

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

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General Certificate of Education
 June 2004
 Advanced Subsidiary Examination



HUMAN BIOLOGY (SPECIFICATION A)
Unit 3 Pathogens and Disease

BYA3

Tuesday 8 June 2004 Morning Session

<p>No additional materials are required. You may use a calculator.</p>
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For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
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9			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 75.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

Answer **all** questions in the spaces provided.

- 1 (a) **Table 1** shows some of the events which take place in protein synthesis.

A	tRNA molecules bring specific amino acids to the mRNA molecule
B	mRNA nucleotides join with exposed DNA bases and form a molecule of mRNA
C	The two strands of a DNA molecule separate
D	Peptide bonds form between the amino acids
E	The mRNA molecule leaves the nucleus
F	A ribosome attaches to the mRNA molecule

Table 1

- (i) Write the letters in the correct order to show the sequence of events during protein synthesis, starting with the earliest.

..... (2 marks)

- (ii) In which part of a cell does **C** take place?

..... (1 mark)

- (iii) Which of **A - F** are involved in translation?

..... (1 mark)

- (b) **Table 2** shows some mRNA codons and the amino acids for which they code.

mRNA codon	Amino acid
GUU	Valine
CUU	Leucine
GCC	Alanine
AUU	Isoleucine
ACC	Threonine

Table 2

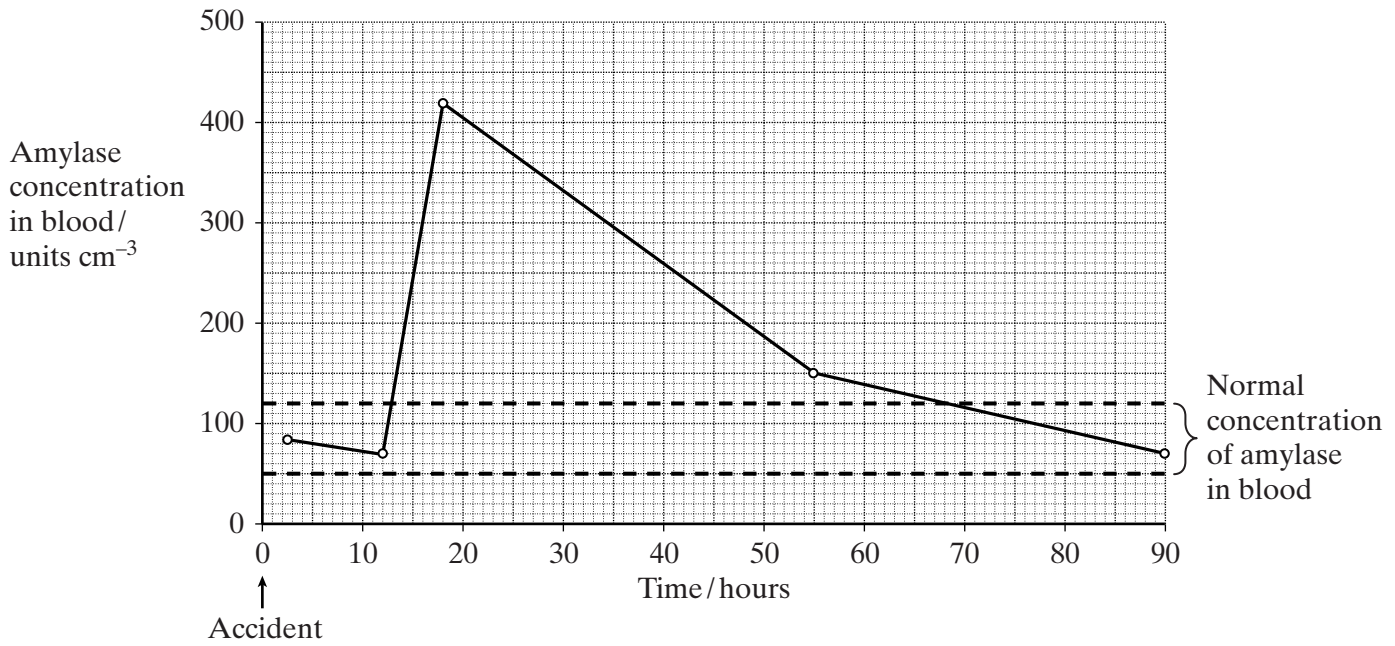
- (i) A tRNA molecule has the anticodon UAA. Which amino acid does the tRNA molecule carry?

