

In all problems you must show your work. In all problems your answers must be clearly labeled. If the grader has to guess which answer goes with which part of the problem then you will not receive credit. If the grader has to guess which part of what you wrote down is actually the answer then you will not receive credit. When possible put a box around your answer and clearly label it. All work must be written in the exam booklet. Put your name, your TA's name and your UIN on the exam booklet. Do not write in the upper right corner of the booklet, this is used to write your scores. You can keep the exam sheet but you must turn in the exam booklet. Only what is in the booklet will be graded. If no work then no credit.

1. Let $f(x) = 2x + 3$ and $g(x) = \sqrt{x - 1}$. Find the rules for the following functions. In each case give the domain and range the new function. Feel free to use your calculator but you must explain your answer. Your answers must be clearly labeled.
 - (a) fg ,
 - (b) $f \circ g$.
2. For this problem it is assumed that you will use your graphical calculator to answer the questions. To show your work, draw the graph from your calculator screen, and indicate each point and interval on the graph. function $y = x^3 - 3x^2 - 6x + 20$,
 - (a) all real zeros (x-intercepts)
 - (b) all local maxima and minima
 - (c) find all intervals where $f(x)$ is decreasing
3. Find the inverse of the function $f(x) = \frac{2x+3}{4x+5}$
4. Find all solutions to the equation: $x + 4 = \sqrt{4x + 12}$ using algebra and not your calculator.
5. Write the rule of a function $g(x)$ obtained by performing the following transformations on $f(x) = x^2$: shift horizontally 3 units to the right, stretch vertically by a factor of 4, shift up by 5 and finally reflect about the x axis. Your final answer should be in the form $y = g(x)$
6.
 - (a) Give the relation that results from shifting the graph of $x^2 + y^2 = 1$ by 2 in the positive x direction 3 in the positive y direction. Graph the new relation by hand. On your graph indicate the origin of the circle and 4 other points on the graph. Give the points as ordered pairs of coordinates.
 - (b) Give the relation that results from shrinking the graph of $x^2 + y^2 = 1$ by 2 in the x direction and stretching by a factor of 3 in the y direction. Graph the new relation by hand. On your graph indicate the two x-intercepts and two y-intercepts of the ellipse. Give the points as ordered pairs of coordinates.