MATH011 Examination, January 2010
Feedback to Students

Average exam mark: 66.96 %

The exam paper (and sillabus) are oriented towards very basic mathematical knowledge. Most of the students have a good level and consider the module and the exam as rather easy. However those who have not encounter difficulties and have to work hard. Some modifications in the exam paper seem desirable to check wider range of basic mathematics.

MATH012 Examination, May 2010
Feedback to Students

Average exam mark: 71.9 %

To prepare for the exam students should make sure that they understand and know how to do the homework problems, and work out past exam papers.

MATH013 Examination, January 2010
Feedback to Students

Average exam mark: 63.34 %

Generally the exam showed a very good understanding of the material and most questions were answered equally successfully. Possible exceptions to this include question 3 where there was some confusion about how to solve the logarithmic equation and identify the correct domains for the two functions. Additionally, few people managed to solve the very last part of question 12.

In many cases, students clearly understood the work but some marks were lost because of presentation. For example, you should ensure that the questions are actually answered; if the roots of a polynomial are asked for, write something like ...therefore the roots of the polynomial are..... rather than writing down some numbers which are unconnected to anything. It is also important to learn the correct use of the equals sign. It has a definite meaning and should not be used to indicate that that one statement implies the next (for which an arrow or therefore can be used). The equals sign also only makes any sense when there is something on either side of it.

MATH014 Examination, May 2010
Feedback to Students

Average exam mark: 66 %

Part A

Almost all students did well on problems 1 and 2 (computing basic definite and indefinite integrals). The most common mistake was not to spot the substitution $t = x^2 - 1$ in 2d, despite a similar problem in the class test. Some students lost marks through minor mistakes due to lack of care.

Problem 3i) was done fully correctly by the majority of students. Problems arise through mistakes or lack of practice in solving simultanous linear equations in 2 or 3 variables. Problem 3ii) was done well by most students. The most common mistake was either to give the indefinite rather than definite integral for 3iib), or incorrect evaluation of the integral $\int \frac{dx}{(x-3)^2}$, despite that the answer could be found on the formulae sheet.

Problem 4, integration by parts, was done essentially correctly by most students. However, about half of these students lost some marks by gaps in their worked solutions (the answer for the integral was given in the exam paper, therefore marks needed to be earned by giving a comprehensible derivation). Another common phenomenon is that students make a mistake and then twist their work towards the correct (given) result. However, making a second mistake deliberately to cover for another mistake results in further subtraction of marks.

Problems 5 (1st order differential equations) and 6 (second order differential equations) were either done well or poorly. There are two methods taught in the module for solving differential equations, and a good part of class seems to have revised (or mastered) only one of them. Almost all students were able to do either problem 5 or problem 6. A small number of students knew how to find the general solution of the differential equation, but not how to implement initial conditions.

Part B (Best three out of four problems are counted)

Problem 7 was done by most students. Part (a) was done well by students who achieve overall high marks, while students with overall low marks concentrated on Part (b), which could be done independently. Part (b) was usually done well. Most students knew how to tackle this part, and marks were typically lost on calculational mistakes. Part (a) required to know how to derive and solve the differential equation for the free fall. This was usually done well by students who also performed well on other problems involving differential equations.

Problem 8 was avoided or done incompletely by many students. Students doing well on other problems on differential equations usually did well on part (a). For part (b) only very few students submitted correct solutions, and the majority did not address this problem. The method needed (solving an integral by applying a given substitution) is taught relatively early in the module, and most students do not seem to have revised this method. However, a very similar problem appeared in a previous exam, and this example was discussed in one of the (not very well attended) revision classes in the final week.

Problem 9 was done very well by many students who struggled with the other problems in part B. Several students secured the marks required for a pass by doing this problem.

Problem 10 was attempted by more students than problem 8 but by less students than problem 7. The first part, which requires the same methods as problems 6 and 8a was usually done well, while marks were typically lost on plotting the solution (according to the specifications taught in the class).

MATH016 Examination, May 2010
Feedback to Students

Average exam mark: 57.6 %

There were generally few questions which provided consistent difficulties, but it is worth noting the following: - in "matching" questions, it is always necessary to have a one-one relationship for a matching, so it was necessary to break down the first checkpoint into TWO separate checkpoints, 1A and 1B, say. - in all algorithms, it is necessary to show details of the method used, so that the examiner can judge that an APPROPRITE algoroithm has been used, rather than an ad hoc method. The Simplex Algorithm question was generally very well answered.

MATH101 Examination, January 2010
Feedback to Students

Average exam mark: 54.6 %

Q1 mostly well done

Q2 difficulties with inequalities for potentially negative numbers or reciprocals

Q3 a few mixed up even and odd; didnt always use $f(-x)$; some seemed to think $|x-1|$ was even (since non-negative)

Q4 limits mostly OK, derivative of $\ln(x-1)$ sometimes ended up as $1/x$

Q5 there were several strange formulae for the limit including $(f(x+h)^2 - f(x))/h$; $(h/expression)/h$ sometimes became $h^2/expression$

Q6 most did (i) and (ii) separately; the substitution (of $x = 2$) was sometimes done too early or not at all

Q7 most had the right idea and many got through to the answer

Q8 fairly well done; some missed one or more of the zeros of $g(x)$; not all graphs were symmetric

Q9 many got lost by attempting integration by parts for (i); (ii) was well done but some integrated the wrong factor

Q10 most had the right idea but few interpreted $|1+x| < 1$ correctly; very few looked at $x = -2$

Q11 (a) reasonably well done but decisions not always in agreement with graph shown; many lost marks by not giving their ARGUMENTS as requested.

Q11 (b) most used continuity of R but some didnt use continuity of R

Q12 most showed a sketch with at least some of the desired features; many found $F(x)$ and identified the need to find the zeros of $1 + x + e^x$ but very few of the attempts at using Newton-Raphson identified which function was being used. It seldom seemed to be $1 + x + e^x$ or $F(x)$, and may often have been $F(x)$, but in any case was not applied correctly as convergence was seldom attained

Q13 (i) was poorly done many seemed not to see that the x was under the square root sign

Q13 (ii) was well done

Q13 (iii) had many reasonably successful attempts although the integration of $1/(4x^2 + 1)$ caused problems

Q14 (a) was well done with quite a few using trigonometry to make the maximum obvious

Q14 (b) was reasonably well done but few looked at the extreme cases: those who did tended to use heuristic arguments which worked for the maximum but not the minimum

Q15 arguments needed to be tightened, especially when the ratio test was used, lim and |...| are both important; occasionally a correct argument would be followed by the wrong conclusion

MATH102 Examination, May 2010
Feedback to Students

Average exam mark: 49.75 %

Students who attended all lectures, tutorials and submitted their homework on a regular basis did well in the exam.

MATH103 Examination, January 2010
Feedback to Students

Average exam mark: 66.29 %

1. There is direct correlation between the exam performance and work during the semester (both at the tutorials and at home).

