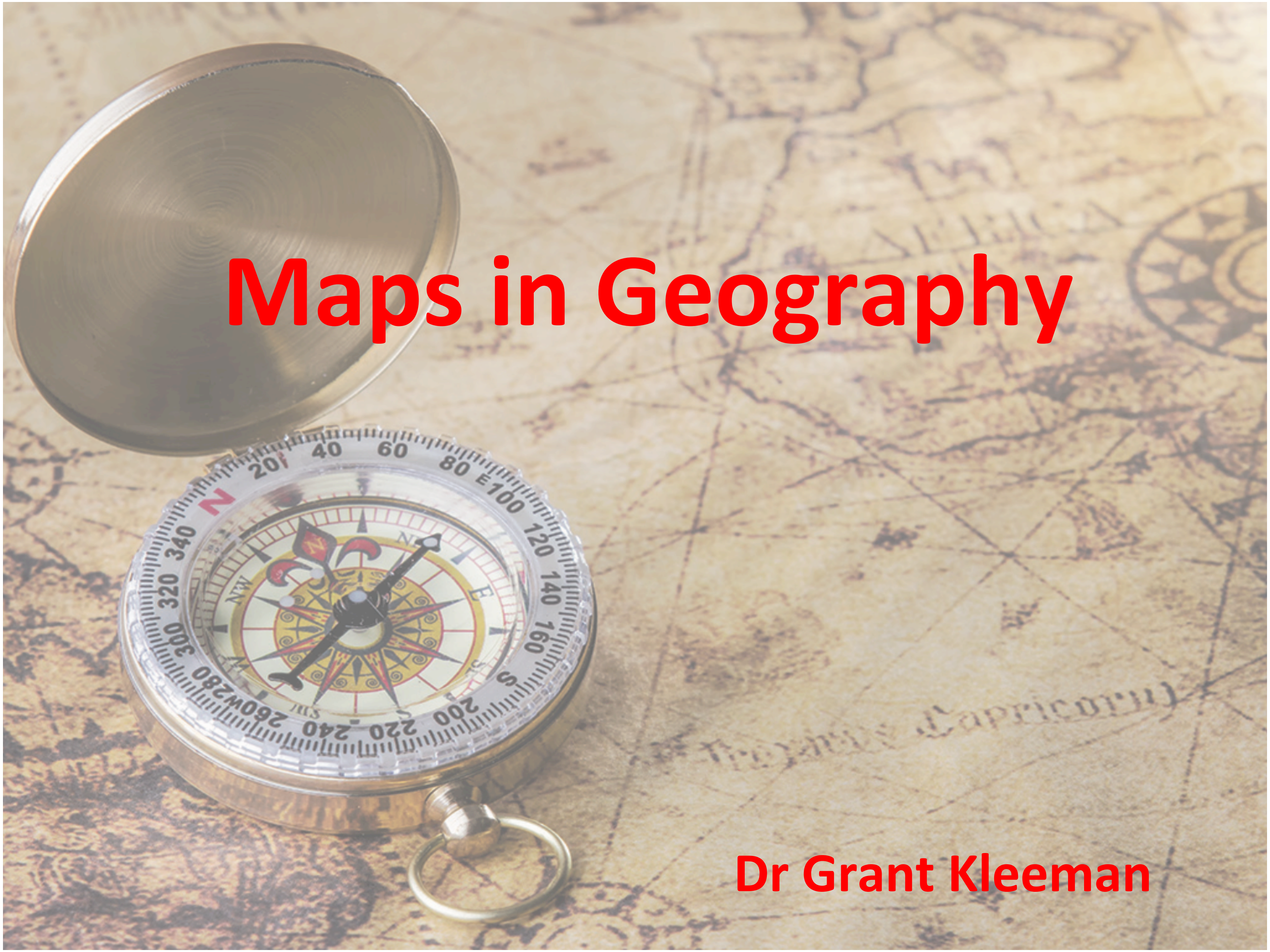
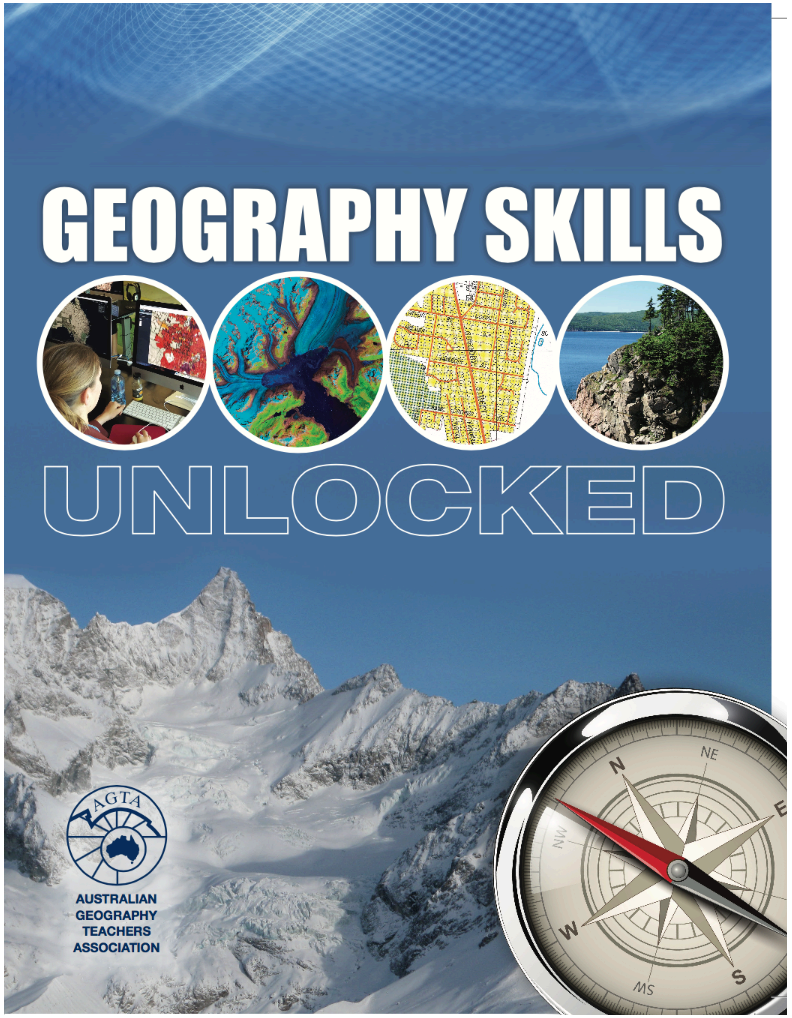
Maps in Geography



Dr Grant Kleeman

Supporting the teaching of Geography skills in the classroom



1. Inquiring
2. Geographic inquiry: The stages
3. Thinking skills
4. The elements of maps
5. The many types of maps
6. Digital maps
7. Working with topographic maps
8. Working with photographs
9. Working with statistics and graphs
10. Working with diagrams
11. Using technology
12. Fieldwork
13. Using virtual field trips
14. Putting inquiry and skills together

About support units

Support units provide illustrations of practice designed to support teacher's professional learning and provide guidance, information and resources in eight areas of geographical education:

- Thinking geographically
- Why teach geography?
- Professional practice
- Fieldwork
- ICTs in geography
- Assessment in geography
- Language of geography
- Geographical inquiry

Each illustration is unique, and a variety of materials and styles are used. All illustrations provide information for teachers to support students' active engagement in learning.

Coming soon!

Geography literacy unlocked

Table of contents

What then do we mean by inquiry-based learning?

