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| INVESTIGATION | **MATHEMATICS** |
|  | **Level 4** |

# The top places to live

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| **MCj02833590000[1]Strands** | **Topics**  |
| **Number** | Number concepts |
| **Chance and Data** | Data |
| **Space** | Location, direction and movement |
| **Outcomes N 4.1, CD 4.2, S 4.2** |

## Investigation

The editor of a travel magazine wants to include an article about the best countries to live in.
Your job is to present information that compares the standard of living in Australia with that of three other countries on three different continents. Use a variety of methods including data displays, data analyses and maps to support your conclusions.

## Overview

The following table shows how this investigation is organised in phases associated with **thinking, reasoning and working mathematically.**

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| Thinking, reasoning and working mathematically |
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| 1. Identifying and describing |  | 2. Understanding and applying |  | 3. Communicating and justifying |
| Discussing standards of livingStudents:discuss and define ‘standard of living’ discuss the standard of living in Australia and compare it to other countries.Unpacking the investigation Students:discuss and clarify the requirements of the investigationidentify prior mathematical knowledge about number, collecting data and using maps that may assist in carrying out the investigationchoose countries to investigate and identify features of the standards of living about which they intend to collect statistical information. |  | Understanding data collection Students: revise data-collection methods, and data displaysUnderstanding number conceptsStudents: revise relevant number concepts Gathering information from mapsStudents: revise how to use conventions of maps to extract information Conducting the investigationStudents:research, gather and record relevant data about the standards of living in three countries use maps to identify relevant informationdraw conclusions about the standards of living in their chosen countries compared to that of Australia. |  | Presenting conclusions Students: present their conclusions and describe the procedures and strategies usedcompare their findings with other students’ findings about the same countries and review their conclusions.Creating the ‘top countries’ listStudents:compare statistical information of all countries researched and order countries according to agreed criteriaidentify the top countries according to the ordering of the data.Reflecting on the learningStudents:consider the new learning that has occurred and relate their findings to their own situation. |

## Core learning outcomes

This investigation focuses on the following core learning outcomes from the *Years 1 to 10 Mathematics Syllabus*:

**N 4.1** Students compare and order whole numbers and common and decimal fractions of any size, make connections between key percentages and fractions, and describe how a range of factors influence financial decisions.

**CD 4.2** Students plan and carry out data collections using their own data record templates, choose and construct appropriate displays and make comparisons about the data based on the displays and measures of location.

**S 4.2** Students interpret maps and plans with reference to conventions including latitude and longitude for maps, and describe movements using compass points and distance.

Using this investigation

The sequence of activities suggested in this investigation provides opportunities for students to demonstrate learning described by core learning outcomes or aspects of core learning outcomes. The investigation may be modified to provide opportunities for students to demonstrate learning described by core learning outcomes at other levels.

Contribution to the attributes of a lifelong learner

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| **Knowledgeable person with deep understanding** | Students identify the familiar mathematics in the investigation, compare and order numbers, carry out data collections and interpret displays. They use the conventions of mapping to gain information about other countries and analyse the information to form an opinion about the standards of living in the selected countries. |
| **Complex thinker** | Students make conjectures and inferences about the standards of living in other countries based on their data collection and analysis. They develop these ideas by analysing and comparing data with relevant Australian data. They challenge their own and others’ claims about the standard of living based on available data and may alter their opinions accordingly. |
| **Active investigator** | Students select and use knowledge, procedures and strategies to conduct the investigation, research and record statistical information about other countries, interpret maps to gain information about quality of life and make decisions about the quality of life in other countries based on the statistical information gathered.  |
| **Effective communicator** | Students gather and manage information about other countries, communicate their opinions and justify their findings based on evidence collected. They may challenge the decision of others about the relative standards of living and engage in substantive conversations about others’ view, procedures and strategies based on their own gathering of statistical information. They can convincingly defend their position and conclusions. |
| **Participant in an interdependent world** | Students collaborate with others, contribute to others’ investigations, cooperate in group activities, and listen to others’ viewpoints about the data and procedures used to inform their decisions about the standards of living in other countries. They use these activities to improve the quality of their own and others’ work. |
| **Reflective and self-directed learner** | Students take responsibility for their engagement in the investigation and the gathering of evidence to inform their conclusions about the relative standards of living in different countries. They plan, organise and manage the steps of the investigation and monitor the appropriateness of their strategies and the efficiency of their procedures. Students reflect on new learning and look for opportunities to apply the learning. |

Core content

Core content in black text only is included in this investigation.

