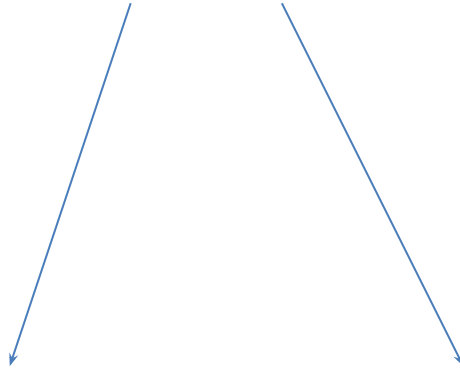


Thinking skills



Problem solving

Critical Thinking

Problem solving

Example 1: Relevant Selection

Very often a real world problem will be overloaded with information, much of which is unimportant. The first step in solving the problem is to decide which bits of the information available are important. It may be that the question has presented you with information which is not important, perhaps redundant, and possibly distracting. This kind of question demands Relevant Selection, in which the task is to select only that information which is necessary and helpful in finding a solution.

The table below shows the price of various ladders. I need a ladder at least 8m long to reach the gutters of my house. I want to store it in my garage which is only 4.2m long.

What is the lowest price I must pay to satisfy these conditions?

| <i>Length closed (m)</i> | <i>Length extended (m)</i> | <i>Lightweight (DIY use)</i> | <i>Heavyweight (Trade use)</i> |
|------------------------------|--------------------------------|----------------------------------|------------------------------------|
| Triple section ladders: | | | |
| 2-6 | 6-0 | £82 | £100 |
| 3-0 | 7-5 | £104 | £120 |
| 3-5 | 9-0 | £133 | £150 |
| 4-0 | 10-0 | -- | £169 |
| Double section ladders: | | | |
| 3-0 | 5-3 | £52 | £64 |
| 3-5 | 6-2 | £67 | £82 |
| 4-0 | 7-2 | £78 | £95 |
| 4-5 | 8-3 | £98 | £115 |
| 5-0 | 9-0 | -- | £140 |
| 5-5 | 10-0 | -- | £155 |

- A £78
- B £98
- C £133
- D £150
- E £169

Example 2: Finding Procedures

Sometimes you will find that even if you have selected all the relevant information, no solution presents itself. You then have to find a method or procedure which you can use to generate a solution. Typically you will have three or four numbers which have to be operated on. This aspect of Problem Solving is called Finding Procedures.

Mr Jones has to renew the white lines on a 1 km stretch of road. Each edge of the road is marked with a solid line and there is a "dashed" line in the centre. Drivers are warned of approaching bends by two curved arrows. Mr Jones will have to paint four curved arrows. The manufacturers have printed the following guidance on each 5 litre drum of paint.

Solid lines - 5 metres per litre.

Dashed lines - 20 metres per litre

Curved arrows - 3 litres each

How many drums of paint will Mr Jones require?

- A 53
- B 92
- C 93
- D 103
- E 462

The answer is C. The solid lines require 200 litres for each side of the road ($1000 \div 5 = 200$). The dashed lines require 50 litres ($1000 \div 20 = 50$). The arrows require $3 \times 4 = 12$ litres. The total amount of paint is $200 + 200 + 50 + 12 = 462$ litres. Each drum contains 5 litres of paint; so 93 drums will be needed ($462 \div 5 = 92.4$). 92 drums will not be enough so 93 will be needed. The final drum will be only partially used.

- A It has been assumed that there is a solid line on only one side of the road.
- B The calculations are correct but it has been assumed incorrectly that 92 drums would be sufficient.
- D It has been assumed that there are two dashed lines rather than one.
- E The total amount in litres has been calculated but not the number of drums required.

Example 3: Identifying Similarity

In each of these questions you will be presented with a situation and asked to choose another situation which has a similar structure:

I wish to tile an area of wall 120 cm wide by 100 cm high. Tiles are 20cm square. I will, therefore, need $6 \times 5 = 30$ tiles.

Which of the following uses the same method of calculation as that above?

