

EVALUATION OF YOUR MATHEMATICS SKILLS FOR CAREERS IN
Science, Technology, Engineering, Mathematics, Etc...

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Interested in a Career in Science, Technology, Engineering, Etc.?

In the United States as well as in Canada, if you are seriously interested in a STEM [science, technology, engineering, mathematics] or any other mathematics-based career [such as finance or investment] for yourself or for your child, please read on.

According to the NCES [National Center for Education Statistics] 2014-001 by the U.S. Department of Education, "... 69 percent of associate's degree students who enter STEM fields between 2003 and 2009 had left these fields by spring 2009." In other words, an associate-degree student, who pursued a STEM field in a four-year college, had only 31 percent chance to earn a bachelor's degree in the chosen STEM field.

Science, technology, engineering, et cetera are mathematics-based. The cause of this low rate of success in STEM fields is obviously inadequate preparation in mathematics as evidenced in these: "The Nation's Report Card" of January 28, 2016, by the National Center for Education Statistics indicated that only 26 percent of students were "at or above proficient" level in mathematics. On May 29, 2015, San Francisco Chronicle reported: "In California, about 85 percent of students at community colleges must take remedial math courses."

Failing mathematics is also serious in Canada. On June 22, 2017, thespec.com stated: "Fewer than half of Hamilton's public school children meet the provincial standard in Grade 6 math." Toronto Sun, on July 25, 2017, reported: "Ontario is churning out high school graduates unable to add fractions or multiply numbers without the help of a calculator."

Over the decades, concerning the large number of students failing in mathematics, there are many other similar news items; some of them are listed on the next page.

Passing mathematics at any level does not mean a total readiness for the next level. Quantitatively and qualitatively speaking, if a score of 70 out of 100 is considered passing at a given level and 70 at the next level, then the combined effect is 70 percent times 70 percent which is 49 percent. Next, will be 49 percent times 70 percent or 34.3 percent. In some school systems, 50 percent is considered passing; 50 percent times 50 percent is only 25 percent. At any rate, eventually, failure will occur.

Listed below are more news items concerning failures in mathematics. If you wish, you may skip them and go directly to the next page about the needed tests for assessing mathematics skills.

- a. June 13, 2003, juneauempire.com: "... more than 60 percent of eighth-graders failed the math test [in Alaska]."
- b. "In June 2003, 63 percent of those who took the Math A exam failed it,..." from the New York Times on June 25, 2005.
- c. According to dallasnews.com, in 2006-07, only "32%" Spruce High School students met the state mathematics requirements.
- d. reallifemymusic.org: In 2009, only 33 percent of the Detroit 4th graders responded to a sample math problem correctly.
- e. November 9, 2010, New York Times: "...only 12 percent of... eighth-grade boys are proficient in math..."
- f. August 8, 2013, Suffolk Times: "Statistics for all New York schools showed... 69 percent of students failed math."
- g. July 9, 2014, Education News: "Majority of Georgia High School Students Fail State Math".
- h. March 14, 2015, New York Daily News: "Only one in three city students meets state standards in math."
- i. July 9, 2015, jonathanpelto.com [CT]: "Only 29 percent of Washington High School students passed the SBAC math test."
- j. July 22, 2015, Washington Post: "74 percent of high school students in Montgomery [MD] failed...Algebra 1..."
- k. October 1, 2015, Florida Times-Union stated that in Duval, "...about two thirds would fail the Algebra 2...exam."
- l. October 16, 2015, Associated Press: "More than 82 percent of students failed... algebra tests..." in New Mexico.
- m. October 27, 2015, Bismarck Tribune reported: 40 percent of North Dakota students were deemed proficient in mathematics.
- n. February 17, 2016, Las Vegas Review Journal: "91% of Algebra 1 students [in Clark County School District] failed."
- o. June 27, 2016, azcentral.com: "More than 60 percent of the state's students failed the math... of AzMERIT [AZ test]..."
- p. June 25, 2017, breitbart.com: "NY eighth graders failing common core math test tripled since testing began."
- q. September 1, 2017, juneauempire.com: "68.2 percent of students [in Alaska] were rated 'below proficient' in math..."
- r. June 16, 2017, pressreader.com: "...rate of math illiteracy has doubled for [Alberta] Grade 4 students since 2011..."
- s. August 30, 2017, cbc.ca: "Only 50 per cent of Grade 6 students [in Ontario] met the standard for mathematics..."

For the purpose of minimizing failure and ascertaining readiness, a series of arithmetic (including common geometric figures) and algebra skill tests has been designed for the students from 6th to 12th grade and for the college students who are enrolled in remedial mathematics courses. Usually, the well-prepared students in middle school [grades 6 to 9] are able to complete the arithmetic skill test with flying colors; the well-prepared students in high school [grades 9 to 12], the algebra skill test.

