# Agricultural Science marking guide

External assessment

## Combination response (115 marks)

### Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. describe and explain animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise
2. apply understanding of animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise
3. analyse evidence about animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise to identify trends, patterns, relationships, limitations or uncertainty
4. interpret evidence about animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise to draw conclusions based on analysis.

**Note:** Objectives 5, 6 and 7 are not assessed in this instrument.

# Purpose

This document is an External assessment marking guide (EAMG).

The EAMG:

- Provides a tool for calibrating external assessment markers to ensure reliability of results
- Indicates the correlation, for each question, between mark allocation and qualities at each level of the mark range
- Informs schools and students about how marks are matched to qualities in student responses.

# Mark allocation

Where a response does not meet any of the descriptors for a question or a criterion, a mark of ‘0’ will be recorded. Where no response to a question has been made, a mark of ‘N’ will be recorded.

*Allow FT mark(s)* – refers to ‘follow through’, where an error in the prior section of working is used later in the response, a mark (or marks) for the rest of the response can still be awarded so long as it still demonstrates the correct conceptual understanding or skill in the rest of the response.

# External assessment marking guide

## Paper 1 — Multiple choice

| Question | Response |
|---|---|
| 1 | A |
| 2 | B |
| 3 | B |
| 4 | A |
| 5 | D |
| 6 | B |
| 7 | C |
| 8 | D |
| 9 | C |
| 10 | D |
| 11 | C |
| 12 | B |
| 13 | C |
| 14 | C |
| 15 | D |
| 16 | A |
| 17 | A |
| 18 | B |
| 19 | B |
| 20 | C |

## Paper 1 — Short response (44 marks)

| Q | Sample response | The response: | M |
|---|---|---|---|
| 21 | An agricultural plant product that undergoes post-harvest processing is bananas.<br><br>At the beginning of the process, bunches of bananas are removed from bags and broken down into hands, which are packaged in boxes. In the next step, ethylene and cold storage are used to ripen the bananas. Finally, the bananas are transported from the markets to the stores for sale. | • identifies an agricultural plant product that undergoes post-harvest processing **[1 mark]**<br>• identifies relevant processes **[1 mark]**<br>**AND**<br>• describes features of the relevant processes **[2 marks]**<br>**OR**<br>• describes aspects of the relevant processes **[1 mark]** | |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 22 | $\frac{2000 - 1000}{10}$<br>= 100 head could clear 1 ha in 1 day<br><br>100 hd/ha/25 grazing days<br><br>= 4 head could clear 1 ha in 25 days<br><br>Therefore 4 hd/ha × 10 ha = 40 steers | • identifies key data and relationships for calculating stocking rate **[1 mark]**<br>• shows appropriate working to calculate the stocking rate for a day **[1 mark]**<br>• correctly determines the stocking rate for a 25-day period **[1 mark]**<br>• determines the number of steers that can be run on 10 hectares for 25 days **[1 mark]** | |

<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th><th>M</th></tr>
<tr><td rowspan="11">23</td><td rowspan="11">A foot and mouth disease (FMD) outbreak would impact Australian livestock industries in a number of ways.<br><br>Conclusion 1<br>There would be a significant loss of production because the infected animals would need to be euthanised.<br><br>Conclusion 2<br>This would cause a loss of trade with other countries because markets would shut down until the outbreak was controlled.<br><br>Conclusion 3<br>The cost of control measures would be significant and would include the cost of decontaminating premises. For example, contaminated products would need to be burnt or buried.</td><td colspan="2">Conclusions</td></tr>
<tr><td>• identifies 3 appropriate conclusions</td><td>3</td></tr>
<tr><td>• identifies 2 appropriate conclusions</td><td>2</td></tr>
<tr><td>• identifies 1 appropriate conclusion</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
<tr><td colspan="2">Reasoning</td></tr>
<tr><td>• provides reasoning for 3 conclusions</td><td>3</td></tr>
<tr><td>• provides reasoning for 2 conclusions</td><td>2</td></tr>
<tr><td>• provides reasoning for 1 conclusion</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
</table>

