ACCUPLACER
Sample Placement Test

PLACEMENT TESTING SCHEDULE	Other Locations

Photo identification must be presented before taking the test. The following forms of ID are accepted:

College ID (w/name & photo)	Driver's License
Maryland MVA ID card	Employer's ID (w/name & photo)
Passport or Naturalization Certificate	Military ID
Employment Authorization Card	Permanent Resident Card

All Students Must Submit an Application to the College

All students taking the Placement Test must be admitted to the College and must have their college-assigned student identification number with them when they arrive at the Testing Center

How Long Will It Take to Finish The Tests?

The Placement Test is not timed when administered at the Largo Campus (some extension centers have time limits due to space and staffing restraints). Students may take as long as necessary to complete each section of the test. Since each student works at his/her own pace, it is impossible to determine exactly how long a test session will take. However, the following estimates may help you plan your time. Tests will not necessarily be given in the same order as listed below.

If you have a disability that requires special test taking assistance (ex. Reader/Scribe service), please call the Disability Support Services Office at 301-546-0838 (TTY or TDD: 301-546-0122) at least one week in advance to request accommodation. If English is not your primary spoken and written language, you should request a different sample test booklet, which will prepare you for the test administered to non-native English speakers.

TESTING ACTIVITY	ESTIMATED TIME
Identification, background questions, and directions	15 Minutes
Reading Comprehension (20 Questions)	30 Minutes
Sentence Skills (20 Questions)	30 Minutes
VERBAL SUBTOTAL: 1 hour, 15 minutes	
* Arithmetic Skills (17 Questions)	30 Minutes
* Elementary Algebra (12 Questions)	40 Minutes
* College-level Mathematics (20 Questions)	45 Minutes
MATH SUBTOTAL: 1 hour, 10 minutes	

Total Average Estimated Testing Time: 2 - 2½ hours
* No more than two math tests can be taken during a testing session.

Which Test Do You Need to Take?

While most students born in the United States will take a computerized placement test known as ACCUPLACER, some students will instead be required to take the Michigan Test of English Language Proficiency - a test designed for non-native English speakers. To determine whether ACCUPLACER or The Michigan Test is the most appropriate placement test for you, please answer the following questions:

1. Are you a native of the United States OR one of the following countries?

Antigua & Barbuda	Cayman Islands	New Zealand
Australia	Commonwealth of Dominica	St. Kitts & Nevis
Bahamas	Grenada	St. Lucia
Barbados	Guyana	St. Vincent & Grenadines
Belize	Ireland	Trinidad & Tobago
Bermuda	Jamaica	United Kingdom
Canada	Montserrat	Virgin Islands

2. Did you attend Middle School and High School in the United States?

If you answered NO to both questions 1 and 2, you will probably be required to take the Michigan Test of English Language Proficiency and should request a different Sample Test. This Sample Test is designed to prepare students for the ACCUPLACER Placement Tests. If you answered YES to either question, you will take the ACCUPLACER English skills placement tests. The ACCUPLACER test is used for all placements in mathematics courses.

<u>Testing Requirements</u>

The Placement Test is required of all new students applying for admission to the college. If you have earned credit at a U.S. college or university or from one of the countries listed above, you should discuss your educational background with an academic advisor before taking any placement tests.

<u>If you took the SAT or ACT, do you still have to take the placement test?</u>

If you obtained a score of 480 or higher on the Evidence-Based Reading and Writing section or 530 or higher on the Math section of the SAT, then you may present your original report to Student Assessment Services to obtain a waiver for that test area (after being admitted to the College). If you took the ACT, a score of 21 or higher is required on the Reading, English, or Mathematics sections. Scores older than **2 years** from when you took the test **will not** be accepted

<u>Test Purpose</u>

The Placement Test is not an admissions test. No student is denied admissions to the College on the basis of Placement Test scores. The test serves four primary purposes:
1. To evaluate the Reading, English, and Mathematics achievement of entering students for the purpose of appropriate course placement.
2. To provide a basis for academic and career counseling.
3. To provide criteria on which to evaluate the initial admissions eligibility to Allied Health programs.
4. To identify potential Honors Program candidates.

<u>Test Preparation</u>

Students are advised to take the test seriously. Performance on the Placement Test will determine which college courses a student may or may not take. Non-credit, developmental courses may be required for students who earn scores below the standards set for college-level courses. Accordingly, students are encouraged to prepare as follows:
- Read through this entire publication so that the instructions received on the day of testing will be familiar.
- Eat well and get sufficient rest prior to taking the placement test.
- Visit a library or bookstore to obtain other publications (a textbook on elementary algebra, college math, etc.) which will help you review material you may have forgotten.

<u>What to bring with you to the testing center</u>

1. Photo-bearing Identification (see list on first page of this Sample Test booklet).
2. A single quarter (US 25 cent coin) to lock your belongings in the locker room. The quarter is returned upon leaving the testing center.
3. PGCC-assigned student identification number
4. Writing instruments, like pens and pencils.

<u>DO NOT bring any of the following:</u>

- Mobile phones, calculators, smart watches, music players, or any other electronic devices are NOT ALLOWED. The testing center has lockers for you to store them, that cost one quarter (US 25 cent coin).
- Children/friends/family are not permitted in the testing room and college staff cannot be responsible for the safety of children.

Placement Test Overview

The Placement Test is taken using a personal computer. The test questions appear on a screen, and students answer the questions using a computer keyboard and mouse.

