Ten Common A-level Maths Mistakes

These are ten of the most common mistakes which A-level students make in exams, often costing them unnecessary marks. Make sure you don't make any of these!

1. Confusions with powers and negatives

It is easy to make silly mistakes when working with powers or lots of negatives. Make sure to remember that x^2 is always positive and $-x^2$ is always negative, but also that x^3 can be positive or negative. Additionally, do not confuse $(-x)^2$ and $-x^2$.
When working with a lot of negative numbers, write down as much of your method as you can; this will not avoid confusion, but also save you marks if you do make a mistake.

For example (FP1 paper):
Find the determinant of matrix $\begin{pmatrix} 1 & -2 \\ -5 & -4 \end{pmatrix}$.

$$\text{Determinant} = (1) \times (-4) - (-2) \times (-5)$$
$$= -4 - (+10) = -14$$

2. Thinking that $(a + b)^2 = a^2 + b^2$

This is an easy mistake to make if you are not concentrating. In reality, $(a + b)^2$ of course equals $a^2 + 2ab + b^2$. In the same way, you should not think that $\sqrt{a^2 + 25} = a + 5$.

3. Forgetting to take the negative square root

We know that $\sqrt{9}$ has two answers, -3 and 3. Similarly, $\sqrt{x}$ also has two answers. You should make sure to always think about the positive and negative root when doing a square root calculation. Sometimes the negative value can be ignored (it can refer to a length or fall outside of the domain), in this case you should still write it down, but clearly indicate that it is not part of the answer.

For example (C1 Paper):
The function $y = x^3 - 12x + 7$ has stationary points when $x^2 = 4$. This means there is a stationary point when $x = 2$ and when $x = -2$.

4. Thinking that $\frac{1}{x+y} = \frac{1}{x} + \frac{1}{y}$

Although this looks like it could be correct, it isn't. In C4 you learn about partial fractions which show you how to (correctly) rewrite functions such as $\frac{1}{x+y}$ into two fractions.
Having said this, you are allowed to split the numerator up into separate fractions; $\frac{a+b}{x+y} = \frac{a}{x+y} + \frac{b}{x+y}$. *For example:* $\frac{1}{2+3} = \frac{1}{5}$ $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$

5. Forgetting units, decimal points or significant figures

Once you have got an answer, ensure that you write it to the correct degree of accuracy (usually stated in the question). Also include any units such as cm^2 or kg. If there is no mention in the question of how many decimal points your answer should be written to, then do not round it at all. If you incorrectly round your answer and it is unnecessary you can lose a mark, if you don't round it at all when you don't have to, you will not lose any marks.

6. Forgetting the constant of integration

Always remember to write $+c$ after answering indefinite integral questions. This largely applies to C3 exams as they almost always include questions about indefinite integrals.

For example (C3 Paper):

$$\int \frac{9}{4x+3}\mathrm{d}x = \frac{9}{4}\ln|4x+3| + c$$

7. Integrating and differentiating e^x

e^x is special because it has the same value when differentiated or integrated. Make sure you do not fall into the trap of thinking that it integrates to $\frac{e^{x-1}}{x-1}$ and differentiates to xe^{x+1}. But also keep in mind that the derivative of e^{ax} is ae^{ax}.

For example (C3 Paper):

$$\int e^x \mathrm{d}x = e^x + c \qquad \int (3e^{5-2x})\mathrm{d}x = \frac{3}{-2}e^{5-2x} + c$$

8. Mixing up radians and degrees

Unless the question specifically asks for your answer in radians or degrees, you can use the one which you are most comfortable with. Just remember to remain consistent in the question, in order to avoid getting some answers in radians and some in degrees! Also always check your calculator is in the correct mode when doing angle-based questions.

9. Thinking that $\mathrm{cosec} x = \frac{1}{\cos x}$

It is obvious why this is a common mistake, because 'cosec' has 'cos' in its name. However in reality, $\mathrm{cosec} x = \frac{1}{\sin x}$ and $\frac{1}{\cos x} = \sec x$. A good way to remember which reciprocal function belongs to sin, cos and tan is to look at the third letter. The third letter of cosec is an s, so it is the reciprocal of sin. The third letter of sec is a c, so it is the reciprocal of cos and cot is the reciprocal of tan.

10. Thinking that if $\frac{d^2y}{dx^2} = 0$, the stationary point is a point of inflection

When $\frac{d^2y}{dx^2} > 0$, the stationary point is a minimum. When $\frac{d^2y}{dx^2} < 0$, the stationary point is a maximum. If $\frac{d^2y}{dx^2} = 0$, then the extreme point can be a minimum, maximum or a point of inflection. To determine what type of point it is you should test further, either by drawing the function, or by looking at values either side of the x_0 value and finding the gradient of the function at those points.

For example (C1 Paper):

$y = -x^4$ has a maximum point at $(0,0)$, but $\frac{d^2y}{dx^2} = 0$ when $x_0 = 0$.

Points to remember:

- You should be spending about a minute per mark, in order to leave yourself some time to check over your work at the end of the exam. If a question is only worth 1 mark and you do not know the answer, move on rather than spending valuable time on it.
- More often than not, if you get a 'nice' answer (ie $x = 4$ rather than $x = 4.328$) then your answer is correct. If you are running short on time, check the questions with awkward answers first.
- If you can't do part (a) of a question, you should still try to answer the other parts. Even if the answer to part (a) is necessary to answer subsequent parts, you can start part (b) by saying something along the lines of 'assume the answer to part (a) is $x = 5$' and then work through the question.
- Checking your work does not only mean checking to see if all your calculations are correct. If it is possible, you should check your answers by using the question. For example when finding the value of angles in C2 and C3, you can substitute the values of the angles which you found back into the initial equation to see if you were correct. If you have a lot of time left, you can consider starting the question from scratch and seeing if you get the same answers.

GOOD LUCK!