ADELAIDE ZOO

Mathematics at the Zoo

SECONDARY

ZOOS SOUTH AUSTRALIA

Government of South Australia
Department of Education and Children's Services

Acknowledgements

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For the Teacher

General Information

Welcome to Adelaide Zoo!

The Zoo is a great place for learning. Adelaide Zoo Education aims to support student learning by providing resources to assist classes to have educational and enjoyable experiences at the Zoo.

This booklet will provide a range of activities which may be undertaken by your students during their visit to the Zoo. A map and suggested order of activities is provided to give a logical circuit to travel during the visit.

Animal species change from time to time, and sometimes animals are "off limits" or out of sight during visits, so a flexible approach to completion of activities is recommended.

In planning, please consider whether

- you would like your class to regroup for lunch, animal feeds, the Discovery Zone or at the Entrance at the end of the visit. If so, relay the times and meeting places to students or supervisors (in writing if possible.)
- you would like to see the Pandas or use the Nocturnal House: if so, book a time when making the Zoo booking so your students are not disturbed by other school groups.
- you would like a session with a Zoo Education Officer to support your study theme. Lesson requests are met wherever possible, though at busy times of the year you may need to have a few options with dates to enable a time to be negotiated. Again, this time is arranged at the time of booking your class visit.

If your class is not booked in to a program involving an Education Officer, we will attempt to meet your class at the Entrance on arrival at the Zoo. At this meeting the group will be welcomed and given some information about the Zoo to assist their visit. General behaviour expectations will also be outlined.

Specific information relating to this Zoo Trail will follow for the teachers and for adult supervisors. Please ensure that supervisors have a copy of the relevant pages **before they come to the Zoo** so they can also be mentally prepared to maximise the learning for the students in their care.

Teacher notes - Mathematics trail

This trail will provide students with opportunities to use Mathematics to solve problems in a work environment – the Adelaide Zoo.

It aims to

- encourage the use of different mathematical skills, eg. Estimation, artithmetical calculations, financial costings, graphing, scale diagrams, probability and mensuration in solving realistic Zoo-related problems.
- broaden students' knowledge about the complexity of managing a zoo. Not just in terms of looking after the animals, the zoo environment and resource usage, but also the transfer of animals between zoos, addressing conservation issues and other aspects of zoo business.
- Relate the mathematical skills and thinking to realistic problems.

The booklet is designed for group work with groups of 2-4 recommended. Some of the activities require deep thinking, broad general knowledge or a large number of independent estimations and calculations. These things are more achievable in a team situation. Teamwork in navigation, organisation and writing will also add to students' involvement, learning and enjoyment of the trail.

Some of the activities can be done in the classroom. Some need to be done at the Zoo. Some require information and ideas to be collected at the Zoo, but need to be completed in the classroom. It is probably good to select the activities that you think are most suitable for your class: you could give students a choice of activities to do at the Zoo, a choice of those that need to be completed in school and perhaps the Zoo Poo exercise could be done as a class activitity.

Activities to complete at the Zoo

- Hosmer's skink proportions & scales
- Meerkat behaviour
- Hippopotamus pool water

Activities which require information collection at Zoo and completion at school

- Enclosure design
- Lion enclosure material costs

Activities which could be completed entirely at school.

- Probability of preferred sex in lion cubs
- Meerkat population growth
- Graphing the Zoo population
- Wages of Zoo workers
- Estimates of food and poo at the Zoo.

The activities are discrete, and omitting any particular ones will not impact on the others.

Two blank pages are included at the end to allow more room for notes and calculations: for many of the activities there is not sufficient room on the page to enable detailed answers or calculations. You may want to select the tasks your class will use, add an extra page after each and staple it together as a workbook.

Pre-visit ideas

- Seat the students in the work groups they will be in at the Zoo. They should read through the various activities that they will be doing, and perhaps choose which activities to do depending on how you wish to organise the day. They should discuss and plan out their route, approach to the tasks and individual roles on the day of the excursion.
- Discuss and experiment with ways of estimating things like length or mass. eg. Hand spans, arm span, paces to estimate length or margarine packs, 5kg bags of potatoes, calculators to estimate mass. Students may be able to accurately measure some of these things and to work out how to use them easily in practical situations.
- Encourage students not to be too fussy about estimations – they need to find a balance between wasting too much time and obtaining an estimate which is useful.

