



ATAR course examination, 2018

Question/Answer booklet

PLANT PRODUCTION SYSTEMS

Please place your student identification label in this box

Student number: In figures

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In words

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: non-programmable calculators approved for use in this 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	7	7	90	109	50
Section Three Extended answer	3	2	60	40	30
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2018*. 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.

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.

1. Which statistical measure provides information about the spread of data?

- (a) mean
- (b) median
- (c) mode
- (d) standard deviation

2. Below is an extract from the records of a farm that grows 500 hectares of lupins.

New machinery shed	\$30 000
Rates and taxes	\$12 000
Seed costs	\$35 000
Fertiliser costs	\$10 000
Harvest costs	\$15 000
Lupin income	\$200 000

The gross margin per hectare for the lupin crop referred to in the table above is

- (a) \$220.
 - (b) \$260.
 - (c) \$280.
 - (d) \$320.
3. Compared with agricultural ecosystems, natural ecosystems are
- (a) less stable.
 - (b) nutrient dependent.
 - (c) a monoculture.
 - (d) more biodiverse.
4. Selective weed control can be achieved by using
- (a) low spray rates.
 - (b) larger volumes of water.
 - (c) synthetic hormones.
 - (d) an adjuvant treatment.

See next page

5. The increase in the popularity of organic products is a response to
- (a) expensive supermarket produce.
 - (b) consumer demand for local produce.
 - (c) the low cost of production.
 - (d) changing consumer trends.
6. Carbohydrates are translocated from leaves by the
- (a) phloem.
 - (b) stomata.
 - (c) xylem.
 - (d) epidermis.
7. Which of the following is critical to the rate of absorption of nutrients from the soil into the plant?
- (a) carbon dioxide
 - (b) oxygen
 - (c) temperature
 - (d) light
8. Which of the following plays an important role in managing pesticide resistance?
- (a) active ingredient
 - (b) mode of action
 - (c) withholding period
 - (d) droplet size
9. When plant breeders cannot find genetic diversity for resistance to a disease in cultivated varieties, they look to
- (a) another variety.
 - (b) graded seed.
 - (c) a seed bank.
 - (d) seed merchants.
10. Duty of care in the workplace should be initiated at the
- (a) induction.
 - (b) interview.
 - (c) annual meeting.
 - (d) start of each day.

11. In a natural ecosystem, all organisms are supplied with energy and
- (a) only plants use sunlight.
 - (b) waste does not break down.
 - (c) minerals are recycled.
 - (d) most animals are producers.
12. The difference between wilting point and field capacity is
- (a) available water.
 - (b) unavailable water.
 - (c) saturation point.
 - (d) water dispersion.
13. One factor that will decrease the rate of photosynthesis in a plant is
- (a) low light intensity.
 - (b) low concentration of oxygen.
 - (c) long day length.
 - (d) high concentration of carbon dioxide.
14. The chemical control of weeds that germinate after a crop has been sown is best undertaken with a
- (a) pre-emergent.
 - (b) post-emergent.
 - (c) broad spectrum.
 - (d) non-selective.
15. In plant production, the 'triple bottom line' refers to managing
- (a) stewardship.
 - (b) social, economic and genetic factors.
 - (c) intergenerational equity.
 - (d) social, economic and environmental factors.
16. The use of an independent contractor to audit the harvesting and storage systems in a plant production system is an example of
- (a) comparative advantage.
 - (b) risk management.
 - (c) duty of care.
 - (d) quality assurance.

17. Genetic modification (GM) and ethical issues have been linked by some people because they consider that
- (a) GM products are cheaper.
 - (b) humans interfering with genes is unnatural.
 - (c) very little GM produce is available to buy.
 - (d) not every country has access to GM technology.
18. The main role of cytokinins in plants is
- (a) cell division.
 - (b) cell elongation.
 - (c) seed dormancy.
 - (d) fruit ripening.
19. The aim of risk mitigation is to
- (a) identify all risks.
 - (b) assess risk probability.
 - (c) find solutions to reduce risk.
 - (d) identify consequences of risk.
20. Planning for next year's crop is **most** influenced by
- (a) current production.
 - (b) market feedback.
 - (c) labour availability.
 - (d) exchange rates.

End of Section One

See next page

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See next page

Section Two: Short answer

50% (109 Marks)

This section has **seven** 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.

