SAMPLE FINAL EXAM QUESTIONS: ALGEBRA II

The purpose of these sample questions is to clarify the course objectives, and also to illustrate the level at which objectives should be mastered. Each Algebra II final exam will have a part that is common to *all* Algebra II sections; this common part will consist of problems that are similar in format to these Sample Final Exam Questions. The remainder of the final exam will be created by the individual instructor.

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."

See all my course materials:
http://www.onemathematicalcat.org/getPrereqsAndObjectiveSheets.htm

1. 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	ANSWER
(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
x^2+2x+3	involving a perfect square, $(x+k)^2$	
$\lvert 2x+3\rvert$, for $x < -\frac{3}{2}$	without absolute values	
$2\begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}$	$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$	
$2+3i-i^2+(1-i)(3+4i)\,,\ (i=\sqrt{-1})$	$a+bi$	
$\dfrac{x^2-x-1}{x-3}$	$Q(x)+\frac{R(x)}{D(x)}$	
$\log_7 5$	involving the natural log	
$\dfrac{4\log 10^x}{3}$	without logarithms	
$\ln x^4 - \ln x^2 + \ln(x^2+1)$	a single logarithm	
$(x-2y)^4$	expanded form (Hint: use Pascal's triangle)	
$(-\infty,-2] \cap (-4,5]$	as a single interval	
$\{x \mid x \geq -2\}$	using interval notation	
${}_5C_2$	as a whole number	
${}_5P_2$	as a whole number	

See all my course materials:
http://www.onemathematicalcat.org/getPrereqsAndObjectiveSheets.htm

2. Solve each equation/inequality/system. For full credit, each solution must display the following:

(1) a graph that clearly illustrates the solution set

(2) a numerical approximation of the solution(s), if needed (round to 4 decimal places)

(3) the (exact) solution(s)

A sample is done for you.

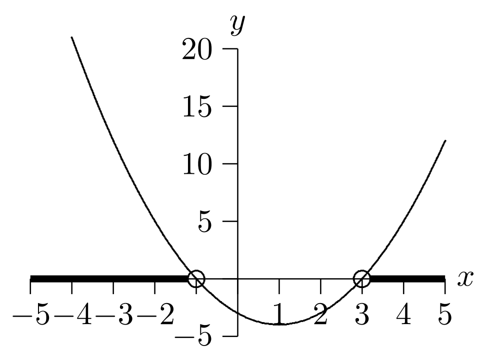
(sample) $x^2 - 2x > 3$

Solution: Rewrite:

$$x^2 - 2x - 3 > 0$$
$$(x-3)(x+1) > 0$$

(graph $y = (x-3)(x+1)$; see where graph lies above x-axis and read off solution set)

$$x < -1 \quad \text{or} \quad x > 3$$



(a) $|2x - 3| > 5$

(b) $2x - 3x^2 \le -1$

(c) $3^{2x-1} = 10$

(d) $\log_3(x^2 - 1) = -2$

(e) $\sqrt{3x^2 + 5x - 3} = x$

(f) $y = x^2 + 1$ and $y = 2x + 4$

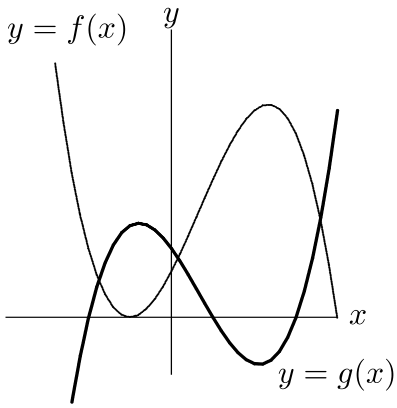
(g) Let $f(x) = \begin{cases} x+2\,, & \text{if } x < 0 \\ 2\,, & \text{if } 0 \le x < 1 \\ x - 1 & \text{if } x \ge 1 \end{cases}$. Solve the equation $f(x) = 1$.

