MATH1040/7040   Assignment 5

All questions should be submitted by 4pm on Friday, 21 May. Assignments can be submitted at your tutorial, or to the MATH1040/7040 assignment boxes (4th floor Priestley Building #67). **Make sure that your name, student number, tutorial group and your tutor's name are on each sheet of your answers**. You do not need a cover sheet nor do you need to include this question sheet. Solutions will be distributed in class later.

1. Answer each of the following questions, showing all working.

   (a) Find the domain of $f(x) = 2\sqrt{x^2}$.

   (b) Find the domain of $f(w) = \dfrac{-3}{w^2 + 3}$.

   (c) Find the domain and the range of $f(z) = \sqrt{3\,|z|}$.

   (d) Find the range of $f(x) = \left| -8 \times \dfrac{-10}{x} \right|$.

   (e) Find the range of $f(z) = \dfrac{4}{\sqrt{z} + 10}$.

2. Solve each of the following equations **without** using the quadratic formula:

   (a) $8z\,(4z + 7) = 0$

   (b) $(-5 - 6y)\,(3y + 1) = 0$

   (c) $(y - 3)\,(7 + 3y) = 0$

   (d) $(3 + 10x)^2 = 0$

3. Solve $-12 + 3x + x^2 = 3x^2$.

4. Given the quadratic equation $y = -3x^2 + 12x - 9$:

   (a) Find the roots of y.

   (b) Find the y-intercept of the quadratic.

   (c) Sketch the graph of the quadratic.

5. Cassanova loves Cassandra. Alas, her father Baron Bruce de Burgundy does not approve, and shuts her in a tower. Cassanova looks sadly up at her window. After a while, his rampant hormones become irresistible, so he buys a ladder.

   (a) Cassanova could only afford a ladder $2\sqrt{10}$ metres long. He leans it against the wall, with the ladder's base 2 metres out from the wall. If her window is exactly 7 metres above the ground, can he reach her? (Hint: first work out how high his ladder reaches up the wall. Assume he is scared of heights, and can only get in if his ladder exactly reaches the height of the window.)

   (b) Cassanova is not fussy: Cassandra has a younger sister, Cecelia. When the bottom of the ladder is placed at the point $(0,0)$, and the ladder has a gradient of 2 (note: 2, not -2), the top of the ladder just reaches Cecilia's window. Find the equation which describes the ladder.

   (c) If the distance from the origin to the bottom of the building is $2\sqrt{2}$ metres, find the height of Cecilia's window.

   (d) When Cassanova climbs in the window, quietly singing Italian love songs, he receives a surprise: it is not Cecelia, but is instead Baron Bruce, dressed in Cecelia's clothes. Cassanova is still not fussy and carries the Baron down the ladder. Alas, their combined weight is too much, and when they are **halfway** down, the ladder breaks and they fall vertically. Find the equation of the line along which they fall.

   Ensure your name, student number, tutorial number and tutor's name are on each sheet of your answers.