Because the placement test utilizes *computer adaptive testing* techniques, each section has fewer questions than traditional paper and pencil tests. The questions will appear one at a time on the computer screen. All ACCUPLACER questions are multiple-choice and all you will need to do is use the mouse to select the desired answer. After you select and confirm your answer, a new screen will appear with the next question.

Important Information Concerning *Computer Adaptive Testing*

The difficulty of items is adjusted based on your performance on earlier questions.

Although each student will have the same number of questions in each section, the computer will select which questions to include in the test. The selection process is conducted while the test is in progress, and is determined by the student's answer to the previous question. Once the student incorrectly answers a series of questions of a certain difficulty level, the computer will start to present questions of lesser difficulty. This technique "zeroes-in" on just the right questions without administering a test that is too easy or difficult.

The correctness of your answer to the *first* question is very important.

Since the computer starts branching to questions of higher or lower difficulty levels immediately after the first question, it is important that you take your time when answering the first question. If you can answer the first question correctly you will have a better chance of taking a test that is sufficiently challenging.

You cannot go back to earlier questions

Unlike paper and pencil tests, you cannot review your test by going back to previous questions. Once you have confirmed your answer to a question, you may not go back later to change your answer. Consequently, it is advantageous to take your time as you proceed through the test.

You may not skip a question

Although the computer will allow you to change your answer to a particular question before proceeding, you **must** answer the question before you will be allowed to move to the next question. If you do not know the answer to a question, try to eliminate one or more of the choices. Then pick one of the remaining choices. **There is no penalty for guessing.**

Retest Policy: How many times can you take the Placement Tests?

1. **Placement tests may not be taken more than two times during a two year period.** You are encouraged to take the placement test for a second time if the results from the first test indicate a need for developmental courses, or if the first test results do not meet your personal expectations. If you decide to retest, the higher score from either test will be used for placement. However, a third test attempt will not be allowed until two years have passed since the second.

2. **No placement test can be taken after you enroll in a course or sequence considered to be preparatory in nature (ex. Developmental Studies, ESL courses.)**

Once you enroll in any course considered to be preparatory in nature, you will be expected to demonstrate achievement in the subject area by passing the course or course sequence in which you were placed. Placement tests cannot be used as a substitute for passing the preparatory course(s).

Test Descriptions

Reading Comprehension

There are 20 questions of two primary types on the Reading Comprehension test.

  ➢ The first type consists of a reading passage followed by a question based on the text. Both short and long passages are provided. The reading passages can also be classified according to the kind of information processing required including explicit statements related to the main idea, explicit statements related to a secondary idea, application, and inference.

  ➢ The second type of question, sentence relationships, presents two sentences followed by a question about the relationship between these two sentences. The question may ask, for example, if the statement in the second sentence supports that in the first, if it contradicts it, or if it repeats the same information.

Sentence Skills

There are 20 Sentence Skills questions of two types.

  ➢ The first type is **sentence correction** questions that require an understanding of sentence structure. These questions ask you to choose the most appropriate word or phrase to substitute for the underlined portion of the sentence.

  ➢ The second type is **construction shift** questions. These questions ask that a sentence be rewritten according to the criteria shown while maintaining essentially the same meaning as the original sentence.

  ➢ Within these two primary categories, the questions are also classified according to the skills being tested. Some questions deal with the logic of the sentence, others with whether or not the answer is a complete sentence, and still others with the relationship between coordination and subordination.

Writing Sample

Students wishing to appeal their English placement after two test attempts may complete a Writing Sample (sometimes called a Challenge Essay). It will be reviewed and evaluated by at least two English department faculty to determine whether a student's placement can be improved.

Students will be presented with choice of three topics from which they will select one for their essay. The essay may be typed on the computer, or it may be printed on essay paper (provided).

Students are encouraged to construct an outline or rough draft prior to typing or printing their final copy. Ideas presented in the essay should be supported by specific evidence such as details, facts, examples, or reasons. All essays must have an introduction, a solid thesis with support, and a conclusion.

Arithmetic

This test measures your ability to perform basic arithmetic operations and to solve problems that involve fundamental arithmetic concepts. There are 17 questions on the Arithmetic tests divided into three types.

  ➢ Operations with whole numbers and fractions: topics included in this category are addition, subtraction, multiplication, division, recognizing equivalent fractions and mixed numbers, and estimating.

  ➢ Operations with decimals and percents: topics include addition, subtraction, multiplication, and division with decimals. Percent problems, recognition of decimals, fraction and percent equivalencies, and problems involving estimation are also given.

  ➢ Applications and problem solving: topics include rate, percent, and measurement problems, simple geometry problems, and distribution of a quantity into its fractional parts.

Elementary Algebra

A total of 12 questions are administered in this test.

- ➤ The first type involves operations and computation with positive and negative integers and rational numbers, the use of absolute values, and ordering.

- ➤ The second type involves operations with algebraic expressions using evaluation of simple formulas and expressions. Questions include adding, subtracting, multiplying and dividing monomials and polynomials. Questions may also involve the evaluation of positive rational roots and exponents, simplifying algebraic fractions, and factoring.

- ➤ The third type of question involves the solution of equations, inequalities, and word problems. Questions involve solving linear equations and inequalities, solving quadratic equations by factoring, solving verbal problems presented in an algebraic context (including geometric reasoning and graphing), and the translation of written phrases into algebraic expressions.

College-Level Mathematics

There are 20 questions on the College-Level Mathematics.

The College-Level Mathematics test assesses from intermediate algebra through pre-calculus.