2. For good performace in the exam and for CA, regular work on the lectured material is vital (students should come to a lecture having properly revised their notes from the previous one).

3. When answering any question, read attentively what you are asked about. Every minor subquestion should be answered, and the answer should be exhibited explicitly (do not hide it inside lengthy calculations).

4. Use words. Use maths signs correctly (especially $=$ and $\Longrightarrow$). Make your script readable. It should not all look like kind of rough work.

5. Be ready to see questions differring from those in the past papers.

6. Comments on particular exam questions:

– notions of linear dependence/independence should not be messed up

– it should be well understood what a given system of vectors spans

– mind the sign in the 2nd component of a vector product

– mind the signs when expanding a determinant along an arbitrary row/column (not just the first ones)

– an invertible (in particular, orthogonal) matrix can't have a zero column

– when writing out a matrix which is assumed to be orthogonal, take care of it being indeed orthogonal

– when answering a question on finding the inverse of a matrix, spend a couple of minutes on checking that your answer is indeed the inverse

– inverting a 3x3 matrix using row operations generates a lot of mistakes in calculations

– this year (comparing with the previous ones) I was very pleased with how the questions on complex roots and diagonalising a 3x3 matrix were done (of course, this is due to the extensive practice during the revision week)

MATH104 Examination, May 2010
Feedback to Students

Average exam mark: 58.27 %

Examination: A small number of students appeared to be very ill prepared for the examination, but the general standard was satisfactory. A small number of student did not hand in any, or handed in very little, homework for MATH104a and this affected their final mark.

MATH104b: The most likely reason for failing is not turning up to the sessions. There was also evidence that some groups did not organize themselves well in the production of posters which have to be done without assistance from the lecturer.

MATH122 Examination, May 2010
Feedback to Students

Average exam mark: 57.33 %

There were no common mistakes as far as it concerns mathematical techniques. The majority of students skept problems on relative motion and especially on concervation laws - this might indicate a lack of confidence with these topics.

MATH142 Examination, May 2010
Feedback to Students

Average exam mark: 58.99 %

One of the aims of M142 is to provide an introduction to logic and mathematical reasoning. In other words, M142 is not so much about "getting the numbers right" as about getting them right for a right reason. So it is very important to present one's thoughts in a coherent way using correct terminology, especially in the group theory and mathematical induction questions. Here are some specific comments.

1. When using the mathematical induction to prove that a certain formula is valid say for every positive integer n it is important to distinguish between the statement one wants to prove (which says that the formula is true for a given n) and the left and right hand sides of the formula itself. (This year there were less mistakes of this kind than last year, but there were some nonetheless.)

2. There was some confusion regarding the notion of a binary operation. A binary operation on a set is a map from the cartesian square of the set to the set itself. In other words, it is a way to associate a unique element of the set to each ordered couple of elements of the set. A map from the cartesian square of a set to the set itself does not have to satisfy any axioms to be called a binary operation. But if it does satisfy the group axioms, then the set together with this operation is called a group.

3. A subset of a group G is called a subgroup if it is a group with respect to the operation of G. There were quite a few people however who wrote literally this "a subset of a group G is a subgroup if it is under the operation of G" (or a slight variation thereof). Just one word went missing, but the definition has become completely meaningless.

MATH161 Examination, January 2010
Feedback to Students

Average exam mark: 57.68 %

All exam questions were equally easy. Students who worked hard received good marks; those who skipped lectures and tutorials, failed.

MATH162 Examination, May 2010
Feedback to Students

Average exam mark: 70.48 %

Questions 1 and 3 were generally answered well. A few students derived a full mark for Question 2, a fact which reflects students were short of exercises for this kind of problem. Most students can give a satisfactory solution for Questions 7, 8 and 10. This reflects that students are generally good at the statistics material, compared to other parts in connection with elementary probability. Question 9 were mildly attempted because this part material was taught at the end of the module, quite close to the exam date.

MATH171 Examination, January 2010
Feedback to Students

Average exam mark: 52 %

Most students have learned a lot of new mathematics this semester. When questions went wrong, it was very often because of mistakes in basic algebra:

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c} \text{ is True} \quad \text{but} \quad \frac{c}{a+b} = \frac{c}{a} + \frac{c}{b} \text{ is False}$$

$$\sqrt{ab} = \sqrt{a}\sqrt{b} \text{ is True} \quad \text{but} \quad \sqrt{a+b} = \sqrt{a} + \sqrt{b} \text{ is False.}$$

(a lot of students used this wrong identity in 11 b)

$$\frac{b}{abc} = \frac{\not{b}}{a\not{b}c} = \frac{1}{ac} \text{ is True} \quad \text{but} \quad \frac{b}{a+b+c} = \frac{\not{b}}{a+\not{b}+c} = \frac{1}{a+c} \text{ is False.}$$

(The false cancellation was common in question 4).

If you use some of these false simplification rules, it would be good to "unlearn" them as soon as possible.

MATH172 Examination, May 2010
Feedback to Students

Average exam mark: 58.50 %

The exam paper has covered a rather wide variety of topics, which required an extensive revision, and not all students have done it in full measure. Apart from the topics which are in this module's syllabus, many students had problems with previous material, such as integration and differentiation techniques, and even elementary maths, such as properties of exponential and logarithmic functions. E.g. a mistake like $\exp(-\ln x) = -x$ instead of the correct $= x^{-1}$ was quite common. The most challenging questions happened to be question 9, about a linear first-order ODE, for part A, and question 14, about a mathematical model involving a second-order linear ODE with constant coefficients, for part B.

MATH181 Examination, January 2010
Feedback to Students

Average exam mark: 59 %

In general the exams were satisfactory, though there were a few very low scores, mostly from students who had not done much homework during the semester. One common problem in Q8 and Q12 was caused by students splitting up square roots: It is not true that

$$\sqrt{a+b} = \sqrt{a} + \sqrt{b} \qquad FALSE!$$

Another surprise was the number of students who could not put $-i$ into polar form (Q15). If you plot the point on the complex plane picture you will see straight away that

$$-i = \exp\left(-i\frac{\pi}{2}\right) \text{ or } -i = \exp\left(i\frac{3}{2}\pi\right)$$

(both answers are OK).

MATH186 Examination, May 2010
Feedback to Students

Average exam mark: 66.29 %

The exam paper has covered a rather wide variety of topics, which required an extensive revision, and not all students have done it in full measure. Apart from the topics which are in this modules's syllabus, many students had problems with previous material, such as integration and differentiation techniques, and even elementary maths, such as properties of exponential and logarithmic functions. E.g. a mistake like $\exp(-\ln x) = -x$ instead of the correct $= x^{-1}$ was quite common. The most challenging questions happened to be question 8, about a linear first-order ODE, for part A, and question 14, about a mathematical model involving a second-order linear ODE with constant coefficients, for part B.