..... (1 mark)

- (ii) Give the DNA base sequence that codes for threonine.

..... (1 mark)

2 A man was taken to hospital after an accident. The concentration of amylase in his blood was measured. The results are shown in the graph.



(a) (i) Explain why the points on the graph have been joined with straight lines.

.....

 (1 mark)

(ii) Explain the advantage of giving the units **per cm^3 of blood**.

.....

 (1 mark)

(b) Explain the difference between the readings at 12 and 18 hours.

.....

 (2 marks)

- 3 (a) Tuberculosis is caused by the bacterium, *Mycobacterium tuberculosis*. Describe how *Mycobacterium tuberculosis* enters the human body.

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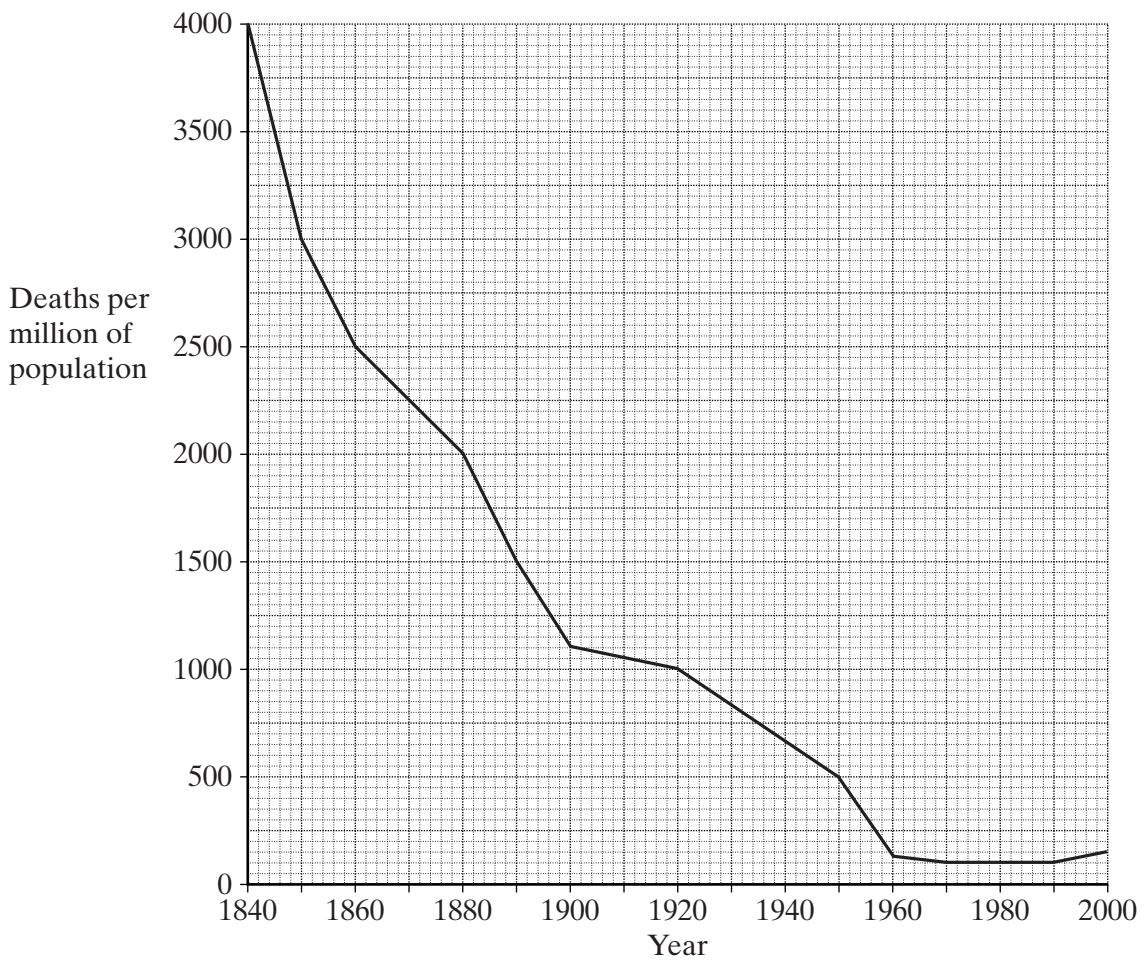
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(2 marks)

The graph shows the death rate from tuberculosis in England and Wales.