These are paper-and-pencil tests; calculators may not be used. For rapid assessment, these are "power tests", not "speed tests", therefore time limit may not be pre-determined; however, with a conscientious student, each session may last two hours.

Each problem in each test involves a cluster of specific skills. By correctly answering all 21 problems in the arithmetic skill test, students are ready for algebra with the needed prerequisite skills. And, by correctly solving all 21 problems in the algebra skill test, students are ready for a college algebra course.

With a given test, a student may not correctly answer all of the questions; therefore, the arithmetic skill test has two versions of a "pre-test" and a "post-test" with comparable items. Also, there are a "pre-test" and a "post-test" in algebra. Needless to say, a pre-test must be taken first. If the pre-test is perfectly completed, readiness is obvious and the post-test is to be ignored. However, if there is any wrong answer to the pre-test, before the post-test is taken, remediation must be engaged to learn not only each problem with a wrong answer but also the type of problems in the specific skill cluster listed on Page 4.

In order to reach a long-term goal successfully, both determination and persistence are necessary. It is intended that this test project may help some of the students who are seriously interested in the STEM and other mathematics-based careers.

The following six pages, from Page 4 to Page 9, contain:

4. Skill Clusters,
5. Arithmetic Pre-Test,
6. Arithmetic Post-Test,
7. Algebra Pre-Test,
8. Algebra Post-Test and
9. Answer Keys.

Skill Clusters in Arithmetic and Common Geometric Figures:

1. Adding whole numbers
2. Subtracting whole numbers
3. Multiplying whole numbers
4. Dividing whole numbers
5. Rounding decimal numbers
6. Adding and subtracting decimal numbers
7. Multiplying decimal numbers
8. Dividing decimal numbers
9. Adding and subtracting fractions
10. Multiplying and dividing fractions
11. Adding and subtracting mixed numbers
12. Multiplying and dividing mixed numbers
13. Finding percentages from quantities or vice versa
14. Finding quantities from percentages or vice versa
15. Solving proportions in different formats
16. Calculating radius from circumference and vice versa
17. Calculating perimeters and areas of squares and rectangles
18. Calculating edges and volumes of cubes and parallelepipeds
19. Finding the lengths of legs and hypotenuses of right triangles
20. Applications of LCM or HCF
21. Applications of HCF or LCM

Skill Clusters in Algebra:

1. Whole numbers, decimal numbers, fractions and mixed numbers
2. Grouping symbols
3. Negative numbers
4. Exponents over numbers
5. Radicals
6. Scientific notation
7. Exponents over variables
8. Polynomials
9. Factors
10. Algebraic fractions
11. Linear equations
12. Literal equations
13. Quadratic equations
14. Inequalities
15. Equations containing absolute values
16. Intercepts and midpoint of a line segment
17. Systems of two linear equations
18. Maximum and minimum of a parabolic function
19. Applications of mixture and concentration...
20. Applications of combined speeds...
21. Graphing parabolas

Perform all indicated and implied operations without using any calculator. Reduce all answers in fractions to lowest terms and convert all improper fractions to mixed numbers. If appropriate, a unit (such as cm or sq in) must be given with the numerical answer.

Answers:

1. _____ 1. $857 + 1694 = ?$
2. _____ 2. $2413 - 587 = ?$
3. _____ 3. $206 \times 1020 = ?$ "x" is the multiplication sign.
4. _____ 4. 623070 divided by 207 = ?
5. _____ 5. Round 479.058 to the nearest ten.
6. _____ 6. $38 - 1.6 = ?$
7. _____ 7. $0.02 \times 4.3 = ?$ "x" is the multiplication sign.
8. _____ 8. 56 divided by 22.4 = ?
9. _____ 9. $\frac{4}{35} + \frac{5}{42} = ?$ "/" indicates a fraction of "numerator/denominator".
10. _____ 10. $\frac{9}{49}$ divided by $\frac{3}{14} = ?$
11. _____ 11. $(426 \text{ and } \frac{2}{9}) - (215 \text{ and } \frac{7}{9}) = ?$
12. _____ 12. 14 times $(3 \text{ and } \frac{5}{7}) = ?$
13. _____ 13. Three percent of 2400 = ?
14. _____ 14. 0.021 percent of a quantity = 147. Find the quantity.
15. _____ 15. $21:14=h:42$. $h=?$
16. _____ 16. If the radius of a circle = 4 yd and $\pi = 3.14$, circumference = ?
17. _____ 17. A 30-ft by 4-ft rectangular walkway is paved in a 50-ft by 50-ft lawn. Find the unpaved lawn area.
18. _____ 18. Length of a shoe box = 11 in; width = 5 in; height = 4 in. Volume = ?
19. _____ 19. One leg = 15 cm; the other leg = 8 cm. Hypotenuse = ?
20. _____ 20. Adam mows his lawn every 20 days; Buddy, every 14 days; Carl, every 15 days. Today, all three of them are mowing their lawns. In how many more days will they mow their lawns on the same day again?
21. _____ 21. There are 56 girls from Japan; 80, from Korea; 24, from Laos. These girls are to be divided into groups each of which must have the same number of girls from a specific country. At the most, how many groups can be formed?

