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NATIONAL 5 AND CfE HIGHER ENGLISH AND MATHEMATICS

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We hope that you find this CfE supplement of great use and very best of luck to you in your studies and in your final exams.

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THE ROLE OF PUNCTUATION
Faulty punctuation can confuse your meaning – and lose you valuable marks.
A good understanding of the function of punctuation marks will not only help your writing to be clearer – it can also boost your performance in Reading for Understanding.

ACTIVITY 1
How much do you know?
Test your general knowledge of punctuation by answering the following questions:

1. A full stop is required when a word has been abbreviated or shortened. True or false?
2. A phrase in apposition requires a comma before and after it. True or false?
3. ‘This is,’ he said, ‘My brother’s wife.’ Correct or incorrect?
4. A colon is only used to introduce a list. True or false?
5. Inverted commas round a word or phrase suggest the writer does not take the word or phrase at face-value. True or false?
6. Ellipsis may be used to add a touch of drama to the end of sentences. True or false?
7. A comma splice is an acceptable way to connect two independent statements. True or false?
8. A semi-colon may be used to separate longer phrases in a list. True or false?
9. ‘Macbeth’ is a person and Macbeth is a play. True or false?
10. Phrases in parenthesis are vital to the meaning of a sentence. True or false?

ANSWERS TO ACTIVITIES 1 AND 5

Sentence structure may vary:

Activity 5 – Think, Substitute and Rewrite
1. The …     It is …     I …      They …
2. Imagine a country where the sun always shines. (Creative)
3. He is an embarrassment no matter where you take him. (Creative)
4. Pete is an embarrassment no matter where you take him. (Persuasive)
5. We always need to be wary of the promises of politicians. (Persuasive)

Activity 1 – How much do you know?

ANSWERS TO ACTIVITIES 1 AND 5
1. True
2. True
3. False
4. True
5. False
6. True
7. False
8. True
9. True
10. False

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WORKING WITH PARAGRAPHS

Check out paragraphs you have written recently for essays or assignments against these points:

- A successful paragraph will focus on a single idea and fully support that idea before moving on to another idea.
- Each paragraph should flow smoothly into the next, whether joined by a transitional word or phrase or some connection between the ideas discussed.
- There is no set length for a paragraph; a variety of paragraph lengths invites reader engagement with your text.

Are your paragraphs as reader-friendly as they might be?

EXPAND NOTES INTO A PARAGRAPH

Below are some notes about an item of news. Expand them into a short paragraph. Remember to vary the type and length of your sentences and to use linking words.

Messages from Ankara report catastrophic earthquake in north-western Turkey. Particularly violent in Izmit region. Town completely destroyed. Thousands of people now homeless. Death toll estimated at more than 17,000. Turkish government sending thousands of troops and transport to help. Rescue work hampered by torrential rain and floods. News has aroused world-wide sympathy. Food, water, clothing and medical supplies flown in. Offers of help already received from twelve countries.

DEVELOPING VOCABULARY

Impressive writing requires a varied and lively vocabulary. The very best way to develop vocabulary is to read as widely as you can. Pay particular attention not just to great creative writers but to the writers who produce your textbooks in all your subjects. Look carefully at the vocabulary they use; are you familiar with these words? If not, check them out with a dictionary and start using them yourself.

ACTIVITY 4

FIND, SUBSTITUTE AND REWRITE

- find a substitute word from the box below for the word(s) in bold in each of the following sentences
- rewrite the sentence using that word.

<table>
<thead>
<tr>
<th>coalition</th>
<th>ambidextrous</th>
<th>suburban</th>
</tr>
</thead>
<tbody>
<tr>
<td>translucent</td>
<td>prelude</td>
<td>advent</td>
</tr>
<tr>
<td>antediluvian</td>
<td>circumspect</td>
<td>ultramarine</td>
</tr>
<tr>
<td>contraband</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The cocktail party acted as a kind of opening event to the conference itself.
2. His clothes are so ridiculously old fashioned they look as though they came out of the Ark?
3. The two parties formed a temporary alliance in order to defeat their main political rival.

ACTIVITY 5

CRITICAL ESSAY

You will often write a critical essay as part of a timed assessment. Don’t let time pressure panic you into writing before you have completed the following quick mental checklist:

- Given the text(s) I have studied, is this really the best choice of question for me?
- Have I studied all the wording of the question and not just a few keywords of it?
- Does my plan match up fully to the demands of the question?
- Given the time available, is my plan a realistic one?
- Do I have sufficient evidence to support the opening statements or topic sentences in each paragraph?

ACTIVITY 6

WORKING WITH STATEMENTS, EVIDENCE AND COMMENTARY

Practise constructing a body paragraph using a story from your childhood. Here is a statement from an essay on Little Red Riding Hood which could form the opening of a body paragraph on the tale. Produce the evidence section and then give your commentary on this evidence.

You can probably cite the evidence from your childhood memory of the story. (In case you have forgotten the details, you can check it out at www.eastoftheweb.com – search for ‘Brothers Grimm’.)

Little Red Riding Hood is someone who is not lacking in admirable qualities as a human being. She is both kind-hearted in offering to take food to her ailing grandmother and courageous in facing up to the wolf she encounters in the wood on the way. Sadly, however, her behaviour for much of the story suggests she is lacking in basic intelligence.

Now go on to give the evidence for this lack of ‘basic intelligence’ by referring directly to incidents in the story or using quotations from the tale or a mixture of both. Then go on to explain the implications of this evidence in your commentary for example: ‘From remarks such as these it is clear to us that the child …’
This is a course which allows you opportunities to develop and extend a wide range of language-focused life skills. It’s a well-grounded way of tackling the world of work, one which puts you in charge of your life. It’s an empowering fusion of language and life skills to carry you forward successfully.

THE TEXT

The text on which you will be asked to answer a series of questions will be selected by the examiners from a non-fiction text of distinction. Quality journalism, biography and travel writing are the kinds of texts you can expect to encounter. So, it would be wise to make sure you are familiar with writing of these genres long before the exam. Whatever form the final choice takes, the text in question will run to around 1000 words and will foreground the types of writing skills and techniques on which you will be expected to comment fully.

Read around

Regular exposure to quality non-fiction writing offers you a double bonus: you will be both preparing yourself for the Close Reading exam and at the same time picking up useful tips from successful writers which you can incorporate into your own non-fiction writing for the course assessment.

THE QUESTIONS

You will be expected to answer questions which will test your ability to understand, analyse and evaluate the article’s content in some detail. You will also be asked to give broader answers which will test your ability to infer the author’s general intentions in certain areas of the text and to summarise some key ideas. The number of marks allocated to each question will be clearly marked, thus helping you to manage your time appropriately. Let’s take a brief overview of what your responses need to cover in each of these categories.

Understanding questions

These are by far the most straightforward questions to answer. They mean just what they say: they test your grasp of what the piece is all about and probe your understanding of certain items of vocabulary; you may also be asked to suggest why certain comments are made. Being able to paraphrase ideas and expressions from the text is of prime importance here.

Analysis questions

These are a bit more demanding. Here you need to look at how a writer created a certain effect, by identifying how certain techniques and words or phrases are used to create that effect. Here you will need to quote certain items from the text, identify the technique at work and suggest what its effect on the reader is.

Evaluation questions

These ask you for your opinion of how well you think something has been said. To do this, you will need to find items of evidence to back up your assessment: a particularly successful simile, for instance, or a striking contrast in the choice of words which will form the basis of your comment. You may well have commented on these already in an Analysis question, but now you need to develop your own ‘take’ on them.

Inference questions

These have elements in common with understanding questions. You need to understand what is being said not just directly, but indirectly too. You could call this ‘reading between the lines’. Your ability to work this out and express your deductions in your own words tells the examiner that you are alert at reading subtle signals from the writer and are capable of responding accordingly.

Summarising questions

These demand an ability to take an indicated stretch of text and to extract from it only the key points. These you will need to express in your own words. Again, your understanding is being tested – but, given the higher marks usually involved, your answer may need to be more extended than other understanding questions.
UNDERSTANDING QUESTIONS

These are by far the most straightforward questions you will encounter. They are there to test exactly what their name implies: your understanding of what you have been reading. These questions will often begin as follows:

Explain in your own words ...

