ANSWERS

Thoroughbred fact sheets

Fact sheet
The History of Australian Thoroughbreds

Fact sheet
Evolution and Classification of the Thoroughbred Horse

Fact sheet
Investigating Thoroughbred Energy, Motion, and Movement

Fact sheet
Business, Economics, and Thoroughbred Racing in Australia

Fact sheet
Biosecurity, Welfare, and Ethical Considerations in the Australian Thoroughbred Industry

Fact sheet
Thoroughbred Nutrition, Behaviour, and Handling

Fact sheet
Thoroughbred Breeding and Genetics

Fact sheet
Research and Development in the Thoroughbred Industry

Fact sheet
Technology and Innovation in the Thoroughbred Industry

Fact sheet
Career Opportunities in the Thoroughbred Industry

Primary Industries Education Foundation Australia

TBA Thoroughbred Breeders Australia

ANSWERS

Fact sheet

The History of Australian Thoroughbreds

a) Student answers will vary. Example answer: Name: Star Kingdom; Date of birth: 30 April 1946; Date of death: 21 April 1967; Country of origin: Ireland; Owners: Wilfred Harvey, Claude Leigh, Alf Ellison, Reg Moses, Stanley Wootten; Breeder: Richard Ball; Notable achievements: 5 major wins (1948-1949) and named 5 time leading sire in Australia (1959-1965).

b) Student answers will vary. Example answer: Since its beginning in 1861, the Melbourne Cup has developed to become a uniquely Australian tradition and is widely regarded as 'the race that stops a nation'. Today, it attracts international attention and is one of Australia's most watched sporting events. Every generation has had horses that have captured the nation's heart, from the first winner, Archer, through to Phar Lap in the 1930's, and beyond.

c) Timeline scale, names of winning horses, and flags from countries of origin will vary for students.

d) Type of graphs constructed will vary for students. Examples may include pie chart, bar graph, column graph, etc. The data presented in this table should reflect data represented in student graphs.

	Graph 1 (1870 - 1890)	Graph 2 (1940 - 1960)	Graph 3 (2000 - 2020)
Australian winners	19	17	3
New Zealand winners	2	4	4
Irish winners	0	0	5
UK winners	0	0	4
Japanese winners	0	0	1
French winners	0	0	2
German winners	0	0	2

e) Students answers will vary. Example answer: The timeline and graphs both clearly indicate a dramatic shift in the numbers of international horses competing in, and winning, the Melbourne Cup in recent years. From its beginning in 1861 through to 1979 (a 118 year period), the race was only won by thoroughbreds originating from either Australia or New Zealand. From 1980 onwards, a clear increase in international winners can be seen. This supports the statement suggesting that the 'Melbourne Cup has evolved over time from being a local Australian event to a prestigious international race, attracting top thoroughbreds from around the world'.

Fact sheet

Evolution and Classification of the Thoroughbred Horse

Horse evolution timeline

Student answers will vary. Timelines should be scaled and information accurate for content on pages 1-3.

Create a dichotomous key

Student answers will vary. Sample representations:

1. Start: Is the animal smaller than 1 metre?

- Yes → Does it have a thick, bushy mane and tail, and small, upright ears?
  - Yes → Shetland Pony
  - No → (Other small animals not listed)
- No → Continue to the next question

2. Does the animal have black and white stripes covering its body?

- Yes → Zebra
- No → Continue to the next question

3. Does the animal have large, pointed ears that are easily noticeable?

- Yes → Donkey
- No → Continue to the next question

4. Is the animal very large, with feathering on its lower legs?

- Yes → Clydesdale
- No → Continue to the next question

5. Is the animal slim and muscular, with solid coat colours like brown, bay, black, or grey?

- Yes → Thoroughbred horse
- No → (If no other traits match, then recheck the identification)

