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Government of **Western Australia**
School Curriculum and Standards Authority

ATAR course examination, 2023

Question/Answer booklet

ANIMAL PRODUCTION SYSTEMS

Please place your student identification label in this box

WA student number: In figures | | | | | | | | | |

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: 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	7	7	90	106	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 2023: 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.

See next page

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. Which combination of pest control methods is the **least** likely to impact the environment?

   (a) chemical and biological
   (b) biological and mechanical
   (c) cultural and biological
   (d) mechanical and cultural

2. The pest control method that has the **least** effect on large, mobile pest outbreaks is

   (a) cultural.
   (b) mechanical.
   (c) biological.
   (d) chemical.

3. Which of the following is **not** a role that feed additives play in a ration?

   (a) enhance feed digestibility
   (b) enhance feed flavour
   (c) improve productivity
   (d) replicate growth hormones

4. The mode of action of a pesticide is **best** determined by

   (a) how quickly the pesticide kills the target pest.
   (b) the method used to apply the pesticide.
   (c) the way in which the pesticide enters the pest.
   (d) the disruption caused by the pesticide at its target site.

5. Using integrated pest management to avoid pesticide resistance is **most** successful when

   (a) the pest population is at the economic threshold.
   (b) chemicals are used as a defence against an outbreak.
   (c) a range of control measures are used.
   (d) no chemicals are used to control the pest.

See next page

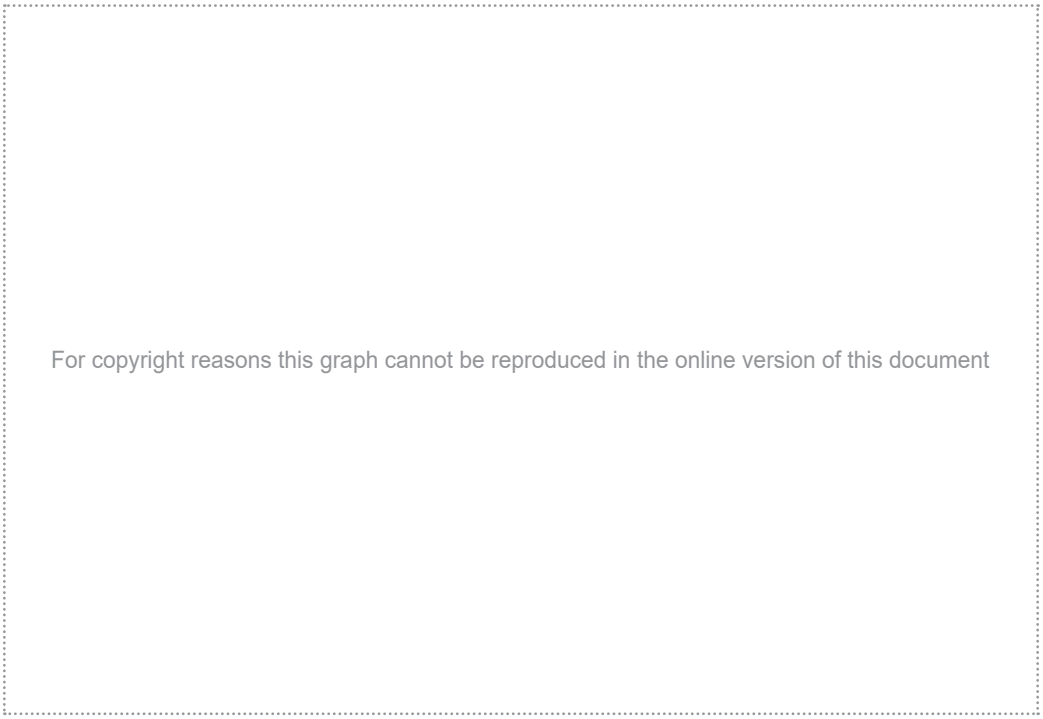
6. The **best** way to reduce the development of pesticide resistance is to

   (a) change the mode of action of the pesticide regularly.
   (b) increase the pesticide application rate to ensure full coverage.
   (c) apply the pesticide more regularly to stop the breeding cycle.
   (d) use a combination of pesticides to cover all stages of the pest's growth.