Inquiry-based learning starts by posing questions, problems or scenarios—rather than simply presenting established facts or portraying a smooth path to knowledge. The process is often assisted by a facilitator (the teacher).

"Inquiry" is, therefore, defined as "a seeking for truth, information, or knowledge – seeking information by questioning."

"We learn more by looking for the answer to a question and not finding it than we do from learning the answer itself."
Lloyd Alexander, American Author

Inquiry-learning cycle

Geographical inquiry & skills

Geographical Inquiry involves individual or group investigations that start with geographical questions and proceed through the collection, evaluation, analysis and interpretation of information to the development of conclusions and proposals for actions. Inquiries may vary in scale and geographical context.

Geographical Skills are the techniques that geographers use in their investigations, both in fieldwork and in the classroom.

Teaching skills in context is more effective. There are, however, times at which direct instruction is appropriate.

Numeracy skills taught in context

Students become numerate as they develop the knowledge and skills to use mathematics confidently across other learning areas at school and in their lives more broadly.

Numeracy involves students in recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills.

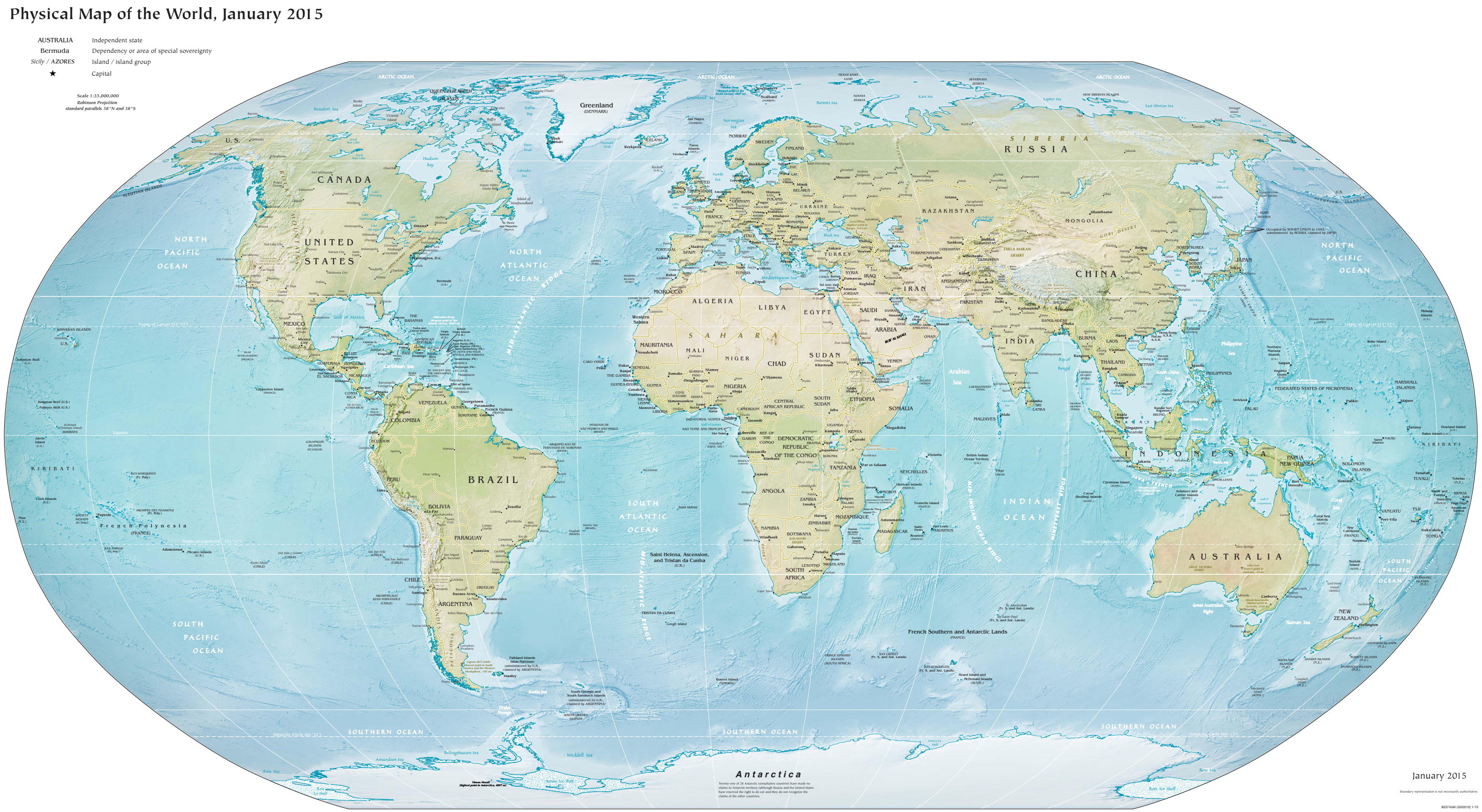
In this session we examine:

- the types of maps used in Geography
- the elements of maps
- direction, scale and distance
- grid and area references
- latitude and longitude (locating places)
- measuring distance and area
- representations of topography on maps; relief, cross-sections and gradient

