Standards for showing work and writing conclusions to math problems in MTH 65

Notation is an important part of how we communicate the results to a mathematical problem. Here is a quick reference for how to write your answers for this course:

Problem Type	**Special Notes**	**How to write your answer**	**Possible Example** **(Check with your instructor for how they prefer you to show your work.)**
Evaluating an expression.	Evaluating means you have an expression (there is no equal sign in the statement of what you are asked to do). You will often times see the word "evaluate," "state," or "find."	Show your substitution step and then work out the arithmetic using equal signs before each line to show equivalency of the expressions.	Evaluate $f(-2)$ for $f(x) = 2x^2 + 5x - 3$. $f(-2) = 2(-2)^2 + 5(-2) - 3$ $= 2(4) - 10 - 3$ $= 8 - 10 - 3$ $= -5$
		If you cannot evaluate, state that the value is *undefined*. DO NOT say "no solution" because you are not *solving*.	Evaluate $f(1)$ for $f(x) = \dfrac{1}{x-1}$. $f(1)$ is undefined.
Simplifying an algebraic expression.	Remember, an algebraic expression represents a number which is dependent on the value we choose for the variable. To write an equivalent expression means that both expression hold the same value no matter what we choose for the variable. You will often times see the word "simplify" in the directions.	Since we are writing equivalent expressions we want to use an equal sign to signify that each subsequent expression is equivalent to the previous.	Simplify $\left(\dfrac{9x^4y^2}{12x^{-2}y^3}\right)^{-2}$. The variables in the final form should all have positive exponents. $\left(\dfrac{9x^4y^2}{12x^{-2}y^3}\right)^{-2} = \left(\dfrac{3x^4x^2}{4y}\right)^{-2}$ $= \left(\dfrac{3x^6}{4y}\right)^{-2}$ $= \left(\dfrac{4y}{3x^6}\right)^{2}$ $= \dfrac{16y^2}{9x^{12}}$

<table>
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<tr><td rowspan="3">Solving an equation.</td><td rowspan="3">You be given an equal sign between two algebraic expressions. You will often times see the word “solve” in the directions.</td><td>Show your work with your equal signs lined up in the middle of each equation.

Do not put equal signs on the left.

State what the solution is in a sentence and use either set builder or interval notation as asked for in the directions.</td><td>Solve $f(x) = 10$ when $f(x) = -2x^2 + 4x + 40$.
$-2x^2 + 4x + 40 = 10$
$-2x^2 + 4x + 30 = 0$
$-2(x^2 - 2x - 15) = 0$
$-2(x-5)(x+3) = 0$
$x - 5 = 0$ OR $x + 3 = 0$
$x = 5$ OR $x = -3$
So the solutions are 5 and 3 and the solution set is {5,-3}.
OR So the solutions are 5 and 3 and the solution set is $\{x \mid x = 5 \text{ or } x = -3\}$.</td></tr>
<tr><td>If there are an infinite number of solutions, communicate this using the “set of all real numbers” symbol.</td><td>Solve $3(x-5) + 1 = 2x - 14 + x$ for x.
$3(x-5) + 1 = 2x - 14 + x$
$3x - 15 + 1 = 3x - 14$
$3x - 14 = 3x - 14$
$3x - 14 - 3x = 3x - 14 - 3x$
$-14 = -14$ Is a true statement.
So every real number is a solution and the solution set is $\mathbb{R}$.
OR So every real number is a solution and the solution set is $\{x \mid x \in \mathbb{R}\}$.</td></tr>
<tr><td>If there is no solution, communicate this using either of the empty set symbols.</td><td>Solve $x + 2 = x + 1$ for x.
$x + 2 = x + 1$
$x + 2 - x = x + 1 - x$
$2 = 1$ Is not a true statement.
So there are no solutions and the solution set is $\{\}$.
OR So there are no solutions and the solution set is $\emptyset$.</td></tr>
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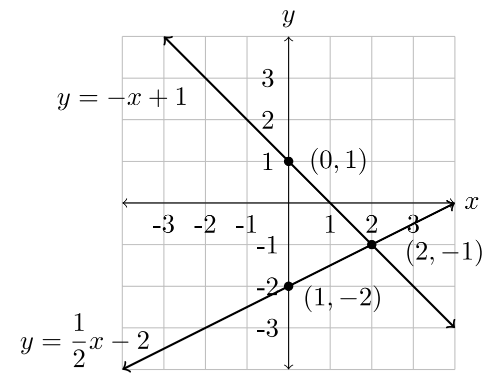
<tr><td rowspan="2">Solving a system of equations.</td><td rowspan="2">You will have two equations with two unknowns and you are looking for a point which satisfies both of these equations. You will often times see the word “solve” in the directions.

You will often be asked to solve the system by either “graphing,” by “the substitution method,” or by “the addition method.”</td><td>When asked to solve the system of equations by graphing be sure to label your horizontal and vertical axes (often x and y) with an appropriate scale, label both lines with their respective equations, the point of intersection of the two lines and any other points required by your instructor (often the vertical intercept and sometimes others).</td><td>Solve $\begin{cases} y = -x + 1 \\ y = \frac{1}{2}x - 2 \end{cases}$ by graphing.


So (2,-1) is a solution to both equations and the solution set to the system of equations is $\{(2, -1)\}$.</td></tr>
<tr><td>If there are an infinite number of solutions, communicate this using set notation.

The set notation reads “The set of all points (usualy (x, y)) that satisfy the given equation.”</td><td>Solve $\begin{cases} y = 2x + 1 \\ 3y - 6x = 3 \end{cases}$ by the substitution method.