- (b) The population of England and Wales in 1860 was 20 066 000. Calculate the number of people who died of tuberculosis that year. Show your working.

Answer
(2 marks)

(c) There was an increase in the number of cases of tuberculosis between 1990 and 2000. Suggest how each of the following might have contributed to this increase:

(i) an increase in antibiotic-resistant strains of *Mycobacterium tuberculosis*;

.....
.....

(ii) an increase in the number of people with AIDS.

.....
.....

(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

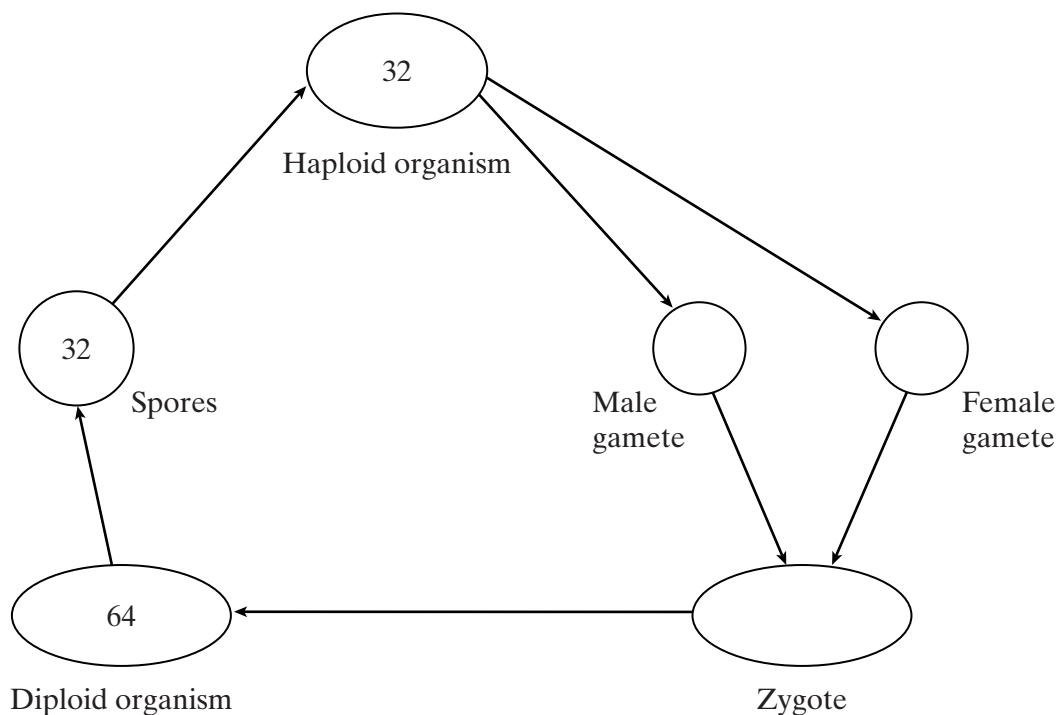
Turn over ▶

- 4 (a) Complete the table to describe some of the events during the cell cycle.

Stage of cell cycle	Main event which takes place
Metaphase	
	Chromosomes coil and shorten
	Daughter chromosomes move to poles of the cell
S-phase	
	Nuclear envelope re-forms

(5 marks)

- (b) The diagram shows the life cycle of an organism. The numbers show how many chromosomes are present in one cell at each stage of the life cycle.



- (i) Name the type of cell division that must be involved in producing the spores.

.....
(1 mark)

- (ii) How many chromosomes are there in a male gamete from this organism?

.....
(1 mark)

5 (a) What is a parasite?

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.....

(2 marks)

(b) *Schistosoma* has a number of adaptations to its parasitic way of life.

(i) The female lives in a groove in the male's body. Explain how this arrangement is advantageous to *Schistosoma*.

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(2 marks)

(ii) *Schistosoma* lives in the blood but is able to resist attack by the immune system of its host. Explain how.

