 12488 - MA 100 - 04 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 10457 - MA 106 - 01 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 10458 - MA 106 - 02 |
| Instructors: James Daniel Foster (P) |
| Intermediate Algebra - 10780 - MA 106 - 03 |
| Instructors: Carol L Sudduth (P) |

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| Intermediate Algebra - 11071 - MA 106 - 04 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 11511 - MA 106 - 05 |
| Instructors: James Daniel Foster (P) |
| Intermediate Algebra - 12489 - MA 106 - 06 |
| Instructors: Michael L Fearheiley (P) |
| Math Content for Elem Teacher - 10460 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Functions - 12247 - MA 114 - 01 |
| Instructors: Daniel Miller (P) |
| Elem Prob and Statistics - 10464 - MA 120 - 01 |
| Instructors: Randal S Beck (P) |
| Elem Prob and Statistics - 11817 - MA 120 - 02 |
| Instructors: Randal S Beck (P) |
| Elem Prob and Statistics - 12249 - MA 120 - 04 |
| Instructors: Carolyn V Likins (P) |
| Elem Prob and Statistics - 10779 - MA 120 - 05 |
| Instructors: Carolyn V Likins (P) |
| Math in the World - 11497 - MA 125 - 01 |
| Instructors: James V Rauff (P) |
| Math in the World - 12251 - MA 125 - 02 |
| Instructors: James V Rauff (P) |
| Calculus I - 10468 - MA 140 - 01 |
| Instructors: James Daniel Foster (P) |
| Calculus I - 10470 - MA 140 - 02 |
| Instructors: James Daniel Foster (P) |
| Statistical Meth.- Behav. Sci. - 10006 - PS 201 - 01 |

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|---|
| Instructors: Rebecca L Jobe (P) |
| Statistical Meth.- Behav. Sci. - 10007 - PS 201 - 02 |
| Instructors: Rebecca L Jobe (P) |
| Developmental and QR Mathematics Courses SP 05 |
| Basic Algebra - 30539 - MA 100 - 01 |
| Instructors: Carol L Sudduth (P) |
| Basic Algebra - 32863 - MA 100 - 02 |
| Instructors: Willard A Brown (P) |
| Intermediate Algebra - 30521 - MA 106 - 01 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 31075 - MA 106 - 02 |
| Intermediate Algebra - 31075 - MA 106 - 02 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 32020 - MA 106 - 03 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 33290 - MA 106 - 04 |
| Instructors: Carol L Sudduth (P) |
| Math Content for Elem Teacher - 32023 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Functions - 33021 - MA 114 - 01 |
| Instructors: Daniel Miller (P) |
| Elem Prob and Statistics - 30524 - MA 120 - 02 |
| Instructors: Randal S Beck (P) |
| Elem Prob and Statistics - 30525 - MA 120 - 03 |
| Instructors: Randal S Beck (P) |
| Elem Prob and Statistics - 30532 - MA 120 - 04 |
| Instructors: Carolyn V Likins (P) |

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|---|
| Elem Prob and Statistics - 32028 - MA 120 - 05 |
| Instructors: Michael L Fearheiley (P) |
| Math in the World - 32596 - MA 125 - 01 |
| Instructors: James Daniel Foster (P) |
| Math in the World - 33022 - MA 125 - 02 |
| Instructors: James Daniel Foster (P) |
| Calculus I - 30530 - MA 140 - 01 |
| Instructors: James Daniel Foster (P) |
| Critical Thinking: Logic - 32594 - PH 213 - 01 |
| Instructors: Jo Ellen Jacobs (P) |
| Statistical Methods - 30481 - PS 201 - 01 |
| Instructors: Rebecca L Jobe (P) |
| Statistical Methods - 31981 - PS 201 - 02 |
| Instructors: Rebecca L Jobe (P) |
| Developmental and QR Mathematics Courses Fall 05 |
| Basic Algebra - 10455 - MA 100 - 01 |
| Instructors: Carol L Sudduth (P) |
| Basic Algebra - 10456 - MA 100 - 02 |
| Instructors: Willard A Brown (P) |
| Basic Algebra - 11510 - MA 100 - 03 |
| Instructors: Willard A Brown (P) |
| Basic Algebra - 12488 - MA 100 - 04 |
| Instructors: Carol L Sudduth (P) |
| Intermediate Algebra - 10457 - MA 106 - 01 |
| Instructors: James Daniel Foster (P) |
| Intermediate Algebra - 10458 - MA 106 - 02 |
| Instructors: James Daniel Foster (P) |