7. Which of the following is considered an essential element of quality assurance?

   (a) accreditation of documents
   (b) accurate record keeping
   (c) daily work planning meetings
   (d) safe working conditions

Use the information in the graph below to answer Questions 8 and 9.



See next page

8. Based on the graph, if you were planning to market lambs in the financial year 2023/24, the **best** month to maximise prices would likely be

(a) March.
(b) June.
(c) August.
(d) November.

9. Based on the graph, an important forecast that could provide producers with confidence to proceed with the lamb production enterprise would be

(a) interest rates.
(b) daily maximum temperatures.
(c) price per lamb.
(d) price per kilogram of lamb.

10. The hormone that stimulates testosterone production in male livestock is

(a) luteinising.
(b) gonadotropin-releasing.
(c) prostaglandin.
(d) follicle-stimulating.

11. The maximum performance of an animal is limited by its genetic

(a) gain.
(b) potential.
(c) ability.
(d) differential.

12. What is the **main** advantage of embryo transfer over artificial insemination?

(a) greater number of progeny
(b) cost effectiveness
(c) increased desirable maternal genes
(d) reduced heritable male characteristics

13. Which of the following **best** describes the underlying principle of intergenerational equity?

(a) allow younger generations increased access to both natural resources and land for farming
(b) recognise the contribution of work completed by older generations and pay them accordingly
(c) ensure that current practices do not compromise the ability of future generations to meet their needs
(d) guarantee that agricultural policies are in line with the economic and welfare needs of current generations

See next page

14. When designing a trial to investigate the effectiveness of a new growth promoter, it would be important to

    I. select groups at random.
    II. control for variables.
    III. measure feed intake.
    IV. provide different feed rations.

    (a) I, II and III only
    (b) II only
    (c) II and III only
    (d) I, II, III and IV

15. If a sheep farm has been exposed to virulent foot rot, what steps should be taken first by the farmer to manage the risk to their livestock?

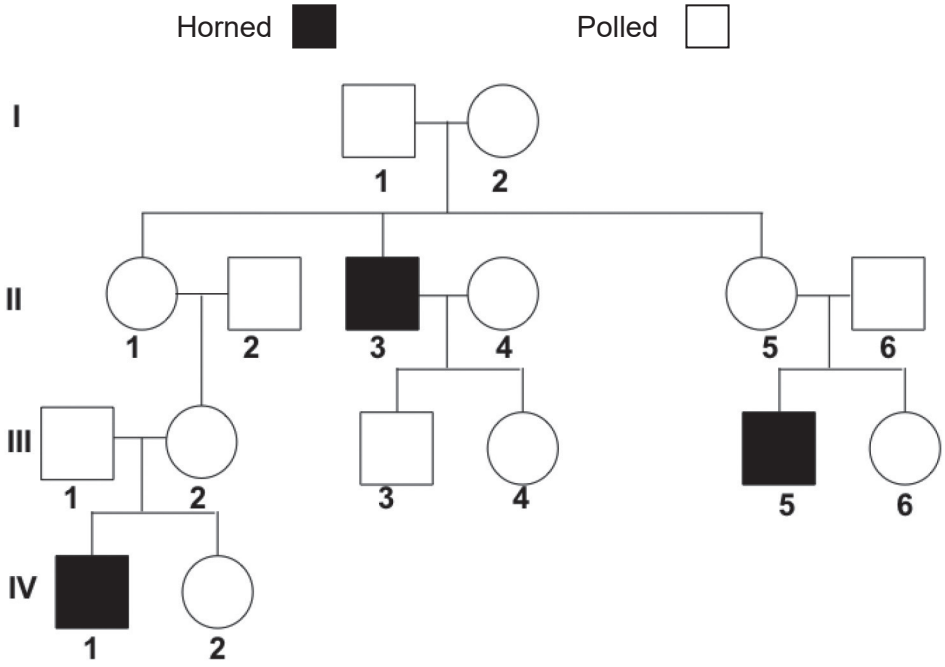
    (a) contact the Department of Primary Industries and Regional Development for testing
    (b) rest paddocks for six months, clean and disinfect indoor pens
    (c) monitor the health of all stock and treat infected animals with antibiotics
    (d) immediately euthanase all stock

16. When aiming to increase the number of progeny using estimated breeding values (EBVs), it is important to select

    (a) females with high EBVs for number of progeny.
    (b) males and females with high EBVs for number of progeny.
    (c) females with low birthweight and high number of progeny EBVs.
    (d) males and females with low birthweight and high number of progeny EBVs.