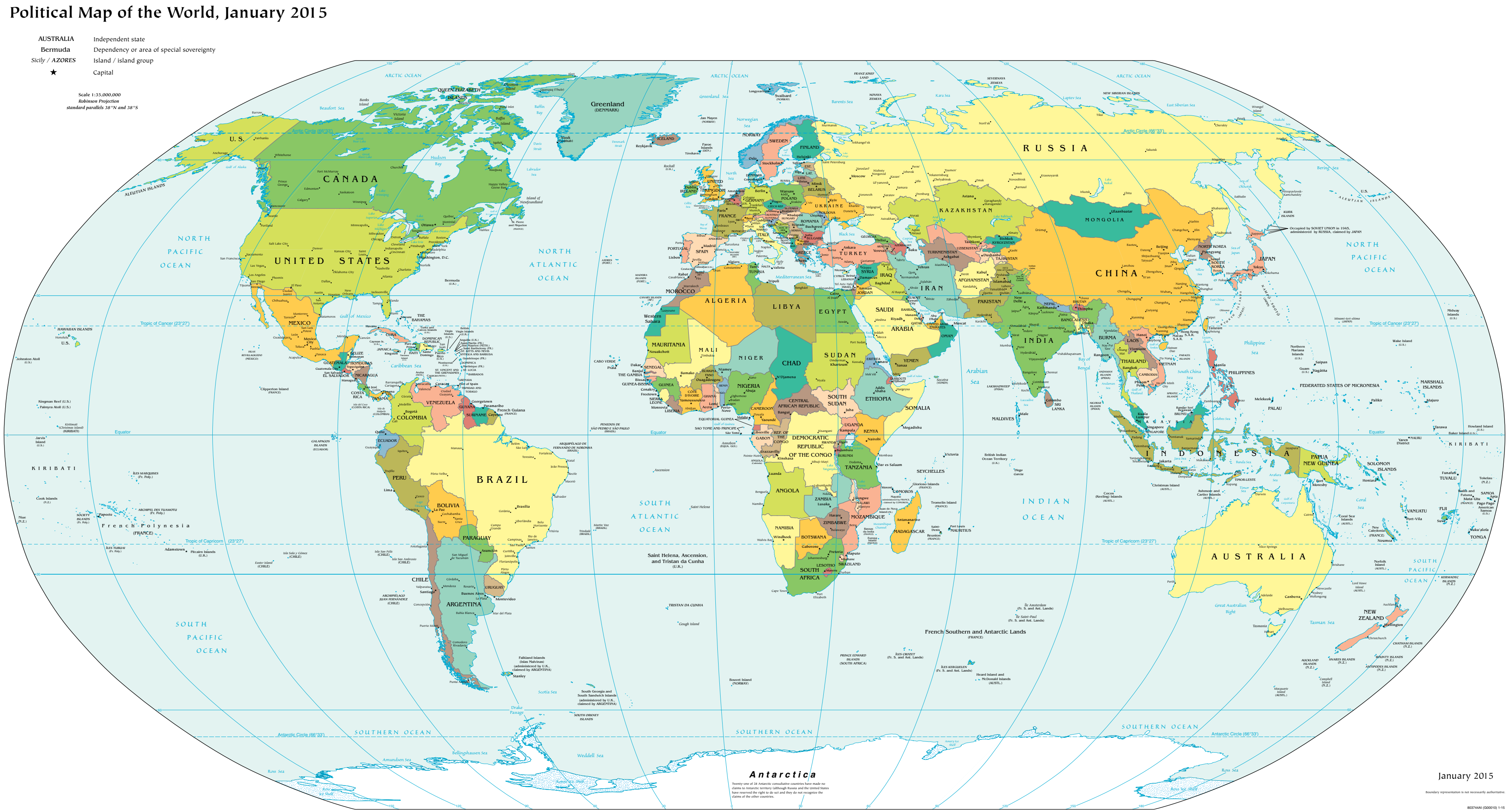
Types of maps

- Atlas maps (physical & political)
- **Topographic maps**
- Thematic maps
- Weather maps
- Flowline maps
- Choropleth maps

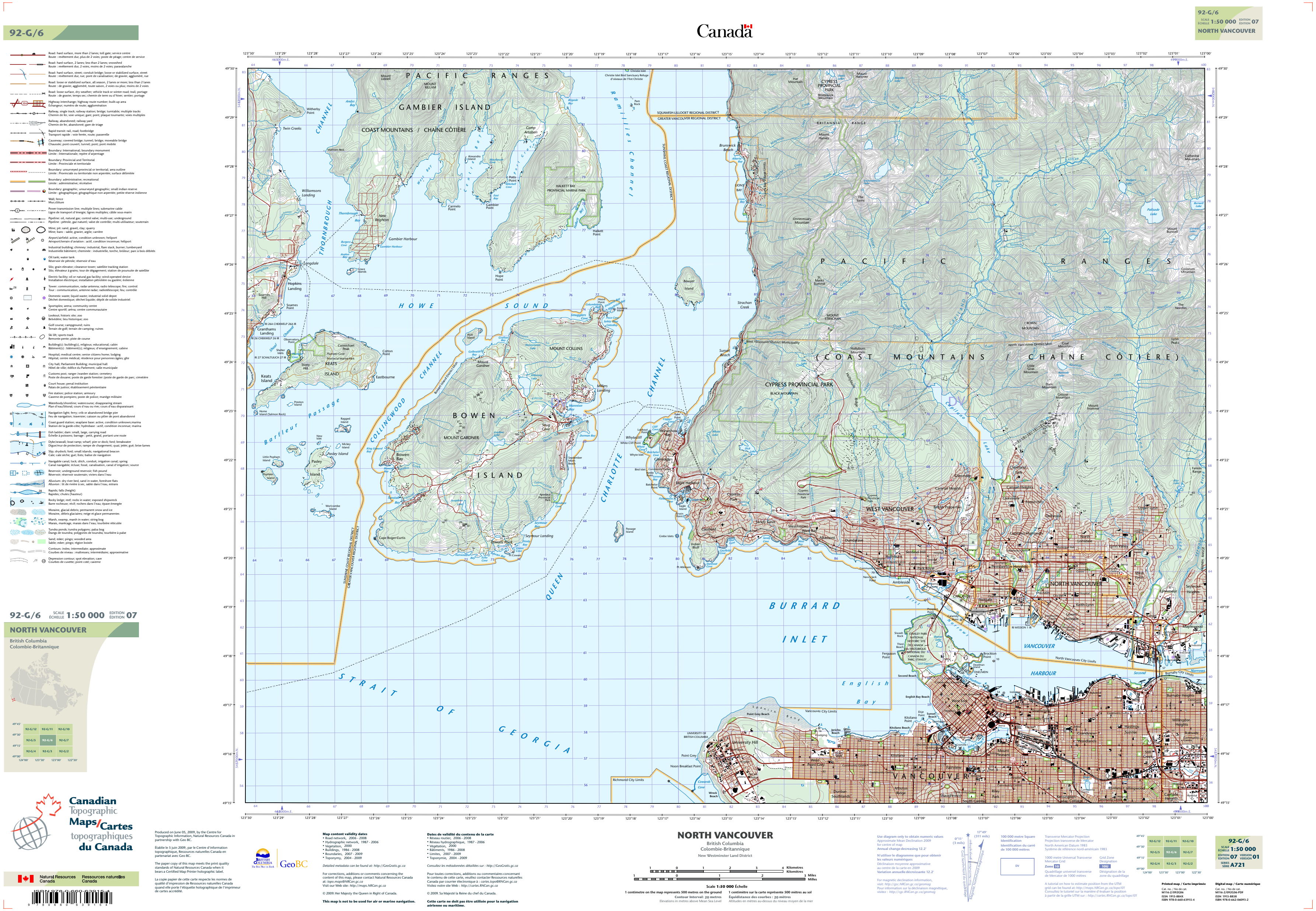
Atlas maps: Physical map



Atlas maps: Political maps



Topographic maps



Thematic map: Liveability in Sydney

The Sydney Morning Herald

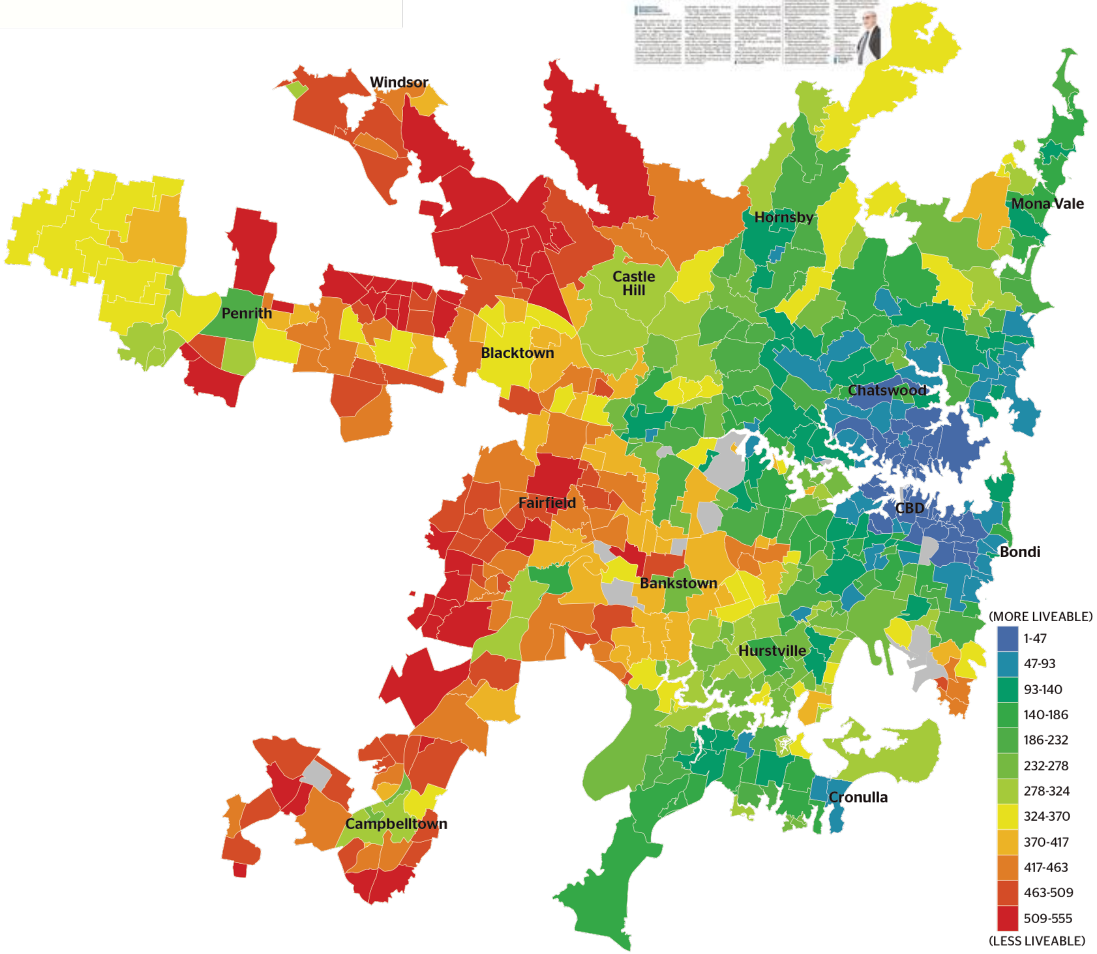
One spot rules all in hunt for the good life