Post visit ideas

- Complete tasks, especially those that required data or information at the Zoo, but equipment at school to do a good job. Eg. Lion enclosure costs, enclosure design.
- Undertaking tasks which did not require direct Zoo observations, eg. Wages costs, Meerkat population growth,
- Class activity – Food and Poo at the Zoo. Students at this stage should have seen a lot of zoo animals up close enough to be able to estimate how much food they need in a day. They may have seen many of their poos and have an idea of the mass produced each day etc. With many brains contributing, and using the figures provided, they should be able to come up with some estimates that will provoke further thought.

Links to SACSA Framework

This trail is designed to be inquiry based and student-focussed. Its use by small groups of students, working cooperatively, should strongly support learning processes.

Depending on the activities undertaken, it is possible that the following areas will be addressed.

SACSA Learning Outcomes.

Mathematics – Exploring, analysing and modelling data

4.2

Reads and describes information in given tables, diagrams, line and bar graphs. Makes predictions based on the information, understanding the limitations of data interpretation and the possible social consequences of these limitations. [In] [T] [KC2] [KC6]

3.3 Analyses data to search for patterns in events where the range of outcomes is generated by situations where chance plays a role. [F] [In] [T] [KC1]

4.3

Interprets data and makes numerical statements about probability, models situations, using data to validate their theories about the fairness of everyday situations including hypothetical situations. [F] [In] [T] [KC1]

Mathematics – Measurement

3.4

Selects appropriate attributes and systems to measure for a variety of purposes and reports on how measurement is used in social practice. [In] [T] [C] [KC1] [KC2]

4.4

Selects appropriate attributes and systems to measure for a variety of purposes and reports on how measurement is used in social practice. [In] [T] [C] [KC1] [KC2]

3.5

Uses a range of standard tools to measure relationships between distances and other measurable attributes to calculate size. [T]

4.5

Applies a variety of techniques and tools, uses a range of measurement formulae to solve problems. [T] [KC6]

Mathematics – Spatial sense and geometric reasoning

3.12

Describes and generalises spatial relationships within and between groups of 2-D and 3-D shapes and objects and appreciates their application in a range of cultural contexts. [Id] [In] [KC2]

4.12

Identifies characteristics and properties of 2-D and 3-D shapes and understands how these have influenced the built environment.[In] [KC1]

3.14

Produces, uses and critiques scaled maps and plans and envisages alternative possibilities. [F] [T] [KC3]

Teacher / Supervisor / Student notes for the Mathematics Trail

This trail is designed to be completed by groups of 2-4 students, sharing ideas and jobs.

It is advisable for groups to start working on different activities at different locations. Decide before you start how your group will tackle the tasks on the day.

Read through the tasks carefully and discuss the best way of going about them before starting. Ensure that you answer questions in sufficient detail and show your mathematical workings. If there is insufficient space for this on the activity page, go to one of the spare pages to complete answers.

- For some of the more complex tasks, which will be completed back at school, make sure you gather **all the necessary information** from the animals / enclosure / signage before you move on.
- Where estimations of length and mass are being made, don't get bogged down by being too fussy. Discuss within the group the best way of getting a reasonable estimation in a reasonable time.
- Make good observations of enclosures as well as animals. Notice how the enclosure prevents the animals from escaping. Notice where the off-limits area is, and how the keepers are able to enter enclosures or to capture animals safely.
- Also, notice the type and quantity of food which may be visible, and how it is given to the animals. See if you can see any faeces (poo) around the enclosure. Could you estimate its mass (weight?) How many times a day do you think particular animals "go?" Would it depend on their diet?

