JUSTIFICATION

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1. What is justification?

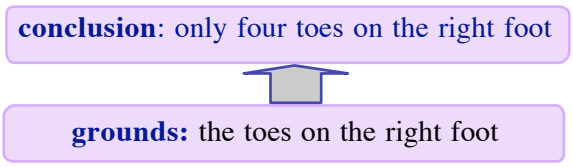
Suppose an article or book claims that the general wellbeing of human beings has improved significantly over the last three hundred years as a result of science and technology. As critical thinkers, we would like to know the grounds are for the claim, and how exactly these grounds support the claim. We can express our critical response in different words, in the form of questions to the author: "What is the evidence for that conclusion?" "What is the proof for that claim?" "Why should we accept your claim?" "Why should we believe that?" "Why do you believe that?" or "How do you know that?" Justification is a response to such questions.

A research paper, article, thesis, or book arrives at a ***conclusion***, and presents it to a skeptical (but open-minded) jury of experts as a ***claim***. Justification is what the researcher provides to convince the jury that the claim must be accepted as correct.

How would you justify (or refute) the claim that the general wellbeing of human beings has improved significantly over the last three hundred years as a result of science and technology? Let us look at a few simple cases before we attempt to answer this question.

2. The structure of justification: grounds, conclusion, assumptions, and reasoning

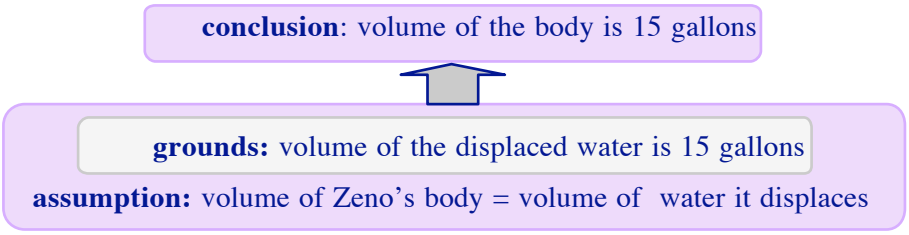
Let us imagine that a person called Zeno tells a person called Andromeda that he has only four toes on his right foot, the big toe having been lost in an accident. Andromeda asks, "Why should I believe you?" Zeno convinces Andromeda by showing her his right foot, and telling her, "See for yourself!" By doing so, he offers a justification for his claim.



In this example, justification consists of pointing or inviting attention to an object or situation. A slightly more complex example involves a ***demonstration*** in which the defender of the claim does something, and invites the skeptic to observe the results. Suppose Zeno claims that his body can fit into a small barrel that is half a meter in diameter. He can convince Andromeda by getting inside such a barrel, and inviting her to see this for herself.

Suppose Zeno has to convince Andromeda that the volume of his body is 15 gallons. Zeno fills a tub with water, and, with Andromeda watching, immerses himself in the tub. He invites Andromeda to ***measure*** the amount of water flowing out of the tub. She does so, and finds that it is 15 gallons. This proves that Zeno's body volume is 15 gallons. Unlike the case of the missing big toe on the right foot or his fitting inside a barrel, Andromeda cannot actually see or measure the volume of Zeno's body. What she measures is the volume of the water overflowing from the tub, from which she ***infers*** Zeno's body volume. Implicit in this inference is an ***assumption*** that

she shares with Zeno, namely, that the volume of Zeno's body is equal to the volume of displaced water.



If Andromeda chooses to question this assumption, Zeno will have to provide justification for it.

In a face-to-face conversation, a speaker can invite the listeners to observe the relevant objects or situations. This is not feasible in a written form of justification. In an email to Andromeda, Zeno can't say, "Measure, and see for yourself, the amount of displaced water." Instead, he will have to do the measuring and report what he observes. The grounds offered in experimental research, interviews, and ethnography are of this kind. The grounds in such justification are ***verbal reports*** of what the researcher observes.

Suppose Zeno is a medical doctor who has just completed the examination of a dead body found in a well. He sends Andromeda an email, saying that the death was not an accident or a suicide: the victim was killed. This might trigger an e-dialogue along the following lines:

A: How do you know he was killed, Zeno?

Z: I just examined the body. There is no water in the lungs.

