

James Madison University
Sample Questions for Calculus and Statistics Placement

Welcome to JMU, and your first academic endeavor as a JMU student! The Math Placement Test is designed to help determine which college mathematics course is most appropriate for you, so that you may have a successful start in your academic career at JMU. The test covers a wide variety of topics for placement from basic quantitative literacy through calculus. There is a large set of first-semester math courses that are offered at JMU (at least seven, in fact!), and we want to try to place you into the course most appropriate for your algebra/precalculus and quantitative proficiencies. Our goal is to get you on the right track for your program of study from the beginning. To do this, we need your help.

First, don't stress out about the Math Placement Test, but do take it seriously. We recognize some of your math skills may be a little rusty, and that you've got lots of things going on at this exciting time, so we want to give you the opportunity to find some time to focus on this important first step in your academic career and refresh your skills before taking the Math Placement Test. We have provided a practice test with some sample problems so that you have a context within which to practice. Some of the questions on the test may not be relevant for the path you will take, so don't be overly concerned if there are a few things you've not seen before. You should break out your old math notes, or go check out an algebra or precalculus book from your local or school library, and practice taking the sample test and the algebra skills highlighted by the sample test. You should also do the sample test **without a calculator**, because it is the ability to perform these skills without a calculator that will be important for your success in your college mathematics classes. It's all about the logical thinking that underlies the calculations. You may get as much help as you want with the sample test (and any other practice you want to do) as you prepare to take the Math Placement Test: enlist your high school math teacher, a tutor, a parent, a friend, etc.

However, once you decide you are ready to take the Math Placement Test and you start the test online, you are subject to the JMU Honor Code (<http://www.jmu.edu/honor/code.shtml>) when taking this test, and no calculators nor outside help of any kind is permitted while taking the placement test. We want you to be successful in your first math class at JMU, so preparing for and taking the test properly is crucial. Data shows that students who end up in a course they are not prepared for are twice as likely to be unsuccessful, and we want you want to be on the right side of those odds. Your math professor may also give a similar assessment of prerequisite skills on the first day of class to be sure you're in the right place, but it is best for you to be enrolled in the best class for you during your registration time so that you have the greatest availability of open classes. So prepare, relax, and give it your best shot!

JMU also provides students with a free drop-in resource with many open tutoring hours available in the Science and Math Learning Center (SMLC). Check out <http://www.jmu.edu/smlc/> for hours, locations, and more info. It's good to be aware of this resource so that you can begin using it early in your first semester as a JMU student. Once again, welcome to the first step in your academic journey at JMU. To quote a favorite movie character, "To infinity, and beyond!"

With the above information in mind, now go to the next page to access the practice problems.

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Basic Skills Algebra

1. Simplify $\frac{(x^4y^{-3})^2}{x^3y^5}$.
2. Find the domain of $f(x) = \frac{1}{\sqrt{x+2}}$. Express your answer in interval notation.
3. Simplify (a) $\frac{x^2+4x+3}{x^2+2x-3}$ and (b) $\frac{\sqrt{x^8+x^4}}{x^2+1}$ as much as possible.
4. Simplify $\frac{\frac{1}{3}}{4}$.
5. Find the solution to the equation $\frac{x-4}{5x+15} = \frac{1}{x+3}$.
6. Simplify $\frac{\frac{1}{b^2} + a^2}{\frac{1}{a^2} + b^2}$.
7. Find the equation of the line through the two points $(5, 3)$ and $(-1, 6)$.
8. Simplify $\frac{5}{9} - \frac{4}{7}$.
9. The expression $x^3y - y^3x$ is equivalent to which of the following?
 - A) $(x-y)(x^2 - y^2)$
 - B) $xy(x-y)^2$
 - C) $xy(x-y)(x+y)$
 - D) $\frac{x^2}{y^2}$
 - E) None of these
10. The expression $a^2\frac{b^3}{c}\frac{c^2}{a}\frac{b^2}{2}$ is equivalent to which of the following?
 - A) $\frac{b}{2a^3c}$
 - B) b^6c
 - C) $\frac{ab^5c}{2}$
 - D) $\frac{a^3b^4}{c^3}$
 - E) None of these

11. If a rectangle has sides of length 6 feet and 8 feet then what is the length of its diagonal?
 12. Solve the system of simultaneous equations $3x + y = 1$, $x - 3y = 17$.
 13. If $8^{2-x} = 64^x$, what is the value of x ?
 14. Given $f(x) = x^2 + 2x + 3$, find and simplify $f(a - 1)$.
 15. Simplify the expression $\frac{4}{2(x-1)} - \frac{x-3}{x(x-1)}$ until it is a reduced quotient of the form $\frac{A}{B}$.
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Algebra and Precalculus

16. If a and b are positive real numbers and $x = \frac{a^2}{b^2}$, what are (a) $x^{\frac{1}{2}}$ and (b) x^{-2} ?
17. Simplify the expression $\frac{x^{-2} - 1}{x - 1}$ until it is a reduced quotient of the form $\frac{A}{B}$ that involves only positive exponents.
18. Simplify the expression $\frac{x^2\sqrt{4x^3}}{3x^{\frac{1}{4}}x^{-2}}$ until it is in the form Ax^k for some real numbers A and k .
19. Solve the equations (a) $x(4x + 12) = -9$ and (b) $2 - 6x + 3x^2 = 0$.
20. Find the solution set of the inequalities (c) $|3x - 8| < 2$ and (d) $x^2 \geq 2$.
21. Find the solution set of the inequality $3x^3 + x^2 - 12x - 4 \geq 0$.
22. If $f(x) = x^2 - x + 1$ and $g(x) = 2x - 1$, find and simplify (a) $f(x + 1)$, (b) $f(g(x))$, (c) $g(f(x))$, and (d) $f(f(2))$.
23. Sketch graphs of (a) $f(x) = (x - 2)^2 + 3$, (b) $g(x) = -\cos x$, and (c) $h(x) = 3 - e^{-2x}$ for $-\infty < x < \infty$.
24. For the three functions in the previous problem, use your graphs to determine if the function has an inverse, and if so, find that inverse function.
25. Find the set of real numbers x for which $\cos x = -\frac{\sqrt{3}}{2}$.
26. Given that $\cos x = -\frac{1}{4}$ and $\pi \leq x \leq 2\pi$, what is $\sin x$?

