



## ATAR course examination, 2024

### Question/Answer booklet

# PLANT PRODUCTION SYSTEMS

Please place your student identification label in this box

WA student number: In figures

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In words

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### Time allowed for this paper

Reading time before commencing work: ten minutes

Working time: three hours

### Materials required/recommended for this paper

#### *To be provided by the supervisor*

This Question/Answer booklet

Multiple-choice answer sheet

Number of additional  
answer booklets used  
(if applicable):

#### *To be provided by the candidate*

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination

### Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	20	20	30	20	20
Section Two Short answer	6	6	90	114	50
Section Three Extended answer	3	2	60	40	30
<b>Total</b>					100

## Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2024: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write your answers in this Question/Answer booklet, preferably using a blue/black pen. Do not use erasable or gel pens.

3. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

**Section One: Multiple-choice****20% (20 Marks)**

This section has **20** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 30 minutes.

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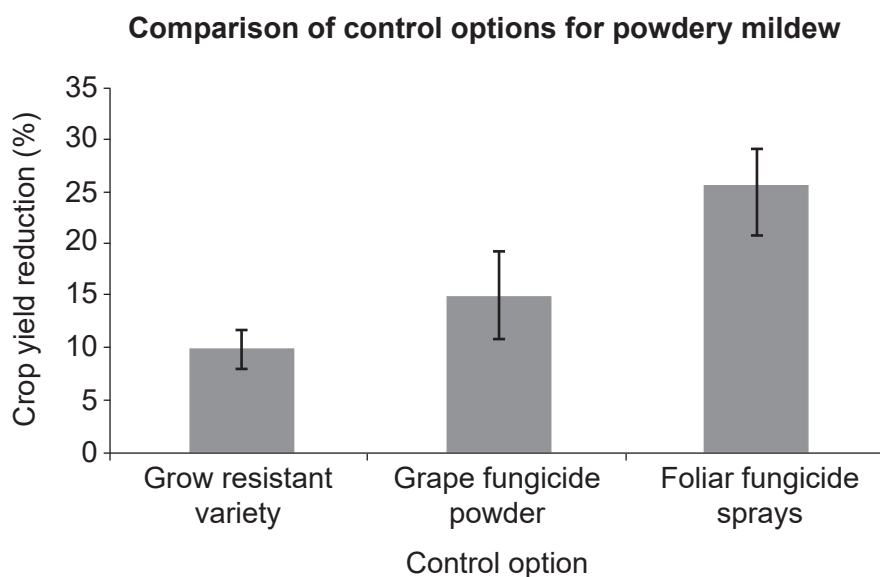
1. It is important to maintain biodiversity in agricultural systems to
  - (a) encourage genetic diversity by promoting system monoculture.
  - (b) reduce the complexity of ecosystems to streamline management processes.
  - (c) improve resilience towards pests, diseases and environmental changes.
  - (d) create pest refuges and encourage uniformity of crops outside them.
  
2. Which of the following statements **best** describes the role of ethylene in plant growth?
  - (a) inhibits seed germination and promotes dormancy
  - (b) stimulates leaf abscission and fruit ripening
  - (c) stimulates flower bud development and flowering
  - (d) enhances root hair formation and nutrient absorption
  
3. Common plant hormones used to stimulate germination through to flowering are
  - (a) cytokinins.
  - (b) auxins.
  - (c) gibberellins.
  - (d) abscisic acid.
  
4. Random mutation in plants always increases
  - (a) genetic diversity.
  - (b) growth rate.
  - (c) disease resistance.
  - (d) seed production.
  
5. Which of the following statements about plant breeding using genetically modified organisms (GMO) is accurate?
  - (a) Conventional breeding methods always rely on the use of GMO techniques to achieve traits.
  - (b) GMO exclusively relies on natural genetic variation without introducing external genetic material.
  - (c) Conventional breeding allows for better control over targeted genetic modifications than GMO.
  - (d) GMO involves the introduction of genes from unrelated species to achieve specific traits.