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|---|
| Intermediate Algebra - 10780 - MA 106 - 03 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 11071 - MA 106 - 04 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 13009 - MA 106 - 05 |
| Instructors: Charles Larry Songer (P) |
| Intermediate Algebra - 13010 - MA 106 - 06 |
| Instructors: Charles Larry Songer (P) |
| Functions - 12247 - MA 114 - 01 |
| Instructors: Daniel Miller (P) |
| Functions - 13078 - MA 114 - 19 |
| Instructors: Daniel Miller (P) |
| Elem Prob and Statistics - 10464 - MA 120 - 01 |
| Instructors: Charles Larry Songer (P) |
| Elem Prob and Statistics - 11817 - MA 120 - 02 |
| Instructors: Charles Larry Songer (P) |
| Elem Prob and Statistics - 12705 - MA 120 - 03 |
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 12249 - MA 120 - 04 |
| Instructors: Michael L Fearheiley (P) |
| Math in the World - 11497 - MA 125 - 01 |
| Instructors: James V Rauff (P) |
| Math in the World - 12251 - MA 125 - 02 |
| Instructors: James V Rauff (P) |
| Calculus I - 10468 - MA 140 - 01 |
| Instructors: James Daniel Foster (P) |
| Calculus I - 10470 - MA 140 - 02 |

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|---|
| Instructors: James Daniel Foster (P) |
| Statistical Meth.- Behav. Sci. - 10006 - PS 201 - 01 |
| Instructors: Linda L Collinsworth (P) |
| Statistical Meth.- Behav. Sci. - 10007 - PS 201 - 02 |
| Instructors: Linda L Collinsworth (P) |
| Developmental and QR Mathematics Courses Spring 06 |
| Basic Algebra - 30539 - MA 100 - 01 |
| Instructors: Carol L Sudduth (P) |
| Basic Algebra - 32863 - MA 100 - 02 |
| Instructors: Willard A Brown (P) |
| Intermediate Algebra - 30521 - MA 106 - 01 |
| Instructors: Carol L Sudduth (P) |
| Intermediate Algebra - 31075 - MA 106 - 02 |
| Instructors: Daniel Miller (P) |
| Intermediate Algebra - 32020 - MA 106 - 03 |
| Instructors: Michael L Fearheiley (P) |
| Intermediate Algebra - 33290 - MA 106 - 04 |
| Instructors: Michael L Fearheiley (P) |
| Math Content for Elem Teacher - 32023 - MA 112 - 01 |
| Instructors: Daniel Miller (P) |
| Functions - 33021 - MA 114 - 01 |
| Instructors: Daniel Miller (P) |
| Elem Prob and Statistics - 33446 - MA 120 - 01 |
| Instructors: Randal S Beck (P) |
| Elem Prob and Statistics - 30524 - MA 120 - 02 |
| Instructors: Randal S Beck (P) |
| Elem Prob and Statistics - 30525 - MA 120 - 03 |

| |
|---|
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 30532 - MA 120 - 04 |
| Instructors: Michael L Fearheiley (P) |
| Elem Prob and Statistics - 32028 - MA 120 - 05 |
| Instructors: Charles Larry Songer (P) |
| Math in the World - 32596 - MA 125 - 01 |
| Instructors: James Daniel Foster (P) |
| Math in the World - 33022 - MA 125 - 02 |
| Instructors: James Daniel Foster (P) |
| Calculus I - 30530 - MA 140 - 01 |
| Instructors: James Daniel Foster (P) |
| Logic - 32594 - PH 213 - 01 |
| Instructors: Jo Ellen Jacobs (P) |
| Statistical Methods - 30481 - PS 201 - 01 |
| Instructors: Linda L Collinsworth (P) |
| Statistical Methods - 31981 - PS 201 - 02 |
| Instructors: Linda L Collinsworth (P) |