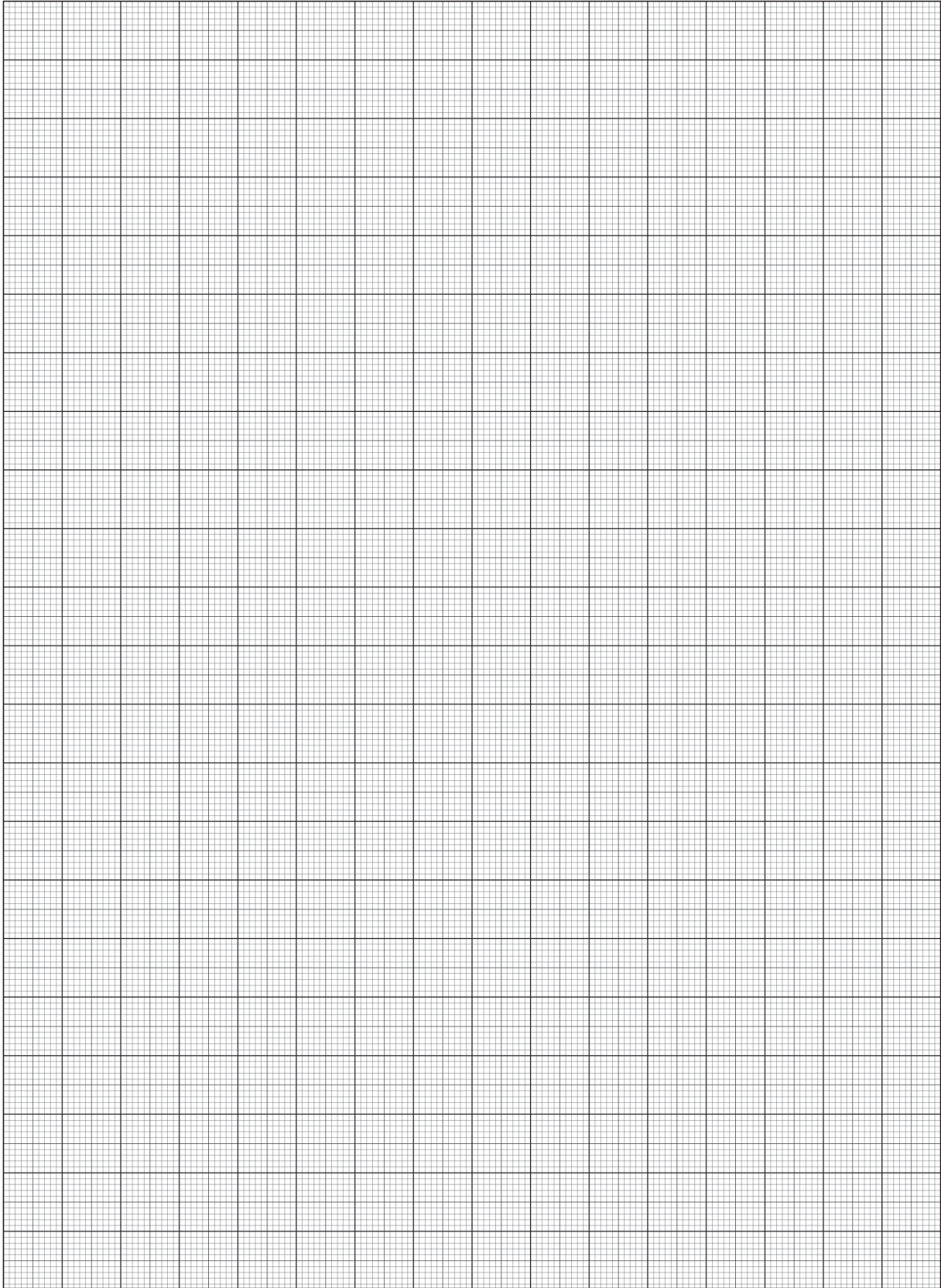
Question 21

(16 marks)

Over the years, the amount of pesticides used worldwide has increased significantly.