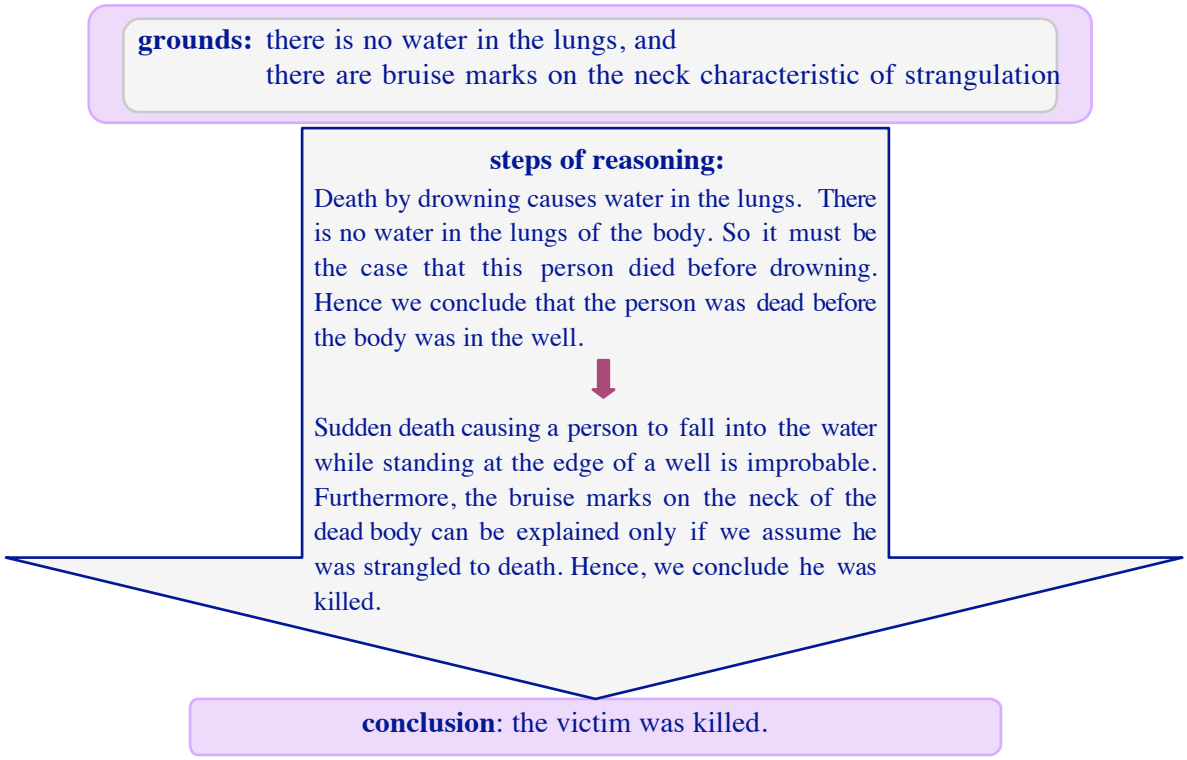
A: So?

Z: When a person dies by drowning, there is always water in the lungs, because of the victim's gasping for air. Water doesn't get into the lungs of a dead body thrown into water. So it must be the case that this person died first, and the body was then thrown into the well.

A: Makes sense. That rules out the suicide hypothesis. But that only means that he died first and hit the water later. He could have had a heart attack when standing at the edge of the well and fallen into the well. What is the evidence to show that he was killed?

Z: Well, let us see. If this was an accidental death, he must have been standing at the edge of the sell, and the death must have been instantaneous and his position so tilted that he died and fell forward rather than backward. Though this is not impossible, the probability is very low. So if there is no evidence either way, we should lean towards the hypothesis that he was killed. And there is indeed some evidence. My post-mortem examination revealed blue bruise marks around the neck. Such marks are produced when a person is strangled. If we assume that he was strangled, we can explain the bruise marks. Otherwise there is no explanation. The bruises on the neck, together with the absence of water in the lungs, pretty much force us to the conclusion that he was killed.

In this example, the connection between the grounds (absence of water in the lungs, bruises on the neck) and the conclusion (killing through strangulation) is mediated through an *extended* form of ***reasoning***, unlike the previous ones. The diagram given below (with the top-to-bottom orientation of conclusion and grounds reversed) provides a visual representation of the justification.