Attachment 3
Student letter

**Math Compass**
**The Millikin University Math Placement Test**

Let us first extend a warm welcome from the faculty, staff, and students of the mathematics department at Millikin University. We are delighted that you have chosen Millikin for your undergraduate studies. You shall soon receive a copy of the University Bulletin which provides a detailed listing of the departments, course offerings, and graduation requirements. This booklet provides an overview of the academic programs at the university and will be helpful to you in planning your academic studies. You should take a few minutes to familiarize yourself with the contents of this bulletin.

Our primary purpose here is to alert you to the university's placement testing for entering freshmen. Millikin University's graduation requirements, listed on pages 20-22 of the bulletin, include a minimum of 3 semester hours in quantitative reasoning (mathematics). The university uses an American College Testing (ACT) exam known as "Compass" to determine each freshman's initial placement level within the mathematics curriculum. You can look forward to taking this test during freshman orientation.

ACT's Compass placement platform consists of two components, MathPass, and WritePass. Your math placement level is assigned using MathPass. The results of the test are used to assign students a placement level of 1 to 5. Placement levels 3 to 5 indicate a student is prepared for college level mathematics. The placement levels correspond to the following five conceptual areas of mathematics: (1) Numerical skills/Pre-algebra; (2) high school or introductory algebra; (3) college algebra; (4) geometry; and (5) trigonometry. A student must receive a placement of 3 to enroll in a course that will satisfy the university's quantitative reasoning requirement.

The test is administered at one of the university's computer labs. Each student is assigned a terminal for testing. Students may use a personal calculator, pen or pencil, and blank scratch paper during the test. A calculator is embedded within the test (standard Windows calculator) if you prefer. If you choose to use the standard Windows calculator, you should familiarize yourself with its function prior to the test. The process begins with collection of biographical information on the test taker. This is followed by brief instructions on use of the computer mouse and how to mark and alter the multiple choice response. Finally, the test begins. There is no time limit on the test, but you must answer the current question before you can move to the next.

All students start with questions from level 1. MathPass evaluates the correctness of your responses and automatically advances to the next level when the minimum proficiency for the current level is satisfied. Repeated incorrect answers result in failure to advance and the student being assigned placement at that current level. To achieve a level 3 placement a student needs a minimum score of 60 percent at level 2 (introductory algebra) and 5 percent at level 3 (college algebra). Students that have taken math through high school algebra II should be able to achieve a level 3 placement.
A brief review of the topics within each level follows. A pool of at least twenty questions was developed for each of the five levels. You will encounter only a sampling of the questions in any pool when taking the test. The questions within each placement pool are divided into content areas. The listing below gives the percent of question devoted to each content area. You are more likely to encounter questions for content areas that have larger percentage representations within the pool. The major concept areas and percentage of the placement level pools are shown below followed by a few sample problems.

Numerical skills/Pre-algebra: Placement level 1

| Content Area | Percent |
|---|---|
| Basic operations with integers | 16 |
| Basic operations with fractions | 17 |
| Basic operations with decimals | 14 |

| | |
|---|---|
| Exponents, square roots, and scientific notation | 13 |
| Percentages | 15 |
| Averages (means, medians, and modes) | 9 |
| Ratios and proportions | 8 |
| Multiples and factors of integers | 2 |
| Absolute values of numbers | 2 |
| Counting problems and simple probability, range, conversions between fractions and decimals, order concepts (e.g., less than), estimation skills, and number theory | 4 |

Sample Problems:

(Basic operations with fractions)

