Maps

Activity 7.1 Maps

1. Use the map to answer the questions.

Survivor map

North

Challenge area

Tribal Council

(Island)

(Sea)

Camp

Water

1 km
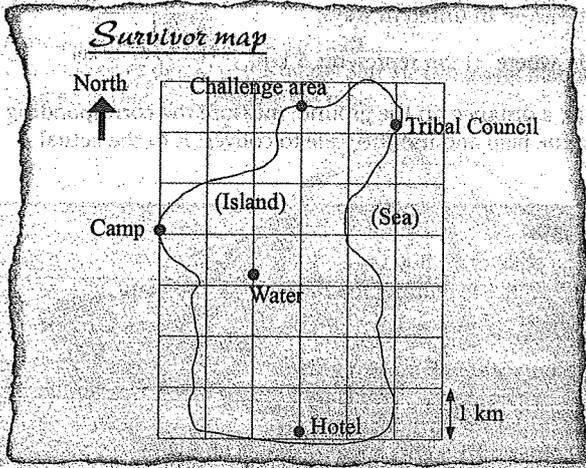
Hotel

West

a) Which place is East of the Tribal Council?

b) Approximately how far is the hotel from the challenge area?

c) Where would you be if you moved North from the hotel three blocks and then West one block?

d) Where would you be if you move three blocks to the East from the camp and then North three blocks?

e) Describe the shortest route from the water to the camp travelling along the grid lines and remaining on the island.

Example

A map has a scale of 1 : 500 000.
What real distance is represented by 2 cm on the map?

Solution

1 cm represents 500 000 cm = 5 km

2 cm represents 10 km

2 cm on the map represents a real distance of 10 km.

Activity 7.2 Distances and maps

30 minutes

1. A model giraffe is made to a scale of 1 : 150.
What does this tell you about:
   a) the height of the actual giraffe
   b) the height of the model giraffe?
   c) the height of the actual giraffe if the model is 3,5 cm tall.

2. A map has the scale:

0 m   10 m   20 m   50 m

Use the scale bar to determine:
   a) how many centimetres on the map represent an actual distance of:
      i) 20 m
      ii) 50 m
      iii) 100 m
   b) how many metres on the ground are represented on the map by:
      i) $\frac{1}{2}$ cm
      ii) 8 cm
      iii) 20 cm

3. A map has a scale of 2 cm representing 1 km.
If two villages are 8 cm apart on the map, what is the actual distance between the villages?

Exercise

An architect draws a map of a shopping centre.

Grocery store	Music shop	Sports shop	Clothing shop	
Coffee shop		PARKING		North
Toilets				Main road
Restaurant	Clothing store	Physiotherapy	Health and Fitness centre	
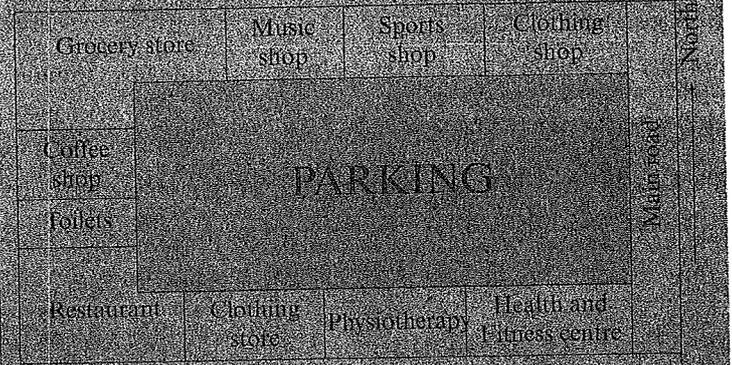
a) If you are facing the sports shop, which shop is directly to the left of the sports shop?

b) Describe the position of the coffee shop in relation to the grocery store in terms of North, South, East or West.

c) If you are travelling south along Main Road, would the parking be on your left or on your right?

