LC MATHS HIGHER MASTERCLASS: March 1st 2025

EXAMINATION TECHNIQUE

OVERALL CONSIDERATIONS

1. Timing

As you know from your Mock exams, each maths paper consists of two sections: Section A and Section B. You will have to answer 5 questions from 6 in Section A and 3 questions from 4 in Section B.

Each question in Section A is worth 30 marks while each question in Section B is worth 50 marks. Thus the total marks for each exam is 5 by 30, which is 150, this is for Section A, plus 3 by 50, which is also 150. Thus the total marks for each exam is 300.

In each exam, you will have 150 minutes to aim for these 300 marks.

We can use this to calculate how long you can afford to spend on each question. It's a simple calculation: dividing 300 by 150, we get 2.

Hence to perform a quick calculation: divide the number of marks for a question by 2 to find the number of minutes you can afford to spend on that question.

Thus, as each question in Section A is worth 30 marks, you have 15 minutes for each question. Also, as each question in Section B is worth 50 marks, you have 25 minutes for each question in this section.

It is important to realise that these are **maximum** times. You should try to cover each question leaving a little time over. This time can prove very beneficial for checking answers at the end of the exam.

A device that some students use is to write down, as they start a question, the end time for that question. For example, if you start a short question (from Section A) at 10:12, you can just jot down 10:27, which is 15 minutes after starting. Then, under no circumstances should you continue with this question after that time.

2. Question Choice

* In each section on both papers you will have to tackle all but one of the questions. In each Section A, you will have to tackle 5 out of 6 questions, and in each Section B, you will have to tackle 3 out of 4 questions.

* You should read all the questions in each section before making any decisions.

* An approach that is used to great effect is to then rank the questions from 'best' to 'worst', from your point of view.

* For example, in a Section A list of questions, we might rank the questions as follows.

Q1	3rd
Q2	5th
Q3	1st
Q4	6th
Q5	2nd
Q6	4th

* Then you should tackle the questions in the order of your preference. In the example we have just looked at, you should start with Question 3, then move on to Question 5, and so on.

* The hope is that by tackling your best questions first, you are putting marks in the bank, and just as important, you are gaining confidence.

* You should also try to gain time on your first few questions, as you will probably encounter difficulties in the questions you have ranked 4th and 5th.

* If one of your preferred questions doesn't work out to be as easy as you first thought, don't be afraid to dump it quickly and move onto your next ranked question. You can always revisit it later and decide between it and your last ranked question.

3. Number of Questions to Tackle

* In theory, you should only tackle the required number of questions in each section.

* However, if you think that you have not done particularly well in one of your questions, you might feel that some of the remaining time might be better spent tackling an alternative question, in other words, the last ranked question in the section.

* This is always a delicate decision. It might be more worthwhile, and more productive, to spend any left-over time reviewing any question parts that you have not finished.

* This is a judgement call you are going to have to make on the day. But it will be important to consider your options carefully.

4. Marking scheme can vary from year to year

* It is important not to become too fixated on wondering how many marks you will get or lose for a particular effort at a question.

* This is because the marks gained and lost can vary from year to year.

* Each year, the marking scheme is formulated to give roughly the same proportion of H1s, H2s, etc from year to year.

* This means that in a year when a paper is difficult, questions will be marked in a generous way. On the other hand, when a paper is easy, it will be marked in a stricter way.

* If I was taking the Leaving Cert maths exams this year, my attitude would be to give the examiners as few opportunities as possible to take marks off me.

ANSWERING QUESTIONS

1. Reading the Question

* Make sure you read each question you have decided to tackle carefully.

* What many students do is underline crucial words like 'explain', 'prove', 'solve', 'differentiate', 'correct to 2 decimal places', etc. This is probably a good idea.

2. Tackling a Question

* When you start tackling a question, it is important to realise that you are under no obligation to answer the parts in the given order. This is made easier by the fact that there is separate answering space under each part.

* If you think that the (b) part of a question is easier than the (a) part, then you should start by answering the (b) part first. Of course, this assumes that the (b) part does not follow on from the (a) part.