MATH191 Examination, January 2010
Feedback to Students

Average exam mark: 59.73 %

Although marks were more polarised than last year, the exam average was higher, and in general students looked to have performed better than last year. Although it could be that this group of students is more able than the average, the introduction of the revision week may have made a difference, as well as the fact that the exam was the first to be taken during the examination period. There was also an impression that students had spontaneously and collectively identified certain keys to success:

the importance of CA mark (essentially "free" in this module)

the importance of section B marks in achieving a better overall mark, certainly 60 or above. Students coming to discuss revision during the preceding week wanted to discuss material likely to be on section B.

Although some changes in format were made to changes in section B questions from previous years, such strategies seem to have paid off.

MATH192 Examination, May 2010
Feedback to Students

Average exam mark: 60.93 %

More students get these questions wrong

- Vector products (normally in evaluating det) - The chain rule (partial derivatives) - integration of sin x and cos x (signs)

MATH197 Examination, May 2010
Feedback to Students

Average exam mark: 66.70 %

1. Many students found it difficult to find the integrating factor and use it in solving a first order diferential equation.

2. Another common mistake was finding a raional power of a complex number.

Questions generally answered well were:

1. Solving second order differential equations. 2. Finding the Laplace transforms of a particular function.

MATH198 Examination, May 2010
Feedback to Students

Average exam mark: 69 %

Qu. 6: Candidates frequently obtained the wrong argument for a complex number through failure to draw a diagram.

Qu. 7: The integral of $1/e^x$ is NOT $\ln e^x$!

Qu. 8: The Laplace transform of a product is NOT the product of the Laplace transforms.

Qu. 12(ii): Candidates often failed to take account of the length of $\mathbf{t}$.

Qu. 13: Integrating factor often computed and applied wrongly

MATH199 Examination, May 2010
Feedback to Students

Average exam mark: 47.2 %

Section A:

Q1: Many good solutions. a) usually fine, but many severe errors concerning the logarithm in b) and, to a lesser extent, the product rule. Sloppiness with bracket often led to nonsensical results in (c).

Q2: Average number of good solutions. Problems with differentiation, often not all stationary points found or taken into account in the sketch.

Q3: High number of good solutions, as usual with this sort of vector problems. Occasionally it was not understood which scalar product was needed.

Q4: Many good solutions. Occasionally the need for a vector product was not understood, or was confused with the scalar product of the product of the magnitudes.

Q5: Rather low number of good solutions. Sometimes the list case was not recognized. Integration by part often poorly understood, errors in differentiation, and solutions marred by errors in basic algebraic manipulations.

Q6: Low number of good solutions. Very often the correct integration limits not identified. Sometimes gross errors concerning the meaning and integration of $1/(x-3)$.

Q7: Complex number manipulation was satisfactory for most. Some very basic algebraic errors in the use of brackets and treatment of things like $1/(a+b)$ (thought by many to be the same as $1/a + 1/b$).

Q8: Mostly fine but some problems with the differentiation of $\sin(3t)$ etc.

Q9: Some very basic errors such as equating the given function $f(t)$ and its Laplace transform $F(s)$. The transform of a product is NOT the product of the transforms.

Q10: Note that $y = 1/x^2$ is a positive function of x.

Q11: Done reasonably well except that some omitted to locate the stationary point despite attempting to classify it.

Section B:

Q12: Differentiation answers to (a) mostly good. Many correct pieces in (b), but transfer of calculated information into the sketch often almost non-existent.

Q13: Fair number of good solutions. Line equations usually no problem, but some misconceptions concerning points on lines and the intersection of lines, e.g., checks performed for collinearity instead.

Q14a: Note that $\cos\theta - i\sin\theta$ is the same as $\cos(-\theta) + i\sin(-\theta)$ and so equals $\exp(-i\theta)$.

Q14b: Reasonably well done except for the integration by parts in some cases.

Q15: Done by very few students. Similar problems as in Q9. The partial fraction step was mostly done correctly by those who knew how to relate the transform of a derivative to the transform of the function.

Q16: Done by very few students although the techniques required were just those of Q10 and Q11.

MATH201 Examination, January 2010
Feedback to Students

Average exam mark: 57.9 %

The performance in this exam was satisfactory overall and I believe generally reflected students' ability and preparation. The average performance in part A questions was rather good, with the exception of Question 1, despite the fact that this question was very close to one of the homework questions set in week 1. The most challenging question in part B was Question 11, which is on the same topic as Question 1, uniqueness and non-uniqueness of solutions, and new for this year's syllabus. The other relatively difficult question in part B was Question 10 on series solutions; this sort of question has been traditionally relatively difficult. A surprisingly large amount of marks has been lost through errors in elementary maths, one rather typical (but alas not unique) example was $(n+1/2)^2 = n^2 + 1/4$ instead of the correct $n^2+n+1/4$, and also ignorance of properties of exponential and logarithmic functions, and some standard integrals, such as $\int \frac{dx}{1+x^2}$. Whereas such things are not in the syllabus of MATH201 itself, still it was not possible to award full marks for solutions with such mistakes.

MATH224 Examination, May 2010
Feedback to Students

Average exam mark: 66.24 %

Generally the students appeared to be very well prepared and there were many solid attempts at virtually all the questions. Comments on each question are:

1. Inability to properly partial fraction as well as unable to do the simple integrals.
2. Most spotted the differential equation was homogeneous but some thought it required an integrating factor despite being nonlinear.
3. The need for a particular integral was missed by a substantial number of people.
4. Incorrect choice of particular integral for a resonant case.
5. The graph was drawn incorrectly as having a period π and not 2π as stated in the question.
6. Some students used the boundary from a previous past paper rather than the one stated; taking the cube root of an equation is not equivalent to taking the cube root of each term on the right hand side.
7. Both Cauchy-Riemann equations must be used to find $v(x, y)$. Unfortunately there was quite a few students who do not know the difference between the notation for a total derivative and a partial derivative, especially when requested to write down the Cauchy-Riemann equations.
8. For the particular integral some students appeared to use a method which may have been taught in MATH102 but in these cases nobody applied it correctly.
9. Matrix method of solution was the popular approach. However for the particular integral either too simple a trial was taken or if the correct one was used, some students were not able to solve the resulting algebraic equations.
10. For the parametrized version of the partial differential equation, the associated ordinary differential equation was not widely recognised as a first order linear one requiring an integrating factor. There was a poor understanding of the significance of the parameters s and t.
11. Few students could draw the graph correctly and hence deduce the period was $\pi/2$.
12. Not answered by a huge number but few understood the need to use a Fourier series to fix the final set of constants.

MATH225 Examination, January 2010
Feedback to Students

Average exam mark: 61.77 %

Exam went well, with the average exam score of 61.77%. One out of 27 students was absent at the exam.

MATH227 Examination, January 2010
Feedback to Students

Average exam mark: 63 %

The microeconomics questions were generally answered well. Students struggled with using substitutions to solve differential equations and finding eigenvalues and eigenvectors for matrices.