| Q | Sample response | The response: | M |
|---|---|---|---|
| 24 | One strategy would be to improve fencing around the creek to limit cattle access. This would reduce overgrazing and soil erosion, decreasing the turbidity of the water.<br><br>Another strategy would be to reduce water allocation for irrigated fodder crops and rely more on using irrigation for improved pastures for pasture production. This strategy would allow greater flow in the creek and decrease salinity in fresh water. | **Identification of strategies** | |
| | | • identifies 2 appropriate strategies | 2 |
| | | • identifies 1 appropriate strategy | 1 |
| | | • does not satisfy any of the descriptors above. | 0 |
| | | **Explanation of strategies** | |
| | | • explains 2 appropriate strategies | 2 |
| | | • explains 1 appropriate strategy | 1 |
| | | • does not satisfy any of the descriptors above. | 0 |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 25 | High and medium energy feed resulted in a similar lower feed intake compared to low energy feed (2.3 kg/day vs. 1.75 kg/day) and similar lower feed conversion ratios (5.1 vs. 4).<br><br>Both medium and high energy feeds produced higher average daily gains (520 g/day vs. 476 g/day) and fat depth (15 mm vs. 6 mm) at the end of the trial.<br><br>Measured values for medium and high energy feeds suggest a significant difference compared to mean values for low energy feeds.<br><br>In conclusion, to produce fat lambs in a shorter period, higher energy feeds should be provided, to increase production (i.e. average daily gain) and potentially be the better option in terms of feed costs (i.e. food conversion ratio) for optimum production. | • contrasts feed intake and FCR data **[1 mark]**<br>• contrasts ADG and fat depth data **[1 mark]**<br>• draws an appropriate conclusion regarding higher energy feed and increased production **[1 mark]**<br>• draws an appropriate conclusion regarding high energy feed and feed costs for optimum production **[1 mark]** | |
| 26a) | A tariff is a tax or duty that businesses pay on the goods they import. | • describes a tariff **[1 mark]** | |
| 26b) | A free trade agreement is an international treaty between two or more economies that reduces or eliminates certain barriers to trade, such as tariffs. | • describes a free trade agreement **[1 mark]** | |
| 26c) | The European Union (EU) has a high tariff on imported lamb and beef to protect the local sales of EU-grown lamb and beef. | • explains the EU tariff **[1 mark]** | |
| 26d) | The tariff makes Australian-produced lamb and beef more expensive in the EU and, therefore, reduces sales. | • explains the impact of the EU tariff **[1 mark]** | |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 27 | Product A was the most effective treatment for the control of the Varroa mite in honey bees.<br>There were more mites remaining in the hive after treatment for *Metarhizium* compared to Product A (21.14 vs. 0.71).<br>Product A significantly reduced the Varroa mite infestation of the adult bees compared to the control (0.02% vs. 1.93%).<br>Product A significantly reduced the Varroa mite infestation of the adult bees compared to *Metarhizium* (0.02% vs. 0.32%). | • identifies an appropriate conclusion<br>• provides 3 pieces of evidence to support the conclusion | 4 |
| | | • identifies an appropriate conclusion<br>• provides 2 pieces of evidence to support the conclusion | 3 |