3. Give an Answer to each Part of every Question you Tackle

* It is important that you make some attempt at each part of each question that you have decided to attempt.

* The worst that can happen is that you get zero marks for that part.

* If you have no idea what is required by a question part, then make your best guess and write down a few lines.

* If the answer to the previous question part is required to tackle the next part, and you don't have an answer to the previous part, make an educated guess. Then use this value as you tackle the next part.

4. Simplify your answer

* The instructions inside the Leaving Cert answer booklet include: 'You may lose marks if your answer are not given in simplest form, where relevant'.

* This is a general requirement that can be used to take marks off in any question where the answer is not tidied up.

* Don't ignore this. If the answer to a question part is an expression, ask yourself if it can be improved. Within reason, if it can, then you should do so.

5. Be neat and organised, where possible

* Although there are no marks being awarded for neatness, it should come as no surprise that there is a high correlation between neatness and excellent marks in a maths exam.

* There are good reasons why being organised leads to more accurate work. If you are constantly crossing things out and moving all over the page with your work, it is very easy to lose track of what is going on. It's much easier to make a mistake. It happens all the time.

* Ideally, you should work in a linear fashion. This means moving down the page line by line. It means not going over to the side of the page or back up the page. I know this is a big ask for many students who have been used to being slightly or very disorganised, but any efforts you make to be more organised are likely to repaid by higher marks.

* You should also treat the 'equal to' sign with respect. If you are dealing with an equation, i.e. a statement containing an 'equal to' sign, the 'equal to' sign should be present line by line. Students who are careless with this tend to make far more mistakes rearranging equations.

6. 'Hence' or 'Hence, or otherwise,'

* Know the difference between 'hence' and 'hence, or otherwise'.

* 'Hence' means that you must use what went before to perform the current task. If you use some other method, you can expect to get few or no marks for that part.

* 'Hence, or otherwise' means that you can use what went before to perform the current task, but you can also use other methods. In practice, on most occasions, the hence method is the easiest. But if you can't see how to use what went before, another method will be fine.

7. Be careful with accuracy and inclusion of units

Typically, not rounding or rounding incorrectly may result in the loss of 1 mark. However, if a question has parts (a) (i), (a) (ii) and (a) (iii), then this deduction will not be applied more than once in part (a) of the question.

Likewise, omission of units is also generally penalised by the loss of 1 mark, but no more than once in a question section.

8. Explain

* If a question asks you to 'explain' a term or a deduction, your explanation must be clear and leave no room for doubt.

2022 P1 Q1 (b)

(b) Explain why the following equation in *x* has **no** real solutions:

$$(2x+3)^2+7=0$$

Solution

(b) $(2x+3)^2+7=0$

$(2x+3)^2=-7$

The square of a real number cannot be negative. Thus there are no possible real values for $2x+3$ and hence no possible real values for *x*.

OR

$(2x+3)^2+7=0$

$4x^2+12x+16=0$

$x^2+3x+4=0$

As $b^2-4ac=(3)^2-4(1)(4)=-7<0$, there are no real roots.

9. Demonstrate an answer given in the question

* If you are asked to demonstrate an answer which is given in the question, then you have to convince the examiner that you are able to join the dots to obtain the answer. Any jump or assumption will be penalised.

2022 P2 Q4 (a) (i)

(a) (i) Prove that $\tan(A-B)=\dfrac{\tan A-\tan B}{1+\tan A\tan B}$

Solution

(a) (i) Replacing B with $-B$ in

$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$

and using the fact that $\tan(-B)=-\tan B$, we get

$$\begin{aligned}\tan(A-B)&=\tan\big(A+(-B)\big)\\&=\frac{\tan A+\tan(-B)}{1-\tan A\tan(-B)}\\&=\frac{\tan A-\tan B}{1+\tan A\tan B}\end{aligned}$$

OR

$$\tan(A-B)=\frac{\sin(A-B)}{\cos(A-B)}$$

$$\tan(A-B)=\frac{\sin A\cos B-\cos A\sin B}{\cos A\cos B+\sin A\sin B}$$

$$\tan(A-B)=\frac{\dfrac{\sin A\cos B}{\cos A\cos B}-\dfrac{\cos A\sin B}{\cos A\cos B}}{\dfrac{\cos A\cos B}{\cos A\cos B}+\dfrac{\sin A\sin B}{\cos A\cos B}}$$

$$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$$

10. Multiple possible methods

* Many questions have many possible correct approaches. As long as you are happy that what you plan on doing has merit, go for it.