- ➤ Algebraic operations include simplifying rational algebraic expressions, factoring, expanding polynomials, and manipulating roots and exponents.

- ➤ Solutions of equations and inequalities include the solution of linear and quadratic equations and inequalities, equation systems and other algebraic equations.

- ➤ Coordinate geometry includes plane geometry, the coordinate plane, straight lines, conics, sets of points in the plane, and graphs of algebraic functions.

- ➤ Applications and other algebra topics ask about complex numbers, series and sequences, determinants, permutations and combinations, fractions, and word problems.

- ➤ The last category, functions and trigonometry, presents questions about polynomial, algebraic, exponential, logarithmic, and trigonometric functions.

NOTICE

The following sample tests are designed to allow students an opportunity to experience the types of questions which can be expected on the day of testing. It is generally useful for students to review sample questions so that they will have a basis for developing test-taking strategies **before** the day of testing.

The actual test will contain more questions than the ones present on the following pages, and will contain questions which some students may find more difficult than the ones included here.

The math sample questions are representative of the types of questions presented on the tests. However, the actual tests will be presented in a **multiple-choice** format.

The sample test is **NOT** designed as a tutorial exercise. If you have questions about solving various problems in the practice test, please **DO NOT** call the Testing Center. You may receive tutoring from a friend or other acquaintance, or visit the library for resource material.

Sample questions are shown for each of the placement tests. **The correct answers are shown at the end of each section.**

Sample Questions for Reading Comprehension

Directions: Two underlined sentences are followed by a question or statement about them. Read each pair of sentences and then choose the best completion of the statement.

1. Managers need to listen to the different ways different groups communicate.

    Managers also need to respect the ways and values of ethnic groups.

    What does the second sentence do?
    A) It gives the main idea.
    B) It gives a major supporting detail.
    C) It gives a minor supporting detail.
    D) It gives a conclusion.

2. Japanese food is on the whole superb, one of the adornments of the culture.

    Merely by eating it one begins to feel part of a society that is frugal, competitive, and keen-edged.

    The relationship between the two sentences is best described as
    A) time.
    B) contrast.
    C) comparison.
    D) cause-effect.

3. Another important role of peer groups is to give kids a sense of identity.

    From their friends, teens learn who they are in relation to other kids around them.

    What does the second sentence do?
    A) It gives the main idea.
    B) It gives a major supporting detail.
    C) It gives a minor supporting detail.
    D) It gives a conclusion.

4. A paraphrase is a statement in our own words of what a person has said.

    For instance, after a person has given you direction on how to get to a certain place, you might say, "In other words, what I should do is…"

    How are these two sentences related?
    A) They present problems and solutions.
    B) They provide definition and example.
    C) They establish a contrast.
    D) They repeat the same idea.

5. Psychologists think that road rage is caused by a buildup of stress that acts like a time bomb waiting to explode.

   Once an event triggers the release of tension, road rage strikes.

   What does the second do?
   A) It explains what is stated in the first.
   B) It reinforces what is started in the first.
   C) It establishes a cause-effect relationship with the first.
   D) It draws a conclusion about what is stated in the first.

6. Riding along with a unified culture is like riding a bike with the wind: as the wind carries us along, we hardly notice it's there.

   However, when we try riding against it we feel its force, as when moving to or visiting another part of the world.

   How are these two sentences related?
   A) They present problems and solutions.
   B) They provide definition and example.
   C) They establish a contrast.
   D) They repeat the same idea.

Part 2
   Directions: Each passage in this section is followed by questions based on its content. After reading a passage, choose the best answer to each question.

The stress under which morally responsible behavior breaks down can be of varying kinds. It is not so much the sudden, one-time, great temptation that makes human morality break down, but the prolonged stressful situation. Hunger, anxiety, the necessity to make difficult decisions, overwork, hopelessness, and the like all have the effect of sapping moral energy and, in the long run, of breaking down moral resistance. Anyone who has had the opportunity to observe people under this kind of strain, for example in prisoner-of-war camps, knows how unpredictably and suddenly the moral breakdown sets in. People in whose strength one trusted unconditionally suddenly break down. Anyone who has experienced such things knows that the fervor of good intention is not always equal to its power of endurance. Once you have realized this, you cease to feel superior to the person who breaks down a little sooner than you do yourself. Even the best and noblest reach a point where resistance is at an end.

7. **The passage is mainly concerned with?**
   A) Defining moral energy.
   B) Showing that people cannot be trusted.
   C) Explaining some human behavior.
   D) Analyzing stress.

8. **What is the main point the author is making?**
   A) We cannot predict what life will be like for any of us.
   B) If you believe you have moral courage, it will be there when you need it.
   C) There is a point at which each one of us will break.
   D) We should not put ourselves through the stress of trying to be perfect.

9. **Which of the following provides an example of the kind of person the passage is most concerned with?**
   A) A hostage, during a brief holdup, who obeys her captors' orders.
   B) A woman who, during a famine, calmly watches two people drown.
   C) A member of a burglary ring who has robbed eighteen houses in the past six months.
   D) A general who, believing the government to be undemocratic, commits treason.