What is the meaning of …? How does the context help you work it out?

What did the writer's mother …?

In your opinion, who is …? Give a reason for your answer.

What does the expression ‘…’ tell you about the writer’s frame of mind?

When you see questions which may begin this way, be aware that the examiners are testing not only your understanding of specific words or expressions but also your ability to express them in your own words. You cannot ‘lift’ sections of the sentence to provide an answer, because then you are avoiding the very test that is being set.

Using your own words

Be warned here! When explaining an idea ‘in your own words’ or giving an answer which is ‘in your own opinion’, don’t automatically try a word-for-word ‘translation’; you will often find this difficult. Try to explain the idea rather than find substitutes for individual words. For instance, suppose the answer to a question lay in the sentence:

Total-immersion courses based in Italian families are seen by some as a valid alternative to college studies.

Phrases such as ‘total immersion’ and ‘valid alternative’ could be tricky on a word-for-word basis, so avoid this by trying to reshape the sentence entirely as if you were explaining this to someone who was not sure what these phrases meant. Starting with somewhere else rather than ‘Total immersion’ might be a good idea. Perhaps start with ‘Some people …’ or ‘There are those who think …’. This gives you:

Some people believe that living full-time with an Italian family is just as successful as studying Italian at college.

Or:

There are those who think that sharing life with an Italian family will benefit you as much as learning Italian in a more academic setting.

What do I change?

Another word of caution: there are some words which you will not be expected to change. Here you will have to use your common sense. Proper nouns and common nouns with no obvious alternatives (e.g. ‘crocodile’, ‘brakes’, ‘mortgage’) need to stay as they are, but verbs, adverbs, adjectives and figures of speech will need to be rephrased.

Tracking down the answer

In Understanding questions, a good tip is to adopt a two-stage approach:

Stage 1: Highlight or underline the words or phrases in the text where you know the answers lie.

Stage 2: Work now on putting these words or phrases in a new way, perhaps reshaping the section entirely to make it your own.

ANALYSIS QUESTIONS

Analysis questions are sometimes thought to be a little trickier to answer than understanding ones. They are there to test your ability to analyse how writers make their effects on readers. These questions demand a little more from you and may carry more than two marks to reflect this.

Normally you will need to do three things:

1. Locate relevant words or phrases from the text for your answer – again, highlighting these is a good idea.

2. Identify aspects of style at work: for example, simile, inverted sentence structure, list and so on.

3. Explain in your own words the effect this item is having on readers.

The Analysis questions can often be identified by their frequent use of the word how:

Comment on how the writer’s use of imagery shows …

How does the writer convey his fear of …?

Suggest how the writer shows her disapproval of …

But, be careful! The Analysis question may be expressed in other ways also:

Explain fully the appropriateness of the word …

Quote an expression from the first sentence which …

Comment on the effectiveness of the sentence structure …

Identify and briefly explain the writer’s use of …

These are just some of the ways you will be expected to show your analytical skills in exploring the text in question.

If you find yourself answering an analysis question without short quotations from the text, there is usually something far wrong! Questions asking you to comment on sentence structure might be an exception, but even here sufficient quotation should be given to identify which sentence or part of the sentence is being discussed.

EVALUATION QUESTIONS

Those questions may come towards the end of the series of questions. And there is a good reason for this late positioning. Some of the material you may have noted in answering understanding and analysis questions could be useful again here.

Be careful, however. It is never a question of simply repeating what you have said earlier. It will usually mean taking that earlier material and moving it one stage further. In other words, what is your opinion of how well the writer has used a technique, a way of illustrating a point or structuring a conclusion?

Do not hide behind technical terms when answering evaluation questions. Yes, you need technical terms, but, even more, you need a well-expressed opinion of your own about how well your selected technique for comment is performing its task in the text.
CRITICAL READING

SCOTTISH LITERATURE

What you probably will have noticed so far about your National 5 course is that the skills that you have acquired in one area of study bring you substantial benefits in another. Happily, the Critical Reading section in which you explore Scottish texts is no different. Here again our old friends understanding, analysis and evaluation reappear.

LOOKING FOR LINKS

Now, while much of what you are being asked to do here is quite familiar to you, there are aspects of the course which break new ground. National 5 requires you to get to know a number of prose, drama and poetry texts from the rich heritage of Scottish literature in real depth. This means that the reading skills we have outlined above, while remaining crucial to success in your understanding, analysis and evaluation of the passage, are not the end of the story.

You will also need to know the studied text(s) in considerable detail. Why? Well, in addition to explaining how writers create certain effects, you will also need to be able to point to links or connections between groups of poems or groups of short stories by the selected author – or, in the case of prose or drama, how the novelist or playwright explores elsewhere in the work ideas touched on here in the extract under study. The question which asks you to make these connections is a high-value one, usually accounting for 8 of the 20 marks on offer. So, it needs to be approached seriously. How do we go about looking for these links in each of the genres? Let’s see.

Poetry

You will be asked to study six poems from the works of your selected poet. Only one poem will feature in the extract offered for analysis. The final question, however, will invite you to make connections between ideas and/or language you have noticed here and in the other five poems by the same poet.

In terms of ideas, perhaps we see the poet returning in several poems to portray characters who parallel or contrast with others in, say, their ways of thinking, reacting or relating to others. Perhaps there are situations in relationships which crop up more than once. In terms of language, perhaps we see a fondness for, say, a conversational tone with enjambment as a recurring feature of style. Is the poem rich in other poetic devices, or is it deliberately matter-of-fact, using everyday language? Does the poet appear in the poem, or is there some other speaker narrating the poem? Are some poems written in free verse, or has the poet used a specific form? In Scots or English? You need always to be alert to making connections at several possible levels between the ideas and language of the offered poem and at least one other poem you have studied.

Prose

If you have chosen to study one of the selections of short stories, there will be some overlap between your approach to them and what we have been saying about poetry above. Check if there are certain ideas or situations in the extract which link it to at least one of the five other stories of your choice: lack of communication between the generations, for example. Or scenes in which characters confront or misunderstand each other, perhaps?

If you have chosen to study a novel, the situation is slightly different. Here you are looking for other incidents in the novel where you can spot, say, a character reacting in a way similar to or perhaps contrasting with previous behaviour, or in a manner which shows developing understanding or emotional depth. What has happened in between times to bring about this change? Perhaps one character is viewed in several ways by others in the novel? Maybe a theme is revisited in a way which parallels or contrasts with its treatment elsewhere in the novel? Are there other scenes where setting or atmosphere seems particularly important? What does setting contribute to the overall effect of the incident on the reader? Has setting been used this way before?

Drama

Many of the points about character, theme and setting discussed above with regard to poetry and prose also hold good for a context passage taken from a play. With the play, however, the action unrolls via dialogue, which needs to be carefully examined for typical speech characteristics. Do some characters have topics to which they regularly return? Do characters typically appear asking questions, giving instructions, sounding optimistic or pessimistic, talking about trivia, being violent, needing help, saying little or too much? How well do characters listen to each other? Are there moments when this changes? What is the effect on us of the change? Are there stage props which take on symbolic meanings in different parts of the play? Does lighting change at any key points? And what is the effect of this? Do the costumes of the characters change at any point? What do the changes tell us?
THE CRITICAL ESSAY

WAYS OF SUCCEEDING

WHAT IS BEING ASKED?

Success starts with fully understanding what the question is getting at and providing an appropriate answer.

A good answer does not tell the examiner everything you have learned about a text.

A good answer selects from your information bank only the information to answer the question in front of you.

That means you may come out of the exam room having used only a percentage of your total knowledge. Frustrating, yes, but if you have selected the correct percentage, you will do well.