**See next page**

6. Managing the conflicting demands of the triple bottom line in a production system requires consideration of
- (a) economic, environmental and social factors.
  - (b) production, environmental and social factors.
  - (c) efficiency, economic and societal factors.
  - (d) efficiency, production and societal factors.
7. The purpose of randomisation when designing an experiment is to
- (a) control the variables.
  - (b) eliminate potential bias.
  - (c) provide statistical analysis.
  - (d) allow for experimental repetition.
8. Replication is important in experimental design because it
- (a) distributes variables among treatment groups.
  - (b) guarantees that the hypothesis can be proven.
  - (c) eliminates the need for a separate control group.
  - (d) ensures that the dependent variables can be changed.
9. Photosynthesis produces which of the following as a by-product?
- (a) glucose
  - (b) oxygen
  - (c) carbon dioxide
  - (d) carbon monoxide
10. The rate of photosynthesis increases when there is a
- (a) high concentration of carbon monoxide.
  - (b) low concentration of glucose.
  - (c) low concentration of carbon dioxide.
  - (d) high concentration of carbon dioxide.
11. The Australian Government requires farmers to keep a record of all pesticides used in food production. This is a requirement of
- (a) ethical pesticide use.
  - (b) biosecurity management.
  - (c) pest management and monitoring.
  - (d) international agricultural trading treaties.

12. Synthetic auxin is typically applied to crops as a
- (a) herbicide.
  - (b) pesticide.
  - (c) fertiliser.
  - (d) nutrient booster.
13. Plant water availability is a combination of which measurements?
- (a) water table depth and wilting point
  - (b) irrigation rate and water table depth
  - (c) field capacity and irrigation rate
  - (d) field capacity and wilting point
14. An increase in waterway pollution from nutrients is **most** likely to occur when
- (a) a low solubility fertiliser is applied.
  - (b) soil organic matter is improved.
  - (c) fertiliser is spread in autumn.
  - (d) fertiliser is spread in split applications.
15. A pesticide's mode of action is **best** determined by its
- (a) label name.
  - (b) target pest.
  - (c) application method.
  - (d) active ingredient.
16. Which pest control method would be **most** effective against a soil borne pest?
- (a) slashing
  - (b) cultivating
  - (c) heavy grazing
  - (d) stubble mulching
17. Quarantine and tariffs are protection strategies for Australian markets; however,
- (a) tariffs require large government subsidies.
  - (b) quarantine does not allow any foreign products in.
  - (c) tariffs can be used by other countries to protect their products.
  - (d) quarantine is mostly left up to producers to undertake on their farms.

Question 18 relates to the data in the graph below.



To minimise the impact of powdery mildew on grapevines, a producer compares the effectiveness of three different control options (values are the mean  $\pm$  one standard deviation).

18. The **best** option to minimise the impact of powdery mildew on grape yield is to
- grow a more resistant variety.
  - accept the yield loss and do nothing.
  - apply the grape fungicide powder.
  - apply the foliar fungicide spray.

Questions 19 and 20 relate to the table below.

Total soil phosphorus (P) at the end of the growing season (mg P/kg soil)				
Crop	Replicate 1	Replicate 2	Replicate 3	Replicate 4
Wheat	12	15	19	17
Lupins	12	18	20	14

19. Which crop has the lowest soil P at the end of the growing season?
- wheat, because the mean is lowest
  - lupins, because Replicate 3 removed the most P
  - wheat, because it needs more P to grow than lupins
  - lupins, because the mean is highest
20. How could a producer use the data to manage plant nutrition of the crops?
- only grow the crop that depletes the lowest amount of P
  - tissue test the crop and spread extra P when it is low
  - soil test before seeding and apply P if it is deficient
  - only grow lupins, because they can fix P in the soil

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**See next page**

Section Two: Short answer

50% (114 Marks)

This section has **six** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 21

(18 marks)

Managing production systems into the future will be influenced by consumer trends.