Since $y = 2x + 1$ we plug this in for y in $3y - 6x = 3$:

$3(2x + 1) - 6x = 3$
$6x + 3 - 6x = 3$
$3 = 3$ Is a true statement.
So any point satisfying one equation will also satisfy the other and the solution set is $\{(x, y) \mid y = 2x + 1\}$.
OR So any point satisfying one equation will also satisfy the other and the solution set is $\{(x, y) \mid 3y - 6x = 3\}$.</td></tr>
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Problem Type	Special Notes	How to write your answer	Possible Example (Check with your instructor for how they prefer you to show your work.)
Solving a system of equations (continued).	You will have two equations with two unknowns and you are looking for a point which satisfies *both* of these equations. You will often times see the word "solve" in the directions. You will often be asked to solve the system by either "graphing," by "the substitution method," or by "the addition method."	If there is no solution, communicate this using either of the empty set symbols.	Solve $\begin{cases} y - 2x = 1 \\ 2y - 4x = 3 \end{cases}$ by the addition method. $(-2)(y-2x) = 1(-2)$ → $-2y + 4x = -2$ $2y - 4x = 3$ → $2y - 4x = 3$ $0 = 1$ Is not a true statement. So no point will satisfy both equations and the solution set is $\{\}$. OR So no point will satisfy both equations and the solution set is $\emptyset$.
Solving word problems.	These problems will generally describe a situation and a relationship between two variables with units defined for each variable.	Write your answer as a complete sentence, giving a contextual conclusion which answers the question being asked.	If a rock falls from a height of 20 meters on Earth, the height H, in meters, x seconds after it began to fall is approximately $H(x) = 20 - 4.9x^2$. What is the height of the rock 1 second after beginning its fall? $H(1) = 20 - 4.9(1)^2$ $= 20 - 4.9$ $= 15.1$ The height of the rock 1 second after beginning its fall is approximately 15.1 meters.

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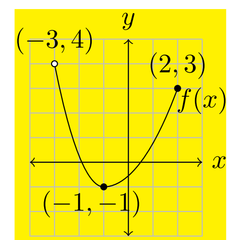
<tr><td>Checking to see if a point is a solution to an equation in two variables.</td><td>A solution to an equation in two variables is a point which, when plugged into the equation for the variables, allows for a true statement. You will often times see the word “check.”</td><td>Show your substitution into the equation, working both sides simultaneously, and then state whether the point being tested is or is not a solution.</td><td>Check if the point $(-1, 2)$ is a solution to the equation $2x - 3y = 6$.

$2(-1) - 3(2) \stackrel{?}{=} 6$
$-2 - 6 \stackrel{?}{=} 6$
$-8 = 6$ Is a false statement.
So the ordered pair $(-1, 2)$ is not a solution to the equation.</td></tr>
<tr><td rowspan="2">Stating the domain and range of a function.</td><td rowspan="2">You will be expected to determine the domain and range of a function based upon a table or a graph of that function. The domain is the set of inputs for the function while the range is the set of outputs for the function.</td><td rowspan="2">Write your answers in either set builder or interval notation (as directed).</td><td>State the domain and range of f given in the following graph.


The domain of f is $\{x| -3 < x \leq 2\}$.
The range of f is $\{y| -1 \leq y < 4\}$.
OR The domain of f is $(-3, 2]$.
The range of f is $[-1, 4)$.</td></tr>
<tr><td>State the domain and range of f, given the following table, using set notation.
<table><tr><td>x</td><td>-2</td><td>0</td><td>3</td><td>7</td><td>11</td></tr><tr><td>$f(x)$</td><td>5</td><td>2</td><td>-1</td><td>-3</td><td>5</td></tr></table>
The domain of f is $\{-2, 0, 3, 7, 11\}$.
The range of f is $\{5, 2, -1, -3\}$.</td></tr>
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<tr><td>Rectangular Coordinate System Guidelines.</td><td>Remember, the graph is a picture of the solutions to the equation. The horizontal-axis (often the x-axis) and vertical-axis (often the y-axis) are the coordinate system or coordinate plane which we draw the graph onto.</td><td>Label your horizontal and vertical axes (often x and y) with an appropriate scale, label the graph with its equation and any points required by your instructor (often the vertical intercept, vertex, horizontal intercept(s) and sometimes others).</td><td>

Graph the function $f(x) = x^2 + 4x + 3$.

The x-value of the vertex is $\frac{-b}{2a} = \frac{-4}{2(1)} = -2$.

So the y-value of the vertex is $f(-2) = -1$, the vertex is $(-2, -1)$ and the axis of symmetry is $x = -2$.

The y-intercept occurs when $x = 0$ and $f(0) = 3$ so $(0, 3)$ is the y-intercept.

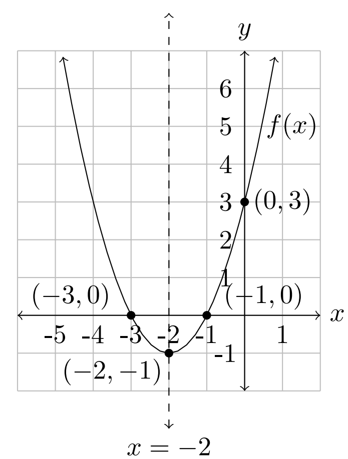
The x-intercepts occur when $y = 0$:

$$0 = x^2 + 4x + 3$$
$$0 = (x + 1)(x + 3)$$

$x + 1 = 0$ OR $x + 3 = 0$

$x = -1$ OR $x = -3$

Thus the x-intercepts are $(-1, 0)$ and $(-3, 0)$.



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