THE SELECTION PROCESS

Choosing the correct question is the first key to success. To choose wisely, you will need to know your texts in depth. That means many readings on your own, not just the reading you have done with your teacher in class. Only with that depth of knowledge will you be able to select or reject questions without undue delay. You simply will not have the time to sit pondering tranquilly whether your play, poems or prose work match up to the demands of the question or not. Decisions need to be made fairly promptly, but not casually. Hence your grasp of the texts must be total.

Once you have decided you have sufficient information to settle on a question, begin by reading the question carefully and underlining or highlighting what you think are key words.

EXAMPLE:

For instance, you may select a question like this:

Choose a short story or novel in which setting figures prominently.

Describe the contribution of the setting and then show how this feature helped your understanding of the text as a whole.

Underline the words that are pointing you to what the essay will be about. In this case, the words will probably be setting figures prominently. In the second line, you will also probably have underlined Describe the contribution. Notice, however, that there is a second part to the question:

... and then show how this feature helped your understanding of the text as a whole.

In exam questions at this level, you must always be ready for this second part to the question. Under all the pressure to write down the full details of the setting, you mustn’t lose sight of that significant later part of the question. Leave yourself short of time for that, and you will be throwing away vital marks.

So, in your planning, remember to include a section which will deal with this second part.

THINGS TO REMEMBER

It is difficult to identify exactly the moment when an examiner decides to award a top grade. There is an accumulation of factors at work here. These are some of the key ones which should be studied well in advance of entering the exam room.

- You need to demonstrate a thorough knowledge of your texts. That means reading them not just in class but regularly on your own as well.
- You must select only the information from your text knowledge which answers the specific question in front of you. Examiners do not want to know everything your teacher has taught you.
- You must be alert to all sections of the question and apportion your time accordingly.
- You need a plan to help you structure a coherent essay which is more than a loose collection of good points. There should be a line of argument that the examiner can follow easily as one paragraph flows smoothly into the next.
- Each paragraph should be carefully structured to ensure that your claims are borne out by evidence and that you unpack this evidence for the reader. In other words, you make a Statement, back it up with Evidence and then give a Commentary on it before moving on to the next paragraph (SEC).
- A soundly structured introduction will help you to stay on task, and a ‘road-map’ in the introduction’s last sentence will help examiners to find their way round your arguments. A brief conclusion reminds them of your key points.
- Use the correct procedure for laying out quotations, long or short. This shows good academic manners and attention to detail that increases your stature as a competent commentator on your texts.
- Make sure that your quotations make sense. This means checking that you have given each one a context, however brief.
- Pay close attention when a specific ‘genre’ is requested. A genre is a type, or category, of literature, poetry, drama or prose.

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READING FOR UNDERSTANDING, ANALYSIS AND EVALUATION

This paper represents 30 of the 70 marks in your final exam, so it is key to your overall success. To meet the challenges and gain maximum marks in this 90-minute exam, you will need to study in detail the question types you are likely to encounter and the techniques you require to answer them.

WHAT ARE THE LIKELY TEXTS?

The texts will be examples of detailed and complex non-fiction writing selected from areas such as serious journalism, travel writing and biography. You will be required to read two texts on a similar topic, answer questions on the first text and then, in a final question, compare the two texts in a way specified by the examiner.

It makes sense to familiarise yourself with such texts as early as possible, because although they will introduce you to many interesting topics, the richness of their expression can be challenging and their ideas thought-provoking, and getting to grips with these for the first time in the examination room probably isn’t the best idea! Make sure you put aside time to read quality newspapers and magazines regularly, so that when you sit the exam, you will be familiar with the vocabulary and structures of good-quality, non-fiction writing.

And doing this will also help your own writing.

MAKING THE BEST START

Time is always short in the exam room, but time spent reading – intelligently – will pay real dividends in the quality of your answers. The intelligent reader adopts a two-stage approach.

THE FIRST READ

Check out any information in the rubric at the top of the passage: there may be a clue there as to the writer’s attitude to the topic; this may help with later questions on tone. Then, read the first sentence of each paragraph to get a feel for the flow of the passage. A sense of where the text is going is often vital to picking up the writer’s overall intentions. Is a question set out at the start and then systematically answered in the various paragraphs?

The Higher English exam is split into two papers:

- Reading for Understanding, Analysis and Evaluation
- Critical Reading

The topics covered here aim to give you plenty of valuable information to help in your exam: help with simply-worded explanations of challenging concepts; help with practising how to answer exam-type questions and help with writing convincing essays of any kind!

For example:

Firstly ... In the second place ...

or

In earliest times ... The Romans later ... Latterly ...

Is there a balanced argument, with the writer changing direction mid-way? Or is there some tie-up between an opening statement and a concluding one? Whatever approach the author has selected, the first sentence in each paragraph will help to give you a strategic overview of the approach adopted and its direction of travel. Always be alert to seemingly inconsequential words and phrases like however, but, nevertheless, whereas, in spite of and similarly: they are invaluable for signalling upcoming shifts in the writer’s stance.

THE SECOND READ

Now that you have an informed sense of the writer’s overall intentions, you can settle down to absorb the passage’s detail. Some people like to read through the entire passage again, marking up key points as they go before tackling the questions; others like to work on analysing the sense of individual paragraphs and then answering their related questions. A thorough second reading of the text, however managed, will be really helpful in appreciating the passage’s complexity of ideas and richness of language features. (But do keep an eye on the time.) Only with this alertness will you pick up top marks.

UNDERSTANDING

SHOWING YOU UNDERSTAND

The aim here is to assess what you have derived from your reading. In other words, have you understood what the writer is saying? You are expected to be able to understand the key points the writer is making and, at times, to summarise them. You are also expected to demonstrate your understanding by suggesting what the writer is also saying ‘between the lines’.

Often, an understanding question will ask you to identify something the writer has commented on: for example, a reason, feeling, purpose, claim or fear. Or it might ask you to use your own words to explain or say in what ways two people or things are different or similar, making the relationship between them clear.

It’s essential to remember that whether you are summarising, inferring meaning or simply showing understanding, you must do all this in your own words. ‘Lifting’ words or expressions from the texts is a sure-fire way to lose marks. Examiners argue that you do not understand any concept until you can express it in your own words.
When you are answering an evaluation question, take the usual three-stage approach first:

1. Locate specific items from the text (unless the question has already done so).
2. Identify a language technique that the writer is using (unless the question has already done so).
3. Explain in your own words the effect that this technique has on the reader.
Then take it one stage further:
4. Give a personal assessment, backed up by textual evidence, of how successful you find this technique to be.

CRITICAL READING: SCOTTISH LITERATURE

THE CHOICES

<table>
<thead>
<tr>
<th>DRAMA</th>
<th>PROSE</th>
<th>POETRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cheviot, the Stag and the Black, Black Oil by John McGahgh</td>
<td>Short stories (a selection) by Ian Crichton Smith</td>
<td>Carol Ann Duffy</td>
</tr>
<tr>
<td>Men Should Weep by Ena Lamont Stewart</td>
<td>Short stories (a selection) by George MacKay Brown</td>
<td>Robert Burns</td>
</tr>
<tr>
<td>The Slab Boys by John Byrne</td>
<td>Sunset Song by Lewis Grassic Gibbon</td>
<td>Don Paterson</td>
</tr>
<tr>
<td></td>
<td>The Cone-Gatherers by Robin Jenkins</td>
<td>Liz Lochhead</td>
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<tr>
<td></td>
<td>The Trick is to Keep Breathing by Janice Galloway</td>
<td>Sorley Maclean</td>
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<td>Norman MacCaig</td>
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Those of you who are progressing to the CfE Higher from National 5 will be well aware of the important role that Scottish literature plays in this exam. The critical reading of a Scottish text (or texts) in Section 1 of the English Critical Reading paper counts for 20 marks in the overall exam total of 70 marks. 10 marks will be awarded for answering specific questions on a selected passage. A further 10 marks (usually in the final question) will be awarded for making links to other poems, plays or prose works by the same author, or for making links to other related sections within your chosen poem, play or prose work.

Whichever text you and your teacher have chosen to study, you'll have to know it inside out, because you never know which part of the text the examiners will select for comment. If you haven't got in-depth textual knowledge, you won't be able to comment authoritatively on the language, or relate the extract to similar or contrasting concepts and techniques elsewhere within the same text or in the author's other works.