- (a) (i) State a current consumer trend that is likely to affect a future plant production system. (1 mark)

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- (ii) Describe **one** way a plant production system can be altered in response to the consumer trend selected in part (a)(i). (3 marks)

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- (b) (i) Outline how production systems can ensure the wellbeing of future generations. (2 marks)

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- (ii) State **one** example of a sustainable plant production practice for each aspect of the triple bottom line. (3 marks)

One: \_\_\_\_\_

\_\_\_\_\_

Two: \_\_\_\_\_

\_\_\_\_\_

Three: \_\_\_\_\_

\_\_\_\_\_

- (iii) Explain how each of the examples stated in part (b)(ii) above could support intergenerational equity. (9 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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Three: \_\_\_\_\_

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Question 22

(22 marks)

Plant breeding ensures Australia can remain globally competitive in plant production.

- (a) (i) Explain the role of seed banks in preserving genetic diversity in plant production. (3 marks)

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- (ii) Outline **one** additional strategy to encourage genetic diversity in plant production systems. (2 marks)

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- (b) Describe **three** key steps in breeding a new plant variety using conventional breeding methods. (9 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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Three: \_\_\_\_\_

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**Question 22** (continued)

The use of genetically modified organisms (GMO) has raised ethical issues among consumers.

- (c) Discuss **two** ethical issues associated with use of GMO in plant production. (8 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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**Question 23** (continued)

The following are activities that could degrade ecosystems:

- waste disposal
- habitat removal
- blue gum plantation
- water security
- ploughing
- invasive pests
- fertiliser application
- population increase
- controlled burns.

(b) (i) Select **one** activity that could degrade the natural ecosystem and outline its impact. (3 marks)

Activity: \_\_\_\_\_

Impact: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

(ii) Select **one** activity that could degrade the agricultural ecosystem and outline its impact. (3 marks)

Activity: \_\_\_\_\_

Impact: \_\_\_\_\_

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\_\_\_\_\_

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\_\_\_\_\_

- (iii) Select **one** activity that could degrade the urban ecosystem and outline its impact. (3 marks)

Activity: \_\_\_\_\_

Impact: \_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

- (c) For **one** of the impacts outlined in part (b) above, describe **one** short-term and **one** long-term goal that provides the ecosystem an opportunity to recover. (6 marks)

Impact: \_\_\_\_\_

Short-term: \_\_\_\_\_

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Long-term: \_\_\_\_\_

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Question 24

(16 marks)

A farmer is deciding which crop to plant. They are considering the yield and economic viability of lupins and wheat. The table below states the cost of each crop.

	Lupins	Wheat
Average yield (t/ha)	1.5	2.4
Average price (\$/t)	450	270
Income (\$/ha)	<b>A</b>	<b>B</b>
<b>Variable costs (\$/ha)</b>		
Seed	25	20
Seeding	37	37
Fertiliser	25	22
Spraying	21	21
Herbicide	26	34
Crop insurance	17	13
Insecticide	0	1
Total variable costs	<b>C</b>	<b>D</b>
Gross margin (\$/ha)	<b>E</b>	<b>F</b>

(a) Using the data provided complete the table below.

(6 marks)

	Lupins	Wheat
Income	<b>A =</b>	<b>B =</b>
Total variable costs	<b>C =</b>	<b>D =</b>
Gross margin	<b>E =</b>	<b>F =</b>

(b) (i) State which crop is more profitable.

(1 mark)

\_\_\_\_\_

(ii) List **two** production factors influencing the difference in gross margins between the two crops.

(2 marks)

One: \_\_\_\_\_

\_\_\_\_\_

Two: \_\_\_\_\_

\_\_\_\_\_



- (c) (i) Using the data provided in part (a) on page 16, recalculate the yield increase needed so that both crops have the same gross margin. Show all workings. (3 marks)

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- (ii) Discuss an adaptation to the production system that could reduce the total variable costs. (4 marks)

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**Question 25**

**(16 marks)**

Supporting biodiversity and maintaining resilient crops is important to avoid pesticide resistance.