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| Number — Number concepts: Level 4 | Chance and Data — Data: Level 4 | Space — Location, direction and movement: Level 4 |
| Numeration* whole numbers
* decimal fractions
* key percentages (100%, 50%, 25%, 20%, 10%, 1%)
* fractions
* common fraction format
* terms (vinculum, numerator, denominator)
* decimal fraction format
* percentage format
* equivalence
* square and cubic notation

Number sense* position and order of numbers
* relationships between numbers
* sensible adjustments of numbers
* connections between key percentages, unit fractions and decimal fractions
* everyday representations of numbers (e.g. 20K/20 000, $1.5m/$1.5 million, $3b/$3 billion
* subsets of numbers
* prime and composite
* square
* triangular

Money* financial decisions
* purchases (best buys, discounts)
* advertising (for purchases)
* methods of payment
* budgets for specific events
* key percentages
* simple interest
* discounts
* cashless transactions (e.g. cheques, money orders, EFTPOS, store cards)
 | Collecting and handling data* plans and methods for data collection
* design of data record templates
* data entry into spreadsheets
* extraction of data from existing data sources
* classify data
* check data
* discrete data
* categorical data
* count data
* continuous data

Exploring and presenting data* displays
* pie charts
* bar graphs
* dot-plots
* line graphs
* two-way tables
* lists

Identifying and interpreting variation* features of data
* measures of location (central tendency)
* mean
* median
* mode (for discrete data)
* limitations of measures of location
 | Location and movement* conventions
* simple scale on maps (linear form or 1 cm:1 km)
* coordinates
	+ grid references
	+ movement between grid reference points
* latitude and longitude
	+ key lines of reference (prime meridian, equator)
	+ polar limits
* maps
* flat maps
* globes
* maps
* plans (e.g. shopping centre)

Direction and angle* eight compass points (N, NE, E, SE, S, SW, W, NW)
* connection between the eight compass points and the amount of turn
* angle as a difference in direction
* estimation and measurement of angles in degrees
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## Resources

* internet (e.g. Australian Bureau of Statistics)
* atlases, globes or other maps

1. Identifying and describing

### Discussing standards of living

Students:

* discuss why people might be interested in this type of information
* discuss the features of Australia that may contribute to its being included on the list of best countries in which to live (e.g. climate, space, employment levels, financial status).

Focus questions could include:

If you were describing Australia to someone from another country, what would you say are the best things about living in this country?

What do you think your parents like about living in Australia?

What would you miss about Australia if you went to live in another country?

* nominate another country they would like to live in and explain their choice based on their knowledge of the standard of living in that country.

Focus questions could include:

What is it about that country that makes it seem attractive to you?

How is it the same as, or different from, Australia?

Do you think everyone in your family would like to live in that country? Why or why not?

Have you read anything about that country that you think would make it difficult to
live in?

How do you know about other countries? How do you know what you say is true?

* describe their experiences in, or knowledge of, the countries their parents were born in
— other than Australia
* discuss the term ‘standard of living’ and brainstorm factors that they believe contribute to the standard of living in a country. It may assist students to contribute to the discussion if they can compare life in Australia with life in a less developed or less peaceful country. Lead students to consider employment rates, average wage, birthrate and death rate, war, availability of clean drinking water and so on.

Focus questions could include:

What country would you **not** like to live in?

What is it about that country that you don’t think you’d like?

If someone from that country came to visit Australia, what do you think would impress them about Australia?

What items do you have in your house that a child from a poor African country, for example, might not have?

* create a class list of the features they believe contribute to a country’s standard of living.

### Unpacking the investigation

Students:

* restate the investigation in their own words and brainstorm ways they could approach the investigation
* decide which features on the class list should be included in the investigation and modify the list if necessary
* clarify how and when assessment will occur during the investigation. This may include producing such items as:

statistical information about 10 features, for example, that indicate each country’s standard of living

the data record templates used to record the statistical information (e.g. spreadsheets or tables of statistical information)

data displays showing the comparison of statistical information about the three countries selected

maps showing information that supports students’ conclusions

a presentation to an audience about students’ conclusions

* recall previous mathematics learning that may contribute to this investigation.

Focus questions could include:

Have you collected statistical information before? If so, what procedures did you use that could help you with this investigation?

How have you recorded data in previous investigations?

What other mathematics do you know already that could help you with this investigation?

What mathematics do you think you’ll need for this investigation?

* plan which countries they will research, which features they will collect statistical information about, how the data will be recorded and analysed, and negotiate their plans for the investigation with the teacher. Plans may be recorded in student journals.

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| Assessing learning |
| Sources of evidence could include:* discussions with students
* plans for investigations.

When making judgments, teachers consider whether the student has:* planned a data collection.
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## 2. Understanding and applying

### Understanding data collection

**Note:** It is recommended that students record new information, statistical data, written workings, copies of spreadsheets and data, and other evidence that may support their conclusions, in their learning journals.

Students:

* revise the steps for data collection:
* choose categories for the data collection (selected from the class list of standard of living features e.g. population size, average wage, birthrate, death rate and so on)
* design a template for recording the data (e.g. spreadsheets or lists)
* conduct the data collection from existing sources (e.g. reports from bureaus of statistics and the internet)
* identify the data as being discrete or continuous and explain the difference (e.g. data
from counting the population is discrete and data about climate over a period of time
is continuous)
* choose appropriate data displays
* display the data
* consider the difference between mean, median and mode using Australian statistical information
* discuss the features of different data displays. They pose different ways of displaying data then choose which format is most appropriate to display the Australian statistical information. Students need to be able to access the information on this display later to compare Australia’s statistical information with that of the three countries they research.