See next page

17. The following pedigree tree shows the inheritance pattern of horns in goats.



The presence of horns is

(a) homozygous recessive.
(b) heterozygous recessive.
(c) homozygous dominant.
(d) heterozygous dominant.

18. Which nutrient is provided mainly by rumen microbes?

(a) carbohydrates
(b) proteins
(c) sugars
(d) volatile fatty acids

19. Which of the following is **not** considered a sustainable farming practice?

(a) rotational grazing
(b) planting perennial pastures
(c) promoting biodiversity
(d) practising monoculture

20. Duty of care in the workplace is

(a) the role of the manager.
(b) a legal responsibility for everyone.
(c) important to address weekly.
(d) based on international guidelines.

End of Section One

See next page

Section Two: Short answer **50% (106 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 **(13 marks)**

(a) Identify an example of a gastric and a microbial digestive system in an animal to then complete the table below. (6 marks)

	Gastric	Microbial
Example (animal)		
Location of cellulose digestion		
Main source of protein		

(b) (i) Identify **two** gases produced in the rumen as by-products of cellulose digestion. (2 marks)

One: _____

Two: _____

(ii) State what happens at each of the following steps of digestion in a microbial digestive system. (5 marks)

Mastication: _____

_____

Fermentation: _____

_____

Regurgitation: _____

_____

Nutrient absorption: _____

_____

Elimination: _____

_____

Question 22 **(19 marks)**

Feed additives and hormone growth promotants (HGPs) are used in livestock feeding programs to improve livestock efficiency.

(a) Contrast the legal requirements for using feed additives as against HGPs in livestock feeding programs. (4 marks)