Key

 Observe carefully

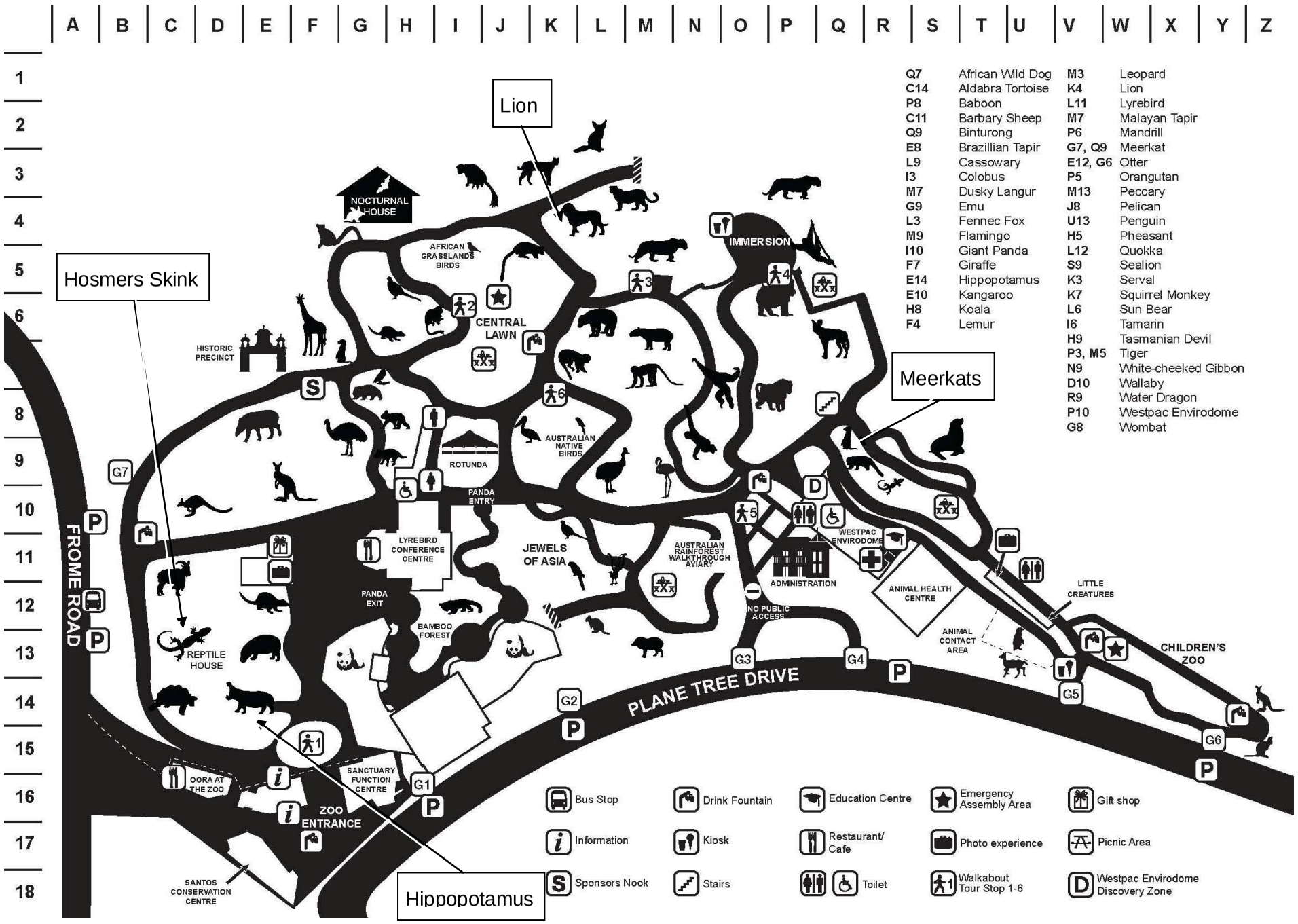
 Discuss and share ideas with your group

 Write down your thoughts

 Challenge question

 Did you know?