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4. A map has a scale of 1 : 400.
Calculate the real distances represented on the map by:
   a) 8 cm
   b) $2\frac{1}{2}$ cm

5. A model is made using the scale 1 : 20.
The table gives details of the model and the real Moses Mabhida Sport Stadium in Durban. Complete the table.
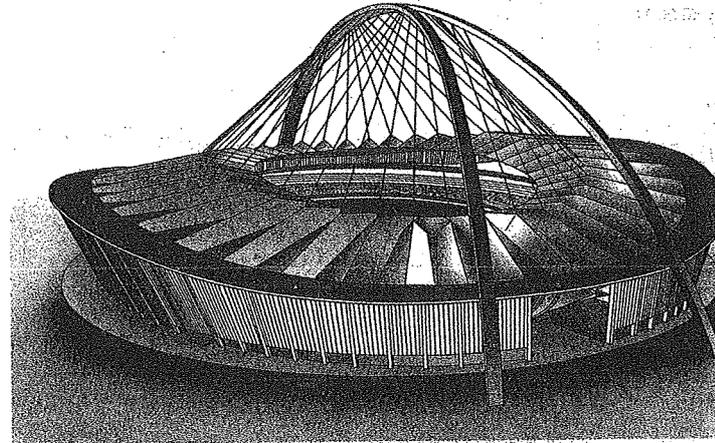
A model of the Moses Mabhida Sport Stadium in Durban.

		Model	Real stadium
a)	length of the field	600 cm	
b)	height of the stadium		30 m
c)	height of entrance gate	20 cm	
d)	width of entrance gate		5 m
e)	width of field	450 cm	
f)	number of seats		70 000

6. A map has dimensions 25 cm by 37,5 cm.

The scale printed on it is 1 : 2 000.

The map is reduced in size to fit a space of 10 cm by 15 cm in a book.
   a) How must the scale of the map in the book be adapted?
   b) What are the dimensions on the map of the rectangular area on the ground?

Lists, two-way tables and tree diagrams

Calculating the probability can be made easier by systematically listing all the possible outcomes.

Example

An absent-minded man writes three letters and addresses three envelopes.
He then puts the letters into the envelopes at random.
Determine the probability that:
a) all the letters are mailed to the correct person
b) exactly one letter gets mailed to the correct person.

Solution

Let A, B and C represent the envelopes and a, b and c their corresponding letters.
The shows the possible ways the letters can be put in the envelopes.

| A	B	C	
a	b	c	(3 correct)
a	c	b	(1 correct)
b	a	c	(1 correct)
b	c	a	(0 correct)
c	a	b	(0 correct)
c	b	a	(1 correct)
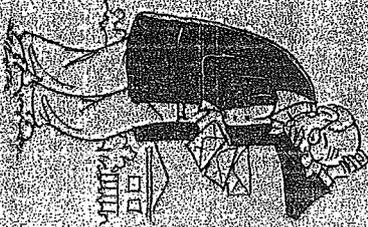
a) $P(\text{correct}) = \frac{1}{6}$
b) $P(\text{correct}) = \frac{3}{6} = \frac{1}{2}$

Note

In probability the word includes the possibility of 'and'.
For example, 'a head or a prime number' means 'a head, a prime number, or both a head and a prime number'.

A prime number is a number greater than 1 whose only two factors are 1 and itself.
Example of prime numbers: 2; 3; 5; 7; 11; 13; 17; 19; 23.

A compound event consists of two or more separate events or outcomes to be considered as one single event or outcome.
If a compound event consists of two happenings, a two-way table can be used to get all possible outcomes in a systematic way.

Example

A coin and a dice are thrown simultaneously.
Draw a two-way table to determine the probability of getting:
a) a tail and a four
b) a head and a prime number
c) a head or a prime number.

Solution

	1	2	3	4	5	6
H	H1	H2	H3	H4	H5	H6
T	T1	T2	T3	T4	T5	T6

a) $P(\text{T and 4}) = \frac{1}{12}$
b) $P(\text{H and prime number}) = \frac{3}{12} = \frac{1}{4}$
c) $P(\text{H or prime number}) = \frac{9}{12} = \frac{3}{4}$

Example

Two dice are rolled simultaneously.
Use a two-way table to determine the probability that the total number of the dots on the uppermost faces is nine.

Solution

Dice B

Dice A	1	2	3	4	5	6
1	1;1	1;2	1;3	1;4	1;5	1;6
2	2;1	2;2	2;3	2;4	2;5	2;6
3	3;1	3;2	3;3	3;4	3;5	3;6
4	4;1	4;2	4;3	4;4	4;5	4;6
5	5;1	5;2	5;3	5;4	5;5	5;6
6	6;1	6;2	6;3	6;4	6;5	6;6
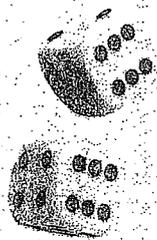
Total number of possible outcomes: 6 × 6 = 36
Number of successful outcomes (shaded cells): 4
$P(9 \text{ dots}) = \frac{4}{36} = \frac{1}{9}$

If a compound event consists of more than two happenings, it is not possible to list the possible outcomes on a two-way table.
If a compound event consists of two or more happenings, a tree diagram can be used to get all the possible outcomes in a systematic way.