Perform all indicated and implied operations without using any calculator. Reduce all answers in fractions to lowest terms and convert all improper fractions to mixed numbers. If appropriate, a unit (such as cm or sq in) must be given with the numerical answer.

Answers:

1. _____ 1. $948 + 2576 = ?$
2. _____ 2. $1352 - 769 = ?$
3. _____ 3. $102 \times 1050 = ?$ "x" is the multiplication sign.
4. _____ 4. 611030 divided by 301 = ?
5. _____ 5. Round 832.746 to the nearest hundred.
6. _____ 6. $4.7 + 21 = ?$
7. _____ 7. $2.1 \times 0.03 = ?$ "x" is the multiplication sign.
8. _____ 8. 42 divided by 1.25 = ?
9. _____ 9. $7/45 - 5/36 = ?$ "/" indicates a fraction of "numerator/denominator".
10. _____ 10. $24/55$ times $11/36 = ?$
11. _____ 11. $(124 \text{ and } 5/7) + (312 \text{ and } 6/7) = ?$
12. _____ 12. 70 divided by $(4 \text{ and } 3/8) = ?$
13. _____ 13. Seven percent of 2100 = ?
14. _____ 14. What percent of 58 is 371.2 ? Write your answer with a percent sign.
15. _____ 15. $90:y::15:45$. $y=?$
16. _____ 16. If radius = 5 in and $\pi = 3.14$, circumference = ?
17. _____ 17. A 20-ft by 20-ft pool is built in a 80-ft by 50-ft lot. Find the remaining area in the lot.
18. _____ 18. Length of a closet = 10 ft; width = 4 ft; height = 8 ft. Volume = ?
19. _____ 19. Hypotenuse = 29 cm; one leg = 21 cm. The other leg = ?
20. _____ 20. There are 45 pieces chocolate candies; 120 pieces caramel; 135 pieces nougat. These three types of candies are to be packed into bags each of which must contain the same number of a specific type of candy. At the most, how many bags can be filled?
21. _____ 21. The gym is scrubbed every 20 days; the cafeteria, every 9 days; the library, every 12 days. When all three areas are scrubbed on the same day, there is low water pressure. Today, all three areas are being scrubbed. In how many more days will there be low water pressure?

Perform all indicated and implied operations without using any calculator.
Reduce all answers in fractions to lowest terms.
In Problem #6, "x" is a multiplication sign.

Answers:

1. _____ 1. $8302.7 \div 203 + 89\frac{4}{9} - 1040/8 = ?$ As a fraction in lowest terms.
2. _____ 2. $(3)(2)+4(3+4\cdot 2)-8/2 = ?$ Note: A centered dot is between 4 and 2.
3. _____ 3. $(-5)+(-1)+\frac{14}{-7}+(-2)(-2) = ?$
4. _____ 4. $9^1 + (\frac{1}{2})^0 - (-1)^2 - 3^2 + 2^{-3} = ?$
5. _____ 5. $14\sqrt{\frac{2}{7}} - \sqrt{225} - \sqrt{56} = ?$
6. _____ 6. $(2.1 \times 10^{-8}) \div (7 \times 10^5) = ?$ In scientific notation.
7. _____ 7. $(h^9 + h^9 + h^9 + h^9) \div 2h^8 = ?$
8. _____ 8. $(v^3-4v^2+24) \div (v+2) - v(v-6) = ?$
9. _____ 9. Factor completely: $4b^2+12b-40$.
10. _____ 10. $3/(d+2) - (d-2)/(d^2-4) = ?$
11. _____ 11. $\frac{1}{7}k-11=32-3(1-k)$. Solve for k.
12. _____ 12. $2c=3d+ef$. $e=?$
13. _____ 13. $6h^2+h-2=0$. $h=?$
14. _____ 14. $4h-7 \neq 9h+8$. Solve.
15. _____ 15. If $|2y-5| = 3$, evaluate y.
16. _____ 16. $2x+5y=20$. Coordinates of the midpoint between the intercepts = ?
17. _____ 17. If $2x+3y+2=0$ and $7y=3x+49$, then $(x,y)=?$
18. _____ 18. $y=3x^2+6x+5$. If a minimum does exist, find its coordinates. If it does not, please state so.
19. _____ 19. Red tea costs 85 cents per ounce; green tea costs \$1.05 per ounce. How many ounces of green tea must be used to produce 100 ounces of a mixture of red-green tea which will cost 90 cents per ounce?
20. _____ 20. If a boat can travel 18 miles per hour downstream (with the current) and can travel 12 miles per hour upstream (against the current), find the speed of the boat in still water.
21. _____ 21. Graph on the reverse side of the paper: $y=-3x^2-12x+15$.