The spider is one of Nature's most successful wanderers. Found all over the world, it is able to travel huge distances. When a traveling spider approaches a stream or river, it uses a unique method of locomotion. Rolling over on its back, the spider shoots out a glue-tipped glob of web material attached to a line as the wind carries the "anchor." If the arrowing line strikes a secure target on the favored side of the water, the spider then climbs a bush and walks over the bridge. Another method of locomotion is even more dramatic. The spider again spins out a sticky line ending a swollen tip. If the line is kept short and the spider does not attach itself firmly to an anchoring bush or rock, the wind will carry the creature far away to an unknown destination. Such sailing spiders have been scraped off the superstructures of ships several hundred miles away from the nearest land.

10. **The passage is mainly concerned with how spiders**
    A) travel
    B) spin webs
    C) reach ships
    D) cross rivers

11. **The author feels that it is especially dramatic that the spider**
    A) rolls over on its back
    B) spins out a sticky line
    C) anchors to rocks and bushes
    D) sails through the air.

12. **From the way "superstructures" is used in line 12**
    It is probably that such ship parts are to be found
    A) inside the ship
    B) at the waterline
    C) near the propeller
    D) on the top section.

Answers for Sample Reading Comprehension Questions
1. B
2. D
3. C
4. B
5. C
6. C
7. C
8. C
9. B
10. A
11. D
12. D

Sample Questions for Sentence Skills

Directions: In each of the following sentences find out what is wrong, if anything. In deciding whether there is something wrong with a sentence, consider the way a sentence should be written in standard written English, usually found in textbooks. Remember that this is sometimes different from the kind of English that you use in talking with your friends.

Some sentences are acceptable without change.
No sentence contains more than one error.

If the sentence has an error, you will find that the error is underlined and lettered. Assume that all other parts of the sentence are acceptable and cannot be changed.

1. In 1968 Julian Bond could not <u>accept</u> the vice-presidential <u>nomination he</u> was <u>too young</u> to
                                                      A   B   C
    qualify for the position. <u>No error</u>.
                                                  D

2. The strike came at a <u>time where</u> the public supported efforts <u>to improve</u> the lot <u>of</u> the farm workers. <u>No error.</u>
                                            A   B   C   D

3. There <u>is</u> a great many people in the United States who <u>do not have</u> <u>enough</u> training to work
                  A   B   C
    easily with computers. <u>No error</u>.
                                              D

4. The new film will <u>show</u> the different <u>kinds of</u> artwork and craftwork <u>produced</u> by the Zuni tribe. <u>No error</u>.
                                      A   B   C   D

5. Jamie was <u>scarce</u> more interested in cooking <u>than</u> she was in <u>hiking</u> or skating. <u>No error</u>
                              A   B   C   D

6. Some nurses will not <u>work</u> for physicians in private practice, <u>and</u> they <u>will work</u> in community
                                            A   B   C
    health programs. <u>No error.</u>
                                      D

7. <u>At</u> the end of the meeting, Clara announced <u>formerly</u> that she was resigning <u>as</u> president. <u>No error.</u>
      A   B   C   D

Part 2

Directions: Rewrite the sentence in your head, following the directions given below. Keep in mind that your new sentence should be well written and should have essentially the same meaning as the sentence given you.

8. Being a female jockey, she was often interviewed. Rewrite, beginning with
    She was often interviewed…
    The next words will be
    A) on account of she was
    B) by her being
    C) because she was
    D) being as she was

9. In his songs, Gordon Lightfoot makes melody and lyrics intricately intertwine.
    Rewrite, beginning with
    Melody and lyrics…
    Your next sentence will include
    A) Gordon Lightfoot has
    B) make Gordon Lightfoot's
    C) in Gordon Lightfoot's
    D) does Gordon Lightfoot

10. It is easy to carry solid objects without spilling them, but the same cannot be said of liquids.
    Rewrite, beginning with
    Unlike liquids…
    The next words will be
    A) it is easy to
    B) we can easily
    C) solid objects can easily be
    D) solid objects are easy to be

11. Excited children ran toward the music, and they told others about the ice cream truck outside.
    Rewrite, beginning with
    The excited children, who had run toward the loud…
    The next words will be
    A) music, they told
    B) music, told
    C) music, telling
    D) music and had told

12. If he had enough strength, Todd would move the boulder.
    Rewrite, beginning with
    Todd cannot move the boulder…
    The next words will be
    A) which he can't
    B) because he does
    C) although he does
    D) without he gets

13. The band began to play, and then the real party started.
    Rewrite, beginning with
    The real party started…
    The next words will be
    A) after the band began
    B) and the band began
    C) although the band began
    D) the band beginning

14. Chris heard no unusual noises when he listened in the park.
    Rewrite, beginning with
    Listening in the park ….
    The next words will be
    A) no unusual noises could be heard
    B) then Chris heard no unusual noises
    C) and hearing no unusual noises
    D) Chris heard no unusual noises

Answers for Sample Sentence Skills Questions

1. B
2. A
3. A
4. D
5. A
6. B
7. B
8. C
9. C
10. C
11. B
12. B
13. A
14. D

Sample Questions for Arithmetic Skills

1. Estimate to the nearest hundred: $31,253 - 1275$

2. Round to the nearest hundredth: 6.4562

3. Find the missing number: $\dfrac{3}{7} = \dfrac{?}{14}$

4. Write as a mixed number $\dfrac{27}{4}$

5. Combine: $3\dfrac{4}{5} - 1\dfrac{3}{4}$

6. Divide: $6 \div \dfrac{3}{5}$

7. Combine: $1.3 + 1.8 + 2.6 + 7.2 + 0.8$

8. Multiply: 0.002×4.31

9. Divide: $3.186 \div 0.03$

10. Mr. Carr is installing wall-to-wall carpeting in a room that measures $12\dfrac{1}{2}$ ft. by 9 ft. How much will it cost Mr. Carr if he purchases carpet priced at $26.00 per square yard?