1. How many yards of material from a 24-yard length of cloth remain after 3 pieces, each 3½ yards long, and 5 pieces, each 2¼ yards long, are removed?
   A. 2¼
   B. 4¼
   C. $4^5/_6$
   D. 10¼
   E. $10^5/_6$

Answer: Total length (24 yards) – sum of the lengths of the pieces removed (3x3½ + 5x2¼) = 24 – (3x3½ + 5x2¼) = 24 – (10½ + 11¼) = 24 - 21¾ = 2¼

(Basic operations with decimals)

2. Ben is making wooden toys for the next arts and crafts sale. Each toy costs Ben $1.80 to make. If he sells the toys for $3.00 each, how many will he have to sell to make a profit of exactly $36.00?
   A. 12
   B. 20
   C. 30
   D. 60
   E. 108

Answer: Profit ($36.00) = Number of toys sold (n) x (sale price ($3.00) – cost ($1.80))
Number of toys sold (n) = Profit ÷ (sale price – cost)
= $36.00 ÷ ($3.00 - $1.80) = $36.00 ÷ $1.20 = 30

(Percentages)

3. Phillip charged $400 worth of goods on his credit card. On his first bill, he was not charged any interest, and he made a payment of $20. He then charged another $18 worth of goods. On his second bill a month later, he was charged 2% interest on his entire unpaid balance. How much interest was Phillip charged on his second bill?
   A. $8.76
   B. $7.96
   C. $7.60
   D. $7.24
   E. $6.63

Answer: Interest charge = (Interest rate ÷ 100) x (unpaid balance)
Unpaid balance = Sum of charges ($400 + $18) – payment ($20) = $398
Interest charge = (2% ÷ 100) x $398 = $7.96

(Averages: Means, Medians, and Modes)

4. What is the average (arithmetic mean) of 8, 7, 7, 5, 3, 2, and 2?
   A. $3^4/_7$
   B. $4^5/_6$
   C. $4^6/_7$

D. 5
E. $6^4/_5$

Answer: Arithmetic mean = sum of values ÷ number (count) of values
Arithmetic mean = (8 + 7 + 7 + 5 + 3 + 2 +2) ÷ 7 = 34 ÷ 7 = $4^6/_7$

(Exponents, Roots, and Scientific Notation) – Numbers expressed as multiples or roots of themselves are said to be in *exponential form*. The number $8^3$ means the same as (8x8x8). We can interpret this to mean that $8^{1\ =}$ 8 and that ($8^1$x$8^1$x$8^1$) = $8^{(1+1+1)}$ = $8^3$ . In similar fashion, $8^3 \div 8^2$ is the same as (8x8x8)÷(8x8) = 8 or $8^{(3-2)}$. A fractional exponent, as in the number $8^{1/2}$, is taken to mean the inverse operation of multiplying a number times itself. Thus, $8^{1/2}$ means the same as the square root of 8, or √8. That is to say, what number when squared equals 8 (i.e., find *x* such that $x^2 = 8$). Finally, consider the number $8^{3/2}$, which can be expressed as either (8x$8^{1/2}$) or ($8^{1/2}$)$^3$. Such fractional exponents can be simplified using addition of fractions [(1 + ½) = 3/2] or factoring of the exponent [½ x 3 = 3/2]. Scientific notation simply combines exponential notation (i.e., $10^x$) and multiplication with a decimal (e.g., 1.23x$10^5$) as a means for conveniently expressing very small or large numbers. Even complex exponential functions can be readily solved with a hand held calculator if you take a moment to simplify the function using these rules.