SO, WHAT'S NEW?

The demands outlined above will be familiar to N5 candidates. So, what has changed for Higher? While there is a slight change in the balance of marks between the two sections, the real difference is in the course's name: Higher. You will need to demonstrate a greater maturity of approach to the analytical process: the points you make should reveal a greater depth of insight than you may have shown in earlier exams; your expression will need to be similarly more polished and persuasive. But don't be alarmed: the preparation you have already done for National 5, together with this year’s Higher course study, will stand you in good stead for the increased demands.
THE WORDING OF QUESTIONS

Pay close attention to the wording of the question to ensure that you are giving the examiners exactly what they want.

Sometimes the question will test your detailed understanding of what is happening in an extract. The clue is in the wording:

By referring closely to ... explain what is revealed about ...
With close reference to the text, discuss the attitudes of ...

You will need to identify words or phrases and then say what they tell you about the person, thing, situation, or whatever the examiner is asking.

Sometimes you will be asked to demonstrate your analytical skills. Again, the clue is in the wording:

Analyse how in lines 10–15 the writer conveys a sense of ***’s growing confidence in her future.

By referring closely to two examples of ***’s speech, explain how ...

When you answer questions of this type, pick out specific words/ phrases/ techniques, unpack them fully and explain clearly the effect that they have on the reader.

‘ran ... hacked down ... charged in’ tells us the boy was energetic, with perhaps a hint of violence about him.

Sometimes you will be asked to make your own assessment or evaluation of some aspect of the extract:

Evaluate the effectiveness of lines1–4 as an opening to ... How effective do you find the speech of ...?

For these types of questions, you will need to identify what is happening in the featured lines, analyse how the writer has used specific words or phrases to achieve a particular effect and then assess how well you think they have succeeded. Remember – it’s your opinion that the examiner is looking for here.

SHOWING UNDERSTANDING

Your knowledge of the text (or texts) needs to demonstrate that you are totally secure in discussing what is going on in it. You need to know the characters in depth, what motivates them, how they behave, how they change, how they interact with others and what other characters think of them. You need to know the main themes that bind the text together. You also need to be familiar with setting and how it might change from time to time and perhaps alter the mood of the text.

SHOWING ANALYSIS

In terms of showing analysis, you are well prepared for the critical essay, because you already have experience of producing evidence to back up your understanding in Reading for Understanding, Analysis and Evaluation. You already know about figurative language (such as similes and metaphors), sentence structure and tone. You already know how to select appropriate quotations or refer to key incidents or events to back up your case.

SHOWING EVALUATION

This is your opportunity to give your own opinion about what the writer has been saying, how they have been saying it and how effectively you think they have been saying it. Think about the points you made in your analysis, base your evaluation on specific details that you have identified, then take them a little further by giving your personal opinion about them.

EXPRESSING YOUR IDEAS WELL

This means not only writing clearly and accurately with the correct spelling, grammar and punctuation, but also being able to structure your essay persuasively by framing it with a relevant introduction and conclusion, by following a clear line of argument throughout and by using critical terminology to set out your thoughts in the most convincing way possible.

ORGANISING A STUDY FILE

Get yourself a study file that you update regularly. Decide how best you memorise information, and organise your notes and quotations in a way that works for you. For example, if you are studying a play, you could organise your notes by what happens in acts and scenes, by understanding characters and their changing fortunes throughout acts and scenes or by themes.
If you are studying a novel, you could keep a chapter-by-chapter summary, a page for each of the characters and their changing fortunes or organise your notes by themes.

If you are studying a short story or poem, go through the same process. Store all your class work, weekly essays and notes in this file, and it will become an invaluable revision tool.

**REGULAR REVISION**

You are being asked to work with detailed and complex texts, so it’s a good idea to read your notes at least once a week. That way, you’ll get to know the text really well, deal with any questions as they arise and avoid major problems and panics at exam time. And that can only be good for your confidence.

**THE CHALLENGE OF THE QUESTION**

Conscientious students often emerge from the examination room with a strong sense of frustration. They feel they have studied and revised well and have only been invited to demonstrate a fraction of their acquired knowledge. But answering an exam question well is a process of selection. The examiners do not wish to know everything your teacher has taught you. They are more interested in focusing on one question and finding out how well you can select the information required to answer it.

**THINGS TO REMEMBER**

It’s an accumulation of factors that will achieve you a top mark. Here are some of the key ones. Study them well before you enter the exam room.

- You need to demonstrate a thorough knowledge of your texts. That means reading them not just in class but regularly on your own as well.
- You must select only the information from your text knowledge that answers the specific question in front of you. Examiners do not want to know everything your teacher has taught you.
- You must be alert to all sections of the question and apportion your time accordingly.
- You need a plan that is more than just a loose collection of good points to help you structure a coherent essay. There should be a line of argument that the examiner can follow easily as one paragraph flows smoothly into the next.
- Each paragraph should be carefully structured to ensure that your claims are borne out by evidence and that you unpack this evidence for the reader. When a question has a second part to it inviting you to discuss ‘central concerns’ or to expand on how some aspect ‘enhances your understanding of the text as a whole’ or to comment on ‘how it engages your interest in a portrayal’, don’t leave it all until the penultimate paragraph to discuss fully. You could leave yourself short of time. Instead, keep this discussion in sight by referring to it in each paragraph. You can then expand on it in the penultimate paragraph.
- A soundly structured introduction will help you to stay on task, and a ‘road-map’ in the introduction’s last sentence will help the marker to find their way round your arguments. A brief conclusion will remind them of your key points.
- Use the correct procedure for laying out quotations, long or short. This shows good academic manners and attention to detail that increases your stature as a competent commentator on your texts.
- Make sure your quotations make sense. That means checking that you have given each one a context, however brief.
- Pay close attention when a specific ‘genre’ is requested. A genre is a type, or category, of literature, poetry, drama or prose.
In order to be successful at National 5 Mathematics, you will have to prepare properly. You must attend lessons, study the course, practise key examples and ask for advice about areas of concern. Do not leave things to the last minute when studying, and do not try to do too much at the one time. The way to get the maximum benefit from the guide is to revise regularly in fairly small doses. This requires planning, so you will need to be organised.

**SCIENTIFIC NOTATION**

You should be familiar with the process of writing numbers in scientific notation. Scientific notation, also known as standard form, is a way of writing very large or very small numbers in a more convenient form.

As an example, we can consider the distance from Earth to Saturn. The distance is approximately 1.277 billion kilometres. In full, this number is 1,277,000,000. When written in scientific notation, the distance is $1.277 \times 10^9$ kilometres, a much more compact form.

On many occasions, you will require a calculator for work on scientific notation; however, you should also be able to carry out some calculations without a calculator. This could involve using the laws of indices.

**EXAMPLE:**

Express $(7 \times 10^4) \times (3 \times 10^5)$ in the form $a \times 10^n$, where $1 \leq a < 10$ and $n$ is an integer.

**SOLUTION:**

$(7 \times 10^4) \times (3 \times 10^5) = 7 \times 3 \times 10^4 \times 10^5 = 21 \times 10^{4+5} = 21 \times 10^9 = 2.1 \times 10^1 \times 10^9 = 2.1 \times 10^{10}$.

**USING A CALCULATOR**

Many very large or very small numbers have too many digits to fit into a calculator. For example, in science, a number known as the Avogadro constant is approximately $6.02 \times 10^{23}$ and would have 24 digits if written in full. To cope with this, we use the EXP key on the calculator. For the Avogadro constant, key in $6.02 \times 10^{23}$. You should see the following, depending on the calculator:

![6.02E23]

If you have a negative power of 10, for example $3.1 \times 10^{-6}$, key in $3.1 \times 10^{-6}$ in full. On some calculators, the $+/-$ key must be used.

Once you are familiar with the EXP key, you will be able to carry out more complicated problems on your calculator.

For $(7 \times 10^4) \times (3 \times 10^5)$, you would key in $7 \times 10^4 \times 3 \times 10^5$. You should see $2.1 \times 10^{10}$.