* If it doesn't work out, think if there is another way of approaching the problem. Then, time allowing, give the question another go.

2024 P1 Q6 (a)

(a) $h(x) = x^2 + bx - 12$, where $x \in \mathbb{R}$ and b is a constant.
Find the value of b for which $x-4$ is a factor of $h(x)$.

Solution

(a) $x-4$ is a factor of $h(x)$. Thus $h(4)=0$.

$(4)^2 + b(4) - 12 = 0$

$4 + 4b = 0$

$4b = -4$

$b = -1$.

OR

As $(x-4)$ is a factor of $h(x)$,

$h(x) = (x-4)(x+3)$, as the constant term is -12

$h(x) = x^2 + 3x - 4x - 12$

$h(x) = x^2 - x - 12$

By comparison with $h(x) = x^2 + bx - 12$,

$b = -1$

OR

As $(x-4)$ is a factor of $h(x)$, by the Factor Theorem,

$h(4) = 0$

$(4)^2 + b(4) - 12 = 0$

$4b = -4$

$b = -1$

11. Especially in Section B, questions can range over many topics

- * It is important not to try and classify questions, especially in Section B, as being an Algebra Question, a Trigonometry Question, a Probability Question, etc.
- * Most questions range over multiple topics. So each question part should be seen as a new challenge, without any pre-conceptions.

2024 Paper 1 Q10

A company grows and sells plants.

(a) The function $W(x)$ is defined below. It can be used to model the height, in mm, of a water spinach plant for the first 35 days after it starts to grow.

$$W(x) = 0\cdot 667x + 1\cdot 5x^2 - 0\cdot 025x^3$$

Here, x is the number of days after the plant starts to grow, where $0 \leq x \leq 35$, $x \in \mathbb{R}$.

(i) Use $W(x)$ to estimate the height of a water spinach plant after 15 days. Give your answer correct to the nearest mm.

Solution

(a) (i) $W(x) = 0\cdot 667x + 1\cdot 5x^2 - 0\cdot 025x^3$

$W(15) = 0\cdot 667(15) + 1\cdot 5(15)^2 - 0\cdot 025(15)^3$

$W(15) = 263$

(ii) Write down $W'(x)$, the derivative of $W(x)$.

Solution

(ii) $W'(x) = 0\cdot 667 + 3x - 0\cdot 075x^2$

(b) The height of a different plant can be modelled by the function $P(x)$, where x is again the number of days after the plant starts to grow.
The derivative of this function is:

$$P'(x) = 1\cdot 1 + 2\cdot 73x - 0\cdot 078x^2$$

Find the range of values of x for which $P'(x) > 24$.
In your answer, give each value correct to the nearest whole number.

Solution

(b) $P'(x) = 1\cdot 1 + 2\cdot 73x - 0\cdot 078x^2$

$P'(x) > 24$:

$$1\cdot 1 + 2\cdot 73x - 0\cdot 078x^2 > 24$$

$$-0\cdot 078x^2 + 2\cdot 73x - 22\cdot 9 > 0$$

$$0\cdot 078x^2 - 2\cdot 73x + 22\cdot 9 < 0$$

Put $P(x) = 0$

$$0\cdot 078x^2 - 2\cdot 73x + 22\cdot 9 = 0$$

$$x = \frac{-(-2\cdot 73) \pm \sqrt{(-2\cdot 73)^2 - 4(0\cdot 078)(22\cdot 9)}}{2(0\cdot 078)}$$

$$x = \frac{2\cdot 73 \pm 0\cdot 555}{0\cdot 156}$$

$$x = \frac{2\cdot 73 - 0\cdot 555}{0\cdot 156} \quad \text{or} \quad x = \frac{2\cdot 73 + 0\cdot 555}{0\cdot 156}$$