Surge in students hurts universities

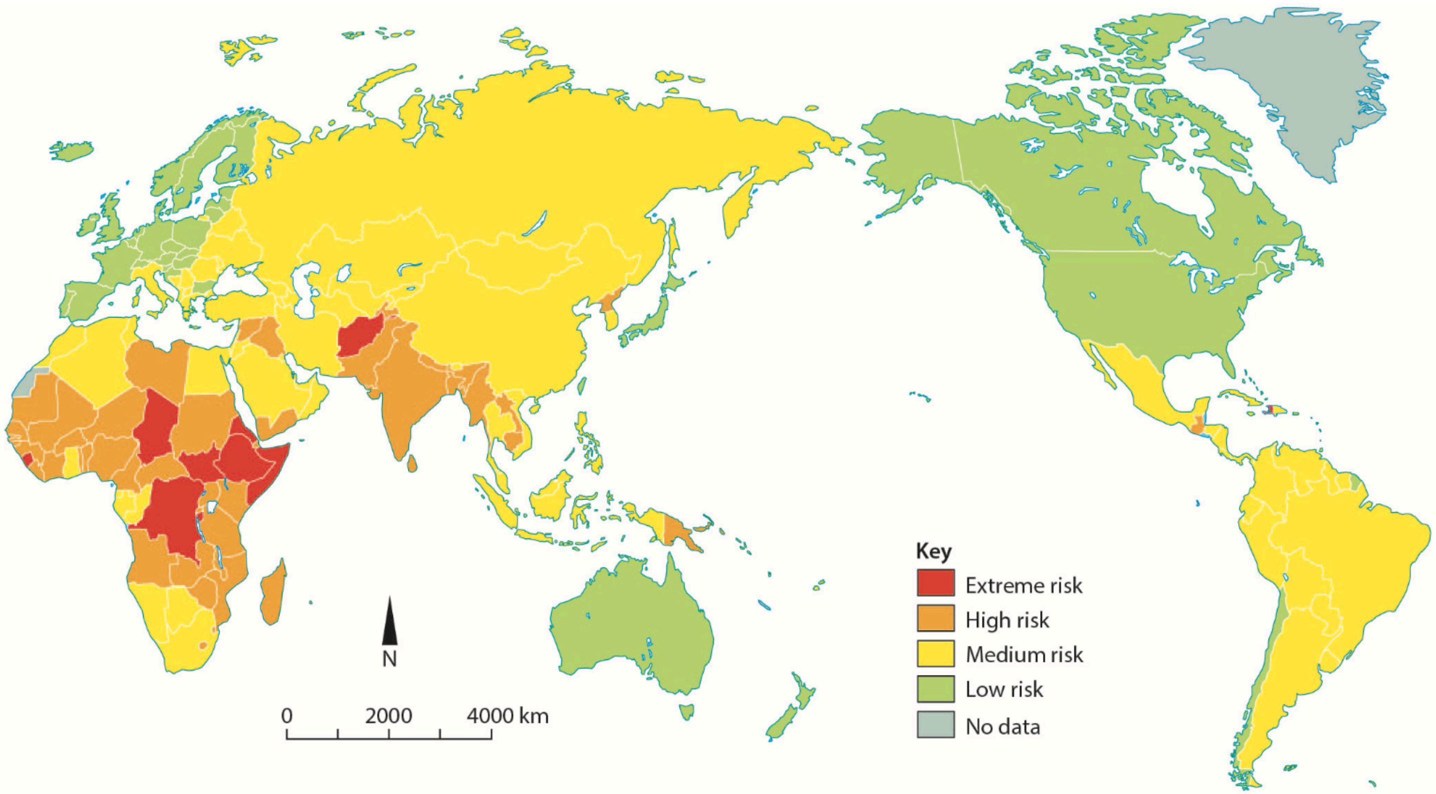
Obeids hire private eye to discover ICAC source

In 2016, the Sydney Morning Herald commissioned a survey of liveability in Sydney. The study used a range of indicators to identify the most (and least) liveable suburbs in the city. The indicators used included:

- access to employment
- availability of train, bus, light rail and ferry services
- proximity to cultural facilities such as libraries, museums and art galleries
- the level of traffic congestion
- closeness to schools, shopping, cafes and restaurants
- amount of open space, tree cover
- topography and harbour and ocean views
- crime level
- broadband coverage