When a child doubts and questions an assertion, implicitly asking why she should believe something, adults tend to respond along one of the following paths:

Because I say so.
Because that is what you have been taught.
Don't ask such stupid questions.
So you think you know everything, do you?
You are too young to know, you won't understand if I tell you.

These responses have the effect of dampening the child's capacity for critical thinking. Let us make a New Year resolution today — whether or not it's New Year's day — that we won't do that to a child.

Imagine that Andromeda is a ten-year old girl, and that you are Zeno. Looking at the night sky, Andromeda says, "Zeno, the moon is so much bigger than the stars!" You correct her: "It only looks bigger, the stars are actually much, much bigger than the moon." Andromeda is surprised. She points to the sky and says, "See for yourself. The moon is much bigger."

Given your New Year resolution, how would you respond to Andromeda?

Suppose you say, "Don't tell lies, Andromeda!" and she says, "Why not?" What would be your response? (Remember the New Year resolution.)

3. Justification, evidence, argument, and proof

The terms *evidence, argument*, and *proof* carry different shades of meaning but they all come under the rubric of justification. When we provide evidence or an argument for a claim, or prove a claim, we are justifying the claim. In what ways are the three concepts of justification different?

We use the term ***evidence*** to the entities and states of affairs in the world serving as the grounds for a claim. A prototypical instance of evidence is something that we can apprehend through our senses, such as a blood-stained knife submitted to a court of law. A photograph taken by an astronomer, the measurements made by a physicist, an interview conducted by a sociologist, the words in a literary text that a literary critic draws attention to, and an ancient scroll discovered by a historian, are all forms of evidence when they serve as the basis for a claim.

The grounds we have appealed to in all our examples of justification so far are instances of evidence. In contrast, the grounds in the following examples do not come under the category of evidence.

Example A

A: I can understand that knowledge is a body of beliefs. But why should I accept the claim that it is a body of *true* beliefs?

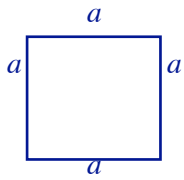
Z: Try this. We can say, "Bill believes that black holes exist, but he is wrong, they don't actually exist." But it would be strange to say, "Bill knows that black holes exist, but he is wrong, they don't exist." That is because saying that X knows that P commits us to the truth of P. So we must conclude that for a body of beliefs to be called knowledge, the beliefs must be true.

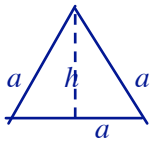
Example B

Z: The area of a square is greater than the area of an equilateral triangle whose side is equal to that of the square.

A: How do you know that?

Z: The area of a square with sides of length a is a x a. We also know that the area of a triangle is $1/2$ b x h, where b is the length of the base and h the height (the perpendicular from the base to the opposite angle.) An equilateral triangle is defined as one whose sides are of equal length. In an equilateral triangle whose side is equal to that of our square, $b = a$.





In the triangle, h is less than a, because a is the hypotenuse of a right-angled triangle, and h is one of its sides. Hence $1/2$ a x h, the area of the triangle, is less than a x a, the area of the square.

The grounds we appeal to in example A are those of shared ***intuitions*** on the concepts that the words *know* and *believe* denote. The grounds in example B are results already proved in mathematics (that the area of a square with sides of length a is a x a, the area of a triangle is $1/2$ a x h, and the height of an equilateral triangle is less than one of its sides). These results, in turn, are proved ultimately by appealing to mathematical ***axioms*** and ***definitions*** as grounds. Neither of these are forms of 'evidence'.

An ***argument*** is a justification that involves *a chain of reasoning* that connects the grounds to conclusion. The extended reasoning that Zeno provides to justify the claim that the dead man in the well was killed makes it an argument. Justifications A and B above are also arguments. In

contrast, there is no need for reasoning in Zeno's justification for the number of toes on his right foot, so we don't call it an argument. As for the reasoning that connects the grounds to the conclusion in the justification for his body volume, it is so obvious that it doesn't need to be spelt out, so we won't call it an argument either.[1]

A ***proof*** is a form of justification that yields a conclusion with very little room for error or doubt. How much error or doubt a proof varies across domains, and even within a domain, it can be controversial. In a court of law, for instance, a proof is an argument that yields a conclusion with certainty beyond *reasonable* doubt. In contrast, mathematical proofs are arguments that are expected to meet a more stringent criterion, namely, certainty beyond *any* doubt. (Whether or not actual proofs meet this criterion is another question.) The justification offered in example B above is a mathematical proof. That offered in the example of the drowned man is admissible as a legal proof: it does not satisfy the more stringent criterion of mathematical proofs. While both these proofs are arguments, the proof that Zeno gives for his body fitting into a small barrel is a demonstration that does not involve an argument.