To complete this section, we shall look at two difficult examples on scientific notation.

**EXAMPLE 1**

The orbit of the Earth is circular. The radius of the orbit is $1.5 \times 10^8$ kilometres. Calculate the circumference of the orbit. Give your answer in scientific notation.

**SOLUTION:**

$C = \pi d = \pi \times 2 \times 1.5 \times 10^8$.

Now key in $\pi \times 2 \times 1.5 \times 10^8$. This leads to $942477796.1$ on the screen.

Express this in scientific notation, that is, $9.4 \times 10^9$ kilometres.

**NOTE:** As the radius was given correct to 2 sig. figs ($1.5 \times 10^8$), then the solution should also be rounded to 2 sig. figs.

**EXAMPLE 2**

The total mass of the Earth is $5.97 \times 10^{24}$ kilograms. The mass of water on the Earth’s surface is $1.35 \times 10^{21}$ kilograms. Express the mass of water on the Earth’s surface as a percentage of the total mass of the Earth. Give your answer in scientific notation.

**SOLUTION:**

$\text{Percentage} = \frac{1.35 \times 10^{21}}{5.97 \times 10^{24}} \times 100$.

Now key in $1.35 \times 10^{21} \div 5.97 \times 10^{24} \times 100$. This leads to $0.02261306533$.

Therefore the percentage is $2.26 \times 10^{-2}$ in scientific notation (to 3 sig. figs).
**ALGEBRAIC FRACTIONS**

**SIMPLIFYING FRACTIONS**

You should know how to simplify fractions such as $\frac{10}{20}$. By expressing $\frac{10}{20}$ as $\frac{1}{2}$ (in other words finding the factors of 10 and 35), we can simplify $\frac{10}{20}$ to $\frac{1}{2}$ by dividing the numerator and denominator of $\frac{10}{20}$ by 5 (the highest common factor of 10 and 35). We say that we cancel the 5s. This process is also known as expressing a fraction in its simplest form.

In a similar way, we can simplify algebraic fractions by cancelling factors common to the numerator and denominator of a fraction. We must use the highest common factor when doing this. For example, $\frac{ax}{bx}$ would simplify to $\frac{a}{b}$ terms. Note that fractions such as $\frac{a}{a}$ cannot be simplified, due to the + and – signs.

We can, however, cancel brackets common to the numerator and denominator. For example, $\frac{(a + b)}{(a - b)}$ would simplify to $\frac{4}{(a - b)}$ by cancelling the $(a + b)$ brackets.

**EXAMPLE:**

Express $\frac{ax}{bx}$ as a fraction in its simplest form.

**SOLUTION:**

$\frac{ax}{bx} = \frac{a}{b}$

In some examples, it might not be obvious that the fraction can be simplified, for example $\frac{ax + b}{a + b}$. However, this can be simplified if we factorise the numerator by taking out a common factor. Hence $\frac{ax}{a}$ can be simplified to $\frac{x}{1}$.

**EXAMPLE:**

Express $\frac{ax + b}{a + b}$ as a fraction in its simplest form.

**SOLUTION:**

$\frac{ax + b}{a + b} = \frac{x}{1}$

Next, we shall consider the four operations with algebraic fractions – addition, subtraction, multiplication and division.

**ADDITION**

You should know how to add simple fractions without using a calculator. This is done by finding the LCM (Least Common Multiple) of the denominators of the fractions and using this as a common denominator.

**EXAMPLE:**

Calculate $\frac{a}{x} + \frac{b}{y}$.

**SOLUTION:**

$\frac{a}{x} + \frac{b}{y} = \frac{ax}{xy} + \frac{by}{xy} = \frac{ax + by}{xy}$

Note that we find the LCM (Least Common Multiple) of 4 and 5, which is 20 ($4 \times 5$), and then form two equivalent fractions with denominator 20. The same method is used to add algebraic fractions.

**SUBTRACTION**

The method of subtracting fractions is the same as addition in that it is necessary to find the LCM of the denominators of the fractions and use this as a common denominator.

**EXAMPLE:**

Calculate $\frac{a}{x} - \frac{b}{y}$.

**SOLUTION:**

$\frac{a}{x} - \frac{b}{y} = \frac{ax}{xy} - \frac{by}{xy} = \frac{ax - by}{xy}$

**MULTIPLICATION**

We multiply the numerators together and the denominators together, then simplify the fraction, if possible, by cancelling. You could cancel first, then multiply instead. Again, the same approach is used with algebraic fractions.

**EXAMPLE:**

Express $\frac{a}{x} \times \frac{b}{y}$ as a single fraction in its simplest form.

**SOLUTION:**

$\frac{a}{x} \times \frac{b}{y} = \frac{ab}{xy}$

**DIVISION**

You should know how to divide simple fractions without using a calculator. To divide two fractions, leave the first fraction as it is, change the division sign to a multiplication sign, invert the second fraction, that is turn it upside down, then do in the same way as a multiplication of fractions.

Again, the same approach is used with algebraic fractions.

**EXAMPLE:**

Calculate $\frac{a}{x} \div \frac{b}{y}$.

**SOLUTION:**

$\frac{a}{x} \div \frac{b}{y} = \frac{a}{x} \times \frac{y}{b} = \frac{ay}{xb}$

**SUMMARY**

After studying algebraic fractions, you should be able to:

- simplify algebraic fractions
- add, subtract, multiply and divide simple fractions without a calculator
- add, subtract, multiply and divide algebraic fractions.

Check carefully over the four operations, as it is not unusual for students to get the techniques for addition and subtraction mixed up with the techniques for multiplication and division.
QUADRATIC FUNCTIONS

THE EQUATION OF A QUADRATIC FUNCTION

The general equation of a quadratic function is

\[ f(x) = ax^2 + bx + c, \]

where \( a \) cannot equal zero. Remember also that \( y = f(x) \).

Hence functions such as \( f(x) = x^2 + 3x + 4 \), \( f(x) = 2x^2 - 5x \), \( f(x) = 3x^2 + 12 \), \( f(x) = 3x^2 \) and \( f(x) = 6 + 4x - x^2 \) are all examples of quadratic functions. We shall consider a very straightforward quadratic function, that is \( f(x) = x^2 \). We can draw the graph of this function by creating a table of values.

<table>
<thead>
<tr>
<th>( x )</th>
<th>(-3)</th>
<th>(-2)</th>
<th>(-1)</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>(9)</td>
<td>(4)</td>
<td>(1)</td>
<td>(0)</td>
<td>(1)</td>
<td>(4)</td>
<td>(9)</td>
</tr>
</tbody>
</table>

By plotting points from this table, we can see the graph of the function \( f(x) = x^2 \).

This type of graph is called a parabola. The graphs of all quadratic functions are parabolas. A parabola is a smooth symmetrical curve with an axis of symmetry. For the above parabola, the axis of symmetry is the \( y \)-axis, that is the straight line with equation \( x = 0 \). All parabolas have turning points. The above parabola has a minimum turning point with coordinates \((0, 0)\). Parabolas with minimum turning points are sometimes described as \( \cup \)-shaped.

The graph of the function \( f(x) = ax^2 + bx + c \) will be \( \cup \)-shaped if \( a > 0 \).

If the quadratic function \( f(x) = ax^2 + bx + c \) is such that \( a < 0 \), for example \( f(x) = -x^2 + 5 \), then the parabola will be \( \cap \)-shaped and have a maximum turning point.

EXAMPLE:

Part of the graph of \( y = ax^2 \) is shown in the diagram. If the point \((2, 8)\) lies on the graph, find the value of \( a \).

SOLUTION:

Substitute \( x = 2 \), \( y = 8 \) into the equation \( y = ax^2 \).

Hence \( y = ax^2 \Rightarrow 8 = a \times 2^2 \Rightarrow 8 = 4a \Rightarrow a = 2 \).

EQUATIONS OF THE FORM \( y = (x + p)^2 + q \)

By completing the square, we can find out the coordinates of the turning point of a parabola.