Example

A parent having three children is chosen at random. Use a tree diagram to determine the probability of this mother having two boys and one girl in any order.

Solution

Let B denote a boy and G a girl.

1st child	2nd child	3rd child	Outcome
B	B	B	BBB
		G	BBG
	G	B	BGB
		G	BGG
G	B	B	GBB
		G	GBG
	G	B	GGB
		G	GGG
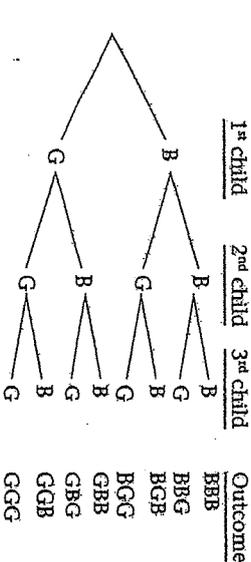
Total number of possible outcomes: 8
Number of successful outcomes: 3
$P(2 \text{ boys, 1 girl}) = \frac{3}{8}$

Theoretical probability

Example

A dice is rolled.
Calculate the probability of getting:

a) 2 b) an even number c) not 2

Solution

There are 6 possible outcomes (1; 2; 3; 4; 5; 6).

a) There is one successful outcome (2).
$P(2) = \frac{1}{6}$

b) There are three successful outcomes (2; 4; 6).
$P(even) = \frac{3}{6} = \frac{1}{2}$

c) There are 5 successful outcomes (1; 3; 4; 5; 6).
$P(not\ 2) = \frac{5}{6}$

Or: $P(not\ 2) = 1 - P(2)$
$= 1 - \frac{1}{6}$
$= \frac{5}{6}$

Example

There are ten contestants in a *Survivor* series.
Four contestants are female.
Three females are below 40 years.
Five men are below 40 years.
Calculate the probability of the winner being a:

a) female
b) male
c) female under 40
d) person 40 years or older

Solution

a) $P(female) = \frac{4}{10} = \frac{2}{5}$

b) $P(male) = \frac{6}{10} = \frac{3}{10}$

c) $P(female\ under\ 40) = \frac{3}{10}$

d) $P(40\ or\ older) = \frac{2}{10} = \frac{1}{5}$

Activity 8.2 Theoretical probability

30 minutes

1. A coin is taken at random from a purse.
   What is the probability of taking:
   a) a R1 coin
   b) a silver coin
   c) a coin worth less than 50 cents?

2. At an intersection, traffic lights are green for 1 minute, amber for 5 seconds and red for 55 seconds. What is the probability that a motorist arriving at the traffic light finds it:
   a) green b) amber c) red?

3. A box contains 20 coloured balls. Five balls are blue.
   a) What is the probability that a ball, taken at random, is blue?
   b) The probability of taking a green ball is $\frac{1}{5}$.
      How many green balls are there in the box?
   c) The remainder of the balls are yellow.
      What is the probability of taking a yellow ball at random?

4. Complete the table showing the probabilities of favourable outcomes when a dice is thrown.

Favourable outcome	Probability		
	Fraction	Decimal	Percentage
Getting a six			
Getting an odd number			
Getting a multiple of three			
Getting a number smaller than five			

5. The numbers 2; 2; 5; 7; 8 and 9 are written on a small cube.
   When the cube is rolled once, what is the probability of getting:
   a) 2 b) 3 c) 5
   d) not 7 e) a number less than 8

6. Lindiwe celebrates her birthday on 24 March.
   What is the probability that Lindiwe's best friend celebrates her birthday on the same day?

7. Suppose you tossed a coin four times and the outcome was H; H; H; H.
   What is the probability of getting another H with the next throw?

8. Volume 1 to Volume 10 of a series of books is in the correct order on a shelf.
   Jeff takes out Volumes 3, 4 and 5 and looks through them.
   He then puts them back in random order between Volume 2 and Volume 6.
   What is the probability that:
   a) the books are all in the correct order
   b) exactly two books have to be swapped to get all the books in the correct order?

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