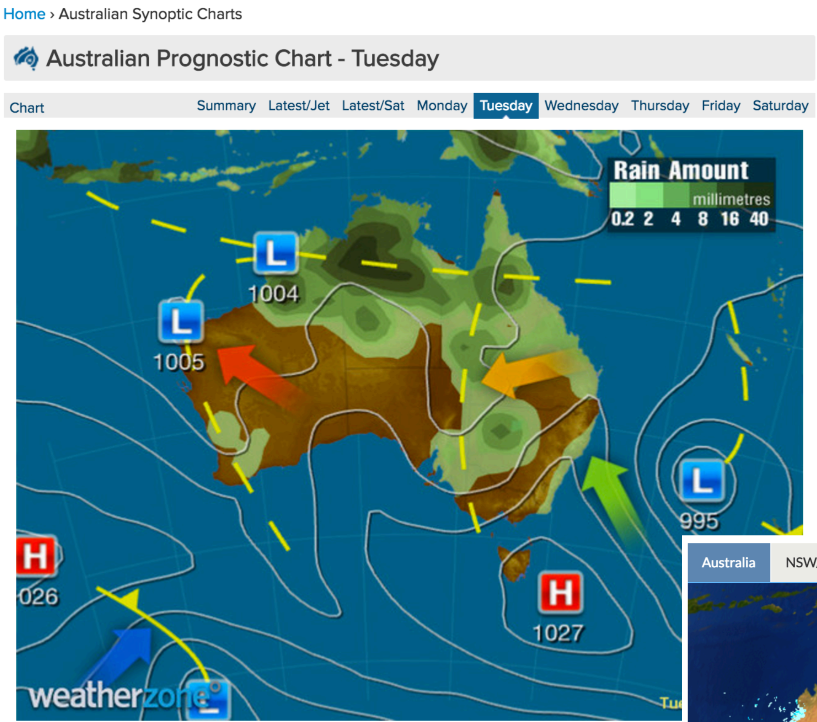


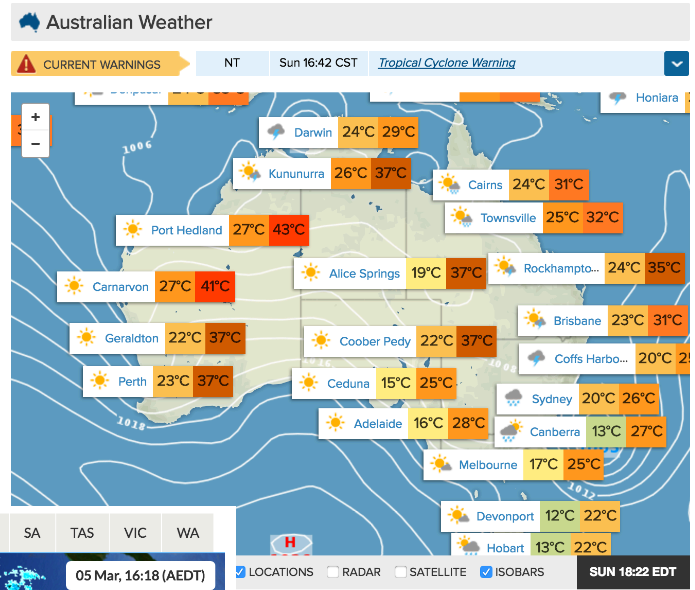
Thematic map (2)