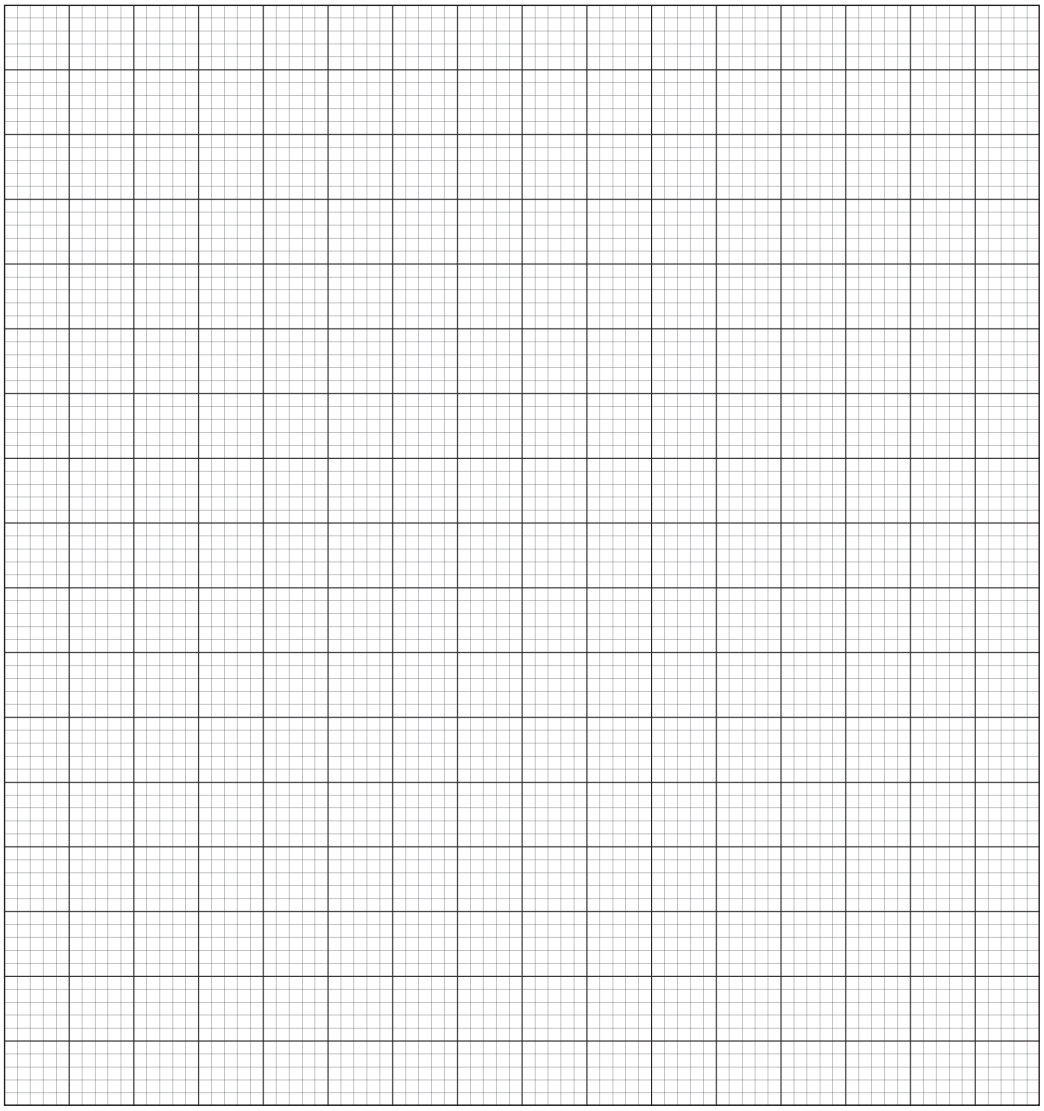
See next page

Question 22 (continued)

The table below shows the average weekly liveweight in kilograms of feedlot lambs with and without the food additive Grosum.

Week	Without Grosum Average liveweight in kg	With Grosum Average liveweight in kg
1	35	35
2	32	34
3	34	36
4	38	43
5	45	46
6	44	47
7	46	48

(b) Use the data in the table above to graph the liveweight of feedlot lambs. (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.

See next page

(c) (i) State a valid hypothesis for the trial in part (b) on page 10. (2 marks)

(ii) Outline a conclusion you could draw from the trial in part (b) on page 10. (2 marks)

(d) How could a producer use the results of this trial in part (b) on page 10 when trying to sell lambs at the market specification liveweight of 50 kg. (3 marks)

(e) State **two** potential sources of bias that could be relevant to this trial. (2 marks)

One: _____

Two: _____

Question 23 **(15 marks)**

Intensive finishing rations are fed to animals to maximise weight gain while ensuring good animal health.

(a) Outline a critical ingredient that must be included when mixing a finishing ration that is suitable for cattle, but not pigs. (2 marks)

(b) Calculate a two-ingredient ration for pigs using the Pearson square method and the following criteria.

Ration protein % = 16

Wheat – 15%
Barley – 12%
Lupins – 30%
Hay – 10%

State the two ingredients as a percentage of the total ration (to the nearest whole number). (7 marks)

See next page

The list below shows the cost per tonne of each ingredient.

Wheat – $500/t
Barley – $400/t
Lupins – $600/t
Hay – $200/t

(c) (i) Calculate the cost of the ration devised in part (b) on page 12. (3 marks)

(ii) Do you consider the ration devised in part (b) to be the least cost? Justify your reasoning. (3 marks)

See next page

Question 24 **(16 marks)**

Economic loss caused by a pest is controlled with careful management. The graph below depicts lice on livestock over a 12-month period.

(a) Use the above graph to describe the economic effect of the lice on the livestock. (3 marks)

(b) (i) Redraw the graph to show how a lice outbreak should be managed. (1 mark)

See next page

(ii) Describe an action that could be used to support the prevention of a lice outbreak as in part (b)(i) on page 14. (3 marks)

(iii) Describe an action that could be used to minimise the risk of pesticide resistance in the lice population in part (b)(i) on page 14. (3 marks)

See next page

Question 24 (continued)

(c) Compare the strategies used to prevent an outbreak of a contagious disease, such as foot and mouth, at a local, national, and international level. (6 marks)

Local: _____

_____

_____

_____

National: _____

_____

_____

_____

International: _____

_____

_____

_____

Question 25 **(19 marks)**

Profitability of an enterprise is affected by market specifications. The table below is a sample of a market price grid of lamb, in $/kg carcass weight at different fat scores.