Fact sheet

Investigating Thoroughbred Energy, Motion, and Movement

a) i) 3 x 3.6 = 10.8 km/h
ii) 60 / 3.6 = 16.7 m/s

b) 201.168 metres in one furlong

c) 3200m/201.168 = 15.9 furlongs in the Melbourne Cup (This is rounded to 16 Furlongs)

d) 1 furlong = 201.168m
201.168m/10.6s = 18.98 m/s

e) i) C

ii) B

iii) A

f) B to describe a horse coming out of the gates; A during the middle of the race, and C after the finish line.

g) Newton's first law (the law of inertia)
An object at rest will remain at rest, and an object in motion will continue in motion at constant velocity (the same direction and speed) unless acted upon by an unbalanced force.

Newton's second law (the law of acceleration)
The acceleration of an object depends on the mass of the object and the force applied to it (Force = mass x acceleration; F = ma).

Newton's third law (action and reaction)
For every action, there is an equal and opposite reaction.

h) F_{net} = 1000 N - 280 N
= 720 N to the right.

So the horse will travel with acceleration:
a = F_{net}/m
a = 720 / 502
= 1.4m/s²

The horse will travel with acceleration of 1.4m/s²

i) F_{net} = ma
= 486 x 3.0
= 1458 N
The horse will exert a net force of 1458 N to accelerate 3.0 m/s².

Fact sheet

Business, Economics, and Thoroughbred Racing in Australia

a)

State/Territory	Year	Total Economic Contribution ($ million)	Full-time equivalent (FTE) jobs	Total Household Income ($ million)
Victoria	2016/2017	$3,187.1 million	25,157	$1734.0 million
New South Wales	2016/2017	$3581.1 million	27,601	$1971.1 million
Tasmania	2016/2017	$367.0 million	2,933	$201.1 million
Queensland	2016/2017	$1,187.1 million	9,444	$653.8 million
Western Australia	2016/2017	$562.0 million	4,629	$304.1 million
Australian Capital Territory	2016/2017	$54.5 million	429	$31.4 million
Northern Territory	2016/2017	$122.2 million	991	$71.6 million

b) Student answers will vary. Suggested data representations: bar graph, pie chart, etc.

1. A bar graph provides a visual comparison of the economic contributions between states and territories, highlighting differences so that it is easy to identify which states have the largest and smallest contributions.
2. New South Wales had the highest total economic contribution at $3,581.1 million.
3. The Australian Capital Territory had the lowest total economic contribution at $54.5 million.
4. The total economic contribution varies significantly across states, with New South Wales having the highest contribution ($3,581.1 million), followed by Victoria at $3,187.1 million. States and territories, including the Northern Territory and Australian Capital Territory, have much lower contributions. Factors influencing these trends could include the number of race meetings, the scale of the breeding and training operations, local population size, tourism impact from major events, etc.

c) Student answers will vary. Example answer: The thoroughbred racing industry greatly impacts Australia's economy and communities. It contributes about $9 billion each year and supports 80,000 jobs, contributing significantly to regional economies. The industry also gives back socially, with local race events supporting community needs and larger clubs donating to charities. If the industry declines, it could hurt jobs, local economies, and the community benefits it provides. Therefore, keeping the industry strong is important for both economic and social reasons.

Fact sheet

Biosecurity, Welfare, and Ethical Considerations in the Australian Thoroughbred Industry

a) The term "zoonotic" refers to diseases that can be transmitted from animals to humans. These diseases pose significant risks to both animal and human health, and controlling them is a key aspect of biosecurity in the thoroughbred industry.

b) Hendra virus is a zoonotic disease that affects horses and can be transmitted to humans. It threatens the Australian thoroughbred industry because it can lead to severe illness or death in horses, which directly impacts the industry's productivity. Industry workers, such as veterinarians and stable hands, are also at risk of contracting the virus through close contact with infected horses, which can lead to illness and even death. Spectators and other stakeholders are also at risk if the virus is not contained, particularly at large events where horses gather, such as races or sales.