| | | • identifies an appropriate conclusion<br>• provides 1 piece of evidence to support the conclusion | 2 |
| | | • identifies a conclusion<br>**OR**<br>• provides 1 piece of evidence to support the conclusion | 1 |
| | | • does not satisfy any of the descriptors above. | 0 |
| 28a) | 2009 — 4%<br>2019 — 32%<br>Percentage change between 2009 and 2019 — 28% | • identifies the percentage of producers that mulesed with pain relief in February 2009 and 2019 **[1 mark]**<br>• determines a consequentially correct percentage change **[1 mark]** | |
| 28b) | The alternative method is breeding. This can be identified from the data in the table. | • identifies that the alternative method is breeding **[1 mark]** | |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 28c) | Producers were reluctant to use the alternative method.<br>The wool growers using the alternative method (i.e. Ceased mulesing and Not mulesed data from the graph) increased from about 2% to just over 15% between 2008 and 2019.<br>However, there has been a far greater increase, from 1% to over 30%, in the number of producers who have continued mulesing but given pain relief.<br>This is probably because it can take a long time (i.e. 10 years) for the alternative method to become effective. | • draws an appropriate conclusion **[1 mark]**<br>• identifies the percentage of producers using an alternative method **[1 mark]**<br>• identifies that there has been a large increase in producers using pain relief **[1 mark]**<br>• explains that alternative methods such as breeding can take a long time to become effective **[1 mark]** | |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 29 | Hydroponic strawberries:<br>$Yield = 85 \times 5.4 = 459\ g$<br>$Cost = \$593.80 + \$47.38 = \$641.18$<br>$\frac{Cost}{kg} = \frac{\$641.18}{0.459} = \$1396.91$<br>Soil-grown strawberries:<br>$Yield = 70 \times 7.1 = 497\ g$<br>$Cost = \$270.59 + \$20.48 = \$291.07$<br>$\frac{Cost}{kg} = \frac{\$291.07}{0.497} = \$440.78$<br>The cost of production of hydroponic strawberries is more than three times that of soil-grown strawberries. A 10% price premium is not enough to compensate for the higher production cost.<br>The best growing medium for strawberries is soil. | • provides correct reasoning to compare production costs<br>• identifies that the 10% price premium does not compensate for the higher production costs<br>• identifies soil as the best growing medium | 4 |
| | | • uses a partially correct process to compare production costs<br>• identifies that the 10% price premium does not compensate for the higher production costs<br>• identifies soil as the best growing medium | 3 |
| | | • uses a partially correct process to compare production costs<br>• draws a consequentially correct conclusion | 2 |
| | | • provides a conclusion<br>• provides a supporting reason | 1 |
| | | • does not satisfy any of the descriptors above. | 0 |
| 30 | An example of a genetically engineered crop is Bt cotton.<br>The benefits of Bt cotton include improved crop yields due to better pest resistance and reduced use of pesticides, which is better for the environment. | • identifies a genetically engineered crop<br>• describes 2 benefits of the identified crop | 3 |
| | | • identifies a genetically engineered crop<br>• describes 1 benefit of the identified crop | 2 |
| | | • identifies a genetically engineered crop | 1 |
| | | • does not satisfy any of the descriptors above. | 0 |