MATH228 Examination, May 2010
Feedback to Students

Average exam mark: 52.68 %

Students had more success with the short questions in Section A than the extended questions in section B. Questions 1,2 and 4 were the best in section A, Question 7 the best in section B.

Students relied too much on memorising, not enough on understanding. As extreme examples, for Q5 I got several perfect answers to last year's Euler's equations question; and for Q8, several answers to a Coriolis force question from the homework sheets. More common were people who had learned a lot of formulae and answers, without knowing when they should be used, and when they can not be used. $PE = mgh$ is correct in Q10 — a cannonball near the Earth's surface, but it would be wrong for Q11, a moon in orbit around Jupiter. In question 10 lots of people remembered that a cannon would shoot farthest if aimed at 45 degrees — but that's only true on level ground, not shooting uphill or downhill. In question 11 people quoted their memorised formulae for orbits in a gravitational potential $-GM/r$. However, the potential in Q11 has been changed by adding on a small term $\propto 1/r^3$, which means that all the orbital formulae are changed a little bit — the point of the question is to work out some formulae for the new situation, to show that you understand where the original formulae came from.

MATH241 Examination, January 2010
Feedback to Students

Average exam mark: 57.2 %

General Comment: The exam was designed so that it would not be possible to get very high marks just by learning techniques: some understanding of the theory is also necessary. The average mark on section A, which was primarily about techniques, was high (about 71%), while that on section B, which tested theoretical understanding much more, was about 40%.

Questions 3 and 9, on convergence and continuity respectively, were done particularly poorly. Very few students showed any understanding of what it means for a sequence to converge to a limit, which is the central concept in this module (and indeed is one of the central concepts in mathematics). The average mark in Question 9 was about 3.4/15, even though the question is a combination of bookwork and standard homework-type examples.

Question 4: Most students knew how to approach this question: the main problem was an inability to expand $(4 + x - x^2)^2$.

Question 6 (and question 11): Remember that the first question you should ask before computing the Fourier series expansion of f is whether f is even or odd (or neither): if it is either even or odd, then the amount of calculation necessary is reduced.

Question 8: This topic (countability) is conceptually hard, but the question was largely bookwork. Part (c) is particularly hard, and only one correct solution was submitted – see the solutions to question 3 on Problem Sheet 3.

Question 10: This question was generally well done. However, almost all students missed the fact that the last part asked about a period 6 orbit *of this pattern*. Since there is a loop of length 3 in the Markov Graph, a period 6 orbit of this pattern implies all periods.

Question 11: Almost no students showed an understanding of the distinction between pointwise and uniform convergence, even though this is the main theoretical content of Chapter 3 of the module. Surprisingly few were able to compute the Fourier series expansion of t, even though this is a standard example.

MATH243 Examination, January 2010
Feedback to Students

Average exam mark: 64.53 %

Questions involving either algebraic transformations, or some theoretical elements cause traditional difficulties.

Average students have difficulties when dealing with infinite series, limits. These gaps in the prerequisite modules are very sensitive during the term and at the exam. In general the class performance is satisfactory.

MATH244 Examination, May 2010
Feedback to Students

Average exam mark: 57.28 %

Two questions were rather poorly answered:

Question 4 deals with the fundamental notion of this module, vector spaces. It is standard, was covered on several problem sheets, and discussed a lot during the lecture. Therefore it appears in Part A. But it was not part of previous exams, and therefore not studied thoroughly enough. That's a mistake! Please note that ALL the material from the problem sheets is relevant for the exam, may it also occur on previous exams or not.

Question 9 tests your understanding of the translations from linear maps to matrices in a way not seen before, in particular not in a previous exam - therefore it appears in Part B. But it is split up in digestable pieces, so does not require the insight of a genius. On the other hand, if you really want a very good mark, you also must be able to solve problems like this.

Finally a general advice for everybody: You MUST recall the contents of MATH103, in particular the calculations of eigenvectors and eigenvalues which involves calculations of determinants. Have a look in your notes from the lecture!

MATH247 Examination, January 2010
Feedback to Students

Average exam mark: 63.39 %

The section A questions were done well in general. Q6 presented some problems; a surprisingly large number of students were unable to compute the quotient of two complex numbers without error; some students confused the Gaussian integer $a + bi$ with its norm $N(a + bi) = a^2 + b^2$ (and so wrote nonsensical answers).

The first parts of Q7 were done well. However when it came to finding the order of $x + 1$ in part (ii) fewer were able to make the necessary deductions (and some, despite the hint that no computation was required, attempted to compute rather than reason).

For Q8 a large number of students wrote down *all* the p-primary and Smith Normal Form decompositions for a group with the same number of elements as A, rather than simply writing down the p-primary and Smith Normal Form decompositions of A itself. Apparently they had not understood that each abelian group has *unique* such decompositions, and that different decompositions correspond to different isomorphism classes of groups.

The penultimate part of Q9 caused problems. Only a few students realised that they had to show both i) r a prime element implies $\langle r \rangle$ a prime ideal, and ii) $\langle r \rangle$ a prime ideal implies r is a prime element. In addition the arguments given were not well written, and often contained errors or logical gaps.

Q10 was attempted by less than half the students. Those that tried it and who had a clear understanding of what the power set of a set is did very well; those that hadn't, wrote nonsense.

For Q11 many students produced half a page of algebra to show that the norm $N(a + bi) = a^2 + b^2$ on the Gaussian integers is multiplicative. It is much easier to notice, as several did, that $N(r) = r\overline{r}$ where $\overline{r}$ is the complex conjugate (from which multiplicativity of the norm follows in one line). In the last part many students omitted to show that the factors they found where irreducible. This lead to some absurdities, for instance several claimed that $8 = 2 \times 4$ was a factorisation into irreducible elements, seemingly forgetting that $4 = 2 \times 2$.

As a general comment, students who checked their answers (and most of the answers could be easily checked) did well. When they had made errors, they noticed and corrected them.

MATH248 Examination, May 2010
Feedback to Students

Average exam mark: 57.65 %

On the whole, the exam results were good: those who attended lectures regularly performed very well. As usual, Question 1 on the conic was most popular. The exam confirmed, once again, that to plot and sketch curves one needs some exercise: although simple, this is a practical skill and as such requires some experience. This year more students attempted the problem on projective curves and usually did quite well in it. The problems on calculating the intersection number and on the blow ups were less popular, and in my opinion, undeservedly.

MATH261 Examination, January 2010
Feedback to Students

Average exam mark: 70.04 %

Nothing surprising happened in this exam. Students who attended all lectures and tutorials and submitted all homeworks, received good marks, generally over 70. Those who skipped many lectures/tutorials were not that successful.

MATH262 Examination, May 2010
Feedback to Students

Average exam mark: 70.04 %

The general exam performance was very good.

A bit more care should be addressed to performing computations and evaluating integrals and derivatives.

Problems 3 and 9 presented the most difficulties but they were based on examples discussed in classwork/homework.

A bit more attention is required to understand problems involving arbitrage discussions.