EXAMPLE 1

Express the equation \( y = x^2 + 8x - 4 \) in the form \( y = (x + p)^2 + q \). Hence state the coordinates of the turning point on the graph of the quadratic function with equation \( y = x^2 + 8x - 4 \).

SOLUTION:

Use the technique of completing the square.

\[ y = x^2 + 8x - 4 \Rightarrow y = x^2 + 8x + 16 - 16 - 4 \Rightarrow y = (x + 4)^2 - 20. \]

As this has a minimum value of \(-20\) when \( x = -4 \), the coordinates of the turning point are \((-4, -20)\).

NOTE: We know that the turning point of the graph is a minimum turning point by inspecting the equation \( y = x^2 + 8x - 4 \). Remember that the graph of the function \( f(x) = ax^2 + bx + c \) will be \( \cup \)-shaped if \( a > 0 \). In the case of \( y = x^2 + 8x - 4 \), the coefficient of the \( x^2 \) term is greater than zero.

EXAMPLE 2

The diagram shows part of the graph of \( y = 15 - (x - 4)^2 \).

(a) State the coordinates of the maximum turning point.

(b) State the equation of the axis of symmetry of the graph.

SOLUTION:

(a) \((4, 15)\) \(\quad\) (b) \(x = 4\).

SOME IMPORTANT FACTS

- The general equation of a quadratic function is \( y = ax^2 + bx + c \) or \( f(x) = ax^2 + bx + c \)
- By completing the square, the equation can be written as \( y = a(x + p)^2 + q \)
- The graph of a quadratic function is a parabola
- The parabola with equation \( y = a(x + p)^2 + q \) has a turning point with coordinates \((-p, q)\)
- The axis of symmetry of the parabola with equation \( y = a(x + p)^2 + q \) is \( x = -p \)
- If the coefficient of the \( x^2 \) term in a quadratic function is positive, the graph has a minimum turning point
- If the coefficient of the \( x^2 \) term in a quadratic function is negative, the graph has a maximum turning point
PYTHAGORAS' THEOREM
You should be very familiar with Pythagoras' Theorem. Pythagoras was a Greek mathematician who lived in the 6th century BC. A reminder of his theorem is shown here.

\[ a^2 + b^2 = c^2 \]

**EXAMPLE 1**

Find \( x \).

\[ 9.6^2 + 6.7^2 = x^2 \]

\[ x^2 = 92.16 - 44.89 \]

\[ x^2 = 47.27. \]

Hence \( x = \sqrt{47.27} = 6.9 \) cm (to 2 sig. figs).

**EXAMPLES WITH COORDINATES**
You can find the distance between two points, given their coordinates, by plotting the points on a grid and then using Pythagoras' Theorem.

**EXAMPLE 1**

Point A has coordinates (-3, 1). Point B has coordinates (4, 3). Find the length of the line AB.

**SOLUTION:**

Plot A and B and join them. Create a right-angled triangle with AB as the hypotenuse, and then use Pythagoras' Theorem.

\[ AB^2 = 7^2 + 2^2 = 49 + 4 = 53 \]

\[ AB = \sqrt{53} = 7.3 \text{ units (to 2 sig. figs)}. \]

**PYTHAGORAS' THEOREM IN THREE DIMENSIONS**

**EXAMPLE 1**

AB represents a flagpole at the corner of a field. The flagpole is 8 metres high. BCDE represents the field, which is rectangular.

BC is 9 metres long and DC is 24 metres long.

A rope stretches from A, the top of the flagpole, to M, the midpoint of DC.

Calculate the length of the rope.

**SOLUTION:**

We do two calculations involving Pythagoras' Theorem, firstly in triangle BCM and secondly in triangle ABM.

\[ BM^2 = 9^2 + 12^2 = 81 + 144 = 225 \Rightarrow BM = \sqrt{225} = 15 \]

\[ AM^2 = 15^2 + 8^2 = 225 + 64 = 289 \Rightarrow AM = \sqrt{289} = 17 \text{, hence the rope is 17 metres long}. \]

THE SINE RULE

**WHEN TO USE THE SINE RULE**

In mathematics, we can use the ideas from trigonometry (SOHCAHTOA) and Pythagoras' Theorem to solve many problems in right-angled triangles. However, in triangles which are not right-angled, we need other formulae to find the lengths of sides and the sizes of angles. One of the most important formulae is called the sine rule. The formula for triangle ABC is given below.

\[ \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \]

This formula can be used in any triangle:

- to find the length of a side when you are given two angles and one other side.
- to find the size of an angle when you are given two sides and an angle other than the included angle.

**FINDING THE LENGTH OF A SIDE**

**EXAMPLE 1**

In triangle ABC, AB = 28 centimetres, angle ABC = 86° and angle ACB = 29°. Calculate the length of side AC.

**SOLUTION:**

\[ \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \]

\[ \Rightarrow b \times \sin 29° = 28 \times \sin 86° \]

\[ \Rightarrow b = \frac{28 \times \sin 86°}{\sin 29°} = 57.61 \]

Hence AC = 58 cm (correct to 2 sig. figs).

**EXAMPLE 2**

For triangle ABC, shown above, calculate the length of side BC.

**SOLUTION:**

At first, this appears impossible, as we have no information about A (the angle) or a (the side we have been asked to find). However, it is easy to calculate the size of angle A, as the sum of the angles in a triangle is 180°.

Hence angle BAC = \((180 - 86 - 29)° = 65°\).

Now we can use the sine rule:

\[ \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \]

\[ \Rightarrow a \times \sin 65° = 28 \times \sin 86° \]

\[ \Rightarrow a = \frac{28 \times \sin 65°}{\sin 29°} = 52.34 \]

Hence BC = 52 cm (correct to 2 sig. figs).
As you prepare for your Higher Mathematics exam, remember that success depends on your knowing many important topics from National 5. You will benefit from regular practice in algebraic manipulation and from consolidating your numerical skills. You need to use correct notation and you should try to become familiar with mathematical terminology and vocabulary. The correct use of brackets is also very important.

### REVISION TIPS

#### General advice
- Don’t leave your revision until the last minute. When you are still learning new topics, revise the ones you have already covered.
- Study for periods of between 30 and 45 minutes, unless you are doing a complete paper.
- Take short breaks, away from your study area, to keep your level of concentration high.
- During your study leave, build treats and relaxation time into your revision timetable. This will help you to focus and help you stick to your plan.
- In the run up to the exams, Eat Well, Exercise Well and Sleep Well.

#### Maths-specific revision tips
- The best way to revise mathematics is by doing it. There is a time for learning the necessary formulae and rules, but there is no substitute for practice.
- Once you have learned a topic or skill, try questions. Start off with straightforward questions, then Unit level, and progress to examination style. Test your knowledge on topic-based questions, then progress to a mixture of past-paper questions. It is important to recognise what to use and when, which skill to apply and where.
- Use the space in the margin of your notes to add your own revision reminders.
- Mathematics is a subject to be practised often. If you complete one extra question every night in addition to your normal homework, you will reap the rewards. You will be able to ask for help the next day when the problem is fresh in your mind, and so you will quickly build up your knowledge and confidence.
- Mathematics also demands perseverance and time management – you will need to tackle a number of questions or a whole examination paper in one sitting.
- Mathematics is different from other subjects in so many ways – the good thing about revising it is that you can be active.

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**ASSESSMENT**

The Higher Mathematics course has unit assessments and an external Course assessment.

The Course assessment is a written examination consisting of two papers.

- Paper 1 (Non-calculator) lasts 70 minutes and has 60 marks.
- Paper 2 (Calculator) lasts 90 minutes and has 70 marks.

Both papers consist of short and extended response questions. Paper 1 usually has more questions of a shorter nature than Paper 2. The course is graded A (bands 1 and 2), B (bands 3 and 4), C (bands 5 and 6) or D (band 7) based on how well you do in the external examination.

**Exam hints**

You do not need to answer the questions in order. It may be better to choose a question that you can answer easily first, so that you settle your nerves. However, remember that the questions should be in order of difficulty. You should look for connections between parts of questions. These are almost always linked and, sometimes, an earlier result in part (a) or (b) is needed and its use avoids repeating work.