- (a) Two pesticides are available to control an insect in a ripe crop. Graph the results, using the data table below that shows the percentage of pests controlled. (6 marks)

Days after spraying	Pesticide A	Pesticide B
	Percentage of pest population controlled	
1	20	20
2	40	20
3	60	30
4	80	40
5	100	70
6	100	90
7	100	100
8	100	100



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

See next page

Question 21 (continued)

(b) (i) Define economic threshold (ET). (2 marks)

(ii) Consider the graph in part (a). State which pesticide is more effective at the point where the ET equals 60%. (1 mark)

(iii) Describe **one** relevant factor that would enable the ET to be estimated. (2 marks)

(iv) Explain which pesticide is a better choice if the withholding period (WHP) for both pesticides is 5 days. (3 marks)

(c) Describe how the pest could become resistant to either of the pesticides in part (a). (2 marks)

Question 22**(15 marks)**

Transpiration is the process of water evaporating from the plant.

(a) Complete the table below.

(6 marks)

Environmental change	Transpiration response	Reason
High temperature	Increased transpiration	Evaporation from leaf surface
High humidity		
Low light intensity		
Strong wind		

(b) Select two environmental changes from part (a) and describe how transpiration rates can be manipulated artificially to improve production. **(4 marks)**

See next page

Question 22 (continued)

- (c) State how **two** end products of photosynthesis are used. (2 marks)

One: _____

Two: _____

- (d) (i) State which hormone plays an important role in a plant's ability to take full advantage of available light for photosynthesis. (1 mark)

- (ii) Describe a relevant commercial use for the hormone selected in part (d)(i). (2 marks)

Question 23**(14 marks)**

A new plant variety is available that is resistant to a common fungal disease. It has been developed using genetically modified (GM) techniques.

- (a) Complete the following gross margin analysis of the current variety and the new variety. Round to the nearest dollar. (2 marks)

	New variety	Current variety
Income (\$ per tonne)	\$350	\$350
Yield (tonnes per hectare)	1.5	1.0
Income (\$ per hectare)	\$525	\$350
Costs (\$ per hectare)		
Seed	\$150	\$50
Fertiliser	\$100	\$100
Weed control	\$75	\$75
Fungicide	\$0	\$50
Gross margin (\$ per hectare)	A	B

A: _____

B: _____

- (b) Apart from financial gain, describe another reason why you would choose one variety over another. (2 marks)

Question 23 (continued)

During the budgeting process, you have been advised that there will be an increase of 20% in the price per tonne for all varieties and an increase of 10% for all costs.

- (c) (i) Recalculate the gross margins in part (a). Round to the nearest dollar. A table is included for calculations. No marks will be awarded for its completion except for the total of A and B. (2 marks)

	New variety	Current variety
Income (\$ per tonne)	\$	\$
Yield (tonnes per hectare)	1.5	1.0
Income (\$ per hectare)	\$	\$
Costs (\$ per hectare)		
Seed	\$	\$
Fertiliser	\$	\$
Weed control	\$	\$
Fungicide	\$	\$
Gross margin (\$ per hectare)	A	B

A: _____

B: _____

- (ii) Describe the effect your calculations in part (c)(i) will have on your crop decision making. (2 marks)

- (d) Explain **one** positive impact genetically modified organisms (GMO) might have on the natural ecosystem. (3 marks)

- (e) Other than GMO, identify and describe a new technology that could be used to reduce costs in the gross margin in part (a). (3 marks)

Question 24

(16 marks)

Australia produces a large variety of primary products for both export and domestic consumption.

- (a) Identify an Australian plant product and nominate its major export destination. (2 marks)

Product: _____

Destination: _____

- (b) Describe how Australia has a comparative advantage for the plant product in part (a). (2 marks)

- (c) Explain how Australia maintains its global competitiveness in the plant product selected in part (a). (3 marks)

- (d) Explain **one** protection strategy Australia can use against foreign products entering Australian markets. (3 marks)

(e) If there was an outbreak of a highly-contagious plant disease in Australia, describe **one** strategy that could be implemented at each of the following levels to mitigate the effect of the disease.

- local
- national
- international

(6 marks)

Question 25

(16 marks)

Societies such as Australia face choices about how to respond to the consequences of future climate change.