- A A staircase is 3m high. Each step rises 0.25m. Therefore, there are 12 steps.
- B A room is 4.2m by 2.0m. Carpet costs £10.00 per square metre. Therefore, it will cost £84.00 to carpet the room.
- C A box containing sugar cubes is 10cm x 10cm x 5cm. A sugar cube is 1cm on each side. Therefore, the box contains 500 cubes.
- D Using square tables 1.5m on each side, I need to make up a conference table 6m x 3m. Therefore I will need 8 tables.
- E I work 40 hours a week and earn £5.00 an hour. Therefore, in 4 weeks I will earn £800.00.

The answer is D. The procedure of multiplying 6×5 is based on 6 tiles fitting along one edge and 5 tiles along another. In option D, 4 of the small tables will fit along the 6 m side and 2 along the 3m side. The computation will therefore be 4×2 .

Option A divides 3 by 0.25.

Option B multiplies 4.2 by 2.0 by 10.

Option C multiplies 10 by 10 by 5.

Option E multiplies 5 by 40.

Although in D there is a multiplication this is the only case in which the numbers to be multiplied must first be obtained as they are in the tiling example.

Critical Thinking

Critical thinking

Critical thinking is a general term that covers all thinking processes that strive to get below the surface of something: questioning, probing, analysing, testing and exploring. It is not a negative term as such, although it can sound it. Critical thinking requires detective-like skills of persistence to examine and re-examine an argument, in order to take in all the angles and weigh up evidence on every side.

To think critically is never to take something on 'face value' but to question and think independently about an issue, however 'authoritative' a writer or thinker may be.

Critical thinking questions – quick summary

- What is the main point/argument?
- Is it convincing?
- What evidence is given? Is it strong/weak? Why?
- What's the conclusion?
- Does it follow on from the rest?
- What's the aim? Purpose? Agenda?
- Any gaps/information you think should be given?

Using critical thinking to develop your own writing

- Be clear about your argument or standpoint
- Be clear about your conclusions
- Have a clear line of reasoning
- Use evidence to support your reasoning
- 'Critically' read and reflect on your own writing

Finally.....critical thinking

- is about asking questions, getting under the surface, finding out what's really going on, testing things out
- is a key skill in academic study
- helps make you a deep, rather than a 'surface' thinker - able to think and argue independently, explore issues in depth, make connections between ideas, relate them to real life
- improves memory, as you engage more closely with ideas
- helps you develop your own opinions

Conclusions

- State the main point of an argument
- Are what the author wants to justify
- May be at the beginning, in the middle, or at the end
- Different from a summary

Reasons

- Support a conclusion
- Should be less controversial than the conclusion

Example 1: Summarising the Main Conclusion

Vegetarian food can be healthier than a traditional diet. Research has shown that vegetarians are less likely to suffer from heart disease and obesity than meat eaters. Concern has been expressed that vegetarians do not get enough protein in their diet but it has been demonstrated that, by selecting foods carefully, vegetarians are able to amply meet their needs in this respect.

Which of the following best expresses the main conclusion of the above argument?

- A A vegetarian diet can be better for health than a traditional diet.
- B Adequate protein is available from a vegetarian diet.
- C A traditional diet is very high in protein.
- D A balanced diet is more important for health than any particular food.
- E Vegetarians are unlikely to suffer from heart disease and obesity.

Example 2: Drawing a Conclusion

Private airline companies say that they are now determined to operate a transport system that is as safe as it can be, while still remaining viable. But a private sector business can only be viable if it makes money for its owners. If for all flights and at all airports there were thorough foolproof screening for firearms and for explosives planted by terrorists, then the system would be safer; but really effective screening would preclude all possibility of profit.

Which one of the following conclusions is best supported by the passage above?

- A A private airline which is not profitable will be safer than one that is.
- B To stay in business, a private airline company has to sacrifice some safety.
- C Private airlines, in the past, were not sufficiently concerned with safety.
- D Even if airlines could afford the cost, effective screening against terrorist attacks would be impossible.
- E Those who run private airline companies are more interested in profit than in the safety of their passengers.