11. Write as a percentage: $\dfrac{3}{8}$

12. Find 250% of 36

13. In a given university, 720 of the 960 new students will study algebra during their first year. What percentage of the new students will study algebra during their first year?

14. An investment pays 8% simple interest per year. If the investment earns $84 interest in the first year, then how much money was originally invested?

15. If Mary wants to finish a 16 kilometer race in no more that 2 hours, then what is the minimum distance in kilometers that she should run every 15 minutes?

<u>**Answers For Sample Arithmetic Questions**</u>

1. 30,000
2. 6.46
3. 6
4. $6\dfrac{3}{4}$

5. $\dfrac{41}{20}\ or\ 2\dfrac{1}{20}$
6. 10
7. 13.7
8. 0.00862
9. 106.2

10. $325
11. 37.5%
12. 90
13. 75%
14. $1,050
15. 2 kilometers

Sample Questions for Elementary Algebra Skills

1. Combine Like terms: $13a - 15b - a + 2b$

2. Multiply: $(2x - 1)(4x + 1)$

3. Solve for x: $5(2x - 3) - (x + 3) = 0$

4. Find all the factors of $x^2 + x - 12$

5. Factor out the greatest common factor: $xy^3 + yx^3$

6. Divide: $\dfrac{x^2}{y} \div \dfrac{x}{y^2}$

7. Simplify: $\dfrac{b^3}{b^5}$

8. Multiply: $\left(\dfrac{2x}{3y}\right)\left(\dfrac{9y}{4x^2}\right)$

9. Simplify: $\sqrt{64x^{16}}$

10. The average of *x, y*, and z is 80. If two of the numbers are 74 and 78, then what is the other number?

11. Find all the solutions of $4(x + 3)(3x - 2) = 0$

12. Find the value of *x* in the solution of the following system of equations:

$$\begin{cases} x & + & y & = & 7 \\ 3x & - & y & = & 5 \end{cases}$$

13. In which quadrants (I, II, III, and/or IV) will you find ordered pairs for which x > -3 and y<0?

14. Find the values of *x* for which $-x - 3 > 12$

15. What are all values of *x* for which $x^2 - 9x = 0$?

16. Factor: $2x^2 + 17x - 30$

17. Solve: $\dfrac{5 - z}{z} = 9$

18. $(3a - b)^2 =$

19. $\dfrac{3}{x} - \dfrac{5}{x + 2} =$

20. If Sam walks 650 meters in *x* minutes then write an algebraic expression which represents the number of minutes it will take Sam to walk 1500 meters at the same average rate.

Answers For Sample Elementary Algebra Questions

1. $12a - 13b$

2. $8x^2 - 2x - 1$

3. 2

4. $(x-3)(x+4)$

5. $xy(y^2 + x^2)$

6. xy

7. $\dfrac{1}{b^2}$

8. $\dfrac{3}{2x}$

9. $8x^8$

10. 88

11. $-3 \ and \ \dfrac{2}{3}$

12. 3

13. III and IV

14. $x < -15$

15. $x = 0 \ or \ x = 9$

16. $(2x-3)(x+10)$

17. $\dfrac{1}{2}$

18. $9a^2 - 6ab + b^2$

19. $\dfrac{-2x+6}{x(x+2)}$

20. $\dfrac{1500x}{650} \ or \ \dfrac{30x}{13}$ minutes

Sample Questions for College Level Mathematics

1. Simplify each fraction:

   a) $\dfrac{12xy^2}{-6x^3y^4}$

   b) $\left(\dfrac{3ab^2}{c^3}\right)^2$

2. Combine the following polynomial: $(3x^2 - 6x - 9) + (-5x^2 + 13x - 20)$

3. Express with positive exponents: $3x^2 y^{-3} z^{-4}$

4. Modern personal computers can perform one operation in 5×10^{-10} second. How many operations can such a computer perform in 1 minute? Answer in scientific notation.

5. Remove the greatest common factor: $2x^2 y - 6xy + 12xy^2$

6. Solve for the root(s) of the quadratic equation: $\dfrac{3x^2 - 7x}{2} = 3$

7. Simplify the rational expression: $\dfrac{\dfrac{x-y}{x} - \dfrac{x+y}{y}}{\dfrac{x-y}{x} + \dfrac{x+y}{y}}$

8. Solve and graph on a number line: $4(2 - x) \le 3$

9. Solve for h: $A = \pi r^2 h$

10. Factor: $8a^3 - 38a^2 b - 10ab^2$

11. Find the slope of the line $4x - 3y - 7 = 0$

12. Line p has a slope of $-\dfrac{1}{4}$. What is the slope of a line parallel to line p? What is the slope of a line perpendicular to line p?