27. Find the exact value of $\tan^{-1}(\sqrt{3})$.
28. Simplify the expression $\log_2(8(16^x))$ until it is in the form $Ax+B$ for some real numbers A and B .
29. Given $f(x) = \ln\left(\frac{3x+1}{x-1}\right)$, determine the values of x for which $f(x) = 0$ and the values of x for which $f(x)$ is not defined.
30. Given $f(x) = \frac{\sin x + \cos x}{e^x - 3}$, determine the values of x for which $f(x) = 0$ and the values of x for which $f(x)$ is not defined.

Quantitative Reasoning – Sample questions for Statistics Placement

31. Bob has saved \$500 at the bank. He wants to save \$2,300 for a trip to Alaska. What percent of his goal has been reached?
- A) 4.6 B) 21.7 C) 35.4 D) 66.7 E) 115.0
32. Suppose that y and x are related through $y = 6 + 1.5x$. Then,
- A) the amount of increase in y for a unit increase in x is constant.
B) the amount of increase in y for a unit increase in x is 6.
C) the amount of change in y depends on the value of x .
D) y and x are independent.
E) y and x are disjoint.
33. Which of the following is equivalent to 2×10^{-2} ?
- A) -200 B) -0.002 C) 0.002 D) 0.02 E) 200
34. The probability of the occurrence of any event is
- A) any real number.
B) always positive.
C) always positive and less than 1.
D) always a nonnegative number bounded above by 1.
E) None of the above.
35. A discount store had monthly sales of \$50,200 and spent 20% of it on health insurance. How much was spent on health insurance?
- A) \$10,040 B) \$25,100 C) \$100,400 D) \$251,000 E) None of these.

36. The following diagram describes the cars on a used car lot. How many cars on the lot are not red?
- A) 10 B) 35 C) 38 D) 55 E) 58
37. An answer given by a calculator is listed as $-4E3$. Which of the following is equivalent to this number?
- A) $-30,000$ B) -4000 C) -0.004 D) 0.0004 E) 0.004
38. Which of the following units is most likely used to measure the amount of water in a bathtub?
- A) kilograms B) liters C) milliliters D) centigrams E) volts
39. To find the equation of a line, the minimum number of distinct points required is
- A) 0 B) 1 C) 2 D) 3 E) 4
40. The regular selling price of an item is \$180. For a special year-end sale, the price is at a markdown of 20%. Find the discount sale price.
- A) \$36 B) \$42 C) \$90 D) \$144 E) \$160

Answers: 1. $\frac{x^5}{y^{11}}$; 2. $(-2, \infty)$; 3. (a) $\frac{x+1}{x-1}$, (b) $\frac{x^2\sqrt{x^4+1}}{x^2+1}$, which does not simplify further; 4. $\frac{1}{12}$; 5. $x = 9$; 6. $\frac{a^2}{b^2}$; 7. $y = -\frac{1}{2}x + \frac{11}{2}$; 8. $-\frac{1}{63}$; 9. C; 10. C; 11. 10 feet; 12. $x = 2, y = -5$; 13. $\frac{2}{3}$; 14. $a^2 + 2$; 15. $\frac{x+3}{x(x-1)}$; 16. (a) $\frac{a}{b}$, (b) $\frac{b^4}{a^4}$; 17. $\frac{-(x+1)}{x^2}$; 18. $\frac{2}{3}x^{\frac{2}{4}}$; 19. (a) $x = -\frac{3}{2}$, (b) $x = \frac{1}{3}(3 \pm \sqrt{3})$; 20. (a) $2 < x < \frac{10}{3}$; (b) $x \leq -\sqrt{2}$ or $x \geq \sqrt{2}$; 21. $-2 \leq x \leq -\frac{1}{3}, x \geq 2$; 22. (a) $x^2 + x + 1$; (b) $4x^2 - 6x + 3$, (c) $2x^2 - 2x + 1$, (d) 7; 23. (a) the graph of x^2 shifted right 2 units and up 3 units, (b) the graph of $\cos x$ reflected over the x -axis, and (c) the graph of e^{-2x} reflected over the x -axis and then shifted up 3 units; 24. only $h(x)$ has an inverse, and it is $h^{-1}(x) = -\frac{1}{2} \ln(3 - x)$; 25. $\frac{5\pi}{6} + 2\pi k$ or $\frac{7\pi}{6} + 2\pi k$ for any integer k ; 26. $-\frac{\sqrt{15}}{4}$; 27. $\frac{\pi}{3}$; 28. $3 + 4x$; 29. zero when $x = -1$, undefined when $-\frac{1}{3} \leq x \leq 1$; 30. zero when $x = \frac{3\pi}{4} + \pi k$ for any integer k , undefined when $x = \ln 3$; 31. B; 32. A; 33. D; 34. D; 35. A; 36. D; 37. B; 38. B; 39. C; 40. D.