Most of the students answered very well questions 2,4,5,8,10.

Question 11 was discussed in class but mistakes in the scripts were frequent.

MATH263 Examination, May 2010
Feedback to Students

Average exam mark: 66.17 %

In order to answer Questions 3 and 4 correctly, students need to choose appropriate method to do statistical testing. Most of students answered these two questions quite well. They understood, for example, under what conditions parametric or nonparametric testing method should be used. However, quite a few students, though less than one fifth, made mistakes in judging whether the testing involved is one-sided or two-sided. A possible reason is that some students didn't check the questions carefully before they answering these questions.

Not too many students answered Question 6 regarding ANOVA model. But among those who answered, majority answered the question pretty well. They could understand the structure of ANOVA table and thus be able to point out the "designed mistakes" (part A of Q6) and then could work out the correct Table. However, quite a few mistakes have happened in the topic of degrees of freedom.

To answer questions 1 and 2 well, students need to have a clear thought about concepts of statistical terminologies. But quite a few students have just ignored these terminologies during their study. Question 2 is in fact similar to a question in homework. However, there are still some students who have lost significant marks here. If such students had done assignments more carefully, they would have got higher marks.

In question 5, many students have lost points on the ANOVA table in the aspect of degrees of freedom, similarly as happened in Question 6. This seems to remind us that in the future teaching, this aspect needs to be more emphasized and students need to do more exercises as well. Also in Question 5, many students failed to answer the last part, which is to find the confidence interval for the slope of the regression line. These students failed at here because they didn't know how to calculate the standard error of the fitted slope.

MATH264 Examination, January 2010
Feedback to Students

Average exam mark: 57.02 %

Generally, the students' performance is OK, especially those from XJTLU showed better strengths than local students in handling questions. Questions 1 to 5 are much better attempted, compared to Questions 6 and 7. Few of them can present a full solution to Q. 6 and 7, a fact which suggested some more examples and homework practice might be needed to this kind of questions.

MATH266 Examination, May 2010
Feedback to Students

Average exam mark: 63 %

Overall students performed well on the exam - with a few exceptions mostly correlating with those students who handed in very little homework.

Some detailed comments on individual questions:

Q1: Many students were unable to give a convincing argument using simple sketches that the equation had exactly one solution.

Q3: Very few students were able to explain what the point of using the LDM decomposition is. It isn't sufficient to say it's quicker - constructing the decomposition typically may require quite a lot of computation! Once the decomposition has been computed, it is computationally faster to solve the system using the method of forward and backward substitution than with Gaussian elimination. However, because of the effort involved in computing the decomposition, it is only worthwhile if the system is to be solved many times for different right-hand sides.

There were also some common problems which I think were mostly associated with students who limited their revision to only looking at past papers rather than also reading through lecture notes & studying homework questions:

Q4: Quite a number of students got muddled between the 1-norm & infinity-norm

Q5: Very similar to a HW 6 question 2 - but many students went wrong.

Q9: Many students were unsure as to how many iterations were required until their solution was sufficiently accurate - you needed to compare the nth iterate with the (n+1)th iterate and check they agreed to the correct number of decimal places. See HW5, question 3.

Q10: Very poor attempts at this - but very similar to HW7, question 3 & 4.

MATH268 Examination, January 2010
Feedback to Students

Average exam mark: 61.19 %

Students performed very well on the questions that required mainly computation with known formulas (Q4, Q5, and Q7). One common mistake here is not remembering well the formulas, and not being careful in calculations.

On Q1 students performed poorly. This was more of a bookwork, and was well within to what has been covered in tutorials.

On Q2, Q3, and Q6, students performed averagely.

My advice in improving their performance, is to cover well ALL the material that was distributed to them (lecture notes, tutorials, homework, class test, and last year exam paper) - an advice given to them many times during the lectures.

MATH283 Examination, January 2010
Feedback to Students

Average exam mark: 67.7 %

General comment: It is very important in this subject to distinguish between scalars and vectors. I strongly recommend distinguishing them by writing a line under, or an arrow over, all vectors. Similarly, it is important to write the dot in scalar products, divergence, etc.

Question 1: This question was generally well done. Quite a lot of students derived the formula for the divergence of a quotient from the formula for the divergence of a product. This is not really acceptable as an answer, since the two formulae are more or less equivalent. The intention was for the answer to be derived from the normal quotient rule for scalars, as was done in lectures.

Question 2: This question was very well done by almost all students. Note that the final integral should be evaluated using the scalar potential, and not by direct integration (which is probably impossible).

Question 3:

- An important part of the statement of the divergence theorem is that the unit normal vector (in the expression for the flux) is outwards from the solid body. (By contrast, it was not necessary to give a precise statement of the "sufficiently regular" conditions, which weren't treated in lectures.)
- Several students found $\nabla \cdot \mathbf{v} = y^2 + 3z$ rather than the correct answer $3z$, since they differentiated y^3 to get $2y^2$. This made part (ii) harder than it would otherwise have been.
- It isn't really necessary to use cylindrical polars to do the integrations in this question, but if you do then you must remember to include the Jacobian (R).

Question 4: As in question 3, an important part of the statement of Stokes's theorem is to specify the connection between the orientation of the curve C and the normal vector to the surface S. (Several people said the normal to the surface should be "outwards", but this doesn't make sense in this question as the surface isn't closed.)

Questions 5 and 6: Fewer students attempted these questions, though those who did managed fairly well. In answering such questions, it is important to include some *words* as well as a list of formulae, e.g.

- "We seek solutions of the form $u(x, t) = X(x)T(t)$."
- "Since the left hand side is a function of x only and the right hand side is a function of t only, both must be equal to a constant."
- "By the principle of superposition, any function of the form ... is also a solution."

MATH284 Examination, May 2010
Feedback to Students

Average exam mark: 56 %

- Most get the wrong indexes for the Legendre recursion formula P_(n+1) = (2n+1)/(n+1) P_n - ... e.g. to find P_3, we take n=2 rather than n=3!
- The other common mistake is the sign of cofactors.

MATH299 Examination, January 2010
Feedback to Students

Average exam mark: 60.5 %

Most students did well on questions 1 and 2. As a general point, it is a good idea to read the question carefully. For example, in question 3(c) you were asked to find some eigenvalues. Quite a few candidates also calculated all 6 eigenvectors too, even though the question didn't ask for them - that must have cost valuable exam time.

Question 4 was attempted by a majority of students and mostly done very well. Some forgot to find a numerical value in 4(a) for the derivative of f with respect to t at $t = 0$. Also note that it was not necessary to write the derivative in terms of t, to be able to find this numerical value. In 4(c), it is important to emphasise that the differentials dx, dy, dz are small. Also Question 5(a) was attempted by a majority of students and it was fine, but unfortunately many students who attempted to solve 5(b) thought that the function they had to maximise was given in 5(a). Clearly, the area of a rectangle has nothing to do with the function given in 5(a). Many students had a fair attempt at question 6(a) but there were only a handful who managed to establish the link between the equation of the tangent plane and the linear approximation.