Exercises

A) Justice demands that all human beings be treated equally, regardless of their race, ethnicity, gender, economic status, religion, etc. Does the criminal justice system – as it exists today – have elements of injustice? For instance, does it have an unjust bias against the poor? Does it discriminate against powerless minorities? Formulate your position and justify it, paying attention to the following points.

- The criminal justice system identifies certain actions as criminal offenses, and punishes the offenders with imprisonment, and in extreme cases, death.
- Good defense lawyers charge high fees, the fees charged by excellent defense lawyers is still higher.
- Laws are created by those who are in power, even in a country where everyone has the opportunity to vote.
- Politics in most election-based democracies demands that rulers pay attention to the wishes of the majority, but not necessarily to moral integrity.

After formulating and justifying your position, reflect on whether or not it is a proof. Is it evidence-based, intuition-based, or axiom-based? Is the justification an argument?

B) Think critically about the above task. Do the points you have been asked to consider carry a bias towards a particular conclusion? If your answer is no, explain why not. If your answer is yes, explain what the bias is.

Is your conclusion likely to be different if you consider additional points not mentioned in the bulleted points above? What would those points be?

C) Do you have a kidney inside your body? Provide adequate justification in support of your answer.

Indicate the structure of your justification using the diagrammatic representation of justification illustrated in our examples. Indicate whether it is a proof or not. Is it evidence-based, intuition based, or axiom-based? Does the justification advanced count as an argument?

[1] This is just a matter of the meaning of the English word "argument", not a theoretically significant distinction. Nothing important hangs upon the practice of not referring to these instances as arguments.

D) The following statements about the past can be viewed either as (i) a true claim about what really happened (as in history) or (ii) a product of creative imagination (as in fiction.) For each of these accounts, formulate your choice of (i) or (ii), and justify your choice.

1. South America and Africa were once a single super-continent, called Pangaea. As the rock plates that the continents sit on moved, the super-continent broke up and moved apart.
2. Long ago, in search of Rama's wife Sita, Hanuman the monkey god jumped from India across the ocean to Sri Lanka.
3 Long ago, Moses divided the Red Sea to take his people to safety.
4. In 59 BCE, Julius Ceasar crossed the river of Rubicon in Northern Italy.
5. Kerala, the land in Southern India between the Western mountains and the sea, was created by sage Parasuram. From the top of the mountain, he hurled his axe far into the sea. And the sea receded all the way to the point where the axe fell.

4. Counter-evidence, counter-arguments and Rational Debates

In the justification of scientific theories and interpretations, a conclusion that has been justified and established as correct may at a subsequent point of time be shown to be incorrect on the basis of the discovery of contrary evidence or of a better alternative. For instance, Newton's theory of gravity and motion, which subscribes to the ideas that time and space do not interact and that space in our universe is Euclidean, was the established theory till the beginning of the twentieth century. With the advent of Einstein's theory, these positions were shown to be incorrect. Likewise, an early version of atomic theory which held that protons are indivisible was shown to be false subsequently.

Examples of this kind show that in certain perfectly legitimate forms of reasoning, a conclusion may turn out to be incorrect even if the premises are true and the steps leading from the premises to the conclusion are correct. Such forms of reasoning come under the category of ***defeasible*** reasoning. (The unit on reasoning discusses abductive reasoning, speculative deductive reasoning, and non-probabilistic sample-to-population reasoning as examples of defeasible reasoning.)

In the form of justification employed in mathematical proofs, a conclusion that has been justified does not require further scrutiny, as long as the justification does not contain incorrect premises or incorrect steps of reasoning. Mathematics, in other words, employs ***non-defeasible*** reasoning. The standard mode of sample-to-population reasoning used in statistical inquiry is also non-defeasible.