- (a) Outline **one** strategy used to support plant biodiversity in a plant production system. (2 marks)

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- (b) Outline **one** negative impact of reduced plant biodiversity. (2 marks)

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- (c) Describe the process of pesticide resistance. (3 marks)

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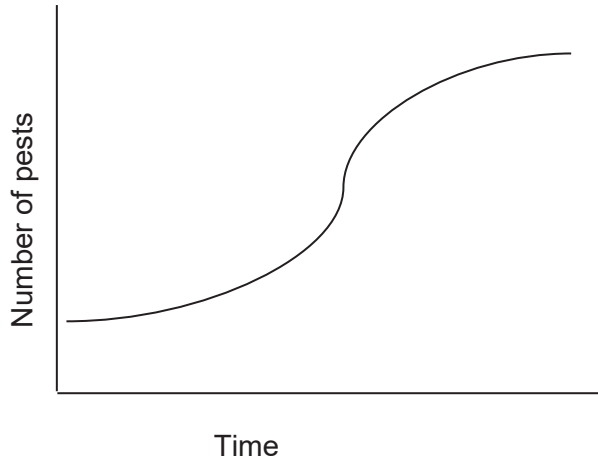
- (d) (i) Define 'economic threshold'. (2 marks)

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- (ii) On the graph below, draw a horizontal line that shows where the economic threshold of a high-value crop might intersect with the number of pests. (1 mark)

**Change in pest population number over time**



- (iii) Outline **three** pieces of relevant information that would be useful when planning to control the pests in part (d)(ii). (6 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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Three: \_\_\_\_\_

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## Question 26

(22 marks)

Data analysis provides producers with useful information when making decisions.

- (a) Define 'plant transpiration'. (1 mark)

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- (b) State **two** factors that affect a plant's rate of transpiration. (2 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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You are planning to investigate how the rate of transpiration would be affected by the colour of a plant's leaves.

- (c) Write a hypothesis to support the investigation. (2 marks)

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- (d) Outline **four** aspects of experimental design required to test the hypothesis in part (c) on page 20. (8 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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Three: \_\_\_\_\_