13. Find the equation of a line that passes through $(-1, 6)$ and $(2, 3)$.

14. Find the indicated values for a function: $f(x) = 3x - 7$

    a) $f(-2)$　　　　b) $f(4)$

15. To the nearest thousandth, how much error can be tolerated in the length of a wire that is supposed to be 2.57 centimeters long? Specifications allow an error of no more than 0.25%

Answers for Sample College-Level Mathematics Questions

1. a) $\dfrac{-2}{x^2 y^2}$

   b) $\dfrac{9a^2 b^4}{c^6}$

2. $-2x^2 + 7x - 29$

3. $\dfrac{3x^2}{y^3 z^4}$

4. 1.2×10^{11} operations in one minute

5. $2xy(x - 3 + 6y)$

6. $x = -\dfrac{2}{3}; x = 3$

7. $\dfrac{-x^2 - y^2}{x^2 + 2xy - y^2}$

8. $x \geq \dfrac{5}{4}$

9. $\dfrac{A}{\pi r^2}$

10. $2a(4a + b)(a - 5b)$

11. $\dfrac{4}{3}$

12. $-\dfrac{1}{4}; 4$

13. $y = -x + 5$

14. a) -13

    b) 5

15. $\pm 0.006 \, cm$

A Brief Review of Math Skills

Topic	Procedure	Examples
Absolute Value	The absolute value of a number is the distance between that number and zero on the number line. The absolute value of any number will be positive or zero.	$\lvert-2\rvert=2 \quad \lvert3\rvert=3 \quad \lvert0\rvert=0$ $\lvert-1.38\rvert=1.38 \qquad \left\lvert\dfrac{5}{6}\right\rvert=\dfrac{5}{6}$
Adding signed numbers with the same sign	If the signs are the same, add the absolute values of the numbers. Use the common sign in the answer	$(-3)+(-7)=-10$
Adding several signed numbers with opposite signs	If the signs are different: 1. Find the difference of the larger absolute value and the smaller. 2. Give the answer the sign of the number having the larger absolute value.	$(-7)+(+13)=6$ $(7)+(-13)=-6$
Adding several signed numbers	When adding several signed numbers, separate them into two groups by common sign, Find the sum of all the positives and all the negatives. Combine these two subtotals by the method described above.	$(-7)+6+8+(-11)+(-13)+22$ $\begin{array}{rr} -7 & 6 \\ -11 & 8 \\ -13 & 22 \\ \hline -31 & 36 \end{array}$ $(-31)+(36)=5$
Subtracting signed numbers	Change the sign of the second number and then add	$(-3)-(-13)=(-3)+(+13)=10$
Multiplying and dividing signed numbers	1. If the two numbers have the same sign, multiply (or divide). The result is always positive. 2. If the two numbers have different signs, multiply (or divide) as indicated. The result is always negative	$(-5)(-3)=+15$ $(-36)\div(-4)=+9$ $(28)\div(-7)=-4$ $(-6)(3)=-18$
Exponent form	The base tells you what number is being multiplied. The exponent tells you how many times this number is used as a factor.	$2^5=2\cdot2\cdot2\cdot2\cdot2=32$ $4^3=4\cdot4\cdot4=64$ $(-3)^4=(-3)(-3)(-3)(-3)=81$
Raising a negative number to a power	When the base is negative, the result is positive for even exponents, and negative for odd exponents.	$(-3)^3=-27$ $(-2)^4=16$
Removing Parentheses () and Brackets [] using multiplication	Use the distributive law for multiplication to remove parentheses and brackets: a(b + c) = ab + ac	$3(5x+2)=3(5x)+3(2)$ $\qquad =15x+6$
Combining like terms	Combine terms that have identical letters and exponents	$7x^2-3x+4y+2x^2-8x-9y$ $=7x^2+2x^2-3x-8x+4y-9y$ $=9x^2-11x-5y$

Order of operations	Remember the proper order of operations: 1. Operations inside Parentheses () and Brackets [] 2. Exponents 3. Multiplication and Division from left to right. 4. Addition and Subtraction from left to right.	$3(5 + 4)^2 - 2^2[3 \div (9 - 2^3)]$ $= 3(9)^2 - 2^2[3 \div (9 - 8)]$ $= 3(81) - 4(3 \div 1)$ $= 3(81) - 4(3)$ $= 243 - 12$ $= 231$
Substituting into variable expressions	1. Replace each letter by the numerical value given. 2. Follow the order of operations in evaluating the expression	*Evaluate* $2x^3 + 3xy + 4y^2$ *for* $x = -3, y = 2$ $2(-3)^3 + 3(-3)(2) + 4(2)^2$ $= 2(-27) + 3(-3)(2) + 4(4)$ $= -54 - 18 + 16$ $= -56$
Using formulas	1. Replace each variable in the formula by the given values. 2. Evaluate the expression. 3. Label units carefully	*Find the area of a circle with radius* 4 *feet.* *Use* $A = \pi r^2$ *with* π *approximatley* 3.14. $A = (3.14)(4\, feet)^2$ $\quad = (3.14)(16\, feet^2)$ $\quad = 50.24\, feet^2$ *The area of the circle is approximately* 50.24 *square feet.*
Removing grouping symbols, such as Parentheses () and Brackets [], to simplify algebraic expressions	1. Remove innermost grouping symbols first. 2. Continue until all grouping symbols are removed. 3. Combine like elements.	$5\big(3x - 2[4 + 3(x-1)]\big)$ $= 5\big(3x - 2[4 + 3x - 3]\big)$ $= 5(3x - 8 - 6x + 6)$ $= 15x - 40 - 30x + 30$ $= -15x - 10$
Solving equations without parentheses or fractions	1. On each side of the equation, collect like terms if possible. 2. Add or subtract terms on both sides of the equation in order to get all terms with the variable on one side of the equation. 3. Add or subtract a value on both sides of the equation to get all terms not containing the variable on the other side of the equation. 4. Divide both sides of the equations by the coefficient of the variable. 5. If possible, simplify solution. 6. Check your solution by substituting the obtained value into the original equation.	Solve for X: $5x + 2 + 2x = -10 + 4x + 3$ $7x + 2 = -7 + 4x$ $7x + (-4x) + 2 = -7 + 4x + (-4x)$ $3x + 2 = -7$ $3x + 2 + (-2) = -7 + (-2)$ $3x = -9$ $\dfrac{3x}{3} = \dfrac{-9}{3}$ $x = -3$ Check: Is $x = -3$ a solution? $5(-3) + 2 + 2(-3) = -10 + 4(-3) + 3$ $-15 + 2 - 6 = -10 + (-12) + 3$ $-13 - 6 = -22 + 3$ $-19 = -19$