(Ratios and proportions)
5. A boy in a fashion design contest made a shirt for himself and a proportional one for a small doll. The boy was 5 feet 5 inches tall, and the doll was 13 inches tall. If the boys shirt sleeve was 30 inches long, how long, in inches, was the sleeve of the dolls shirt?
   A. $28\ ^1/_6$
   B. 17
   C. 15
   D. $7\ ^1/_{11}$
   E. 6

Answer: The boy's height of 5 feet 5 inches is equal to 65 inches. If boy and doll are proportional, then 13 / 65 = (doll's shirt sleeve length) / 30 in inches. Therefore,
doll's shirt sleeve (inches) = 30 (13 / 65) = 6 inches

Algebra: Placement level 2

| Content Area | Percent |
|---|---|
| **Elementary Algebra** | **57** |
| Linear equations in one variable | 16 |
| Substituting values into algebraic equations | 7 |
| Setting up equations for given situations | 7 |
| Basic operations with polynomials | 7 |
| Factoring polynomials | 7 |
| Exponents and radicals | 5 |
| Solving polynomial equations by factoring | 3 |
| Formula manipulation and field axioms | 2 |
| Linear equations in one variable | 1 |
| **Intermediate Algebra** | **15** |
| Rational expressions | 7 |
| Exponents and radicals | 5 |
| Systems of linear equations in two variables | 2 |
| Quadratic formulas, absolute value equations and inequalities | 1 |
| **Coordinate Geometry** | **27** |
| Linear equations in two variables | 13 |
| Graphing relations in the plane | 4 |
| Distance formulas in the plane | 3 |
| Graphing conics (circle, parabola, etc.) | 3 |
| Graphing parallel lines | 1 |

Algebra (continued):

| Content Area | Percent |
|---|---|
| Graphing perpendicular lines | 1 |
| Graphing systems of equations and rational Functions | 1 |
| Midpoint formulas | <1 |

Sample Problems

Elementary Algebra: Linear Equations in one variable)

1. A student has earned scores of 87, 81, and 88 on the first 3 of 4 tests. If the student wants and average (arithmetic mean) of exactly 87, what score must she earn on the fourth test?
   A. 85
   B. 86
   C. 87
   D. 92
   E. 93

Answer: Arithmetic mean = $(87 + 81 + 88 + x) \div 4 = 87$
$x = 4 \times 87 - (87 + 81 + 88) = 348 - 256) = 92$

2. A certain school's enrolment increased 5% this year over last year's enrollment. If the school now has 1,260 students enrolled, how many students were enrolled last year?
   A. 1,020
   B. 1,155
   C. 1,200
   D. 1,255
   E. 1,323

Answer: The current year's enrollment is 105% of last year's enrollment. Therefore,
(105/100) Last year's enrollment = 1260
Last year's enrollment = 100 (1260) / 105 = 1200 students

(Elementary Algebra: Basic Operations with Polynomials)

3. Which of the following expressions represents the product of 3 less than twice $x$ and 2 more than the quantity 3 times $x$?
   A. $-6x^2 + 25x + 6$
   B. $6x^2 + 5x + 6$
   C. $6x^2 - 5x + 6$
   D. $6x^2 - 5x - 6$
   E. $6x^2 - 13x - 6$

Answer: $f(x) = (2x - 3)(3x + 2)$ where,
$(2x - 3) = 3$ less than twice $x$, and
$(3x + 2) = 2$ more than the quantity 3 times $x$.

$(2x - 3)(3x + 2) = 6x^2 - 9x + 4x - 6 = 6x^2 - 5x - 6$

(Elementary Algebra: Substituting Values into Algebraic Expressions)

3. If $x = -1$ and $y = 2$, what is the value of the expression $2x^3 - 3xy$?
   A. 8
   B. 4
   C. -1
   D. -4
   E. -8

Answer: Given (-1, 2): $2x^3 - 3xy = 2(-1)^3 - 3(-1)(2) = -2 + 6 = +4$

(Setting up Equations for Given Situations)

4. A person travels $x$ miles in $y$ hours and then 10 miles in 2 hours. Which expression represents the person's average rate, in miles per hour, for the entire distance traveled?
   A. $(x + 10) / (y + 2)$
   B. $(x + 10) / 2y$
   C. $(x + 10) / 2$
   D. $(x + y) / 20$
   E. $10x / 2y$

Answer: The average rate of travel is just the total distance traveled divided by the total time spent traveling. Therefore, the average rate is:
$(x + 10)$ miles / $(y + 2)$ hours

(Intermediate Algebra: Rational Expressions)