## Paper 2 — Short response (36 marks)

| Q | Sample response | The response: | M |
|---|---|---|---|
| 1a) | 600 days: 51 kg − 35 kg = 16 kg | • provides 16 kg **[1 mark]** | |
| 1b) | The birth weights and live weights of the animals are increasing over time (1.1 kg and 16 kg).<br>If producers continue to select for animals with higher EBVs, the breed will get heavier into the future.<br>Higher birth weights may result in greater calving problems. | • identifies that birth weights and live weights are increasing **[1 mark]**<br>• predicts that the breed will get heavier **[1 mark]**<br>• concludes that calving problems may occur **[1 mark]** | |
| 2a) | An advantage of tissue culture is that a desirable plant can be multiplied rapidly.<br>This can speed up the testing and evaluation time for plant breeders and decrease the time taken to reach commercial production. | • identifies an advantage **[1 mark]**<br>• explains the advantage **[1 mark]** | |
| 2b) | They are clones. | • provides clone **[1 mark]** | |

<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th><th>M</th></tr>
<tr><td>3a)</td><td>$25/kg − $10/kg = $15/kg change</td><td colspan="2">• provides $15/kg change [1 mark]</td></tr>
<tr><td>3b)</td><td>The greatest supply of strawberries is available in spring. This is when the price is decreasing.</td><td colspan="2">• identifies spring as the season of greatest supply [1 mark]<br>• identifies that supply is greater when prices are decreasing [1 mark]</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Variety 3 would be the most profitable variety to plant for commercial use, based on oil content and yield.<br><br>Premium/discount for oil<br>= 1.5% × $592<br>= $8.88<br><br>Variety 1:<br>$592 × 1.87<br>= $1107.04/ha<br><br>Variety 2:<br>($592 + 3 × $8.88) × 1.76<br>= $618.64 × 1.76<br>= $1088.81/ha<br><br>Variety 3:<br>($592 – $8.88) × 2.12<br>= $1236.21/ha</td><td>• correctly applies a correct method to determine the relative incomes per hectare for the 3 varieties<br>• concludes that Variety 3 should be selected</td><td>4</td></tr>
<tr><td>• correctly applies a correct method to determine the relative incomes per hectare for the 3 varieties<br>OR<br>• applies a correct method for determining the relative incomes per hectare for 2 varieties<br>• concludes that Variety 3 should be selected</td><td>3</td></tr>
<tr><td>• correctly determines the income per hectare for 2 varieties<br>OR<br>• applies a correct method for determining the relative incomes per hectare for 1 variety<br>• concludes that Variety 3 should be selected</td><td>2</td></tr>
<tr><td>• correctly determines the income per hectare for 1 variety</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
</table>

| Q | Sample response | The response: | M |
|---|---|---|---|
| 5 | **Plant pest 1: Citrus — fruit flies**<br>Fruit flies infest citrus plants and cause significant damage to seedlings, flowers and fruit, significantly reducing crop yields. | • identifies a plant pest and affected industry **[1 mark]**<br>• describes the pest's effect on the industry **[1 mark]** | |
| | **Plant pest 2: Cotton — bollworm**<br>Bollworms do significant economic damage to cotton crops by damaging the lint in cotton bolls. This negatively influences the yield and quality of the crop. | • identifies a plant pest and affected industry **[1 mark]**<br>• describes the pest's effect on the industry **[1 mark]** | |
| 6a) | Land is often cleared to prepare new ground for cropping. | • provides a reason **[1 mark]** | |
| 6b) | A short-term effect could be soil erosion. A long-term effect could be decreased fertility. | • identifies a short-term effect **[1 mark]**<br>• identifies a long-term effect **[1 mark]** | |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 7a) | **Ethylene**<br>Ethylene is responsible for fruit maturation, and the graph demonstrates that increased application rates of hormone decreases the amount of time taken for apples to mature. | • provides ethylene **[1 mark]**<br>• provides an explanation **[1 mark]** | |
| 7b) | Optimum concentration<br>= 25 mL/$m^2$<br>This is because at greater application rates, the days to maturity do not decrease. | • provides 25 mL/$m^2$ **[1 mark]**<br>• identifies that greater application rates have no effect **[1 mark]** | |
| 8a) | Group 1:<br>Final weight<br>= 4.25 + 0.25 × 120<br>= 34.25 kg<br>Final carcass weight<br>= 34.25 × 0.43<br>= 14.73 kg<br>Group 2:<br>Final weight<br>= 4.25 + 0.25 × 90 + 0.4 × 40<br>= 43.00 kg<br>Final carcass weight<br>= 43.00 × 0.44<br>= 18.92 kg | • determines that<br>– Group 1 final weight = 34.25 kg **[1 mark]**<br>– Group 1 final carcass weight = 14.73 kg **[1 mark]**<br>– Group 2 final weight = 43.00 kg **[1 mark]**<br>– Group 2 final carcass weight = 18.92 kg **[1 mark]** | |
| 8b) | Group 1 is suitable for light export.<br>Group 2 is suitable for domestic manufacturing. | • identifies that the target market for<br>– Group 1 is light export **[1 mark]**<br>– Group 2 is domestic manufacturing **[1 mark]** | |

| Q | Sample response | The response: | M |
|---|---|---|---|
| 9a) | The most suitable crop rotation system is legume fallow.<br>In general, sites that used legume fallow were able to produce a similar yield but use significantly less nitrogen fertiliser. | • concludes that legume fallow is the most suitable crop rotation system **[1 mark]**<br>• identifies that legume fallow produces the same yield with less fertiliser **[1 mark]** | |
| 9b) | Advantages of reducing the use of fertiliser are that it would significantly reduce costs and potential run-off into waterways. | • identifies 1 advantage of the crop rotation system **[1 mark]**<br>• identifies another advantage of the crop rotation system **[1 mark]** | |
| 9c) | A disadvantage of the legume fallow system is that the cost of planting soybeans and ploughing them back into the soil could outweigh the cost of the nitrogen fertiliser. | • identifies a disadvantage of the crop rotation system **[1 mark]** | |