MATH322 Examination, May 2010
Feedback to Students

Average exam mark: 55.64 %

Some simple calculations, such as finding the derivative of the given mapping in question 2, caused considerable trouble to quite a few students. There were many decent attempts at questions 1,3,4 and 5, but question 6 was not well received. This question was attempted by less than 50% of the students and not really attempted with great success. Finally, whereas bookwork parts of question 7 were reasonably well answered, many students could not solve the part on finding the similarity dimension of the Koch snowflake, even though a very similar example was covered in the lectures.

MATH323 Examination, January 2010
Feedback to Students

Average exam mark: 62 %

Question 1 (as always) presented difficulties due to inability to recognise common integrals ($\sec^2 x$ and to a lesser extent $\tan x$, in this case). Questions 2 and 3 were on the whole gratifyingly well done. Unfortunately the somewhat laborious algebra in Question 4 defeated many students, though it was clear they were happy with the basic method; a simple slip early on could easily make further progress very difficult. Many students found Question 5 much easier but I suspect some were running out of time by this point. As usual hardly anyone attempted Questions 6 and 7 which is regrettable as they were straightforward and in the case of Question 7 just a mechanical reproduction of lecture notes.

MATH325 Examination, January 2010
Feedback to Students

Average exam mark: 51.20 %

The exam was a mix of bookwork style problems together with calculations similar to homework questions and material given in the lectures. Several questions were answered well. Common errors derived from lack of basic knowledge of calculus and algebra such as the inability to find the second derivative of $e^{-x^2/2}$, integration by parts of $x^2 \cos(x)$ and the eigenvectors of a 3×3 matrix. In particular in the latter case for question 2 nobody correctly determined the eigenvector for the eigenvalue 2 which is actually trivial since the Hamiltonian is block diagonal. For question 3 which is a standard calculation of the bound state a common error was deriving the wave function outside the potential well as being a free wave rather than the correct situation which is an exponentially decaying solution. This question and another asked for graphs of mathematical functions. Whilst their forms are simple several students simply were unable to draw the graphs remotely correctly. On question 7 several students tried to compute the expectation value of the kinetic energy without applying the formula given in the question by using an erroneous definition of the momentum operator in spherical polar coordinates. On the whole the better prepared students, defined by those who attended lectures regularly, fulfilled the assignments and attended the tutorials, did well.

MATH326 Examination, May 2010
Feedback to Students

Average exam mark: 57.6 %

This module suffered from a very poor attendance, even in the revision phase, by a substantial part of the class. The average mark, which still exceeds the January cohort average by about one mark, has to be viewed in this context: all students who fully attended the course (and at least attempted the homework assignments) did much better than this average, while all others obtained (mostly considerably) lower marks.

Some comments on the exam questions.

Q1: All 13 students attempted this first special-relativity question, 6 with very good success ($\geq$ 16 marks). The other half mostly failed to solve part (ii) beyond the first step (from 'Determine the remaining'). Some scripts did not address part (iii). The answers to the bookwork question (i) was adequate in all scripts.

Q2: This question was not addressed at all in 4 scripts, and sustained attempts were made by only five students, of which 3 were at least good ($\geq$ 12 marks). (b) beyond the first part (from 'Verify your results') was fully addressed in only one script (in which all other solutions were pretty weak), but there almost perfectly.

Q3: The second question attempted, at least in part (a), by all students. The bookwork question (a) was adequately answered in all but two scripts, while the calculation in (b) were carried out by only a third of the students, the main problem being the correct identification of the conservation laws.

Q4: This first differential-geometry problem was not addressed at all in 6 scripts, there were four sustained attempts of which three were first-class ($\geq$ 14 marks) and the fourth was as good but simply stopped after the equation displayed in part (b) of the problem sheet.

Q5: This problem was attempted by all but 4 students. Among the remaining 9 scripts, there were two (almost) perfect solutions, but also 3 below 8 marks. The verification of the Christoffel symbols was fine in almost all attempts, but the calculation of the Riemann tensor often suffered from simple errors. Few students were able to do (b), especially the second covariant derivative.

Q6: This standard general-relativity problem was addressed in all but 2 scripts. There were 6 very good solutions ($\geq$ 15 marks), but also 4 answers which were basically confined to the first paragraph of part (a). The answers to part (b) were adequate with only two exceptions.

Q7: Only 3 students did this last problem, but all of them perfectly or almost perfectly.

MATH331 Examination, May 2010
Feedback to Students

Average exam mark: 58.3 %

Most of the questions were tackled well. Question 7 on co-operative games was the least well done, perhaps because it was taught last, perhaps because it was the last question on the paper. Students had difficulty defining the conditions satisfied by the core imputations and no student was able to come up with a completely correct solution. The game-tree diagram in Question 1 was perhaps a little too complicated and in any future questions of this type, I will probably make things slightly simpler.

MATH332 Examination, January 2010
Feedback to Students

Average exam mark: 57 %

Overall students found this exam hard. A worrying number of students appeared to have virtually no understanding of the material, and additionally struggled with basic algebra and first year material covered in the core modules. A significant number of students were unable to apply their good basic knowledge to unseen problems in the final parts of questions. I was surprised by how many students attempted to answer all the questions (rather badly) instead of focussing their efforts on answering a few questions well.

Q1(a): Few students knew what the generation time of a population was, perhaps due to lack of emphasis in lectures. (c): An unseen question requiring quite simple maths threw almost all students.

Q2: Mostly answered well. Very similar question seen in previous exams and homework.

Q3: Part (iv) very poorly answered, yet mathematics all covered in section on delay differential equations (e.g. HW5 Q1)

Q4: There was an ambiguity in setting up the Leslie matrix. I assumed that individuals in class i (i=0,1,2) died if they didn't progress to the next class, but didn't make this explicit in the question. I therefore was generous in my marking of this question so that if students set up a more complicated Leslie matrix they weren't penalised for not being able to solve the rest of the question.

Q5: Mostly fine, although lack of ability to draw phase portrait in b(iii)

Q6: Although very much a bookwork question (see many examples in recent exams and HW 10), I was surprised by the many errors.

Q7: (a,b) mostly answered fine. Problems writing out sum in (c).

MATH340 Examination, May 2010
Feedback to Students

Average exam mark: 53 %

FEEDBACK FOR STUDENTS: It is impossible to pass this difficult course and exam successfully with bad attendance and by doing nothing.

MATH341 Examination, January 2010
Feedback to Students

Average exam mark: 57.7 %

One general point: pure mathematics is an area in which absolute precision is necessary. Students should not expect to get many marks for bookwork parts of questions unless their answers are completely accurate: a "small" mistake like inverting the order of two quantifiers makes a definition completely wrong. Many students would have obtained several more marks had they prepared more carefully for these bookwork questions.