 Calculator will help here


A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
1 2 3 4 5 6 8 9 10 11 12 13 14 15 16 17 18
Lion
Hosmers Skink
Meerkats
Hippopotamus
NOCTURNAL HOUSE
AFRICAN GRASSLANDS BIRDS
CENTRAL LAWN
IMMERSION
HISTORIC PRECINCT
AUSTRALIAN NATIVE BIRDS
ROTUNDA
PANDA ENTRY
LYREBIRD CONFERENCE CENTRE
JEWELS OF ASIA
AUSTRALIAN RAINFOREST WALKTHROUGH AVIARY
WESTPAC ENVIRODOME
ADMINISTRATION
NO PUBLIC ACCESS
ANIMAL HEALTH CENTRE
ANIMAL CONTACT AREA
LITTLE CREATURES
CHILDREN'S ZOO
PANDA EXIT
BAMBOO FOREST
REPTILE HOUSE
FROME ROAD
PLANE TREE DRIVE
OORA AT THE ZOO
SANCTUARY FUNCTION CENTRE
ZOO ENTRANCE
SANTOS CONSERVATION CENTRE
Q7 African Wild Dog
C14 Aldabra Tortoise
P8 Baboon
C11 Barbary Sheep
Q9 Binturong
E8 Brazillian Tapir
L9 Cassowary
I3 Colobus
M7 Dusky Langur
G9 Emu
L3 Fennec Fox
M9 Flamingo
I10 Giant Panda
F7 Giraffe
E14 Hippopotamus
E10 Kangaroo
H8 Koala
F4 Lemur
M3 Leopard
K4 Lion
L11 Lyrebird
M7 Malayan Tapir
P6 Mandrill
G7, Q9 Meerkat
E12, G6 Otter
P5 Orangutan
M13 Peccary
J8 Pelican
U13 Penguin
H5 Pheasant
L12 Quokka
S9 Sealion
K3 Serval
K7 Squirrel Monkey
L6 Sun Bear
I6 Tamarin
H9 Tasmanian Devil
P3, M5 Tiger
N9 White-cheeked Gibbon
D10 Wallaby
R9 Water Dragon
P10 Westpac Envirodome
G8 Wombat
Bus Stop
Drink Fountain
Education Centre
Emergency Assembly Area
Gift shop
Information
Kiosk
Restaurant/ Cafe
Photo experience
Picnic Area
Sponsors Nook
Stairs
Toilet
Walkabout Tour Stop 1-6
Westpac Envirodome Discovery Zone

DESIGNING AN ENCLOSURE

?

Background Fifty years ago, zoos were “menageries”, with as many species as possible housed separately in small, concrete cages with bars in front. In most cases the needs of the animal were not met, and animals were stressed, often dying young or failing to reproduce or to raise young successfully. Conservation and extinction were not ideas which occurred to people often as there were still large areas of most ecosystems on the Earth and large wild populations of most species.

Modern zoos are very different. Conservation and good animal management are the highest priorities. This means that when enclosures are designed and built the animals’ needs, in terms of appropriate social groupings, space and behavioural requirements (trees to climb, places to dig, things to do which utilize senses and brains,) are considered. Often several species, which occur in the same habitat in the wild, are located in the same enclosure.

At the same time, the needs of the zoo staff must be catered for: the enclosure must be safe to work in, easy to clean and maintain, and the animals must not pose a danger: night quarters enable animals to be caught safely, and with little stress, for transport or health checks and also allow cleaning of day enclosures to occur safely.

Zoo visitors provide a large share of the Income for the Zoo so their needs must also be met. Good viewing positions, aesthetically pleasing enclosures and appropriate signage and information needs to be provided.

Teaching suggestion: Groups could pick the animal they will use at the Zoo and write down relevant information using observations, signage etc. They can then do the drawings back at school, manually using rulers etc, or perhaps on the computer, using CAD or drawing programs.

Task

*For an animal of your choice**, list** all the things you can about its needs in terms of the enclosure it lives in – its structure, size and extra features needed for behaviour enrichment. Your observations and the signage will help you to do this. List also the needs of the Zoo staff and the needs of the public with respect to the enclosure.*

***Sketch** the main features of an enclosure which would be good for these animals, staff and public – mark in any features such as trees, rocks, ponds, perches, night quarters, hot (electrified) wires, sprinklers, heaters, etc. Indicate how many animals will share this space and what the make-up of the group will be.*

Back at school, draw a neat scale diagram of the enclosure, labeling all the important features directly or with the use of a key. Mark the scale on your design.

PROBABILITY OF PREFERRED SEX IN A LITTER OF LION CUBS

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Background When Zoos breed wild animals, the question arises – Where will the babies go when they have reached sexual maturity, and must be moved away from their parents and opposite sex siblings?

For some species, like the Yellow-footed Rock-wallaby and Bilby, there are places in the wild that young can go, joining populations there. For other species, this is not possible, so zoos and wildlife parks around Australia, New Zealand and Oceania cooperate in exchanging animals to avoid inbreeding and to maintain genetically strong populations within the Australasian region. Exchanges also occur with countries on all the continents of the Earth.