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Four: \_\_\_\_\_

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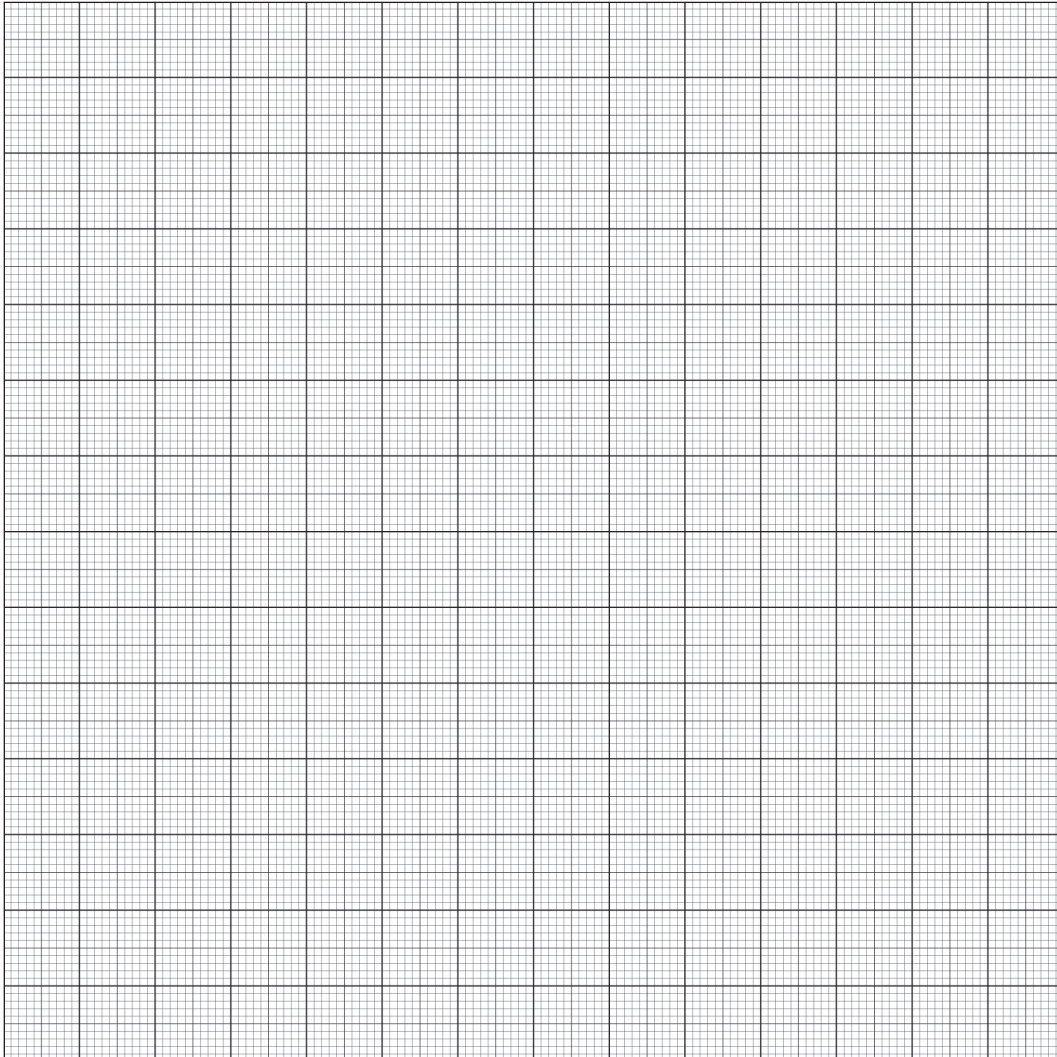
**Question 26** (continued)

A study looking at average wheat yield in Western Australia for the period of 2010–2023 was conducted and the results are recorded in the table below.

<b>Year</b>	<b>Average yield (tonnes/ha)</b>
2010	1.5
2011	1.9
2012	2.4
2013	1.9
2014	1.7
2015	1.8
2016	2.0
2017	2.6
2018	1.9
2019	1.6
2020	1.5
2021	1.8
2022	2.6
2023	1.7

**See next page**

- (e) Using the data on page 22, construct a suitable graph. (6 marks)



A spare grid is provided at the end of this Question/Answer booklet. If you need to use it, cross out this attempt and indicate that you have redrawn it on the spare grid.

- (f) (i) Based on the data trend in the graph, predict the average crop yield for 2024. (1 mark)

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- (ii) Justify your prediction in part (f)(i). (2 marks)

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**End of Section Two**  
**See next page**





- (b) Describe **one** short-term and **one** long-term strategy that would preserve a natural resource of your chosen plant production system. (6 marks)

Natural resource: \_\_\_\_\_

Short-term strategy: \_\_\_\_\_

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Long-term strategy: \_\_\_\_\_

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- (c) Describe **two** adaptations to plant growing conditions that could optimise plant production. (6 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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**Question 27** (continued)

- (d) Describe how optimising short-term production may not be in the best interests of long-term sustainability. (3 marks)

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**See next page**

## Question 28

(20 marks)

Australia's global competitiveness is reliant on its high level of biosecurity.

- (a) Describe how comparative advantage benefits an Australian plant production system, and discuss the effect comparative advantage has on Australia's global competitiveness. (8 marks)
- (b) Describe the three levels of biosecurity that protect Australia's plant production, and describe how a plant producer could strengthen their on-farm biosecurity in the face of a disease outbreak in a crop. (12 marks)

or

## Question 29

(20 marks)

How we adapt our plant production systems to climate change is critical to its sustainability.