$$x = 14 \quad \text{or} \quad x = 21$$

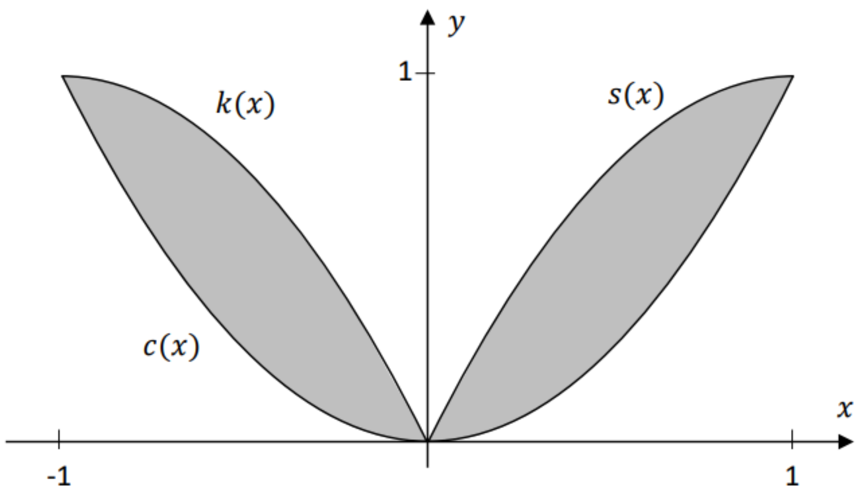
Thus $14 < x < 21$.

(c) The logo for the company is shown on the co-ordinate diagram below. The logo is the region enclosed by three curves, defined by the following functions c, s and k:

$c(x) = x^2$, for $-1 \le x \le 1$, $x \in \mathbb{R}$

$s(x) = 2x - x^2$, for $0 \le x \le 1$, $x \in \mathbb{R}$

$k(x)$ is the image of $s(x)$ under axial symmetry in the y-axis.



(i) Use integration to work out the area of the logo.
Hint: Find the area of the logo in the first quadrant, and then double it.

Solution

(c) (i) Area $= 2\int_0^1 \left(s(x) - c(x)\right) dx$

$$= 2\int_0^1 \left[(2x - x^2) - (x^2)\right] dx$$

$$= 2\int_0^1 (2x - 2x^2) dx$$

$$= \left[x^2 - \frac{2}{3}x^3\right]_0^1$$

$$= 2\left(1 - \frac{2}{3}\right) - 2(0)$$

$$= \frac{2}{3}$$

(ii) The function k can be written in the form $k(x) = -x^2 + bx + c$, where $b, c \in \mathbb{R}$ are constants. Find the value of b and the value of c. Remember that k is the image of s under axial symmetry in the y-axis.

Solution

(ii) Under reflection in the y-axis, (x, y) goes to $(-x, y)$.
To find the equation of $y = k(x)$, $(-x, y)$ lies on $y = s(x)$.
Thus $y = k(x)$ is given by:

$$y = s(-x)$$
$$y = 2(-x) - (-x)^2$$
$$y = -2x - x^2$$
$$y = -x^2 - 2x$$

Thus $b = -2$ and $c = 0$.

(d) In this part, p and r are constants, with $p, r \in \mathbb{R}$ and $0 < r < 0\cdot 9p$.
The company sells bags of plant food.
The usual price of one bag is €p.
In a sale, the customer can choose to pay using either Option 1 or Option 2, as follows.

* **Option 1**: the usual price reduced by 10%, and then reduced by a further €r
* **Option 2**: the usual price reduced by €r, and then this new price reduced by 10%.

Which option (1 or 2), if either, is cheaper?
Write the price for each option (1 and 2) in terms of p and r, to support your answer.

Solution

(d) **Option 1**: price $= 0\cdot 9p - r$
Option 2: price $= 0\cdot 9(p - r)$
$= 0\cdot 9p - 0\cdot 9r$

As $0\cdot 9p - r < 0\cdot 9p - 0\cdot 9r$,
Option 1 is cheaper.