For many species, females are easier to place than males. These are species where one dominant male lives and breeds with a number of females. If extra males are introduced to these groups, in a confined space, the males fight constantly and become stressed or injured. Males from such species often need to be kept alone in enclosures.

For African Lions, the normal situation is for a stable, often related group of females to live together, with their young, and for an unrelated male from another family to dominate the group as the "pride male."

Therefore, when baby lions are born, zoo staff members usually hope that all or most of them are females who will be able to join a pride when they grow up, without much trauma!

In January 2004, an African lioness gave birth to 4 cubs at Adelaide Zoo.

Task:

a) Using whatever method you wish, calculate the probability that all four babies would be male!!! ***Show your working out.***

b) *Using whatever method you wish, calculate the probability that there will be 2 males and 2 females. (Hint: The answer is not ½ !)* ***Show your working out.***

SCALES & RELATIVE PROPORTIONS IN HOSMER'S SKINKS

Background Hosmer's skinks are lizards which come from northern Queensland. They are vivaparous, which means they give birth to live young, rather than laying eggs. Like most reptiles, and unlike mammals, the babies have almost identical body proportions to the adults.

Hosmer's skinks' bodies are covered in short spikes, and when trying to escape from predators they have a habit of squeezing into a crevice in rocks and puffing their bodies up. The spines grip onto their surroundings, and they are very hard to remove.

Teaching suggestion: Task 2 & 3 could be done back at school

Task 1: Estimate how many scales there are on the Hosmer skink's body, ignoring its legs!!

How???

1. *Imagine the skin of the lizard as a sock that gets skinny at the tail end. On your page draw the skin at actual size as it would be if it was a sock and you flattened it. (So you can see one side of the skin).*
2. *Although the scales are not rectangular, draw one on its back that is a rectangle of about the right area.*
3. *If you think the size varies a lot as you go from head end to tail end, divide the sock into zones and draw an actual size, but rectangular scale, in each zone.*
4. *Now create a grid all over the sock (or all over the zone) where the sides of the rectangles are based on the scale(s) you drew.*
5. *Use a calculator to help you work out how many scales in the whole skin. (Don't forget about the side you cannot see).*

Task 2: Write down, with reasons, how accurate you think your estimate is.

Task 3: a) Given the data below, work out ***how many times*** *longer the adult is than the newborn.*

1. Then work out ***how many times*** *heavier the adult is than the newborn.*

Average length at birth:	140mm
Average mass at birth:	14g
Average length at maturity:	230mm
Average mass at maturity:	95g

c) Challenge question: Discuss and write down why the two figures you have calculated are not the same: ie. Why the proportion of adult to baby mass is so much greater that the proportion of adult to baby length.

MEERKATS - POPULATION GROWTH & BEHAVIOUR

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Background Meerkats are small mammals which are related to the mongoose family. They live in semi-arid areas and open plains in southern Africa in groups, or gangs, of up to 30 individuals. They hunt for insects, spiders, scorpions, millipedes and even small mammals and reptiles. They communicate using many different noises and cooperate in raising and caring for young and keeping lookout for predators in the air or on the ground.

In most gangs, only the "alpha pair" breeds, having an average of 3 offspring every 11 weeks if conditions are ideal. Young reach sexual maturity at 12 months of age, and if enough area is available, other pairs occasionally will also begin to breed.

In the Zoo situation, it is important that breeding amongst closely related individuals is avoided. Young animals that are bred at the Zoo and are ready to start breeding themselves are generally relocated within the Australasian region to be with populations of unrelated individuals.

At Adelaide Zoo, the Meerkats near the Giraffe exhibit have been successfully breeding for some time. Currently only the alpha pair breeds.

Task 1 :

A single pair of Meerkats are put into a new exhibit which is suitable for a colony of 30 individuals. Assuming that breeding conditions are ideal, how long will it be until the target number is reached if only the alpha pair breed? ***Show how you reached your answer.***

Task 2:

Meerkats are very active animals. Choose one particular animal to observe. Make sure you can identify him/her amongst the others. (Look carefully at its ears or tail for identifying marks or features.)