Communication is important in questions where standard results and formulae are used. It is insufficient simply to quote a result or formula: they need to be connected to the particular question. For example, using the limit in recurrence relations, it is not sufficient to simply quote \( L = \frac{b}{a} \); it should be used in the context of the question.

You will not be told in every question to ‘show your working’, but you need to remember to be accurate, to give detail and to illustrate your understanding in your working. However, you should simplify expressions and try to use concise and efficient methods where possible.

Remember, the examination will contain unseen and unfamiliar questions and contexts. Do not let this put you off. It is important to get practice in carefully reading and interpreting problems so that you are able to apply your knowledge.
INTEGRATING – ANTI-DIFFERENTIATION

Apart from one complicating feature, if you integrate the result of a differentiation, you should get the original expression back. And vice versa: if you differentiate the result of an integration, you end up with the original expression.

The integral of \( f(x) \) is written \( \int f(x) \, dx \)

Don’t forget the ‘+C’!

The diagram will remind you how to differentiate or integrate a term which is a power of \( x \):

- **Multiply by the index of \( x \)**
- **Divide by the new index of \( x \)**
- **Reduce index by 1**
- **Increase the index by 1**

For example, to integrate the term \( 4x^3 \), increase the index by 1, \( x^4 \), divide coefficient by new index \( \frac{4}{1} = 4 \), so the answer is \( 4x^4 \)

And, for this term, \( \frac{4}{3} \), first rewrite as \( 6x^{\frac{1}{3}} \),

then increase the index by 1, \( x^{\frac{4}{3}} \),

divide coefficient by new index \( \frac{6}{\frac{4}{3}} = \frac{9}{2} \), so the answer is \( \frac{9}{2}x^{\frac{4}{3}} \).

Integration is slightly more complicated than differentiation because of the constant terms. The following three expressions are the same except for the constant terms:

\[
\begin{align*}
3x^2 - 5x + 4 & \quad \text{all differentiate to give } 6x - 5 \\
3x^2 - 5x - 7 & \\
3x^2 - 5x &
\end{align*}
\]

Integrating \( 6x - 5 \) gives the terms \( 3x^2 - 5x\) and it is impossible to know without further information what the constant term could be. We write ‘+C’ to indicate the presence of a constant in the anti-derivative (which could of course be zero).

So, \( \int (6x - 5) \, dx = 3x^2 - 5x + C \)

and, unless there is information to enable you to find \( C \) (the constant of integration), that is how you should write the answer.

**Integration rule**

\[
\int kx^n \, dx = \frac{kx^{n+1}}{n+1} + C \quad \text{provided } n \neq -1
\]

or \( \frac{1}{n+1}x^{n+1} + C \)

**Example: 1**

Integrate \( \frac{2}{x} \) with respect to \( x \).

**Solution:**

Rewrite \( \frac{2}{x} \) as \( 2x^{-1} \)

\[
\int 2x^{-1} \, dx = 2 \ln |x| + C
\]

INTEGRATING USING THE CHAIN RULE

There is no chain rule equivalent for integration with composite functions, but the formula here may be useful:

\[
\int (ax + b)^n \, dx = \frac{(ax + b)^{n+1}}{a(n+1)} + C \quad \text{(provided } a \neq 0, \text{ and } n \neq -1)\]

**Example:**

Integrate \( -\frac{60}{(5x - 2)^2} \) with respect to \( x \).

**Solution:**

First, rewrite as \( -\frac{60}{(5x - 2)^2} \)

\[
\int -\frac{60}{(5x - 2)^2} \, dx = -\frac{60(5x - 2)^{-2}}{5 \times (-2)} + C = \frac{3}{5(5x - 2)^2} + C
\]

CALCULATING DEFINITE INTEGRALS

Using \( F(x) \) to stand for the integral of \( f(x) \),

\[
\int_a^b f(x) \, dx = F(b) - F(a)
\]

Method:

- integrate the expression
- evaluate the result for \( x = b \) and for \( x = a \), where \( a \) and \( b \) are the limits
- find the difference: upper limit value minus lower limit value.

Set out the working as shown here.

\[
\int_a^b f(x) \, dx = \left[ F(x) \right]_a^b = [F(b)] - [F(a)]
\]

Substitute the limit values and subtract

\[
\int_1^3 3x^2 \, dx = [x^3]_1^3 = 3^3 - 1^3 = 27 - 1 = 26
\]

**Example: 1**

Evaluate \( \int (4x^2 - x) \, dx \)

**Solution:**

\[
\int (4x^2 - x) \, dx
\]

\[
= [x^3 - \frac{1}{2}x^2]
\]

\[
= [\frac{1}{3}(1)^3 - \frac{1}{2}(1)^2] - [\frac{1}{3}(3)^3 - \frac{1}{2}(3)^2]
\]

\[
= \frac{8}{3}
\]

**Example: 2**

Evaluate \( \int (x^2 - 6x + 2) \, dx \)

**Solution:**

\[
\int (x^2 - 6x + 2) \, dx
\]

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

\[
= \left[ \frac{1}{3}(1)^3 - \frac{1}{2}(1)^2 + 2(1) \right] - \left[ \frac{1}{3}(3)^3 - \frac{1}{2}(3)^2 + 2(3) \right]
\]

\[
= \frac{7}{6}
\]

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### ALGEBRA

#### EXPRESSIONS AND FUNCTIONS

**Inverse functions**

An inverse function is a function that ‘reverses’ another function. Consider the functions \( f \) and \( g \); if \( f(x) = y \), then \( g \) is the inverse of \( f \), if and only if, \( g(y) = x \). We say \( g = f^{-1} \).

Where \( h(x) = 2x + 1 \), then the reverse is the inverse function \( h^{-1}(x) = \frac{x - 1}{2} \).

However, \( f(x) = x^2 \) does not have an inverse since the domain was real numbers and each possible output has two possible starting points (one positive and one negative).

If the domain is limited to positive numbers, then the function will have an inverse, the square root function. We say that there is a one-to-one correspondence.

**Finding an inverse function**

An inverse function can be thought of as the process or journey in reverse. Flow diagrams or function machines may help to get the correct order.

On the return journey, the result (the destination) of the outward journey becomes the subject (starting point): the output for the function becomes the input for the inverse function.

**Example: 1**

Find the inverse function, \( f^{-1} \), when \( f(x) = 4x - 1 \).

**Solution:**

\[
\begin{align*}
\text{in:} &\quad x \\
\text{times 4} &\quad 4x \\
\text{minus 1} &\quad 4x - 1 \\
\text{out:} &\quad y
\end{align*}
\]

The function, \( f \), defined for all real values of \( x \) by \( f(x) = 4x - 1 \) can be thought of as a sequence of operations.

\[
x \rightarrow \text{multiply by 4} \rightarrow 4x \rightarrow \text{subtract 1} \rightarrow 4x - 1
\]

If you reverse the operations and the flow:

\[
x \rightarrow \text{divide by 4} \rightarrow \frac{x}{4} \rightarrow \text{add 1} \rightarrow \frac{x}{4} + 1
\]

Algebraically,

\[
f(x) = 4x - 1
\]

so,

\[
x = \frac{y + 1}{4} = \frac{f^{-1}(x)}{}
\]

\[
\frac{x}{4} + 1 = f^{-1}(x)
\]

\[
f^{-1}(x) = \frac{x + 4}{4}
\]

### GEOMETRY

#### STRAIGHT LINES: APPLICATIONS

**GRADIENT: \( m = \tan \theta \)**

The gradient of a straight line is the tangent of the angle the line makes with the positive direction of the \( x \)-axis. Any convenient section of the line can be taken to find lengths of the opposite and adjacent sides, and the ratio \( \tan \theta = \frac{\text{opposite}}{\text{adjacent}} \) calculated.

![Gradient Diagram]

**Parallel lines and collinearity**

Parallel lines have the same gradient.

\[
m_1 = m_2 \Rightarrow \text{lines are parallel.}
\]

Collinear points all lie on the same straight line.

