

## Comments on MATH10222/11222 Exam Section A

### Question One

(i)

Most were able to say something about existence & uniqueness. Common mistakes included misidentifying the equation as linear, incorrect differentiation, and failing to point out that the theorem only guarantees a *local* solution.

(ii)

Generally sketches were quite good. Most were able to identify the isoclines and critical point correctly. Common mistakes included drawing the integral curves as circles about the origin and failing to include the critical point or integral curves.

(iii) (a) & (b)

Most marks were lost on this part of the question. Almost all candidates were able to solve the equation for  $y$  and find the constants corresponding to the ICs, but most gave their answers either in terms of  $y^2$  or with  $y = \pm$ , rather than choosing the correct sign. As a result, sketches were poor, especially for part (b).

### Question Two

Mostly full marks on this question. Almost all candidates were able to identify the correct substitution to make ( $z = \frac{y}{x}$ ). Common mistakes included omitting the '+z' from  $\frac{dy}{dx}$ , and basic integration errors.

### Question Three

Surprisingly poor performance on this question. Some candidates even failed to solve the homogeneous ODE correctly. Not many took the hint to use complex numbers, preferring to crank through several pages of algebra before eventually identifying the correct particular integral, or giving up. Many failed to use the correct form for the particular integral. Most were able to give the correct reason for a non-contradiction at the end of the question (even if they got everything else wrong!).

### Question Four

Worst question by far, with only a handful of candidates obtaining full marks. Most students failed to give the correct Taylor series expansion

for  $\exp(\epsilon x)$ , and those that did struggled to expand the entire equation in powers of  $\epsilon$  correctly. Others didn't even attempt to expand the exponential term, only the  $y''$  term. Another common mistake was incorrect application of the boundary conditions. Many students solved the equations at each order using combinations of particular and homogeneous solutions, rather than just integrating!

### **Question Five**

Mostly well done. Some answers had basic errors in integration, but the most common mistake was not correctly applying the ICs, giving a solution with  $\pm$  still in.