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(1 mark)

(c) *Schistosoma* produces a substance that prevents clotting of the host's blood. Suggest why this is an advantage to *Schistosoma*.

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(2 marks)



Turn over ►

6 (a) (i) Some human DNA was cut into separate pieces using a restriction enzyme which produced a staggered cut. A scientist wanted to insert these pieces of DNA into plasmids and used the same restriction enzyme to cut the plasmids. Explain why the pieces of human DNA would be able to join to the cut DNA of the plasmids.

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(2 marks)

(ii) Which other enzyme must the scientist have added to the mixture to form recombinant plasmids?

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.....

(1 mark)

(b) A plasmid may be used as a vector. Explain what is meant by a *vector* in this context.

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(2 marks)

(c) Molecular biologists often use plasmids which contain antibiotic resistance genes. Explain the reason for this.

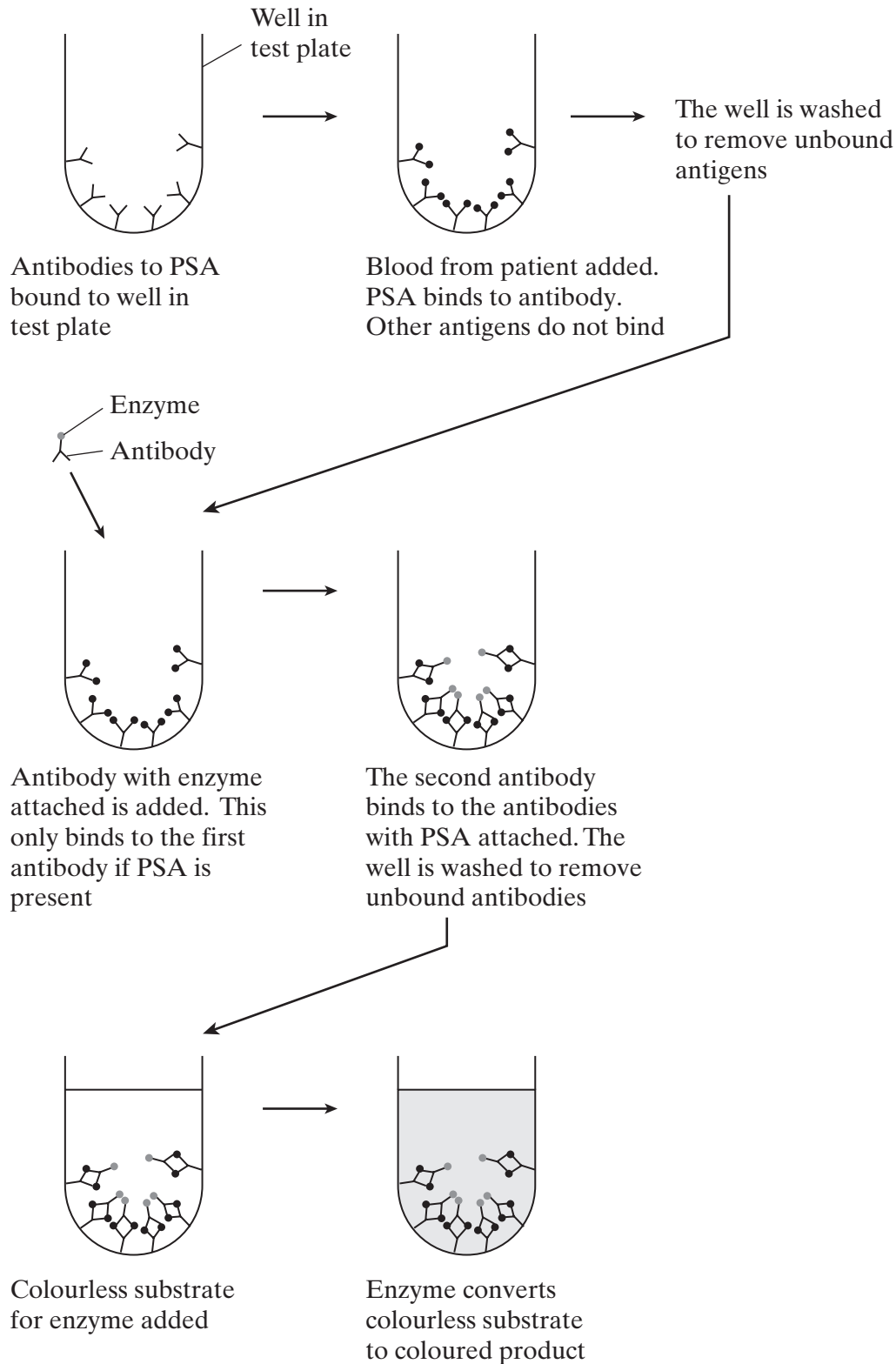
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(2 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 7 An antigen called PSA is present in the blood of men in the early stages of prostate cancer. There is a blood test for PSA. The test uses monoclonal antibodies to PSA. The stages in the test are shown in the diagram.