*Use a watch to observe this animal for 10 minutes. Every 30 seconds, record what the animal is doing **at that moment** on the tally chart below. If its behaviour is not listed, write it down as one of the "Other" options. At school graph your results using a spreadsheet program.*

Behaviour	Tally	Total
Walking		
Sitting on hind legs		
Standing on hind legs		
Eating		
Vocalising		
Resting / sleeping		

Behaviour	Tally	Total
Out of sight		
Investigating/exploring		
Digging		
Grooming		
Other……		
Other……		

ESTIMATING THE VOLUME OF WATER USED IN THE HIPPOPOTAMUS EXHIBIT

Background Hippopotamus are very large animals (4-5 tonnes) which live in a hot, arid climate in Northern Africa. They are fairly nocturnal: during the day they doze, fully submerged, in the water, and at night they come up onto the river bank to graze. At night, if they hear a lion roaring they scramble back into the river for safety. Hippopotamus defaecate (poo) into the water, and in the wild there are schools of fish which eat this and are food for other animals in the food web.

At Adelaide Zoo, the hippopotamus are mostly fed at night in their night quarters. Their exhibit pool must be emptied and cleaned on a weekly basis for hygiene purposes. It is drained on Wednesday night, cleaned on Thursday morning before the hippos are let out, and gradually filled up during the day. Because the hippos are so easy to see on Thursdays, at 1.30pm volunteers feed them large pumpkins. The hippos eat these whole, slicing them up with their huge, sharp teeth. The public, as well as the hippos, enjoy this event.

Currently the water from the draining of pools goes into the sewage system. Some Zoo staff are investigating ways that it could be treated and used elsewhere in the Zoo.

Teaching suggestions. You could ask the students to sketch the shape of the pool, with no scale, on blank paper to start with. Use pencil and be free to redraw and adjust till they have a shape that looks good for them. Then start to pace a few sides so they can transfer the shape to the graph paper. Remember it is an ESTIMATE ONLY, without calibrated instruments and no access to the inside parts – don't let them get too fussy!

Task:

Use the graph paper on the next page to sketch the pool as accurately as you can by pacing and observation.

a) *Knowing the scale you are using on the sketch, estimate the area of the pool surface in m^2. The average depth of the pool, ignoring the 2 sets of steps, is 2.1m.*

b) *Estimate the volume of the pool in kilolitres ($1m^3 = 1kL$), ignoring the steps.*

c) *If the cost of mains water to the Zoo were the same as to domestic consumers, ($2.26 /kL for more than 130kL/yr), what would be the annual cost of replacing the hippopotamus water?*

d) *Notice other exhibits where you find ponds of water, which may also need regular replacement.*

GRAPHING THE ZOO POPULATION

Statistics are presented below for the animal collection at Adelaide Zoo in June, 2009.

	Mammals	Birds	Reptiles	Amphibia	Fish	Invertebrates	Total
Species/subspecies	70	139	39	2	11	14	279
Specimens	356	689	178	40	138	277	1978

This task could be done entirely at school – perhaps as a follow up to the visit.

Task 1.

1) *Graph the total **number of species/ subspecies** for each category of animal in a pie graph. It may be possible for you to do this using a computer spreadsheet or a graphics calculator.*

2) *Graph the total **number of specimens** for each category of animals in a pie graph.*

Task 2.

Challenge question: Thinking about the animals you have seen at Adelaide Zoo, how useful would these pie graphs be for someone who is concerned with the cost of food for different categories of animals? Give some reasons for your answer.

ESTIMATING THE COST OF THE AFRICAN LION ENCLOSURE

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Background: Until late in 2003, the lions lived in an enclosure which has now been demolished. It was a single cage with 2 dens at the back. It was ¼ the area of their current day yard.

When breeding in the wild, females go away from the pride (family) to a safe, secluded place to give birth and to spend the next few months with their cubs. They then return to the pride with their cubs. In the old lion enclosure the only retreat for cubbing was the small den at the back of the enclosure: Consequently successful breeding of lions at Adelaide Zoo has not been possible. (Any babies born were deserted or eaten because suitable conditions were not available for the mothers).