## Paper 2 — Extended response (15 marks)

<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th><th>M</th></tr>
<tr><td rowspan="15">10</td><td rowspan="15">Considering the beef industry:<br><br>**Sustainable social criterion: labour**<br>1. Labour demand is a strength for the beef industry. Stimulus 1 shows that there is a high level of demand for labour in the beef industry (along with sheep and grain farming). However, demand decreased between 2016 and 2011.<br>2. Availability of labour is a strength for the beef industry. Stimulus 3 shows that there is low (i.e. less than 5%) reliance on itinerant workers.<br>3. Working conditions are also a strength for the beef industry. Stimulus 2 shows that over 70% of the workforce comes from owner-operators or family. These workers have a direct stake in the success of the business.<br>**Sustainable social criterion: infrastructure**<br>1. Transport networks are a weakness for the beef industry. These can be prohibitive to people who do not have their own transport, putting greater responsibility on owners to organise transport of workers.<br>2. Telecommunications are a weakness for the beef industry. Lack of access to reliable internet/phone services can be prohibitive to sustainable social practice in many rural situations.<br>3. Social facilities and services are a weakness for the beef industry. In some areas of extensive agricultural production,</td><td colspan="2">**for identification of criteria (components)**</td></tr>
<tr><td>• identifies three criteria</td><td>3</td></tr>
<tr><td>• identifies two criteria</td><td>2</td></tr>
<tr><td>• Identifies one criterion</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
<tr><td colspan="2">**for analysis of labour**</td></tr>
<tr><td>• provides justified analysis of 3 strengths and/or weaknesses</td><td>3</td></tr>
<tr><td>• provides justified analysis of 2 strengths and/or weaknesses</td><td>2</td></tr>
<tr><td>• provides justified analysis of 1 strength and/or weakness</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
<tr><td colspan="2">**for analysis of infrastructure**</td></tr>
<tr><td>• provides justified analysis of 3 strengths and/or weaknesses</td><td>3</td></tr>
<tr><td>• provides justified analysis of 2 strengths and/or weaknesses</td><td>2</td></tr>
<tr><td>• provides justified analysis of 1 strength and/or weakness</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
</table>

<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th><th>M</th></tr>
<tr><td rowspan="11"></td><td rowspan="11">workers need to travel long distances for entertainment and other social needs.<br><br>Sustainable social criterion: standard of living<br>1. Food quality is a strength for the beef industry. There is high demand globally for ‘clean/green’ food. Australia’s traceability systems also support its reputation for producing ‘clean/green’ beef.<br>2. Health is a strength for the beef industry. Many aspects of working on a cattle property (e.g. working outside, working with animals) helps to support physical and mental wellbeing.<br>3. Population distribution is a strength for the beef industry. A growing middle class in China provides a growing market for beef products. This means jobs in the beef industry will still be required into the future.<br><br>There are opportunities for socially sustainable beef production in terms of standard of living where opportunities for growth of the industry exist. However, there are issues with infrastructure that will need ongoing work to continue to find solutions for improving these factors.</td><td colspan="2">for analysis of standing of living</td></tr>
<tr><td>• provides justified analysis of 3 strengths and/or weaknesses</td><td>3</td></tr>
<tr><td>• provides justified analysis of 2 strengths and/or weaknesses</td><td>2</td></tr>
<tr><td>• provides justified analysis of 1 strength and/or weakness</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
<tr><td colspan="2">provides a conclusion</td></tr>
<tr><td>• provides a justified conclusion</td><td>3</td></tr>
<tr><td>• provides a reasonable conclusion</td><td>2</td></tr>
<tr><td>• provides a conclusion</td><td>1</td></tr>
<tr><td>• does not satisfy any of the descriptors above.</td><td>0</td></tr>
<tr><td></td><td></td></tr>
</table>