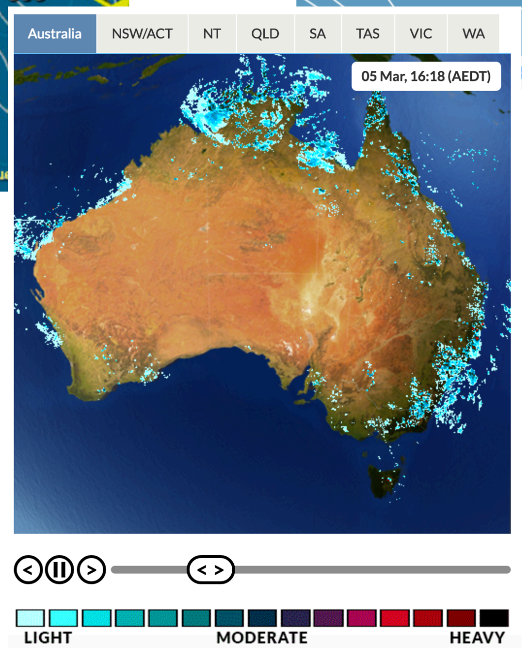


Food Security Risk Index, 2013

Weather maps

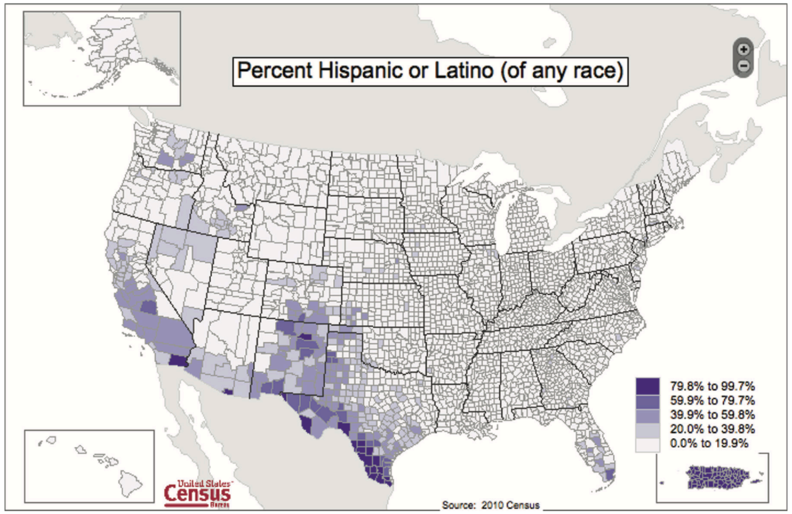


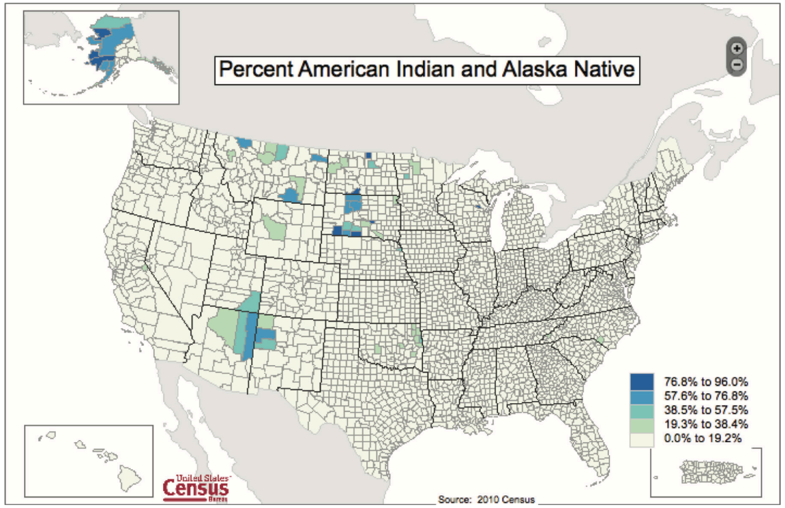


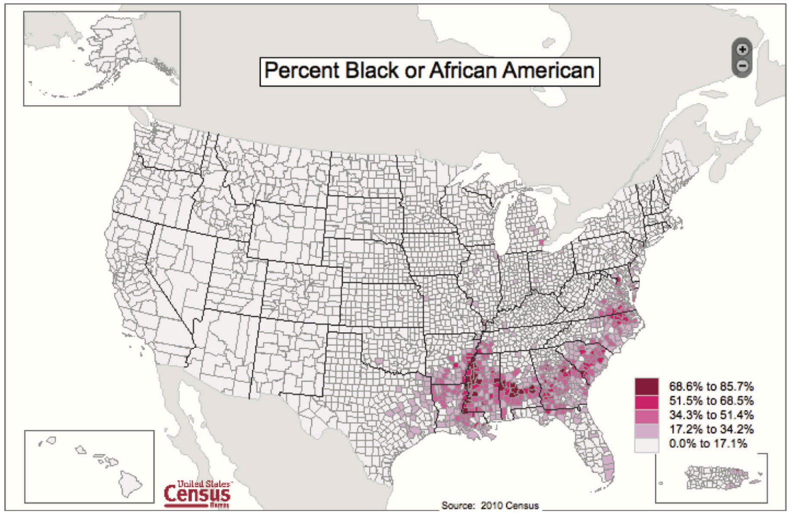


Flowline maps

Choropleth maps







Distribution of selected minority groups in the USA

Working with topographic maps

Elements of maps

Topographic Map of Blue Lake

Title

Direction indicator

Scale

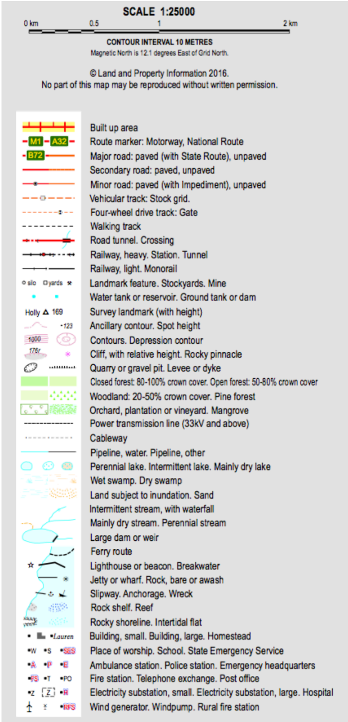
Mt Brown
Lat. 36˚46'S
Long. 148˚26'E

Latitude and longitude

Grid

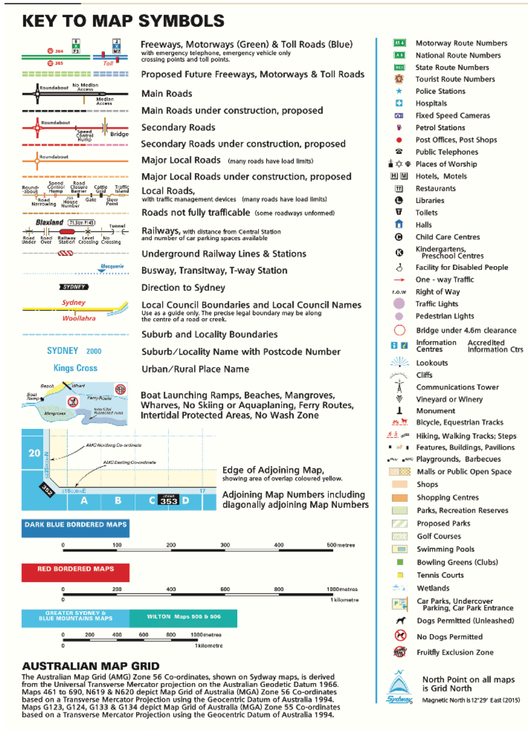
Legend

Map symbols

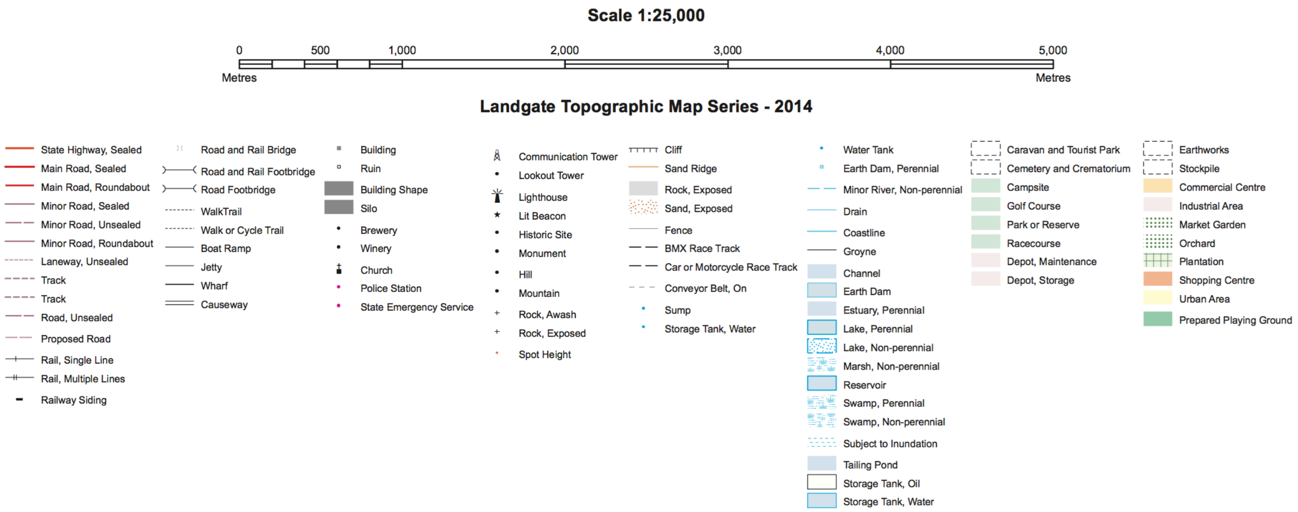


NSW Maps

Street directory



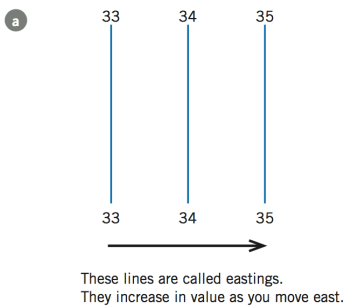
WA maps

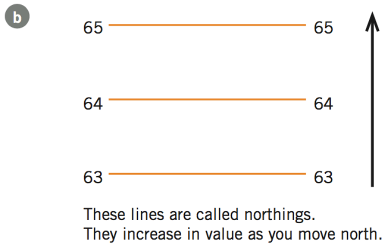


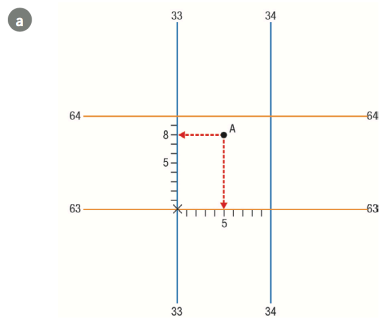
Grid and area references (1)

Grid references
You can locate features on maps by using a six-figure grid reference (GR). The first three digits refer to the eastings and the last three digits refer to the northings. Each set of three digits is referred to as a coordinate. The first two digits of each coordinate refer to the eastings and northings that surround the map. The third digit needed to complete each coordinate is obtained by dividing each easting and each northing into tenths.

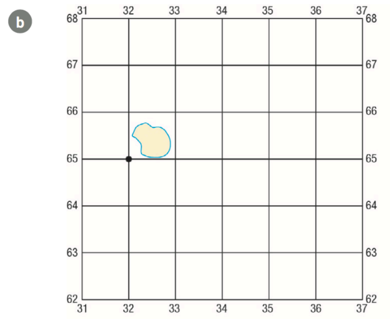
Area references
Features such as a small lake, quarry or village are usually located by means of a four-figure area reference (AR). To find the AR of a feature, use the coordinates of the lower left-hand corner of the grid square in which the feature is located. As in grid references, eastings come before northings in area references.