c) Student answers will vary. Example answer: The thoroughbred industry has adopted several innovations, technologies, and management practices to effectively manage biosecurity threats such as the Hendra virus. Regular vaccinations reduce the risk of outbreaks by immunising horses against the virus. Quarantine protocols help to isolate and monitor horses that may carry infectious diseases when moving between countries, states or stud farms, ensuring that they do not interact with other horses until they are deemed safe. Strict hygiene measures, such as using Personal Protective Equipment (PPE) and regular disinfection of stables and equipment, also help prevent the transmission of zoonotic diseases like Hendra virus. These management practices and innovations help to protect the horse population and the humans who work closely with them, ensuring the safety and sustainability of the thoroughbred industry.

d) Student answers will vary.

Fact sheet

Thoroughbred Nutrition, Behaviour, and Handling

a) The seven nutritional components of a thoroughbred horse's ration are:

1. Carbohydrates
2. Fats
3. Proteins
4. Vitamins
5. Minerals
6. Fibre
7. Water

b) High-powered grains including bruised oats, cracked corn, nuts and mixes. Lucerne chaff, wheaten chaff, Mitavite Athlete Plus (mineral and electrolyte supplement), crushed lupin, whey powder, good quality hay, natural grass, and roughage.

c) Feed rations are individualised for each thoroughbred horse to meet their specific nutritional needs based on factors such as age, activity level, and health status. For instance, a racing horse requires a diet rich in energy, providing carbohydrates and proteins for muscle repair, while a retired horse would need a diet lower in protein due to its reduced energy needs. Individualising the diet ensures that each horse receives the appropriate balance of nutrients for optimal health and performance, preventing overfeeding or underfeeding, which can lead to health issues.

d) Observing the normal behaviour of thoroughbred horses helps stud farm staff and trainers detect any signs of distress, illness, or injury early. By understanding what is normal for each horse, any change to this behaviour can be quickly identified and addressed, which is important for maintaining the horse's health and well-being.

e) Student answers will vary. Suggested answers:

1. Approaching the horse:

- Always approach the horse from their front shoulder so that they can see you.
- Avoid the horse's blind spots and never approach them from behind.
- Give the horse your full attention.
- Make the horse aware of your presence by making a soft noise so they do not startle.

Fact sheet

Thoroughbred Nutrition, Behaviour, and Handling (cont.)

e) 2. Catching a horse in a stable:

- Prepare the lead rope and head collar before entering the stable.
- Look where the horse is before entering the stable.
- Make a soft noise to get the horse's attention before approaching.
- Put the neck strap around the neck before sliding the nose band over the nose, and then buckle the head collar.

3. Holding the lead rein:

- Do not wrap a lead around your hand.
- Always have two hands on the lead when leading young horses.

4. Letting a horse go in a stable:

- Always turn to face towards the stable gate that you entered before letting them go.
- Ensure the arc of the horse is away from you before letting the horse go.
- Never turn your back on the horse.

5. Loading horses on the truck:

- Check that the equipment for leading the horse is in good condition.
- Two people should help to load the horses. One person leads the horse, and the other person works the barriers.
- The person leading the horse should always stay to the side of the horse.
- The person working the barriers holds the partition in place, allowing enough room for the other person to get out after clipping the horse up and taking the lead off.
- Secure the partition in place using the truck pins when the person leading the horse has moved out from the back of the truck.
- Ensure the process is calm and quiet.