Some more specific points:

Question 1: The final part of this question, which was unseen, was poorly answered by almost all students (the remainder of the question was generally well done). Most didn't realise that is was necessary to show that $d(x, y) > 0$ and $d(x, y) = d(y, x)$ for all x and y. The majority of those who did realise that this was necessary used property B to show that both $d(x, y)$ and $d(y, x)$ are less than or equal to $d(x, z) + d(y, z)$, and concluded from this that $d(x, y)$ and $d(y, x)$ are equal!

Question 3: Although all but 3 students attempted this question, the average mark on it was very low. This was largely due to the fact that, although part (a) is elementary calculus, very few students managed to get it right. In particular, it is necessary to observe that $f(x) - g(x)$ changes sign at $x = 1/2$. A consequence of this is that

$$\int_0^1 |f(x) - g(x)| \, dx = \int_0^{1/2} (f(x) - g(x)) \, dx + \int_{1/2}^1 (g(x) - f(x)) \, dx,$$

and there is no simpler way of carrying out this calculation.

No one correctly answered the final part of (c), although this was an idea which had been emphasized several times in lectures.

MATH342 Examination, January 2010
Feedback to Students

Average exam mark: 58 %

It was a pleasure to observe that quite many students have performed the proofs of key results (such as Euler's theorem) in a nice way, demonstrating the appropriate level of professionalism. Another positive impression is that in quite a lot of scripts the students demonstrated a good ability to compute primitive roots and use them in solving congruences of higher degrees – the key computational outcome of the course. There were no common mistakes in the scripts, the mistakes are in dispersion. However, there were mistakes more or less typical in the scripts with average marks. Among them it should be noted a misunderstanding in proving that the last common divisor in Euclid's algorithm is the greatest common divisor. Some students described the algorithm but did not prove what was required. Maybe I can say that, in such instances, the lack of the ability to conduct theoretical reasoning was a serious obstacle in the performance of the exam. And, unfortunately, quite a lot of the students handed in almost empty scripts. I am sorry to say that.

MATH343 Examination, January 2010
Feedback to Students

Average exam mark: 58.61 %

Question 1 was similar to the past exam questions and was solved by many students and solved well.

Questions 2, 3, 4 contained parts which were not similar to past exam questions. While questions 3(a-b), 4(a-d) were solved well, many students did not attempt the unseen parts of the questions at all, not even the easier parts like 2(a), 2(b)(i), 3(c)(i), 4(e)(i), 4(e)(ii).

Question 5 was similar to exercises and was solved well by the few students who attempted it.

Questions 6, 7 were similar to past exam questions. Question 6 was solved by many students and solved well, Question 7 was attempted by few students, these students did well on this question.

The exam was found hard as the proportion of genuinly unseen questions on the exam was higher this year. However, the questions (including the unseen ones) were fair in terms of the lectures, exercises and revision sessions.

MATH349 Examination, May 2010
Feedback to Students

Average exam mark: 62.08 %

Questions 1 and 2 were similar to class test questions. Unfortunately, many students could not remember the formulae for curvature and torsion and many made mistakes differentiating and integrating (in questions 1(b)(vi) and 2(b)(iii)) common functions.

Question 3,4,5 and 7 were similar to past exam questions. These questions were solved by many students and solved well, in particular question 4. Common mistakes were wrong signs in cross-products and difficulty finding principal curvatures.

Only few students attempted Question 6 and the harder parts of other questions, e.g. 1(b)(vi-vii), 2(b)(iii), 3(b)(vi-vii), 4(c)(v).

MATH350 Examination, May 2010
Feedback to Students

Average exam mark: 76.47 %

The module was taught for the first time, and the students who took it worked very well. As a result, the exam scripts were of very high quality. The mistakes were scarce and mostly just mistakes in arithmetic.

MATH361 Examination, May 2010
Feedback to Students

Average exam mark: 71.34 %

The students, in general, have performed very well in this exam.

Most of the students have carried out correctly the calculations of Q6 on hypothesis testing.

On Q7, part (d) was not done by most of the students, although the answer was straightforward.

On Q1, some students made mistakes in calculating the expected value and variance, although two not so difficult integrals had to be calculated.

MATH362 Examination, January 2010
Feedback to Students

Average exam mark: 59.42 %

Questions on Poisson Processes (Questions 5 and 6) were answered well from most of students which shows that most of students have understood and mastered the basic concepts and properties of Poisson process.

Questions 3 and 4 on Markov Chains were also answered quite well except part (i) of Question 3. To answer this part (i) of Question 3, in addition to understand the basic concepts involved deeply, students need also to know how to tackle "practical" problems rather than just "copy" the knowledge they have learned in the classes. It seems that this latter ability should be improved.

Few students tackled Question 7. Among those, who did consider this question, most of them were awarded low marks. The style of this question is similar as part (i) of Question 3 and thus again reflects the fact that most of students need to improve their ability to analyse "practical" problems.

Questions 1 and 2 are regarding a basic technique and method constantly used in Applied Probability. Question 1 and part (i) of Question 2 were answered quite well. However parts (ii) and (iii) of Question 2 were answered quite poor. Possibly these two parts are too difficult.

MATH363 Examination, January 2010
Feedback to Students

Average exam mark: 58 %

Questions on ANOVA tables (Q2 and Q3) were generally answered well.

Many students struggled to solve or not attempted at all: Q4(c), Q5.II(b), Q6(f).

There were many instances where students were struggling to specify the log-likelihood for a generalised linear model (Q1, Q2, Q7).

Identifying the link function and the components of the generalised linear models were also proving difficult (Q4, Q6).

There were some problems in showing that a distributions belongs to the exponential family, specifically, the functions a and b were often wrong (Q6, Q7).

The contingency table in Q5 was analysed as if it was an ANOVA table by some students.

MATH364 Examination, May 2010
Feedback to Students

Average exam mark: 63.83 %

Overall the questions were answered very well. Question 1 in particular was well answered with most students scoring well above 50 percent. There was a number of computational errors, but these were marked as correct providing that the student had demonstrated sufficient understanding of the particular formula. For most questions definitions and explanations were given correctly, however, a number of marks were lost following incorrect interpretation and understanding of computational results.

MATH366 Examination, May 2010
Feedback to Students

Average exam mark: 63.87 %

First, I would like to advice our students to solve all the homework questions. Indeed, the tutorial exercises can help a lot to the better understanding of the theory.

Moreover, I highly recommend our students to attend and participate actively to the tutorials.

Actually, according to my personal academic experience, those students who have attended all the Tutorials, and have tried to solve the all the homework exercises, they have taken greater marks at the exams.

MATH367 Examination, January 2010
Feedback to Students

Average exam mark: 63.77 %

Try to solve more examples and to revise properly the tutorials' exercises.

I highly recommend the new students to attend the tutorials, and to work hard with the homework. Actually, the students who have attended Tutorials, and they have tried to solve the exercises independently, they have succeeded in taking higher marks.