Domains of inquiry that rely on defeasible modes of justification must pay special attention to two considerations, namely,

- ***additional grounds*** from which we can derive conclusions that contradict the conclusion we seek to defend (counter-evidence and counter-examples), and
- ***better alternatives*** that show that our conclusion is not justified (alternative theories, alternative analyses, alternative explanations, alternative causal hypotheses, and alternative interpretations)

Domains that employ defeasible modes of reasoning allow for ***debates***. In a justification, the proponent of a claim seeks to convince a skeptical jury that the claim is correct. In a debate, one group seeks to convince the jury that their claim is correct, while the other group seeks to convince the jury that the claim is incorrect. An archetypal form of debate is that between the prosecution lawyer and the defense lawyer in the court of law: the prosecution seeks to establish that the defendant is guilty, while the defense provides counter-evidence or alternative interpretations to show that the prosecution's conclusion is subject to reasonable doubt. Rational

debates also occur in the domains of theories and interpretations, as well as in matters of public opinion and controversy.

5. Digging deeper

When justifying a claim or evaluating a proposed justification, it is important to scrutinize the grounds advanced, and make an assessment of its reliability, as well as its appropriateness for the conclusion to be justified. Judging the reliability and appropriateness of grounds is an issue that will take us considerable time, but by way of introduction, it might to useful to point to two broad categories of grounds, namely,

A) beliefs (knowledge, opinions, faith, …), information, intuitions, axioms, definitions, and values that *the jury already accepts as legitimate/correct,* independently of the justification offered.

B) new information gathered by the proponent for the purposes of the claim in question, such that *the jury needs to examine the grounds and check its legitimacy/correctness*.

To illustrate, consider the following propositions:

Susan Belliti was five years old when her (=Susan's) grandmother was born.

Susan Belliti was five years old when Jane Perkell's grandmother was born.

You will undoubtedly reject the first proposition as false, even though you don't know either Susan Belliti or her grandmother. How would you defend your judgment? How would you prove that the proposition that Susan Belliti was five years old when her (=Susan's) grandmother was born is false? Write down a proof and see for yourself what it involves.

You are not in a position to judge the truth of the second proposition because you don't know anything about Susan Belliti or Jane Perkell's grandmother. But then, how come you were able to arrive at a near instantaneous judgment in the case of the first proposition? What would you have to do if you wanted to prove that the second proposition was true (or false)?

If you think through these tasks, you will see that the grounds advanced against the first proposition are of type (A), while those advanced for/against the second are of type (B). Mathematics, philosophy and theoretical science typically use A, while experimental science, anthropology, history, and literary studies typically use B.

A deeper understanding of justification requires examining different kinds of conclusions, the kinds of grounds and assumptions that we explicitly and implicitly appeal to in their justification, and the modes of reasoning we use in connecting the grounds to the conclusion. For instance, we may seek to justify conclusions about the *truth of a statement* (e.g., it is true that the stars are bigger than the moon), the *moral goodness of an action or practice* (e.g., it is bad to tell lies), the *quality of a person, product, or procedure* (e.g., my economics teacher is excellent), and so on. Depending on the nature of the conclusion we are justifying, we appeal to different kinds of grounds. These could be in the form of evidence, intuitions, and axioms, as we hinted at earlier. Evidence itself is of varied types: sensory experience, instrumental extensions of sensory experience, quantitative evidence, verbal evidence, semi-subjective evidence, and so on.

As for reasoning, many textbooks distinguish between deductive and inductive reasoning. But a deeper understanding of academic justification requires a more sophisticated typology of reasoning. An exploration of background assumptions in justification reveals that we take for granted certain assumptions in a given instance of justification, but need to provide justification of the same assumptions in another instance. And there are yet other assumptions that in principle are not independently justifiable. There are also assumptions of knowledge; and assumptions of values including those that tell us under what conditions a statement should be admitted to the body of knowledge in a given discipline. All this we reserve for a subsequent exploration.

How would you justify (or refute) the claim that that the general well-being of human beings has improved significantly over the last three hundred years as a result of science and technology?

We regard a belief as a ***superstition*** when we (a) judge it to be false, and (b) attribute to the believer of the proposition a commitment to a supernatural element in it. For those who believe that thirteen is an unlucky number, that belief is knowledge, for those who regard it as false, those who believe it are accepting a supernatural relation, and hence it is a superstition.