- (a) State **two** major impacts of climate change on plant production systems. Describe how **one** of the impacts could affect plant production **and** the role a new technology could have on optimising plant production in the face of climate change. (8 marks)
- (b) Select a plant production system from the list below and discuss **three** adaptations to the system to meet the challenges of climate change:
- broadacre wheat
  - horticulture
  - irrigated pasture
  - pastoral grazing.
- (12 marks)

End of questions















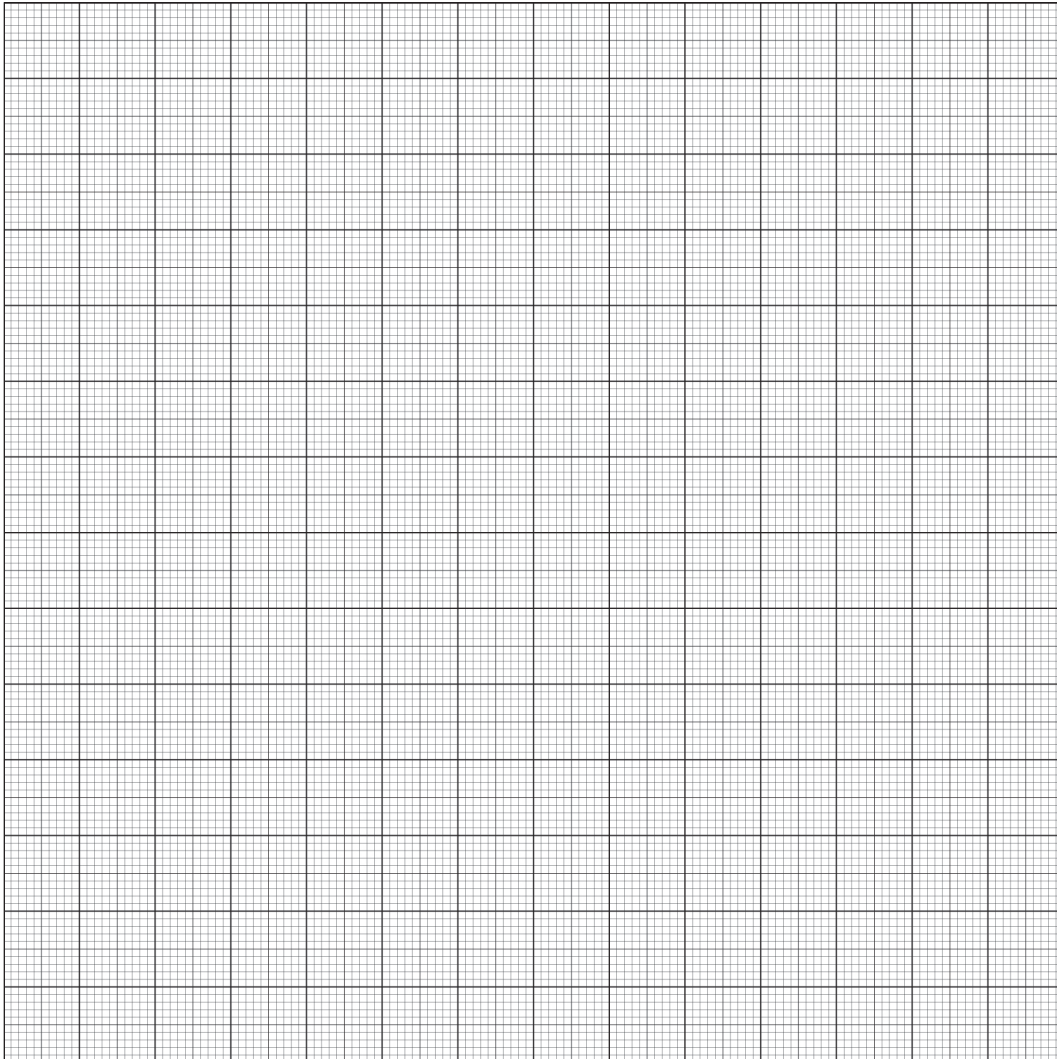








Spare grid for Question 26(e)



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