(a) (i) What is an antigen?

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(2 marks)

(ii) What is a *monoclonal* antibody?

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(2 marks)

(b) (i) Explain why this test detects prostate cancer, but not any other disease.

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(2 marks)

(ii) Explain why there will not be a colour change if the blood sample does not contain PSA.

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(2 marks)



Turn over 

(c) Explain why the nucleic acid on the test strip will only bind to altered DNA (lines 4-5).

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.....

(2 marks)

(d) This test strip will allow cancers to be detected at a very early stage. Explain why cancer is more likely to be treated successfully if the disease is detected at a very early stage.

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(2 marks)

(e) Explain how examining mRNA (line 7) enables scientists to discover whether cancer is present.

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(3 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

(i) Suggest how the expected number of admissions might have been calculated.

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(2 marks)

(ii) Describe the difference between the observed and expected numbers of males experiencing a myocardial infarction over the six days.

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(2 marks)

(c) Explain how repeated stress, such as that involved in watching a penalty shoot-out, may lead to a myocardial infarction.

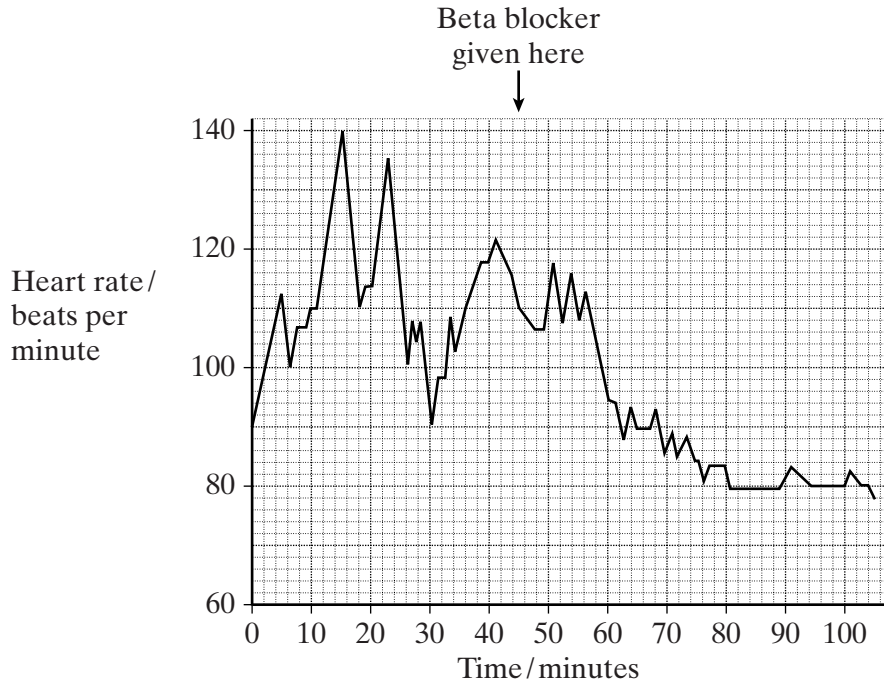
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(2 marks)

QUESTION 9 CONTINUES ON THE NEXT PAGE

Turn over 

- (d) A group of male football supporters was shown a video recording of a football match. At the end of the first half, they were each given a beta blocker. The graph shows the heart rate of a typical individual from the investigation.



Describe and explain the effect of the beta blocker on the heart rate of this person.

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(3 marks)

END OF QUESTIONS