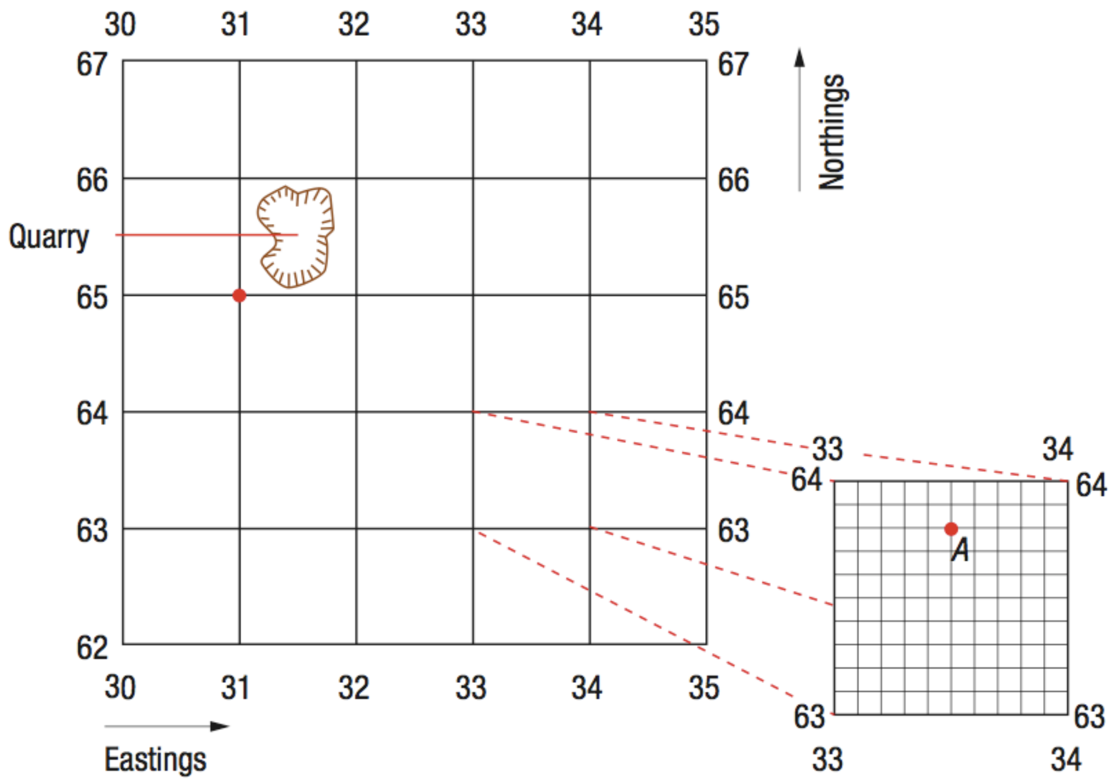


Point A is located at GR 335638.

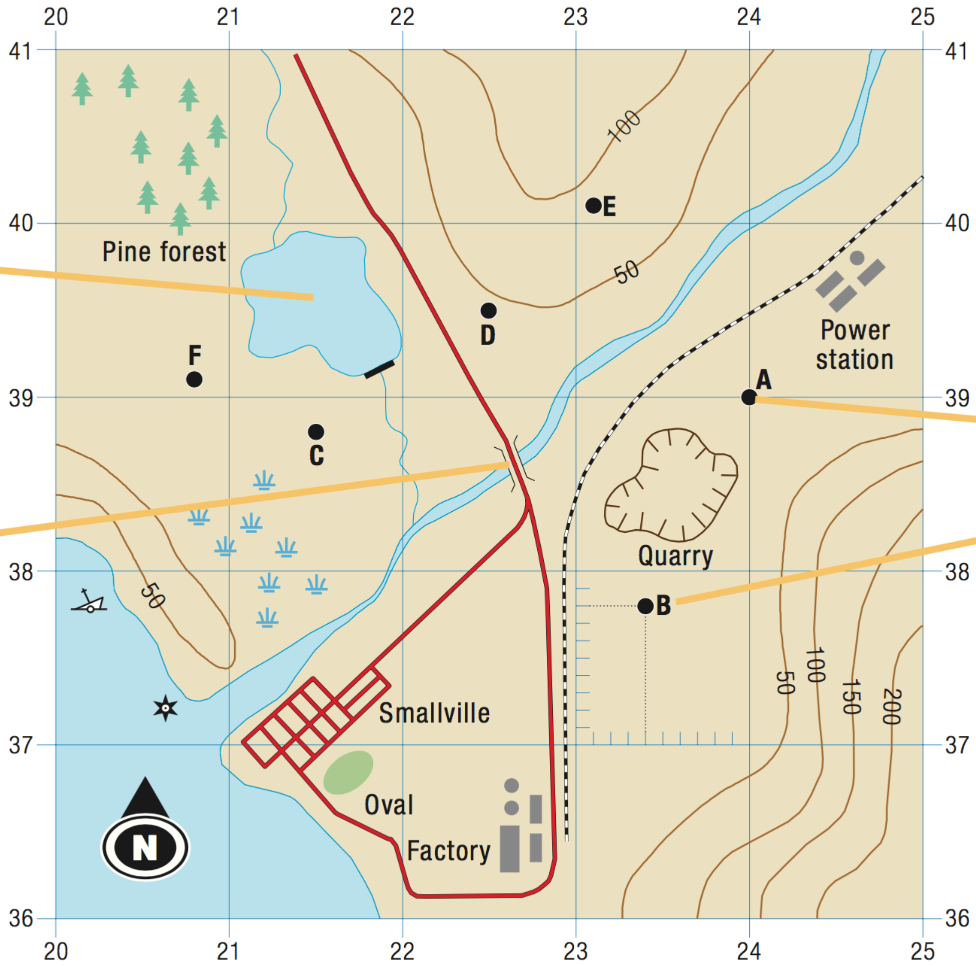


The quarry is located in AR 3265.

Grid and area references (1)



Grid and area references (2)



EXAMPLE 1
Find the grid reference (GR) for point A. Point A is located exactly on the intersection of easting 24 and northing 39. The easting is, therefore, 240 (24 and no tenths towards 25). The northing is 390 (39 and no tenths towards 40). The GR of point A is expressed as 240390.

EXAMPLE 2
Find the grid reference (GR) of point B. Point B is located four-tenths of the way between eastings 23 and 24. The easting is, therefore, 234 (23 and 4 tenths towards 24). The northing is approximately eight-tenths of the way between northings 37 and 38; therefore it is 378. The GR of point B is expressed as 234378.

EXAMPLE 3
Find the area reference (AR) of the dam. The AR of the dam is 2139.

EXAMPLE 4
Find the area reference (AR) of the road bridge. The AR of the road bridge is 2238.

Activities:

1. What is the scale of the map?

2. What is the contour interval used on the topographic map extract?

Grid reference questions

3. Identify the feature of the physical environment located at:

a. GR 132647

b. GR 155673

c. GR 133637

d. GR 286653

4. Identify the feature of the human or built environment located at:

a. GR 162644

b. GR 298655

c. GR 149653

d. GR 229732

5. What is the grid reference of Mount Townsend?

Area reference questions

6. Name the type of physical feature found in AR 1869?

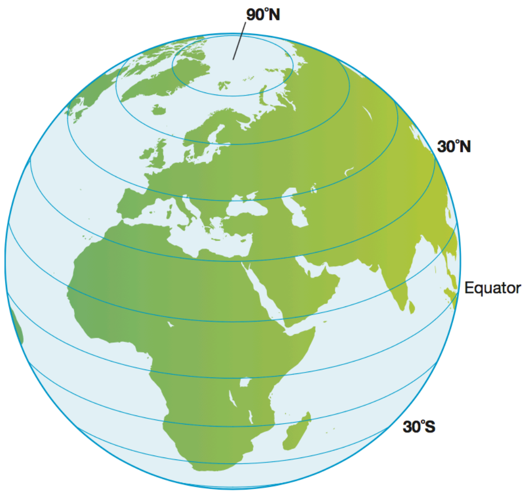
7. Name the type of vegetation found in AR 2563?

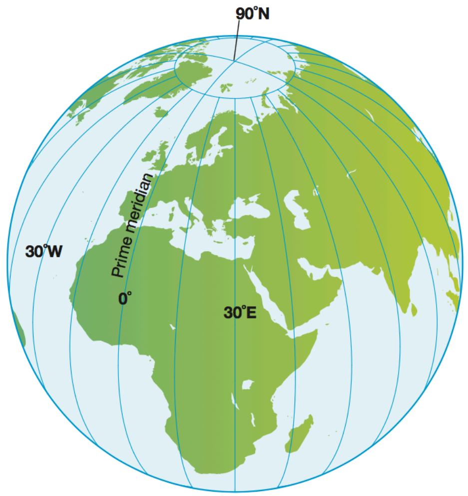
8. Name the type of landuse found in AR 2670?