	Fat score			
Carcass weight (kg)	**2**	**3**	**4**	**5**
18–21	3.20	3.20	3.00	2.70
21.1–24	4.00	4.20	3.90	3.00
24.1–27	3.70	4.00	3.60	2.90
27+	3.20	3.20	3.00	2.70

(a) Using the table above, state the optimum lamb specifications for this market. (2 marks)

(b) Using the information in the table above, explain how product variation would affect financial return. (4 marks)

See next page

Question 25 (continued)

(c) Explain **two** possible causes of variation in **either** product quality **or** quantity in an animal production system with which you are familiar. (6 marks)

Animal production system: _____

One: _____

_____

_____

_____

_____

_____

Two: _____

_____

_____

_____

_____

_____

See next page

A producer is currently growing lambs to a carcass weight of 22 kg with a fat score of 2. They estimate that, at a total additional feed cost of $6, they can grow their lambs to a carcass weight of 26 kg with a fat score of 2.

(d) Compare the profitability of the producer's management choices, using the price grid from the table on page 17 that has been repeated below. Show all workings. (7 marks)

	Fat score			
Carcass weight (kg)	**2**	**3**	**4**	**5**
18–21	3.20	3.20	3.00	2.70
21.1–24	4.00	4.20	3.90	3.00
24.1–27	3.70	4.00	3.60	2.90
27+	3.20	3.20	3.00	2.70

See next page

Question 26 **(10 marks)**

A dairy farmer compared the effect of milking frequency on milk yield at the onset of lactation, over a period of four weeks. The farmer establishes two groups in the herd. One group was milked once per day, and the other was milked three times per day. The experimental period was followed by four weeks of twice daily milking for both groups. The milk yield collected was measured and is presented in the table below.

Weeks of lactation	Milk yield (yield/week)	
	Milked once per day	**Milked 3 times per day**
1	119	147
2	154	179
3	161	193
4	168	203
	Milked twice per day	**Milked twice per day**
5	185	182
6	181	179
7	179	189
8	189	196

(a) (i) State **two** trends shown in the table. (2 marks)

One: _____

_____

Two: _____

_____

(ii) State the milking frequency you would recommend to the dairy farmer, and justify your reasoning for the recommendation. (4 marks)

Milking frequency: _____

_____

Reasoning: _____

_____

_____

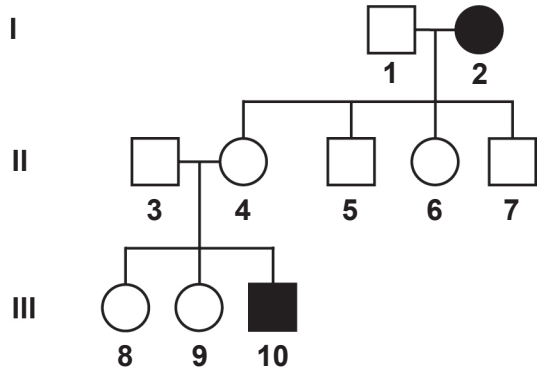
_____

_____

_____

See next page

Some people have food sensitivity and cannot digest A1 milk protein but can digest the A2 version. Animals with an A2A2 genotype produce only the A2 protein in their milk. This is demonstrated in the pedigree below, where black represents the A2A2 genotype.



(b) (i) On the basis of the above pedigree, which animal would you use to develop your A2 herd. (1 mark)

(ii) Compare the genetic benefits of using an A2A2 homozygous sire instead of a heterozygous sire over your herd of heterozygous cows. (3 marks)

Question 27 **(14 marks)**

Rumen size is one heritable factor that can influence methane production in sheep. In an investigation of rumen size, the time that food remained in the rumen (retention time) and methane production were measured and recorded in the table below.