Fact sheet

Thoroughbred Breeding and Genetics

a) EE x ee

	e	e
E	Ee	Ee
e	ee	ee

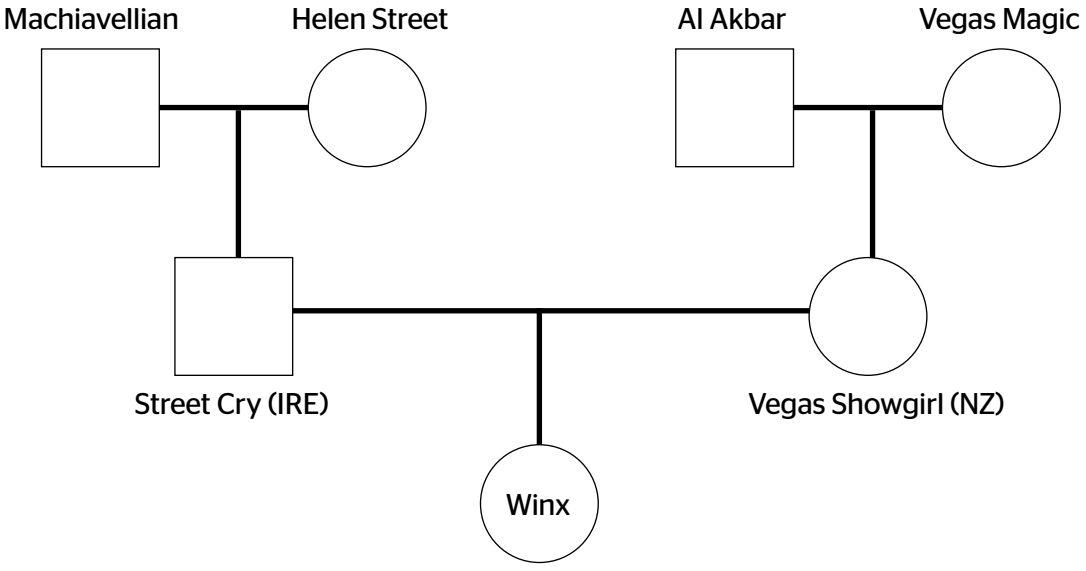
Genotypes:
50% of the offspring will have the genotype Ee (bay coat colour). 50% will have the genotype ee (chestnut coat colour).
Phenotypes:
There is a 50% chance the foal will be bay.
There is a 50% chance the foal will be chestnut.

b) Selective breeding involves choosing specific horses to mate based on their genetic traits to enhance desirable characteristics such as speed, stamina, and strength. It is important because it allows breeders to improve racehorses' performance and maintain healthy bloodlines.

c) A pedigree is a record of a horse's ancestry. It helps breeders predict the likelihood of inheriting desirable traits and avoid genetic health issues by tracking inheritance patterns over multiple generations. It enables breeders to make informed decisions about which horses to mate.

d)
i) Grandsire refers to the father of one of Winx's parents (either sire or dam). Winx has two grandsires. Machiavellian is the grandsire on her sire's side (father of Street Cry), and Al Akbar is the grandsire on her dam's side (father of Vegas Showgirl).
Granddam refers to the mother of one of Winx's parents (either sire or dam). Winx has two granddams. Helen Street is the granddam on her sire's side (mother of Street Cry), and Vegas Magic is the granddam on her dam's side (mother of Vegas Showgirl).

ii)



Fact sheet

Research and Development in the Thoroughbred Industry

a) Student answers will vary. Example answer: R&D projects contribute to the health and welfare of thoroughbred horses by developing advanced technologies and methods to monitor and improve their health. Innovations like genetic testing and digital imaging allow for early detection of potential health issues, enabling prompt treatment and reducing the risk of severe illnesses or injuries. The use of data-driven training technologies helps trainers adjust exercise routines to optimise horse performance safely, enhancing both their physical condition and overall welfare.

b) Genetic testing allows breeders to identify desirable traits such as speed, endurance, and resistance to diseases at the genetic level. This enables them to make informed breeding decisions, selecting horses that are more likely to pass on favourable characteristics to their offspring.

c) Advancements in veterinary science and technology, such as improved diagnostic tools and treatments, lead to healthier, higher-performing horses, resulting in better race results and higher earnings. Healthier horses are more valuable in sales, benefiting breeders, trainers, and owners.

d) AgriFutures Australia: This organisation plays a central role in funding and supporting R&D projects aimed at improving various aspects of the thoroughbred industry, including breeding, training, animal welfare, and environmental sustainability. By investing in research, AgriFutures Australia helps drive innovation and the adoption of new technologies that benefit the entire industry.