See all my course materials:
http://www.onemathematicalcat.org/getPrereqsAndObjectiveSheets.htm

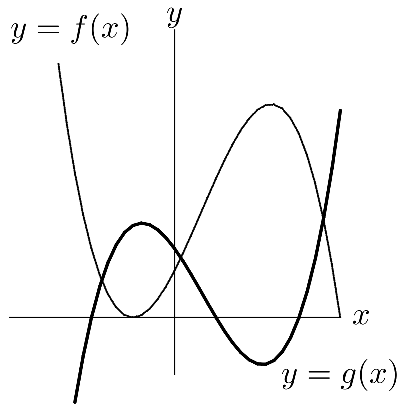
3. (a) Let $f(x) = x^2 - 2x + 1$ and $g(x) = 1 - 3x$. Find both $g(f(x))$ and $f(g(x))$.

(b) Find functions f and g such that $f(g(x)) = \sqrt[3]{x^2 - 1}$.

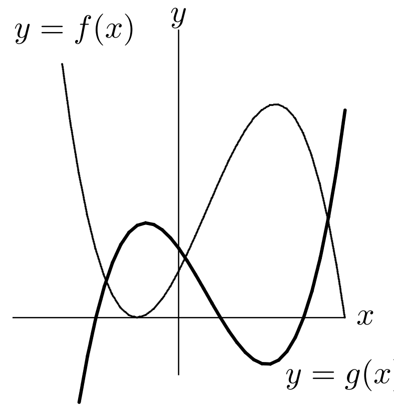
4. On each graph below, clearly shade the solution set on the x-axis.



$f(x) = g(x)$



$f(x) \geq g(x)$



$f(x) < g(x)$

5. Write a list of transformations that takes the graph of $y = f(x)$ to the graph of $y = 5 - 3|f(x+1)|$. There may be more than one correct answer.

EQUATION	TRANSFORMATION
$y = f(x)$	(starting place)

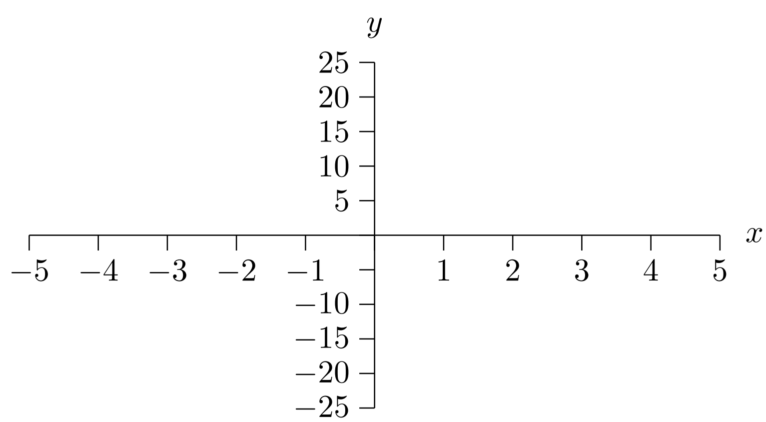
See all my course materials:
http://www.onemathematicalcat.org/getPrereqsAndObjectiveSheets.htm

6. Starting with the equation $y = x^2 - 2x + 1$, apply the specified sequence of transformations.

EQUATION	TRANSFORMATION
$y = x^2 - 2x + 1$	(starting place)
	up 1
	left 3
	reflect about the x-axis
	vertical scale by a factor of 2

7. Find the equation of a polynomial P satisfying the following properties: $P(-3) = 0$, 1 is a zero of P, the graph of P crosses the x-axis at $x = 2$, P has degree 5, and $P(0) = 7$.

8. Graph the rational function $g(x) = \dfrac{x^2 - 1}{(2x-1)(x+3)}$ in the space below.



If any of the following do not exist, so state:

x-intercept(s): ______

y-intercept(s): ______

Equation(s) of any horizontal asymptote(s): ______

Equation(s) of any vertical asymptote(s): ______

Equation(s) of any slant asymptote(s): ______

Fill in the blank: as $x \to \infty$, $y \to$ ______

Fill in the blank: as $x \to -3^+$, $y \to$ ______

See all my course materials:
http://www.onemathematicalcat.org/getPrereqsAndObjectiveSheets.htm