5. For all $r \neq \pm 2$, $(r^2 - 5r + 6) / (r^2 - 4) = ?$
   A. $(r - 3) / (r + 2)$
   B. $(r - 2) / (r + 2)$
   C. $(r - 2) / (r + 3)$
   D. $(r + 3) / (r - 2)$
   E. $(r + 3) / (r + 2)$

Answer: $(r^2 - 5r + 6) = (r - 2)(r - 3)$; $(r^2 - 4) = (r - 2)(r + 2)$
$(r^2 - 5r + 6) / (r^2 - 4) = (r - 2)(r - 3) / (r - 2)(r + 2) = (r - 3) / (r + 2)$

6. A rectangle has an area of $(21s^2 + 18st)$ square meters. If its width is $3s$ meters, what is its length in meters?
   A. $7s + 6t$
   B. $7s + 18st$
   C. $18s + 15t$
   D. $24s^3 + 21s^2t$
   E. $36s^3 + 54s^2t$

Answer: Given the area of a rectangle = length($l$) x width($w$), we have
$21s^2 + 18st = l \times w = l \times 3s$, therefore,
$l = (21s^2 + 18st) / 3s = 7s + 6t$

(Coordinate Geometry: Linear Equations in Two Variables)

7. What is the equation of the line that contains the points with $(x, y)$ coordinates (-3, 7) and (5, -1)?
   A. $y = 3x - 2$
   B. $y = x + 10$
   C. $y = -\frac{1}{3}x + 8$
   D. $y = -\frac{3}{2}x + \frac{11}{4}$
   E. $y = -x + 4$

Answer: A linear equation can be expressed as: $y = mx + b$; where
$m = (y_2 - y_1) / (x_2 - x_1) = (-1 - 7) / (5 - (-3)) = (-8) / (8) = -1$
$b = y - mx = 7 - (-1)(-3) = -1 - (-1)(5) = 4$
therefore, $y = -x + 4$

College Algebra: Placement level 3

| Content Area | Percent |
|---|---|
| Functions | 40 |
| Exponents | 25 |
| Complex numbers | 15 |
| Arithmetic and geometric sequences and series | 7 |
| Factorials | 6 |

| | |
|---|---|
| Matrices (basic operations, equations, and determinants) | 3 |
| Roots of polynomials | 2 |
| Systems of linear equations in three or more variables | 1 |
| Logic and proof techniques | 1 |

Sample Problems

(Functions)

1. I $f(4) = 0$ and $f(6) = 6$, which of the following could represent $f(x)$?
   A. $^2/_3\,x - 4$
   B. $x + 2$
   C. $x - 4$
   D. $^3/_2\,x + 6$
   E. $3x - 12$

Answer: Solve by substitution and evaluation.
For $x = 4$; $x - 4 = 4 - 4 = 0$, and $3x - 12 = 3(4) - 12 = 0$
For $x = 6$; $x - 4 = 6 - 4 = 2$ and $3x - 12 = 3(6) - 12 = 6$

(Complex Numbers)

2. For $i = \sqrt{-1}$, if $3i\,(2 + 5i) = x + 6i$, then $x$ =?
   A. -15
   B. 5
   C. $5i$
   D. $15i$
   E. $27i$

Answer: Expand the left-hand side and rearrange to isolate $x$.
$3i\,(2 + 5i) = 6i + 15i^2 = x + 6i$
Therefore, $x = 15i^2 = 15\,(\sqrt{-1})^2 = -15$

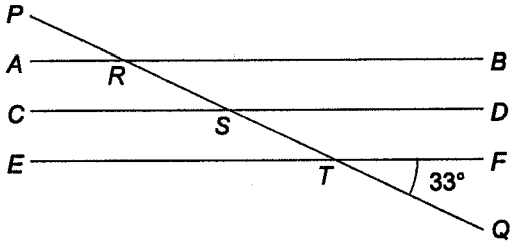
Geometry: Placement level 4

| Content Area | Percent |
|---|---|
| Triangles (perimeter, area, Pythagorean theorem, etc.) | 58 |
| Circles (perimeter, area, arcs, etc.) | 15 |
| Angles (supplementary, complementarty, Adjacent, vertical, etc.) | 12 |
| Rectangles (perimeter, area, etc.) | 4 |
| Three-dimensional concepts | 4 |
| Hybrid (composite) shapes | 4 |
| Trapezoids | 2 |
| Parallelograms | <1 |
| Logic and proof techniques | <1 |