- (a) (i) List **two** environmental changes that are taking place in the agricultural regions of Western Australia due to climate change. (2 marks)

One: _____

Two: _____

- (ii) Select **one** environmental change from part (a)(i) and describe the effect it will have on biodiversity in natural ecosystems. (2 marks)

- (b) Choose a plant enterprise you are familiar with and describe how an adaption to its production system could meet **one** of the changed circumstances identified in part (a)(i). (2 marks)

Plant enterprise: _____

- (c) Identify a farm resource. Describe **one** short-term and **one** long-term improvement that could ensure its sustainability in the face of climate change. (5 marks)

Resource: _____

Short-term: _____

Long-term: _____

- (d) (i) Define intergenerational equity. (2 marks)

- (ii) Choose one of the demands of the triple bottom line and explain a strategy that will support intergenerational equity in the face of climate change. (3 marks)

Question 26

(15 marks)

Quality assurance in the food production sector is rigorous.

- (a) (i) List **four** causes of variation in product quality and/or quantity. (4 marks)

One: _____

Two: _____

Three: _____

Four: _____

- (ii) Describe the on-farm practices that could be used to manage **two** of the variations listed in part (a)(i). (4 marks)

- (b) Identify a plant quality assurance (QA) program and explain how it could mitigate the risk of a poor-quality product being marketed. (4 marks)

Program: _____

- (c) Identify **one** type of market feedback and describe how a plant producer could use this information to plan future production. (3 marks)

Market feedback: _____

Question 27

(17 marks)

Nitrogen can be applied by spray (foliar) or top-dressed (granular). Investigate which application method stimulates the faster growth rate on ryegrass pasture by completing the following.

- (a) Write a relevant hypothesis to test ryegrass growth rate. (2 marks)

- (b) Using control, randomisation and replication aspects of experimental design, describe an investigation to test the hypothesis in part (a) with the following resources:

- one hectare of land in the corner of a 100 hectare paddock
- two varieties of ryegrass. (6 marks)

- (c) The results were inconclusive. Evaluate the investigation in part (b) and describe an improvement that can be made for a future investigation. (4 marks)

- (d) (i) The following data is from a similar investigation under the same climatic conditions. What conclusion can you draw from this data? (2 marks)

Ryegrass growth rate trial comparing granular and foliar application of nitrogen		
	Granular	Foliar
Mean – dry matter/hectare (kg)	155	135
Standard deviation	3.2	7.6
Standard error	4.12	

- (ii) Explain the usefulness of standard error when analysing the results in part (d)(i). (3 marks)

End of Section Two

See next page

Section Three: Extended answer

30% (40 Marks)

This section contains **three** questions. You must answer **two** questions: the compulsory question (Question 28) and **one** of the other questions (Question 29 or Question 30). For Question 28, write your answer in the spaces provided. For Question 29 or Question 30, write your answers on the lined pages following Question 30.

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: 60 minutes.

Question 28

(20 marks)

Plant production enterprise: _____

Water use and plant nutrition are critical to the success of a plant production enterprise.

- (a) Define water availability. Explain **two** factors that would influence water entry into the soil and how those two factors can be managed for a plant production enterprise you have studied. (7 marks)

When planning a nutrition program for a plant production enterprise you have studied, the following nutrition information needs to be taken into account.

- (b) If 3 kilograms of phosphorus per tonne of produce is removed at harvest and a 2.7 tonnes/ha crop was harvested:

- (i) calculate how many kg/ha of phosphorus would be required to replace the lost phosphorus after harvest. (1 mark)

Fertiliser costs

Fertiliser	P%	\$/Tonne
Fertstar	14.0	\$810
Fertflow	17.7	\$876
Fertgras	9.1	\$660

- (ii) for each fertiliser in the table above, calculate the cost per kilogram of the phosphorus. (3 marks)

Fertstar: _____

Fertflow: _____

Fertgras: _____

- (iii) select the most cost-effective fertiliser and calculate the cost per hectare to replace the lost phosphorus. Answers should be correct to two decimal places. Show your workings. (2 marks)

Question 28 (continued)

- (c) In a plant production enterprise you have studied, identify a plant growth stage that requires nitrogen fertiliser. Explain **two** strategies that farmers can use to reduce the fertiliser’s harmful environmental impacts. (7 marks)

Question 29**(20 marks)**

Plant breeding is the science of changing the traits of plants in order to produce desired characteristics.