**Students working towards Level 5:**

* use data displays and data sets to determine spread, range and measures of location
* compare measures of location of data to make generalisations.

### Understanding number concepts

Students:

* revise relevant number concepts to help make sense of the statistical information they have gathered. They use Australian statistical information to model these concepts.

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| Number concept | Examples of Australian statistical information |
| The similarities and differences in place value of whole number and decimal fractions | Population size or gross domestic product (GDP) |
| The format for common fractions, decimal fractions and percentages | Birthrates  |
| The links between common fractions, decimal fractions and percentages | Morbidity rate (e.g. 75% of Australians experience one or more long-lasting illnesses) |
| The position of numbers (whole numbers, and common and decimal fractions) in relation to other numbers | The portion of the population that is male/female, literate, of ethnic origin to model common fractions |
| Representations of numbers (e.g. 3m for 3 million) | Populations of states, territories and cities |

### Gathering information from maps

Students:

* discuss the physical features of a country that could contribute to its standard of living. Lead students to consider such features as:
* climatic regions
* proximity to key lines of latitude
* land use
* natural vegetation
* mineral resources
* climate
* availability of water
* look at the physical features of Australia in maps and discuss what inferences could be drawn about the standard of living in Australia based on that information.

Focus question could include:

* Does Australia have fresh water? Where is most of it? Is it enough?
* Which parts of Australia have very little rainfall? How might this affect the standards of living of people in these areas?
* What can you tell about mineral resources in Australia?
* How much of the land in Australia can be used for farming?
* Which parts of Australia appear to be the best places to live? Why?
* describe the locations of their chosen countries in relation to Australia referring to compass points, distance lines of latitude and longitude.

**Students working towards Level 5:**

* apply scale to describe locations and distances that support inferences about standards of living
* express location of countries studied using latitude and longitude in degrees.

### Conducting the investigation

Students:

* collect, record and display statistical information about their three chosen countries. They gather information about the physical features of those countries from a variety of maps
* compare and order the countries according to the standard of living represented by the information collected
* compare Australian information with that gathered about other countries and decide where Australia ranks
* prepare to present their conclusions to a selected audience.

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| Assessing learning |
| Sources of evidence could include:* data record templates
* data displays
* observation of work in progress
* discussions with students
* student journals.

When making judgments, teachers consider whether the student has:* compared and ordered whole numbers and common and decimal fractions
* made connections between key percentages and fractions
* planned and carried out data collections using a self-created data record template
* chosen and constructed appropriate displays
* interpreted maps with reference to conventions and lines of latitude and longitude
* described movements using compass points and distance.
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3. Communicating and justifying

### Presenting conclusions

Students:

* present their conclusions about the comparative standards of living in the three countries they investigated and how the standards of living in those countries compare with that of Australia. They describe the procedures and strategies used to form their opinions
* compare their findings with those of other students who investigated the same country or countries. If variations exist, they decide to what extent they will modify or maintain their original views and conclusions. They make this decision after they have reviewed the data and their procedures and strategies.

### Creating the ‘top countries’ list

Students:

* use cooperative group strategies to decide which information will be used to order the top countries. They may discuss which features from the class list most clearly indicate the standard of living (e.g. average wage, average savings, death rate)
* are given the opportunity to challenge the presence of a country on the list of top countries and to debate its inclusion or removal based on their findings.

**Note:** It may be necessary to create more than one list (e.g. one list might be the countries with the highest average income. Another list might be countries with the lowest death rate).

### Reflecting on the learning

Students:

* discuss the learning that has resulted from the investigation.

Focus questions could include:

* What mathematics have you learned as a result of this investigation?
* In what other situations are you likely to use the knowledge or procedures?
* Who else might find the information you collected useful?
* What did you learn during this investigation that surprised you?
* Why is statistical information recorded?
* relate statistical information to their own situation.

Focus questions could include:

* Does the geographical position of your town affect your standard of living?
* Does the major income-producing activity in your area depend on its geographical position?
* How do you think your next-door neighbour’s standard of living might compare to the Australian mean?

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| Assessing learning |
| Sources of evidence could include:* written or oral presentations
* responses to challenges about conclusions
* reflection sheets.

When making judgments, teachers consider whether the student has:* compared and ordered whole numbers and common and decimal fractions
* made comparisons based on data displays and measures of location
* interpreted maps.
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Links

This investigation could be connected to core learning outcomes from another key learning area — for example, Studies of Society and Environment.

### Mathematics

**Strand** Place and Space

**PS 4.4** Students use latitude, longitude, compass and scale references and thematic maps to make inferences about global patterns.

Students:

* use climate and vegetation maps to infer how these factors might influence the standard of living in a particular place
* correlate population and per capita income distributions to make inferences about the standard of living in developing and developed nations.

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| For more information, refer to the elaborations in the *Years 1 to 10 Studies of Society and Environment Sourcebook Guidelines,* which are available online from the QSA website: www.qsa.qld.edu.au |