	Low methane production (n=10) (1 standard deviation below the flock mean)	**High methane production (n=10) (1 standard deviation above the flock mean)**
Methane production (g CH_4/kg feed)	19	24
Rumen volume (l)	6	7
Retention time (hrs)	27	32

(a) State how many sheep from the flock were used in the trial and on what basis they were selected. (2 marks)

(b) Write a valid hypothesis for the investigation and state **two** suitable controlled variables. (4 marks)

Hypothesis:

Control variable one:

Control variable two:

(c) State the relationship between rumen size and both retention time and methane production. (2 marks)

See next page

(d) (i) Outline another way of reducing methane production in microbial digestive systems. (2 marks)

(ii) Discuss why it is important to reduce the amount of methane produced in livestock production. (4 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 answers on the lined pages following this question. For Question 29 or 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)**

Approximately 70% of Australia's total agricultural production is exported overseas.

Name an animal production enterprise with which you are familiar and a product of the enterprise.

Animal production enterprise: _____

Name a product of the enterprise: _____

(a) Identify a quality assurance (QA) program relevant to your selected product and explain the role that the QA program plays in ensuring that on-farm practices can meet the requirements of markets. (10 marks)

(b) Identify both a major international market **and** a main competitor of the animal product selected above. Describe a current protection strategy for Australian products and explain how comparative advantage allows Australian producers to be more competitive in the selected international market. (10 marks)

See next page

See next page

See next page

See next page

See next page

See next page

Question 29 **(20 marks)**

Western Australia's (WA) climate has changed over the last century, particularly over the last 50 years. Average temperature has risen about 1°C. Rainfall has increased over the north and interior, declined along the west coast, and declined by about 20% over the lower south-west. Fire risk has increased across the state.

Producers must consider adaptations to climate change to remain productive and sustainable in the future.

(a) Name an animal production system and state **two** adaptations that an animal producer can make to their production system to adapt to changed circumstances caused by climate change. Discuss how these changes will enable the producer to continue to be sustainable. (8 marks)

(b) Identify a consumer trend relevant to the animal production system named in part (a). Discuss the potential impact of a new technology that can be used in this system to optimise production in response to the trend. (6 marks)

(c) Analyse the positive impact of a quality assurance (QA) program, on an enterprise's sustainability, focusing on the triple bottom line. (6 marks)

or

Question 30 **(20 marks)**

The Australian Agricultural Sustainability Framework (AASF) is a unique piece of work which enables a central source of information about Australian agricultural sustainability, providing a visual demonstration of the links between farm practices, markets and the community.

(a) Propose a short-term **and** a long-term goal that is relevant to an animal production system you are familiar with. Explain how aiming for each of these goals could influence intergenerational equity in this system. (10 marks)

(b) Assess how the management of risk could be achieved while integrating the goals proposed in part (a). (10 marks)