In 2003 the Zoo undertook a major revamp of the big cat enclosures. The lions have 2 separation yards for cubbing or night quarters as well as a much larger open area for them to exercise. This has provided suitable conditions for successful breeding of African lions in 2004.

Q. Why keep African lions at Adelaide Zoo when there is so much more space at Monarto Zoological Park (our sister Zoo) for them?

A. 1. For Education: many more people visit Adelaide Zoo than Monarto each year (about 380,000 compared to 100,000), and have the opportunity to learn about African Lions and the conservation issues they face.

2. For Economic reasons. Lions are an "icon" species that draws in people to the Zoo. The Adelaide Zoo is funded largely by gate takings. To run the Zoo and the many important conservation programs it is involved in, it is vital to maximise the number of visitors!

Teaching suggestion: This activity requires careful observation, diagrams, note-taking, many estimates of distances and heights, use of mensuration formulae and numerous mathematical calculations. It would make an ideal group task, with the group deciding what tasks need to be done and dividing them up amongst group members. Final figures for each type of material should be supported by clear working out, which includes any assumptions used.

The initial data could be collected during a Zoo visit, but calculations etc. should done back at school – otherwise the exercise will take up too much excursion time.

The new African Lion Enclosure (main open area) was built using labour from Zoo employed trades people.

TASK :

Estimate the total cost of materials *for the new exhibit given the following approximate cost information.*

Thicker uprights	$80	each	Pavers	$16	per m^2
Thinner uprights	$50	each	Concrete base for fence	$25/m	
Enclosure mesh	$35	per m^2	Moss rocks	$50	per tonne
Upright pineposts	$8	each	Mulch	$30	per m^3
Horizontal pineposts	$12	each	Mound soil	$15	per m^3
Weldmesh	$80	per sheet	Irrigation system	$3	per m^2
Plastic around perimeter	$10	m	Door from cat tunnel	$1200	each
Electric wire holder	$6	each	Security padlocks	$110	each
Plants – outside & inside	$5	each	Wire to attach mesh	$8	per 100m
Trees	$60	each	Big signage- main sign	$2016	
Metal reinforcement for fence	$10	per m of concrete	- small images	$94	each
Paint	$4.50	per L (one L/ apx $10m^2$)	- supporting poles	$108	each

ZOO WORKERS

Background Most people thinking about Zoo workers think immediately of keepers. Some also think of veterinarians and veterinary nurses. The list below indicates the jobs of paid workers at Adelaide Zoo. (About 300 unpaid Volunteers also contribute time to work regularly at the Zoo.)

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Numbers of employees are given where it is more or less than one.

The Zoo is open everyday of the year, so some workers, such as keepers and Gate staff, are employed in the same numbers every day. On weekends and public holidays, most other workers do not work, though a skeleton staff of maintenance, finance and veterinary staff still need to work then.

EMPLOYEES AT ADELAIDE ZOO

Chief Executive	Director of Conservation Programs
Assistant Director Conservation Ark	Curator
Sponsorship Manager	
Marketing, Media and Visitor Services Manager	
Marketing, Media and Visitor Services Assistants x 6	
Veterinarian x 4	Vet nurses x 3
Finance manager	Human Resources & Safety Manager
Species Management Officer	Animal Transfers Officer
Retail Manager	Retail Assistants x 2
Finance Officer x 3	Administration Officer x2
Administration Assistant x 4	Sponsorship/Membership Officer
Librarian x ½	Client Services Officer
Interpretation Manager	Interpretation Officers x4
Volunteers Coordinator	Gate keepers x 5
Research scientists x2	Education Officers x 3
Education Clerical Officer	Supervisors of animal departments x 4
Keepers x 35	Horticulturists x 6
Supervisor of Works	Bricklayer
Painter	Plumber
Storeperson	Welder
General Hands x 3	Human Resource Officers x2

Task: To calculate the approximate annual wages bill for the Zoo and to consider whether the Zoo could be self-sufficient. Employment expenses are the largest single expense at the Zoo.

a) Task: Estimate the Zoo's annual employment expense…….How?

Discuss the jobs listed above amongst your group.

For each job write down what you think would be a reasonable gross weekly wage for the position.

Considering the number of employees in each position, calculate a total weekly gross wage bill for the Zoo.

Now calculate total annual wages bill for the Zoo.