- (a) Explain **three** reasons why plant breeding programs are necessary for the future sustainability of Australian agriculture. (12 marks)
- (b) Describe **four** basic steps involved in breeding a new crop variety. (8 marks)

or

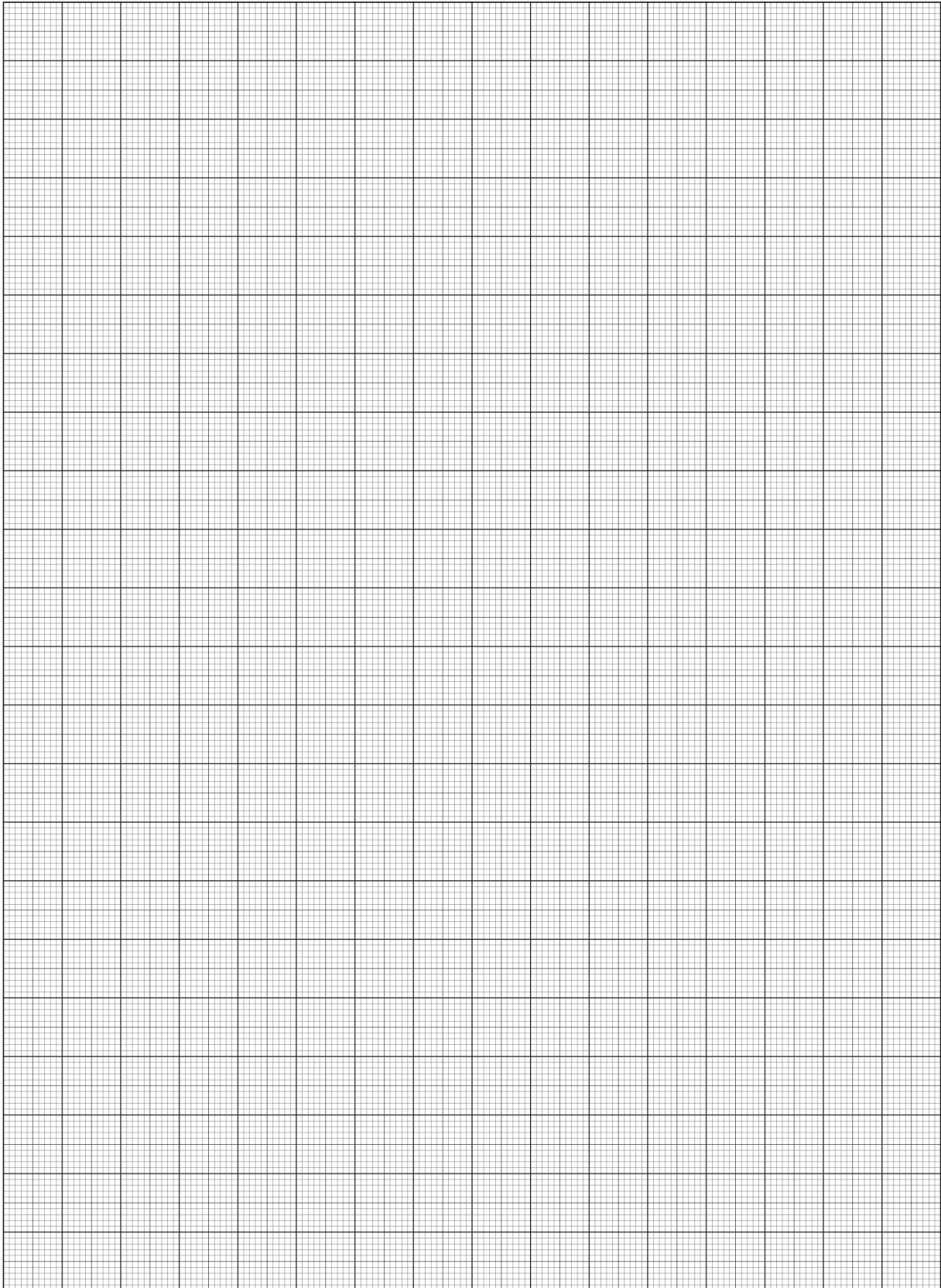
Question 30**(20 marks)**

Plant producers rely on planning, both in the short- and the long-term, to remain profitable.

- (a) Discuss **two** important budget variables that have a significant effect on the profitability of a plant production enterprise in the short-term. For each variable, identify a possible risk that could influence profitability and propose a strategy to minimise that risk. (10 marks)
- (b) Describe **two** long-term strategies that farmers could adopt that would address both rising costs and changing climate patterns, while maintaining profitability. (10 marks)

End of questions

Spare grid



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