Example 3: Identifying an Assumption

People who write books revealing the inner workings of the secret service have usually been dismissed from the service or have retired with a sense of grievance against it. The result is that only the seedy side of the secret service is exposed. This is partly because those who would paint a more favourable picture are unwilling to flout the legal restrictions placed on all who have been employed in the secret service, and partly because the records of the organisations are not available to outsiders.

Which of the following is an underlying assumption of the argument above?

- A The records of the secret service are readily available to its former employees.
- B The work of the secret service is undervalued as a result of publication of distorted accounts of its working.
- C The seedy side of the secret service is of minor significance compared with the important work it carries out.
- D Legal restrictions against revealing the inner workings of the secret service do not apply to those who have been dismissed.
- E Those who have a grievance against the secret service are either unable or unwilling to give a balanced account of its workings.

Example 4: Assessing the Impact of Additional Evidence

Polar bears in captivity frequently engage in obsessive patterns of behaviour, pacing back and forth on the same spot, swinging their heads from side to side, and other signs of stress. They do this even when their living areas are quite spacious. What this shows is that conditions of captivity are not a satisfactory substitute for the natural environment of the polar bear species.

Which of the following, if true, would most weaken the above argument?

- A Polar bears are especially ill-suited to a life in captivity.
- B Many polar bears in the wild engage in obsessive patterns of behaviour.
- C Polar bears in captivity are much better fed than those living in the wild.
- D Polar bears in the wild cover many miles a day when they are hunting for food.
- E Polar bears which have been reared in captivity are incapable of surviving in the wild.

Example 5: Detecting Reasoning Errors

Some people attempt to smuggle a pet into Britain because of the quarantine regulations which are aimed at preventing rabies from entering the country. If there were no such regulations, there would be no reason to smuggle pets. Since the most likely source of a rabies outbreak in Britain is a smuggled pet, if the quarantine regulations were abolished, the danger of a rabies outbreak would be reduced.

Which of the following is the best statement of the flaw in the argument above?

- A Rabies is not likely to enter Britain in a wild animal.
- B The quarantine regulations cannot prevent owners from smuggling their pets.
- C If there were no quarantine regulations, pets with rabies could enter Britain easily.
- D If people did not want to travel with their pets, there would be no need for quarantine regulations.
- E If pets were inoculated against rabies, there would be no need for quarantine regulations.

Example 6: Matching Arguments

I cannot get any answer when I dial my mother's number. Either she is not answering her phone or she has decided to stay away on holiday for an extra week. She must still be away. She would never let the phone ring without answering it.

Which of the following most closely parallels the reasoning used in the above argument?

- A If I want to remain fit and healthy I have to watch my diet and take exercise. I want to stay fit so I eat carefully and go running regularly.
- B If Denise had carried on going to the gym and eating sensibly, she would never have got so run down. She did get run down, so she must either have given up her diet or stopped going to the gym.
- C Joe is looking a lot fitter. Either he has cut down on his eating or he has been out running every day. I know for a fact that Joe couldn't keep to a diet, so it must be exercise that's done it.
- D Anyone who swims over twenty lengths a day has to be pretty fit. Sheena swims thirty lengths a day. Therefore Sheena must be quite fit.
- E Sticking to a diet is hard at first but after about two weeks most people get used to it. I have been dieting for nearly two weeks so I should be getting used to it soon.

Example 7: Applying Principles

Smokers who suffer from heart disease which is caused by their smoking should not be allowed to get free health treatment. That is because this is an example of self-inflicted illness. Those whose actions have caused illness or injury to themselves should make a financial contribution to their treatment.

Which one of the following best illustrates the principle underlying the argument above?

- A Children should get free dental treatment, even if they eat sweets which cause dental decay.
- B Heart disease sufferers who can afford to pay for health treatment should not receive free treatment.
- C Smokers who cannot afford to pay for health care should be allowed free treatment when they are ill.
- D People who are injured in car accidents should receive free treatment regardless of whether they were wearing a seat belt.
- E Motor cyclists whose head injuries are caused by not wearing a crash helmet should make a financial contribution to their treatment.

Thank you very much