Perform all indicated and implied operations without using any calculator.
Reduce all answers in fractions to lowest terms.
In Problem #6, "x" is a multiplication sign.

Answers:

1. _____ 1. $5231.2 \div 104 + 169\frac{6}{7} - 2640/12 = ?$ As a fraction in lowest terms
2. _____ 2. $(4)(3)+2(10-3\cdot 2)+6/2 = ?$ Note: A centered dot is between 3 and
3. _____ 3. $(-2)+(-6)+\frac{9}{-3}+(-3)(-1) = ?$
4. _____ 4. $8^1 + (\frac{1}{4})^0 - (-1)^2 - 2^3 + 3^{-2} = ?$
5. _____ 5. $10\sqrt{\frac{3}{5}} - \sqrt{196} - \sqrt{60} = ?$
6. _____ 6. $(3.2 \times 10^{-3}) \div (8 \times 10^9) = ?$ In scientific notation.
7. _____ 7. $60y^6 \div (y^5 + y^5 + y^5 + y^5) = ?$
8. _____ 8. $(q^3-5q^2+18) \div (q-3) - q(q-2) = ?$
9. _____ 9. Factor completely: $3a^2-6a-24$.
10. _____ 10. $4/(r-3) - (r+3)/(r^2-9) = ?$
11. _____ 11. $23-2(3-a)=\frac{1}{3}a-13$. Solve for a.
12. _____ 12. $3n=2q+mp$. $p=?$
13. _____ 13. $10y^2-y-3=0$. $y=?$
14. _____ 14. $3t-4 \leq 7t+24$. Solve.
15. _____ 15. If $|2w+3| = 7$, evaluate w.
16. _____ 16. $4x+3y=24$. Coordinates of the midpoint between the intercepts = ?
17. _____ 17. If $5x=9-8y$ and $2x+7y+4=0$, then $(x,y)=?$
18. _____ 18. $y=-2x^2-4x-9$. If a maximum point does exist, find its coordinates. If it does not, please state so.
19. _____ 19. How many cc of a 50-percent alcohol solution must be used to mix with 800 cc of a 20-percent alcohol solution to produce an alcohol solution with 30 percent concentration?
20. _____ 20. If a jet can travel 750 miles per hour downwind (with the wind) and can travel 600 miles per hour upwind (against the wind), find the speed of the wind.
21. _____ 21. Graph on the reverse side of the paper: $y=2x^2+8x+5$.

Key

Answers to Arithmetic Pre-Test -----	Answers to Arithmetic Post-Test -----	Answers to Algebra Pre-Test -----	Answers to Algebra Post-Test -----
1. 2551	1. 3524	1. $31/90$	1. $11/70$
2. 1826	2. 583	2. 46	2. 23
3. 210,120	3. 107,100	3. -4	3. -8
4. 3010	4. 2030	4. $1/8$	4. $1/9$
5. 480	5. 800	5. -15	5. -14
6. 36.4	6. 25.7	6. 3×10^{-14}	6. 4×10^{-13}
7. 0.086	7. 0.063	7. 2h	7. 15y
8. 2.5	8. 33.6	8. 12	8. -6
9. $7/30$	9. $1/60$	9. $4(b+5)(b-2)$	9. $3(a-4)(a+2)$
10. $6/7$	10. $2/15$	10. $2 / d+2$	10. $3 / r-3$
11. $210\frac{4}{9}$	11. $437\frac{4}{7}$	11. -14	11. -18
12. 52	12. 16	12. $2c-3d / f$	12. $3n-2q / m$
13. 72	13. 147	13. $-2/3; 1/2$	13. $-1/2; 3/5$
14. 700,000	14. 640%	14. $h \geq -3$	14. $t \geq -7$
15. 63	15. 270	15. 1; 4	15. -5; 2
16. 25.12 yd	16. 31.4 in	16. (5,2)	16. (3,4)
17. 2380 sq ft	17. 3600 sq ft	17. (-7,4)	17. (5,-2)
18. 220 cu in	18. 320 cu ft	18. (-1,2) min	18. (-1,-8) max
19. 17 cm	19. 20 cm	19. 25 ounces	19. 400 cc
20. 420 days	20. 15 bags	20. 15 mph	20. 75 mph
21. 8 groups	21. 180 days	21. Max: (-2,27)	21. Min: (-2,-3)