**Example:**

Show that the points \((-2, -6), (0, -5)\) and \((6, -2)\) are collinear.

**Solution:**

\[
m_1 = \frac{-5 - (-6)}{0 - (-2)} = \frac{1}{2}
\]

\[
m_2 = \frac{-2 - (-5)}{6 - 0} = \frac{1}{2}
\]

\[
m_1 = m_2 \Rightarrow \text{FQ and QR are parallel and since F is a common point, points P, Q and R are collinear.}
\]
VECTORS

BASIC PROPERTIES OF VECTORS

A vector is a quantity with both magnitude and direction. It can be represented by a directed line segment.

In the diagram below, E (5, 3, 4) is a point in three-dimensional space. E is the point (5, 3, 4), so OA = 5 units, OC = 3 units and OG = 4 units in length.

The directed line segments \( \overrightarrow{AB} \) and \( \overrightarrow{BC} \) are vectors, and each can be written with the components vertical.

\[ \overrightarrow{AB} = \begin{pmatrix} 3 \\ 0 \\ 1 \end{pmatrix} \]

The magnitude (length) of a vector \( \mathbf{v} = \begin{pmatrix} a \\ b \\ c \end{pmatrix} \) is given by \( |\mathbf{v}| = \sqrt{a^2 + b^2 + c^2} \).

TRIGONOMETRY

RADIANS

Angles are measured in either degrees or radians.

You should already know that one complete revolution = 360°.

1 radian is the angle subtended at the centre of a circle by an arc of the circle equal in length to the circle’s radius.

Since the circumference of a circle can be expressed as \( C = 2\pi r \), it takes \( 2\pi \) radians to complete a full circle.

So \( 2\pi \) radians = 360°, or \( \pi \) radians = 180°.

Radian measure is very suitable for trigonometric calculations in the real-life uses of trigonometry which scientists and engineers work with, and are essential for work with calculus.

<table>
<thead>
<tr>
<th>Degrees</th>
<th>0°</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
<th>90°</th>
<th>180°</th>
<th>270°</th>
<th>360°</th>
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</thead>
<tbody>
<tr>
<td>Radians</td>
<td>0</td>
<td>( \frac{\pi}{6} )</td>
<td>( \frac{\pi}{4} )</td>
<td>( \frac{\pi}{3} )</td>
<td>( \frac{\pi}{2} )</td>
<td>( \pi )</td>
<td>( \frac{3\pi}{2} )</td>
<td>2( \pi )</td>
</tr>
</tbody>
</table>

TRIGONOMETRIC RATIOS

The word trigonometry comes from the Greek words ‘trigon’ (triangle) and ‘metron’ (measure), and literally means the measuring (of angles and sides) of triangles. The familiar trigonometric ratios of sine (sin), cosine (cos) and tangent (tan) come from measuring in triangles, but trigonometry is much more than that. It is used by engineers to design bridges, and by satellite navigation systems, amongst other things.

The Cartesian axes divide a plane into four quadrants.

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(+, +)</td>
</tr>
<tr>
<td>2</td>
<td>(+, –)</td>
</tr>
<tr>
<td>3</td>
<td>(–, –)</td>
</tr>
<tr>
<td>4</td>
<td>(–, +)</td>
</tr>
</tbody>
</table>

Angles are usually measured from the positive \( x \)-axis.

Those measured anticlockwise are positive, whilst those measured clockwise are negative.

If we consider an acute angle of a right-angled triangle, we get the familiar trigonometric ratios:

\[ \sin \theta = \frac{\text{opp}}{\text{hyp}} \]
\[ \cos \theta = \frac{\text{adj}}{\text{hyp}} \]
\[ \tan \theta = \frac{\text{opp}}{\text{adj}} \]

The trigonometric ratio of any angle can then be obtained by determining

- the quadrant connected with the angle,
- the sign of \( x \) and/or \( y \) within that quadrant and
- the associated acute angle made with the \( x \)-axis.

\( r \) is always taken to be positive.

Example:

Find the value of

\( \sin 120° \)

Solution:

\[ 120° \] lies in the 2nd quadrant, in which \( y \) is positive (and \( x \) is negative).

Associated acute angle = 60°

\[ \sin 120° = \frac{\sqrt{3}}{2} \sin 60° = \frac{\sqrt{3}}{2} \]

Example:

Find the value of

\( \cos \left( \frac{3\pi}{4} \right) \)

Solution:

\[ \frac{3\pi}{4} \] lies in the 3rd quadrant, in which both \( x \) and \( y \) are negative.

Associated acute angle = \( \frac{\pi}{4} \)

\[ \cos \left( \frac{3\pi}{4} \right) = -\cos \left( \frac{\pi}{4} \right) = -\frac{\sqrt{2}}{2} \]

A useful aid is the CAST diagram, which shows which trigonometric ratios are positive in each quadrant (and hence, by process of elimination, which must be negative in each quadrant too). So, for example, \( \cos \left( \frac{5\pi}{4} \right) \) ⇒ 3rd quadrant ⇒ only tan is positive

⇒ \( \cos \left( \frac{5\pi}{4} \right) = -\cos \left( \frac{\pi}{4} \right) = -\frac{\sqrt{2}}{2} \).
EXAM TIMETABLES

Friday 5 May

<table>
<thead>
<tr>
<th>Course</th>
<th>Level</th>
<th>Paper</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>Higher</td>
<td>1 Non-calculator</td>
<td>09:00 - 10:10</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Higher</td>
<td>2</td>
<td>10:30 - 12:00</td>
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Afternoon

<table>
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<th>Paper</th>
<th>Time</th>
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<td>National 5</td>
<td>1 Non-calculator</td>
<td>13:00 - 14:00</td>
</tr>
<tr>
<td>Mathematics</td>
<td>National 5</td>
<td>2</td>
<td>14:20 - 15:50</td>
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Thursday 11 May

Morning

<table>
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<tr>
<th>Course</th>
<th>Level</th>
<th>Paper</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>English</td>
<td>Higher</td>
<td>Reading for Understanding, Analysis and Evaluation</td>
<td>09:00 - 10:30</td>
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Friday 12 May

Morning

<table>
<thead>
<tr>
<th>Course</th>
<th>Level</th>
<th>Paper</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>National 5</td>
<td>Reading for Understanding, Analysis and Evaluation</td>
<td>09:00 - 10:00</td>
</tr>
</tbody>
</table>

THINGS TO REMEMBER

As you go into the exam room, your adrenalin will probably be pumping and you will feel nervous. That’s natural. Take a deep breath, start to read the paper and focus on the techniques and knowledge you have used in your preparation to give you the confidence to produce great answers.

After the exams, sit back, relax and look forward to your results – you’ve worked for them!

GOOD LUCK FROM THE TEAM AT BRIGHT RED!

EXAM CHECKLIST

You have worked really hard during the build-up to the exam, so now it’s time to put everything you have learned into practice. Do this, and you can be confident that you will perform well.

The following exam checklist can help you to gain marks in the exam. Make this part of your routine when you are practising past paper questions.

1. Read the instructions carefully.
2. Read the whole question first.
3. Note how many marks are to be awarded.
4. Which instruction words are used?
5. Underline the keywords in the question.
6. Answer your strongest section first.
7. Write the times.
8. Use diagrams.
9. If you are running out of time – prioritise.
10. If you are running out of time – use bullet points.
11. If you have time left at the end of the exam:
   - Go back to any sections that you missed out or feel you didn’t answer as well as you could. Try to complete the answer or add more depth and detail into your work.
   - Read over your answers. Make sure that what you have written is what you meant and will be understood by the examiner. You can also correct any spelling or grammatical errors.

- If you find you have made a mistake, correct it by using the space in the margin if necessary. If you don’t have space, then draw a line through the incorrect part and put the amendment at the end of the answer paper. Write a comment to tell the examiner to look for the correct answer at the end of the paper – for example:

  Please note: 2b is continued at the end of the answer paper.

At the end of the paper, clearly mark which question the amendment is for – for example:

Question 2b continued.

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