End of questions

Question number: _____

Supplementary page

Question number: _____

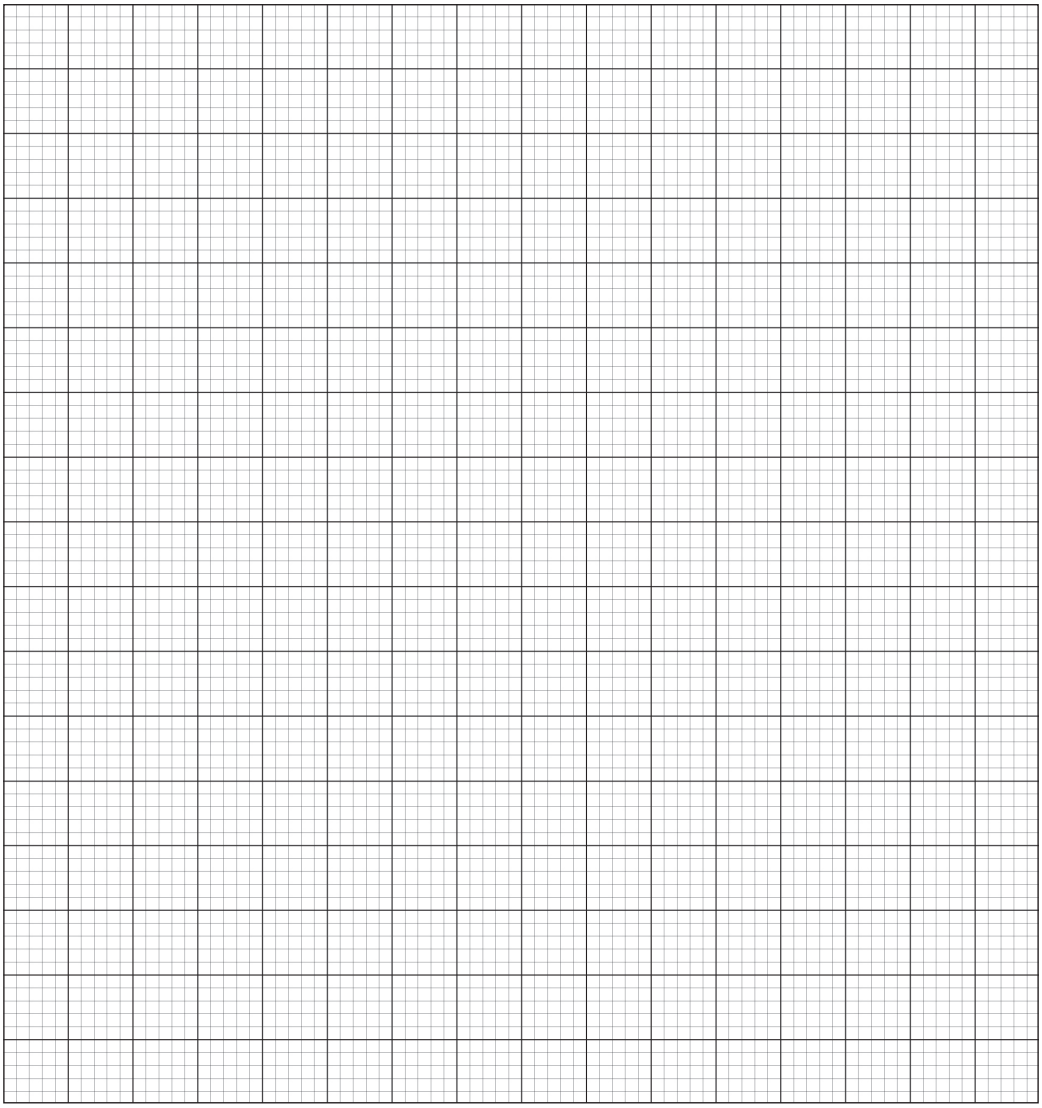
Supplementary page

Question number: _____

Supplementary page

Question number: _____

Spare grid for Question 22(b)



ACKNOWLEDGEMENTS

Questions 8–9 Data from: Meat & Livestock Australia (MLA). (2020). [NLRS eastern states […] lamb]. Retrieved May, 2023, from https://mecardo.com.au/its-the-roast-wonderful-time-of-the-year/

Question 17 Adapted from: Khan Academy. (n.d.). […]. Retrieved May, 2023, from https://www.khanacademy.org/science/ap-biology/heredity/non-mendelian-genetics/a/hs-pedigrees-review

Question 24 Adapted from: El-Wakeil, N. E. (2010, December). Insect Economic Levels in Relation to Crop Production (Figure 3) [Graph]. *Archives of Phytopathology and Plant Protection, 43*(17). Retrieved May, 2023 from https://doi.org/10.1080/03235400902753584

Question 26 Table data from: Patton, J., Kenny, D. A., & Mee, J. F. (2006, May). Effect of Milking Frequency and Diet on Milk Production, Energy Balance, and Reproduction in Dairy Cows (Figure 1) [Graph]. *Journal of Dairy Science, 89*(5). Retrieved May, 2023, from https://www.journalofdairyscience.org/article/S0022-0302(06)72215-9/fulltext

Question 28 Sentence 1 adapted from: National Farmers' Federation. (2018). *2030 Roadmap: Australian Agriculture's Plan for a $100 Billion Industry*, p. 21. Retrieved May, 2023, from https://nff.org.au/wp-content/uploads/2020/02/NFF_Roadmap_2030_FINAL.pdf

Question 29 Paragraph 1: Department of Primary Industries and Regional Development. (2023). *Climate trends in Western Australia*. Retrieved June, 2023, from https://www.agric.wa.gov.au/climate-change/climate-trends-western-australia

Question 30 Adapted from: Australian Farm Institute. (2022). *The Australian Agricultural Sustainability Framework*. Retrieved June, 2023, from https://www.farminstitute.org.au/the-australian-agricultural-sustainability-framework/

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