Universities: University equine research centres focus on studying equine diseases and injuries, with an emphasis on developing new treatments and preventive measures. Their work is important in advancing veterinary care for thoroughbreds, leading to better health outcomes and enhancing the overall welfare of the horses in the industry.

e) "Developing a Novel Diagnostic Test for Early Pregnancy in the Mare."

f)This research project aims to address the challenge of early pregnancy detection and monitoring in thoroughbred mares, which currently faces a high rate of pregnancy failure despite successful fertilisation. The project seeks to develop a reliable and simple blood test to identify early pregnancies and understand why some pregnancies fail, helping breeders reduce economic losses associated with unsuccessful breeding attempts.

g) Student answers will vary. Suggested answer: By improving early pregnancy detection, this research can lead to more successful breeding outcomes, which will economically benefit breeders by reducing the costs associated with failed pregnancies. Socially, it improves animal welfare by ensuring mares receive appropriate care early in pregnancy.

Fact sheet

Research and Development in the Thoroughbred Industry (cont.)

h) "Improving Racetrack Surface Selection for Safer Conditions for Thoroughbred Racehorses."

i) This project addresses the challenge of racetrack safety, focusing on how different track surfaces impact the performance and injury rates of thoroughbred racehorses. By researching and developing guidelines for safer track surface selection, the project aims to reduce the risk of injuries to horses and jockeys, which is a significant concern in the racing industry.

j) Improving racetrack surfaces can lead to fewer injuries, enhancing the safety and welfare of both horses and jockeys, which has social benefits by promoting a safer racing environment. Economically, reducing injuries lowers the costs associated with veterinary care and lost training time, contributing to a more profitable industry. Environmentally, optimising track surfaces can reduce the frequency of maintenance and resource use, supporting more sustainable management of racing facilities.

Fact sheet

Technology and Innovation in the Thoroughbred Industry

a) Student answers will vary. Answers include: smartphones, apps, computers, sensors, heart rate monitors, cameras, etc.

b) Student answers will vary. Answers include: locomotion (stride length and frequency), recovery heart rates, heart rate zones during work, weight, racing speeds, etc.

c) Student answers will vary. Example answer: Innovations in sports science, through the use of data analytics improve productivity, profitability, and animal welfare in the thoroughbred industry. Using wearable sensors on horses allows trainers to monitor their heart rate, speed, and stride patterns during training sessions. This data helps them understand each horse's needs and abilities, allowing trainers to tailor training programs to suit each horse's needs. This helps to improve their performance without overworking them, reducing the risk of injuries. This is important for good animal welfare outcomes in the industry because it ensures that horses are not pushed beyond their abilities, keeping them healthy and fit. Healthier horses mean fewer days lost to injury and lower veterinary costs, which contributes to improved productivity and profitability in the sector.

Fact sheet

Career Opportunities in the Thoroughbred Industry

a) Student answers will vary.

b) Student answers will vary. Example answer:
Stud Managers have the greatest impact on the environmental sustainability of the thoroughbred industry. Stud Managers make decisions that directly affect the environment, such as implementing pasture management plans that prevent soil erosion and maintain the health of the land. By efficiently managing resources like water and pasture, they help to preserve the environment and ensure that the farm remains productive for future generations. Additionally, by focusing on the welfare of the horses and the sustainability of the farm, Stud Managers contribute to the long-term success and viability of the entire thoroughbred industry. Their actions not only protect the environment but also support the economic sustainability of the industry by ensuring that breeding operations can continue to produce high-quality horses without depleting natural resources.

c) Scenario one: Bloodstock Agent
Scenario two: Event Manager
Scenario three: Stud Manager

d) Student answers will vary.