Solving equations with parentheses and/or fractions	1. Remove any parentheses. 2. Simplify, if possible. 3. If fractions exist, multiply all terms on both sides by the lowest common denominator of all the fractions. 4. Now follow the remaining steps of solving an equation without parentheses or fractions.	$5(3y-4)=\dfrac{1}{4}(6y+4)-48$ $15y-20=\dfrac{3}{2}y+1-48$ $15y-20=\dfrac{3}{2}y-47$ $2(15y)-2(20)=2\left(\dfrac{3}{2}y\right)-2(47)$ $30y-40=3y-94$ $30y-3y-40=3y-3y-94$ $27y-40=-94$ $27y-40+40=-94+40$ $27y=-54$ $\dfrac{27y}{27}=\dfrac{-54}{27}$ $y=-2$ *Remember to check your solution (see previous example)
Solving formulas	1. Remove any parentheses and simplify if possible. 2. If fractions exist, multiply all terms on both sides by the LCD, which may be a variable. 3. Add or subtract terms on both sides of the equation in order to get all terms containing the desired variable on one side of the equation and all other terms on the opposite side of the equation. 4. Divide both sides of the equation by the coefficient of the desired variable. This decision may involve other variables. 5. Simplify, if possible. 6. Check your solution by substituting the obtained expression into the original equation.	Solve for z: $B=\dfrac{1}{3}(hx+hz)$ $B=\dfrac{1}{3}hx+\dfrac{1}{3}hz$ $3(B)=3\left(\dfrac{1}{3}hx\right)+3\left(\dfrac{1}{3}hz\right)$ $3B=hx+hz$ $3B-hx=hx-hx+hz$ $3B-hx=hz$ $\dfrac{3B-hx}{h}=z$

Solving Inequalities	1. Follow the steps for solving a first-degree equation up until the multiplication or division step. 2. If you multiply or divide *both sides* of the inequality by a positive number, the direction of the inequality is not reversed. 3. If you multiply or divide *both sides* of the inequality by a **negative number**, the direction of the inequality is reversed.	$$\frac{1}{2}(3x-2) \le -5 + 5x - 3$$ $$\frac{3}{2}x - 1 \le -8 + 5x$$ $$2\left(\frac{3}{2}x\right) - 2(1) \le 2(-8) + 2(5x)$$ $$3x - 2 \le -16 + 10x$$ $$3x - 10x - 2 \le -16 + 10x - 10x$$ $$-7x - 2 \le -16$$ $$-7x - 2 + 2 \le -16 + 2$$ $$-7x \le -14$$ $$\frac{-7x}{-7} \ge \frac{-14}{-7}$$ $$x \ge 2$$
Multiplying monomials	$(x^a)(x^b) = x^{a+b}$ 1. Multiply the numerical coefficients. 2. Add the exponents of a given base.	$$3^{12} \cdot 3^{15} = 3^{27}$$ $$x^3 \cdot x^4 = x^7$$ $$(-3x^2)(6x^3) = -18x^5$$ $$(2ab)(4a^2b^3) = 8a^3b^4$$
Dividing monomials	$\dfrac{x^a}{x^b} = \begin{cases} x^{a-b} & \text{If } a > b \\ \dfrac{1}{x^{b-a}} & \text{If } b > a \end{cases}$ 1. Divide or reduce the fraction created by the quotient of the numerical coefficients. 2. Subtract the exponents of a given base.	$$\frac{16x^7}{8x^3} = 2x^4$$ $$\frac{5x^3}{25x^5} = \frac{1}{5x^2}$$ $$\frac{-12x^5y^7}{18x^3y^{10}} = \frac{-2x^2}{3y^3}$$
Exponent of zero	$x^0 = 1$ if $x \ne 0$	$$5^0 = 1 \qquad w^0 = 1$$ $$\frac{x^6}{x^6} = 1 \qquad 3x^0y = 3y$$
Raising a power to a power	1. Raise the numerical coefficient to the power outside the parentheses. 2. Multiply the exponent outside the parentheses by the exponent inside the parentheses. $\left(x^a\right)^b = x^{ab}$ $(xy)^a = x^a y^a$ $\left(\dfrac{x}{y}\right)^9 = \dfrac{x^9}{y^9}$ $(y \ne 0)$	$$\left(x^9\right)^3 = x^{27} \qquad \left(3x^2\right)^3 = 27x^6$$ $$\left(\frac{2x^2}{y^3}\right)^3 = \frac{8x^6}{y^9}$$ $$\left(-3x^4y^5\right)^4 = 81x^{16}y^{20}$$ $$(-5ab)^3 = -125a^3b^3$$