This definition of superstition implies that not all false beliefs are superstitions. Thus, the proposition that the sun goes around the earth is judged as false by educated people in the twenty first century, but we don't regard it as a superstition because we don't attribute a commitment to the supernatural to those who accept(ed) the Ptolemy's theory.

This account points to four types of propositions:

	True	False
supernatural	A	B
no supernatural	C	D

Find examples of propositions which, in your view, belongs to each of the four categories A-D. Call them P1 (category A), P2 (category B), P3 (category C) and P4 (category D) respectively. If you can't find an example in A, explain why. If you do, justify your decision to

(a) judge P1 and P3 as true and P2 and P4 as false?

(b) judge P1 and P2 as supernatural and P3 nd P4 as non-supernatural?

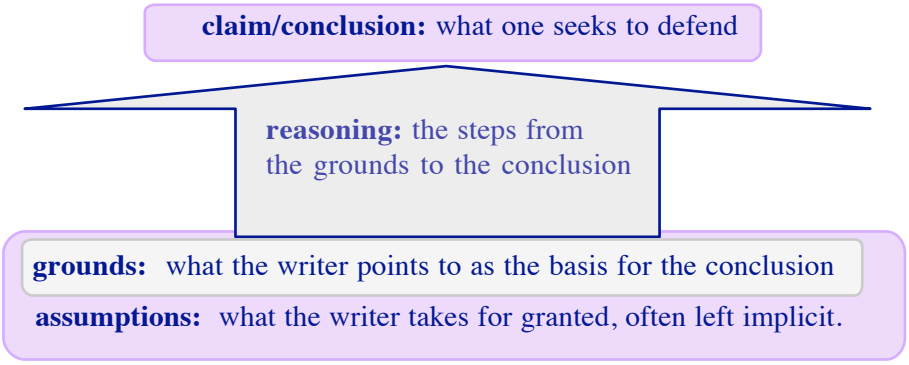
6. Acquiring the capacity to defend one's positions and to read critically

Academic literacy is the ability to read and produce academic writing. During primary and secondary education, students read textbooks and write "essays", but it is only in tertiary education that they read research articles and books, or produce research projects or theses. This has an important bearing on the role of justification in the development of academic literacy among students.

In textbooks, the author seeks to present a body of knowledge already accepted as correct by the research community. In contrast, the author of a research article/book presents presents a knowledge *claim* along with its *justification*. The intended readers of textbooks are novices; the intended readers of research are a jury of experts in the field. The former calls for reading for comprehension; the latter calls for critical reading that involves the evaluation of the proposed claims and justification. (In contrast to both, student essays can be – and they most often are – forms of extended writing produced for the teacher as the reader, often expressing a judgment or an opinion, not necessarily seeking to make a contribution to knowledge.)

The transition from the *expository writing* of textbooks and essays to the *justificatory writing* of research articles, papers, theses, projects and books can be a serious challenge to most students embarking on tertiary education. The challenge of producing such writing can be even more daunting. What follows is a strategy to develop the initial nucleus to meet this challenge.

At the heart of the evaluation of justification (reading) and producing justification (writing) is the ability to unpack the statements in an article, thesis, project, or book into the components of the structure of justification that we have explored in the preceding examples:



As an initial exercise, identify the justificatory structure of the following passages. To make things easier, each passage has been re-written as a set of simplified sentences with a number for reference. For each of these sentences, specify whether it is part of the assumptions, grounds, reasoning, or conclusion. Once this is done, indicate the path in the chain of reasoning from the grounds to the conclusion, the correctness of the assumptions, and so on. Having done this, you may proceed to evaluate the soundness of the proposed justification.

Passage 1

> Even a cursory glance of the history of mathematics reveals a huge asymmetry between men and women in the field. When compared to men, the number of women who have had an impact on the development of ideas in mathematics is negligible. Hence, we must conclude that when compared to men, women have a low aptitude for mathematics. To avoid wasting our limited resources, therefore, it would be wise to give priority to male applicants in our selection for majors in mathematics, computer science, physics, and engineering.
>
> Passage rewritten as numbered sentences.
>
> 1) There is a asymmetry between the numbers of men and women in mathematics.
> 2) The asymmetry is huge.
> 3) Compared to men, there are very few women have had an impact on the development of ideas in mathematics.
> 4) When compared to men, women have a low aptitude for mathematics.
> 5) We should not waste our limited resources.
> 6) We should give priority to male applicants in our selection for majors in mathematics, computer science, physics, and engineering.