MATH425 Examination, January 2010
Feedback to Students

Average exam mark: 80.67 %

The students showed a good knowledge of Quantum Field Theory. They are preparing to apply for post-graduate studies where the subject of the course is a foundation stone.

They answered well most of the questions as I expected from their questions during the class and during the revission week.

MATH426 Examination, May 2010
Feedback to Students

Average exam mark: 71.86 %

Overall students did well on this module exam.

Q1 and Q2 Some students found the problems at the end difficult; such parts pick out strong students from the others. Q3 In the graph, care is needed to display the asymptotic behaviour Q4 It is important to express the dynamics in terms only of the variables used in finding the Jacobian. Q5 Here (iv) caused most problems - the formally equivalent case of a vector borne disease was presented in lectures; students found difficulty in constructuring the parallel. Q6 It is important to express the dynamics in terms only of the variables used in finding the Jacobian Q7 There was a minor difficulty here in expressing reasons in (iii).

MATH441 Examination, January 2010
Feedback to Students

Average exam mark: 68.25 %

This is a theoretical course, starting essentially from scratch and ending with the proof of the prime number theorem. To do this I develop those aspects of the elementary theory of numbers (divisibility, arithmetic functions, average behaviour of arithmetic functions and the elementary theory of prime numbers) and then after surveying complex analysis the residue theorem and some aspects if real analysis (limsups, liminfs, infinite products) I study the analytic theory of the Riemann zeta functions and that of the related L-series. The second of these needs me to discuss character theory, the stucture theory of abelian groups, primitive roots and Legangre symbols and their basic properties. Then we consider analytic continuation of the Riemann Zeta functions and L-series and their zeros free regions. Finally we prove a Tauberian theorem from which the prime number theorem and the density version of Dirichlet's version of the primes in arithmetic progressions are deduced. The purpose of the course is to teach students modern analytic number theory and should make them much more analytically sophisticated.

As usual most students who take this course tend to be strong and I make no apology for pushing them. The are usually rewarded with strong results and this year is no exception. My impression is that students were generally well prepared. There is as as usual a slight bias among students to choose questions based on more elementary material but the questions are structured to adjust for this. I have tried in this course to reward mastery of the material over familiarity with past exams and there is some evidence that students here have responded to this. Over all I was impressed with the way students adapted to the challanges in this course.

MATH442 Examination, January 2010
Feedback to Students

Average exam mark: 53 %

The poor performance in question 1 was mainly due to students not knowing how a matrix changes when you change the basis. This is an important technique practised a lot in MATH244, so students should revise it carefully.

MATH444 Examination, May 2010
Feedback to Students

Average exam mark: 57,82 %

It looks like quite many students were confused with finding a uniformizer at a not 2-torsion point on an elliptic curve, while the situation is quite similar to those developed in the lecture notes. The reason, in my opinion, was that the students were not confident enough with the notion of a local ring at a point and a DVR, though many lectures were devoted exactly to the development of these key notions and their examples.

Another mistake happened for several times was that when we have to compute the order of a rational function at a point it verbally means that we have to compute it, i.e. to apply some reasoning to figure out some precise integer, not just to write that integer without any computational processes.

A confusion with group-theoretical analysis in the study of torsion points happened too many times. I suppose that, psychologically, it was hard to accept that a geometrical object (a curve) can be, at the same time, an abelian group.

On the other hand, the students were brave attacking unifiormizers by applying the division with remainders in the polynomial rings with coefficients in a field of rational functions in one variable, in computing discriminants and their valuations, and using the reduction mod p map.

The general advice for further students: elliptic curves are the node involving ideas coming from different branches of mathematics – geometry, commutative algebra, arithmetic, analysis. To get success in computations with elliptic curves we have to be ready to merger different styles of mathematical thinking.

MATH449 Examination, May 2010
Feedback to Students

Average exam mark: 60.85 %

Students tried all problems, and they did well, in general.

MATH462 Examination, May 2010
Feedback to Students

Average exam mark: 57.67 %

The crucial point in solution of Q1 was realising what orthoginality implies which simplified following calculations, unfortuantely most students found this rather difficult.

MATH464 Examination, May 2010
Feedback to Students

Average exam mark: 65.82 %

All questions generally well done, although relatively few students attempted Q6. A general problem was that although students had the right general idea there was a lack of precise, careful argument (or precise wording), leading to lost marks for, in particular, Q1(a), 1(b)(ii), 4(a)(iii), 5(a)(iii), 5(b), 6(ii), 7(c).

MATH492 Examination, May 2010
Feedback to Students

Average exam mark: 65 %

Problem 1 (vector algebra). This was done very well by almost all students. Some students lost marks due to lack of care in part (a). In part (b) marks were sometimes lost by gaps in the derivation of the given vector identity. In part (c) marks were sometimes lost by incomplete or partly incorrect answers for the definition of a tensor of rank 2.

Problem 2 (vector differential calculus) was again done very well by most students. In part (a) some students lost marks by lack of care in differentiation. Part (b) was done correctly by virtually all students. In part (c) marks were mostly lost for incomplete answers (a complete answer required to explain the meaning of all quantities appearing in the continuity equation). Part (d) was attempted by about 2/3 of the students, most solutions submitted were mostly correct, with marks lost for gaps in the derivation.

Problem 3 was done well by most students. In part (a) marks were lost by calculational mistakes (partial differentiation) and by some for not using the correct formula for the curl of a vector field. In part (b)(i/ii) marks were sometimes lost for incomplete explanations of the concept of path independence, but most students did this part correctly. In parts (b) (iii/iv) calculational mistakes were relatively frequent and some students were not able to convert the line integral fully correctly into a normal integral, or made mistakes in parametrizing the integration path. Several students computed the integral in part iv separately, despite that they could have used parts (ii) and (iii) to give the answer without explicit calculation. Part (b)(v) was done correctly by all students who attempted it.

In problem 4 (a) most though not all students were able to convert the double integral into iterated definite integrals, but almost all students made a mistake in computing the final integral and thus lost one or two marks. The last step required to realize that the integrand was a total derivative, or to find an adequate substitution. Parts (b) and (c) were attempted by most students, and a majority of these were able to get correct intermediate results, while fully correct answers were in the minority. Marks were lost by not applying the Green or Stokes theorem correctly. Many, but not all students realised that the integrals in parts (ii) and (iii) could be found without explicit computation after applying the Green theorem, because the integral is proportional to the area enclosed by the curve.

Most students did not attempt problem 5 (the best 4 out of 6 problems were counted). Parts (a) and (b) were done fully correctly by almost all student who attempted. Part (c) was only attempted by a few students, and no completely correct answer was given. This problem required to remember a derivation explained in the lectures and documented in the lecture notes. In the partial answers given, marks were lost for gaps in the derivation.

Most students did not attempt problem 6 (the best 4 out of 6 problems were counted). Part (a) was done correctly by all who attempted, in part (b) marks were lost by some for incomplete answers. Part (c) was only attempted by a few students, but the submitted solutions were correct and complete.