

SAMPLE FINAL EXAM QUESTIONS: ALGEBRA I

The purpose of these sample questions is to clarify the course objectives, and also to illustrate the level at which objectives should be mastered.

These sample questions are freely available to both instructors and students. They may be used throughout the year for homework, quizzes, and tests.

These sample questions have been carefully created to have the following properties:

- They do a good job of assessing achievement of the course objectives.
- They have enough inherent variability that their use cannot be construed as “teaching to the test.”

This question assesses achievement of many of the MANIPULATING AND RENAMING EXPRESSION objectives.

- For each expression given below, rename the expression as requested. If the requested name is not possible, so state. A few samples are done for you.

EXPRESSION	RENAME IN THIS FORM	PUT YOUR ANSWER HERE
(sample) 12	a sum of even integers	$2 + 10$ or $4 + 8$ etc.
(sample) 12	xy , where x and y are integers, with $x < 0$	$(-3)(-4)$ or $(-2)(-6)$ etc.
(sample) 12	2^x , where $x \in \{0, 1, 2, 3, \dots\}$	not possible
$\frac{1}{\sqrt{2}}$	a fraction with no radical in the denominator	
7	a quotient of integers, where the numerator is greater than 10	
23,070,000	in scientific notation	
7	$x - y$, where x and y are NOT integers	
7	$\frac{1}{2} \cdot x$	
$(x - 2)(x + 3)$	as a sum (i.e., multiply out)	
$x^2 - y^2$	as a product (i.e., factor)	
$\frac{1}{2}$	$\frac{3}{x}$	
$\frac{1}{x} - \frac{2}{3 + x}$	as a single fraction	
0.25	as a percent	
$\frac{x^4 x^{-1}}{(x^2)^3 x}$	x^k	
300 ft/sec	x mph (there are 5,280 feet in one mile)	

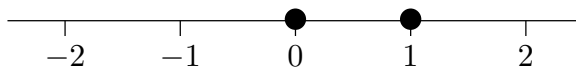
The next two questions assess sentence-solving and graphing skills, including the zero factor law, absolute value as distance, and the mathematical words ‘and’ and ‘or’.

2. Solve each equation/inequality in one variable. Write a list of equivalent sentences, ending with one that can be solved by inspection. Get EXACT answer(s), not decimal approximations. Graph each solution set on a number line. A sample is done for you.

(sample) $x^2 = x$

Solution:

$$\begin{aligned}x^2 &= x \\x^2 - x &= 0 \\x(x - 1) &= 0 \\x = 0 \text{ or } x - 1 &= 0 \\x = 0 \text{ or } x &= 1\end{aligned}$$

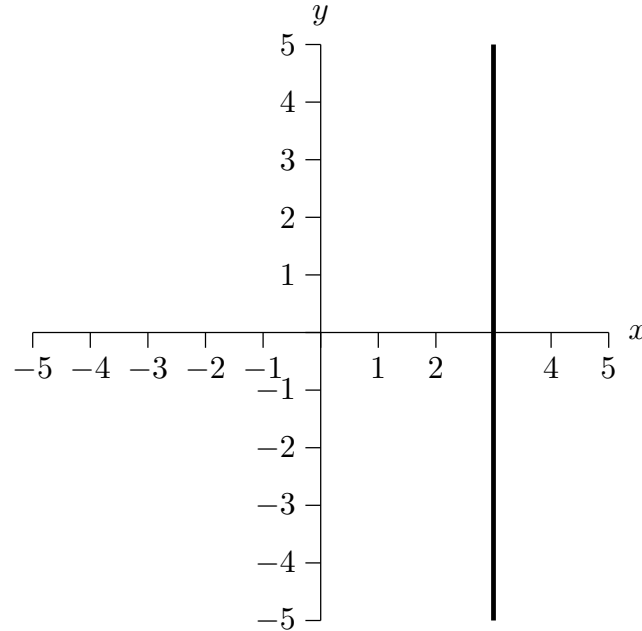


- (a) $3x(1 - 5x)(x^2 - 16) = 0$
(b) $\frac{1}{2}x - 7 = 3x + \frac{x}{5}$
(c) $|x - 3| > 1$
(d) $2 < |x| < 3$
(e) $1 - 2x < 3$
(f) $x^2 = x + 2$
(g) $1 < x$ or $x \leq -1$
(h) $0.005(x - 0.01) = 0.003 + 0.4x$

3. Graph each of the following equations/inequalities, where each sentence is viewed as a sentence in two variables. (That is, $x = 3$ should be viewed as $x + 0y = 3$.) A sample is done for you.

(sample) $x = 3$

Solution:



- (a) $x > 3$
- (b) $2y - 3 = 0$
- (c) $x = 3$ and $y = 2$
- (d) $x = 3$ or $y = 2$
- (e) $y = 2x - 1$
- (f) $y = \sqrt{x}$
- (g) $|x| = 2$
- (h) $y \leq 2$
- (i) $\frac{y-2}{3} = 2x - 1$

This question assesses order of operation and calculator skills.

4. Estimate each of the following numbers on your calculator. For full credit, each answer must be correct to five decimal places.
- (a) $\frac{1 + \sqrt{2}}{\sqrt[3]{5} - 7}$
 - (b) $3x^2 - 5x + 1$, where $x = -1.8$
 - (c) $|1 - 2x|$, where $x = \sqrt{3}$
 - (d) $(2.03 \times 10^{-9})(-4.1 \times 10^7)$

The next three questions assess understanding of the function concept, function notation, and graphing calculator skills.

5. (a) What is the domain of the function $f(x) = \frac{1 - 3x}{x - 2}$?
- (b) Use your graphing calculator to graph the function f in the window $-1 < x < 3$ and $-15 < y < 10$.
- (c) Find the x -intercept of the graph.
- (d) Use your calculator to estimate a value for x for which $f(x) = 5$. (Zoom, as necessary, to get $f(x)$ within 0.01 of 5.)
6. Write an expression (using the variable x) to represent each sequence of operations.
- (a) take a number, multiply by 2, then subtract 3
 - (b) take a number, subtract 3, then multiply by 2
 - (c) take a number, multiply it by 2, cube the result, add 1, then divide by the original number

Write the sequence of operations that is being described by each expression.

- (d) $3x - 1$
- (e) $2(x + 1)^3 - 5$
- (f) $\frac{x - 3}{7} - 1$

7. Let $f(x) = x^2 - 2x + 1$. Evaluate each of the following expressions.
- (a) $f(0)$
 - (b) $f(1) - 2$
 - (c) $f(f(-1))$

The last two questions assess achievement of the LINEAR FUNCTIONS/EQUATIONS/GRAPHS objectives.

8. Write the equation of the line, in $y = mx + b$ form, that satisfies the given conditions.
- (a) slope 3, passing through the point $(2, -1)$
 - (b) the horizontal line that crosses the y -axis at 2
 - (c) the line that is perpendicular to $x - 3y = 5$ and passes through the point $(0, 3)$
9. A certain telephone company charges a \$4.95 monthly fee, for which the customer gets 100 minutes of calls anywhere in the United States. Each additional minute costs 7 cents. Carol always talks more than 100 minutes. Let $x > 100$ denote the number of minutes that Carol talks in a month, and let $C(x)$ denote the dollar amount owed to the telephone company. Find a formula for $C(x)$.