Sample Problems

(Angles)

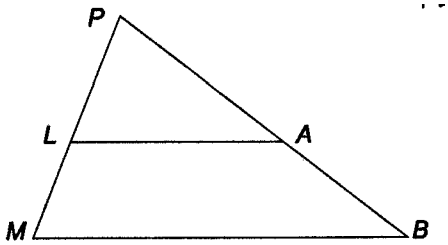
1. In the figure below AB, CD, and EF are parallel, and PQ intersects all 3 lines at points R, S, and T, respectively. If the measure of ∠QTF is 33°, what is the measure of ∠PRB?
   A. 33°
   B. 57°
   C. 66°
   D. 123°
   E. 147°



Answer: The intersection of two parallel lines by a third line results in congruent angles.
Therefore, ∠QTF and ∠PRA are congruent and ∠PRA = 33°
∠PRB and ∠PRA are supplementary, therefore, ∠PRB = 180 - ∠PRA
∠PRB = 180° - 33° = 147°

(Triangles)

2. In ∆MPB below, LA ‖ MB. If PL / LM = 5/3, then PB / PA = ?
   A. 5/8
   B. 2/3
   C. 8/5
   D. 5/3
   E. 8/3




Answer: ∆MPB and ∆LPA are similar triangles. Therefore, PL / PM = PA / PB.
If PL / LM = 5/3, then PL / PM = 5/(5+3) = 5/8. Therefore, PB / PA = 8/5.

Trigonometry: Placement level 5

| Content Area | Percent |
|---|---|
| Trigonometric functions and identities | 35 |
| Right-triangle trigonometry | 27 |
| Graphs of trigonometric functions | 20 |
| Trigonometric equations and inequalities | 10 |
| Special angles (multiples of 30 and 45 degrees) | 8 |
| Polar coordinates | <1 |

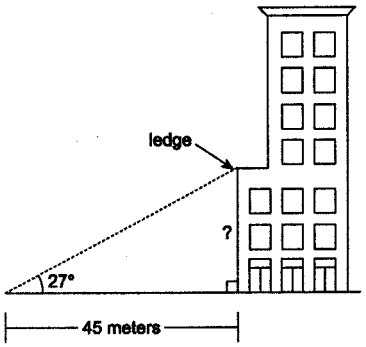
Sample Problems

(Trigonometric Functions and Identities)

1. Which of the following is equivalent to $(1-\cos^2\theta) / \cos^2\theta$?
   A. $\sec^2\theta$
   B. $(\csc^2\theta) - 1$
   C. $\tan^2\theta$
   D. $\sin^2\theta$
   E. $-1 / \sin^2\theta$

Answer: The trigonometric identity: $\sin^2\theta + \cos^2\theta = 1$ can be used to evaluate this expression. Substituting $\sin^2\theta + \cos^2\theta$ for 1 results in the following.
$(\sin^2\theta + \cos^2\theta - \cos^2\theta) / \cos^2\theta = \sin^2\theta / \cos^2\theta = \tan^2\theta$

2. From a point on the ground the angle of elevation to a ledge on a building is 27°, and he distance to the base of the building is 45 meters. High many meters high is the ledge?
   A. 45 / sin 27°
   B. 45 / tan 27°
   C. 45 sin 27°
   D. 45 cos 27°
   E. 45 tan 27°




Just a final reminder, the test is not timed. So take all the time you need to answer the questions. If you choose to study for Math Compass, place your emphasis on those content areas that have the largest percentage representation in each placement level. Good luck.