Negative exponents	If $x \neq 0$ and $y \neq 0$, then $$x^{-n} = \frac{1}{x^n}$$ $$\frac{1}{x^{-m}} = x^n$$ $$\frac{x^{-m}}{y^{-n}} \quad \frac{y^n}{x^m}$$	Write with positive exponents $$3^{-4} = \frac{1}{3^4} = \frac{1}{81} \quad x^{-6} = \frac{1}{x^6}$$ $$\frac{1}{w^{-3}} = w^3 \qquad \frac{w^{-12}}{z^{-5}} = \frac{z^5}{w^{12}}$$ $$\left(2x^2\right)^{-3} = 2^{-3}x^{-6} = \frac{1}{2^3 x^6} = \frac{1}{8x^6}$$
Scientific notation	A number is written in scientific notation if it is the form: $a \times 10^n$ where $1 \leq a < 10$ and n is an integer.	$128 = 1.28 \times 10^2$ $2,568,000 = 2.568 \times 10^6$ $13,200,000,000 = 1.32 \times 10^{10}$ $0.16 = 1.6 \times 10^{-1}$ $0.00079 = 7.9 \times 10^{-4}$ $0.0000034 = 3.4 \times 10^{-6}$
Add polynomials	To add two polynomials, we add the respective like term	$\left(-7x^3 + 2x^2 + 5\right) + \left(x^3 + 3x^2 + x\right)$ $= -6x^3 + 5x^2 + x + 5$
Subtracting polynomials	To subtract polynomials, change all signs of the second polynomial and add the result to the first polynomial: $(a) - (b) = (a) + (-b)$	$\left(5x^2 - 6\right) - \left(-3x^2 + 2\right)$ $= \left(5x^2 - 6\right) + 3x^2 - 2$ $= 8x^2 - 8$
Multiplying a monomial by a polynomials	Use the distributive law	
	$a(b + c) = ab + ac$	$-5x(2x + 3x^2 - 4)$ $= -10x^2 - 15x^3 + 20x$
	$(b + c)a = ba + ca$	$(6x^3 - 5xy - 2y^2)(3xy)$ $= 18x^4y - 15x^2y^2 - 6xy^3$
Multiplying two binomials	1. The product of the sum and difference of the same two values yields the difference of their squares. $(a + b)(a - b) = a^2 + b^2$	$(3x + 7y)(3x - 7y) = 9x^2 - 49y^2$
	2. The square of a binomial yields a trinomial: the square of the first, plus twice the product of first and second, plus the square of the second. $(a + b)^2 = a^2 + 2ab + b^2$ $(a - b)^2 = a^2 - 2ab + b^2$	$(3x + 7y)^2 = 9x^2 + 42xy + 49y^2$ $(3x - 7y)^2 = 9x^2 - 42xy + 49y^2$
	3. Use FOIL for other binomial multiplication. The middle terms can often be combined, giving a trinomial answer.	$(3x - 5)(2x + 7)$ $= 6x^2 + 21x - 10x - 35$ $= 6x^2 + 11x - 35$

Multiplying two polynomials	To multiply two polynomials, multiply each term of one by each term of the other. This method is similar to the multiplication of many-digit numbers.	Vertical method: $$\left(3x^2 - 7x + 4\right)$$ $$\times \quad \left(3x - 1\right)$$ $$-3x^2 + 7x - 4$$ $$9x^3 - 21x^2 + 12x$$ $$9x^3 - 24x^2 + 19x - 4$$ Horizontal method: $$\left(5x + 2\right)\left(2x^2 - x + 3\right)$$ $$= 10x^3 - 5x^2 + 15x + 4x^2 - 2x + 6$$ $$= 10x^3 - x^2 + 13x + 6$$
Multiply three or more polynomials	1. Multiply any two polynomials. 2. Multiply the result by any remaining polynomials.	$$\left(2x + 1\right)\left(x - 3\right)\left(x + 4\right)$$ $$= \left(2x^2 - 5x - 3\right)\left(x + 4\right)$$ $$= \left(8x^2 - 20x - 12\right) + \left(2x^3 - 5x^2 - 3x\right)$$ $$= 2x^3 + 3x^2 - 23x - 12$$
Dividing a polynomial by a monomial	1. Divide each term of the polynomial by the monomial. 2. When dividing variables use the property: $$\frac{x^a}{x^b} = x^{a-b}$$	Divide: $$\left(15x^3 + 20x^2 - 30x\right) \div \left(5x\right)$$ $$= \frac{15x^3}{5x} + \frac{20x^2}{5x} + \frac{-30x}{5x}$$ $$= 3x^2 + 4x - 6$$
Dividing a polynomial by a binomial	1. Place the terms of the polynomial and binomial in the descending order. Insert a 0 for any missing term. 2. Divide the first term of the polynomial by the first term of the binomial. 3. Multiply the partial answer by the binomial, and subtract the results from the first two terms of the polynomial. Bring down the next term to obtain a new polynomial. 4. Divide the new polynomial by the binomial using the process described in step 2. 5. Continue dividing, multiplying, and subtracting until the reminder is at a lower power than the variable in the first term of the binomial divisor.	Divide: $$\left(8x^3 - 13x + 2x^2 + 7\right) \div \left(4x - 1\right)$$ We rearrange the terms: $$\begin{array}{r} 2x^2 + x - 3 \\ 4x-1\overline{)8x^3 + 2x^2 - 13x + 7} \\ \underline{8x^3 - 2x^2} \\ 4x^2 - 13x \\ \underline{4x^2 - \ x} \\ -12x + 7 \\ \underline{-12x + 3} \\ 4 \end{array}$$ The answer is: $$2x^2 + x - 3 + \frac{4}{4x - 1}$$