Add another 20% to this figure for 'on-costs'. These are charges like payroll tax, superannuation, leave allowances and Workcover, which the Zoo must pay for employees.

b) Apart from wages of workers, what would be some of the other big expenses of running a Zoo?

c) *Task: Estimate the annual income collected at the Zoo gates …..How?*

Find out the public entry costs for the Zoo? (Check out the prices at the Entrance or on the website – www.zoossa.com.au .)
School entry is $8.50 or $6.50 (country & disadvantaged school price.)
Each year the Zoo has about 400,000 visitors including about 65,000 school students.

Estimate the income collected from school groups. Most of the teachers and supervisors with school groups have free entry. Write down any assumptions you make about cost of entry per student.

Estimate the income from members of the public. Write down any assumptions you make about cost of entry per person.

What is the total annual gate takings you have estimated?

d) *Considering your estimates for the gate takings and the employment costs, not to mention other big expenses, it is probably clear that the Zoo could not support itself by Zoo entry charges alone.*
Why is the Zoo reluctant to charge more at the gates?

What do you think are the other sources of income which keep Adelaide and Monarto Zoos from going bankrupt?

ESTIMATES OF FOOD & POO AT THE ZOO.

Background Efficient management of food and manure are essential functions in Zoos.

Good quality, appropriate food must be ordered in accurate amounts (and not wasted) for a range of animals that includes snakes, giraffe, tigers, wombats, baboons, finches, penguins, red backed spiders and chickens, to name a few. The food stores staff must order in appropriate amounts of food for all animals, accept suitable donations (eg. of lame horses, spotted or small fruit,) store food properly and organise its distribution to different animal departments on a daily basis.

The Works department, on the other hand must organise for the collection of manure (stored in wheelie bins within each animal department) several times per week. This manure is sent to a business which mulches it and produces bags of "Zoo Poo" which are returned to the Zoo and sold through the Zoo shop as fertilizer.

Teaching suggestion: This task can be done entirely at school. It would be a fun activity to do as a class exercise, using many heads to come up with suitable assumptions to base calculations on. Alternatively it could be done by groups and individuals, then discussion generated about differences in estimates between groups.

Task

a) *Using your knowledge of animal needs and activity levels, the information given below and the numbers in the table as a guide,* ***estimate the mass (weight) of food consumed daily at the Zoo****.*

Write down assumptions you use to simplify your calculations.

Eg. 30 primates from Tamarins to Orangutans. Assume a Baboon is an average-sized primate. Considering that they are fairly active animals, I'd guess that a baboon would need about 2kg of food daily. X 30 primates = 60kg food for primates daily

(The actual variety of foods consumed by particular animals is amazing, so just worry about the masses you expect them to consume.)

b) *Once you have an estimate for food used, estimate the ratio of Food Weight : Poo Weight you would expect. You may want to think about domestic animals at home to help with this.*

Use the answer to part a) and the ratio you have given to ***estimate the mass of poo which is produced daily at the Zoo.***

Animal information

Mammals include 2 Sea Lions, 11 Otters, 5 bears, 7 big cats, 7 African wild dogs, 7 medium cats, 30 Primates, 20 Kangaroos and Wallabies, 6 Echidna, 4 Bilbies, 3 Quockas, 2 Bettongs, 5 Possums, 2 Quolls, 2 Tasmanian devils, 2 Koala, 3 Tree kangaroos, 2 wombats

Ungulates: 2 Giraffe, 6 Deer, 6 Barbary sheep, 6 Tapir, , 2 goats, 2 Hippopotamus, 1 Pygmy hippopotamus.

Others: 5 peccary, 6 agouti, 8 bats, 15 meerkats, 5 Red panda,

Birds range from tiny Finches to Cassowaries.

Reptiles range from Anaconda and American alligator to baby Bearded dragons (less than 1g.)

Invertebrates range in size from Red backed spider (<0.1g)to large Yabby (apx 200g)

Fish range from tiny native fish (< 1g) to Queensland lung fish (>4kg)

	Mammals	Birds	Reptiles	Amphibia	Fish	Invertebrates	Total
Species/subspecies	70	139	39	2	11	14	279
Specimens	356	689	178	40	138	277	1978

Pages for notes and calculations

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