Passage 2

> At the core of inquiry in the physical sciences is the search for laws: Galileo's laws, Kepler's laws, Newton's laws, Ohm's law, Boyle's law, Maxwell's laws, and so on. Now, the purpose of instituting laws is to prevent the occurrence of what law makers regard as undesirable. We have traffic laws to prevent actions that lead to accidents, laws against kill to prevent humans killing one another, property laws to protect property, and so on. It is arrogant and foolish of scientists to pretend that they can control Nature by prescribing laws. No matter what scientists tell Mother Nature to do or not to do, she will do as she pleases. The search for laws in scientific inquiry does not serve its purpose.

Passage rewritten as numbered sentences

1. The search for laws is at the core of inquiry in the physical sciences.
2. Galileo's laws, Kepler's laws, Newton's laws, Ohm's law, Boyle's law, and Maxwell's laws, are examples of laws.
3. The purpose of instituting laws is to prevent the occurrence of what lawmakers regard as undesirable.
4. Traffic laws to prevent actions that lead to accidents, laws against kill to prevent humans killing one another, and property laws to protect property are examples of how laws prevent the occurrence of what lawmakers regard as undesirable.
5. It is arrogant and foolish of scientists to pretend that they can control Nature by prescribing laws.
6. No matter what scientists tell Mother Nature to do or not to do, she will do as she pleases.
7. The search for laws in scientific inquiry does not serve its purpose.

Passage 3

Central to the experimental method in science is the doctrine of control: scientific experiments are expected to control for the independent variables that affect the dependent variable. Research students in psychology learn about control groups, while those in medicine learn about the design of controlled double blind experiments. Is it surprising that this methodology has led to the control and domination of the less powerful and less privileged? The methodology of control legitimizes the domination of men over women, of whites over non-whites, and of the West over the rest of the world. We can fight against systematic subjugation and marginalization only by recognizing and exposing what lies at its roots: the doctrine of control. As academics who have a responsibility to say no to all forms of tyranny and oppression, we must refuse to extol the virtues of controlled experiments in the classrooms, and expose the political agenda of control that hides behind the patriarchal mask of objectivity and rationality.

Passage re-written as numbered sentences:

1) The doctrine of control Central to the experimental method in science.
2) Scientific experiments are expected to control for the independent variables that affect the dependent variable.
3) Research students in psychology learn about control groups, while those in medicine learn about the design of controlled double blind experiments.
4) The methodology of control has led to the control and domination of the less powerful and less privileged.
5) Given (1), (4) is an expected consequence.
6) The methodology of control legitimizes the domination of men over women, of whites over non-whites, and of the West over the rest of the world.
7) We must fight against systematic subjugation and marginalization.
8) The doctrine of control lies at the roots of subjugation and marginalization.
9) We can do (7) only by recognizing and exposing the doctrine of control that lies at its roots.
10) Academics have a responsibility to say no to all forms of tyranny and oppression.
11) The political agenda of control hides behind objectivity and rationality
12) Objectivity and rationality are marks of patriarchy.

13) Academics must refuse to extol the virtues of controlled experiments in the classrooms, and expose the political agenda of control.

These passages are relatively short and easy to manage. The unpacking becomes somewhat more complex when dealing with extended pieces of more than two or three pages, whether in reading or in writing. In these situations, it would be useful to summarize the extended writing in one or two paragraphs, and do the exercise of unpacking the justification on the summary. If you are not an accomplished researcher, it would be a good idea for you to practice such summary+unpacking both in your reading and your writing.

Let us go back to the question we started with: how would you justify (or refute) the claim that the general wellbeing of human beings has improved significantly over the last three hundred years as a result of science and technology? Do this in three steps:

- What do we mean by "wellbeing"? What are the different aspects of wellbeing? How do we "measure" each of these (if it is not measurable, how do we compare it across individuals or across situations, so that we can judge it to have improved or not improved?
- How would we gather the relevant evidence?
- How would you construct an argument on the basis of that evidence?