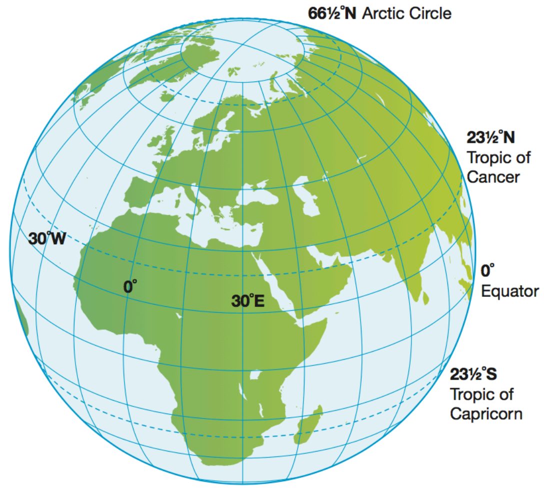
9. What creek flows into the Snowy River at GR 210710?

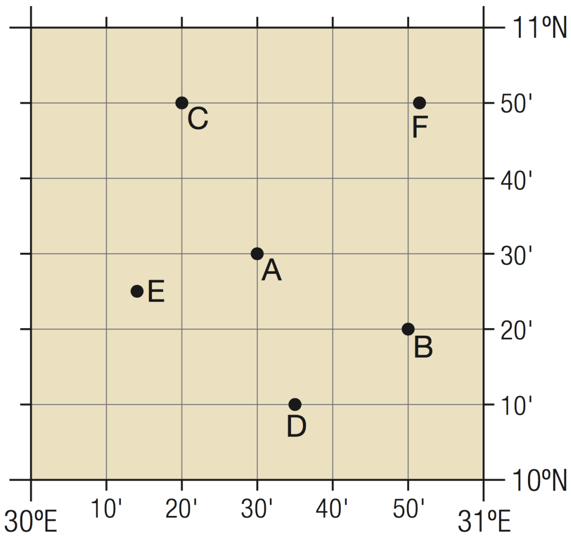
10. Name the tributary that joins the Thredbo River at AR 2966.

Latitude & Longitude









A is 10°30´ N; 30°30´ E

B is 10°20´ N; 30°50´ E

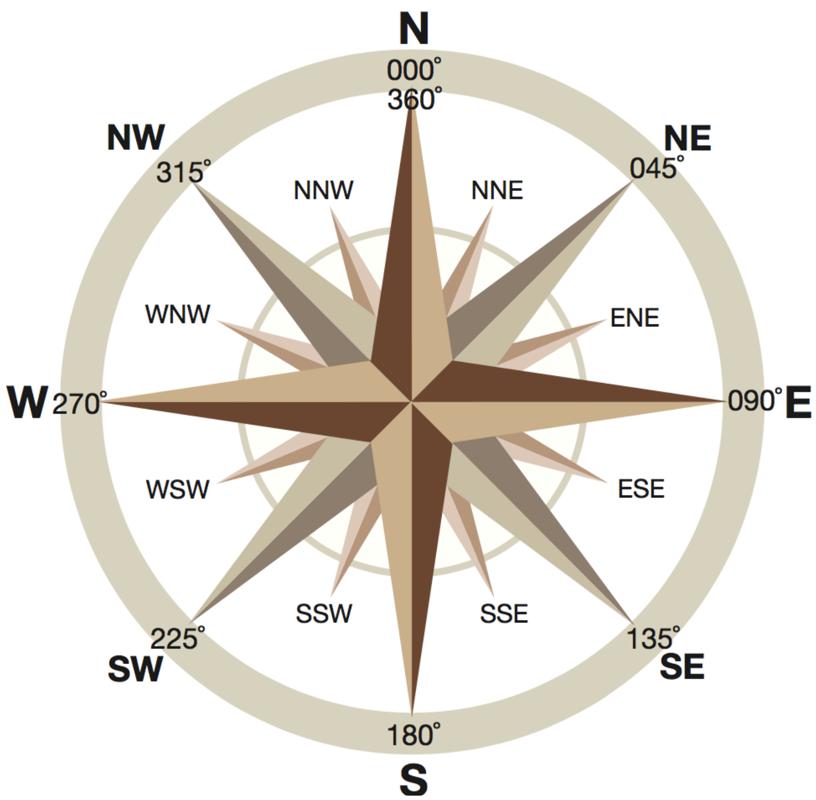
C is 10°50´ N 30°20´ E

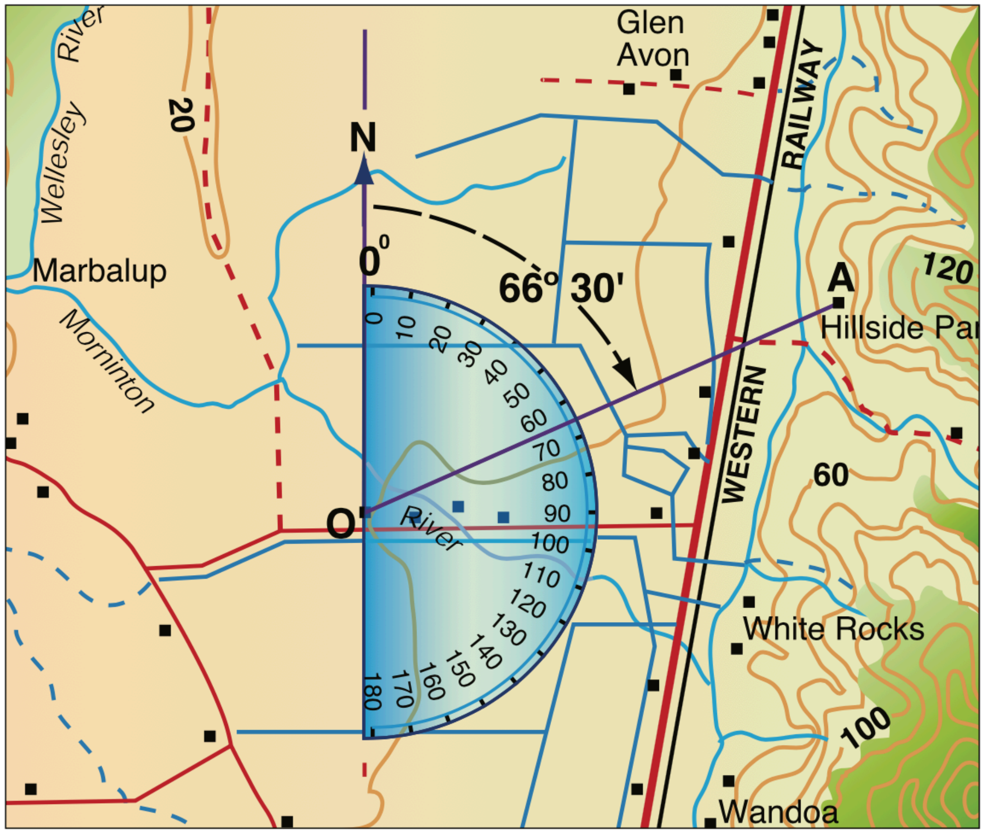
D is 10°10´ N 30°35´ E

E is 10°25´ N 30°14´ E

F is 10°50´ N 30°51´ E

Direction & bearings

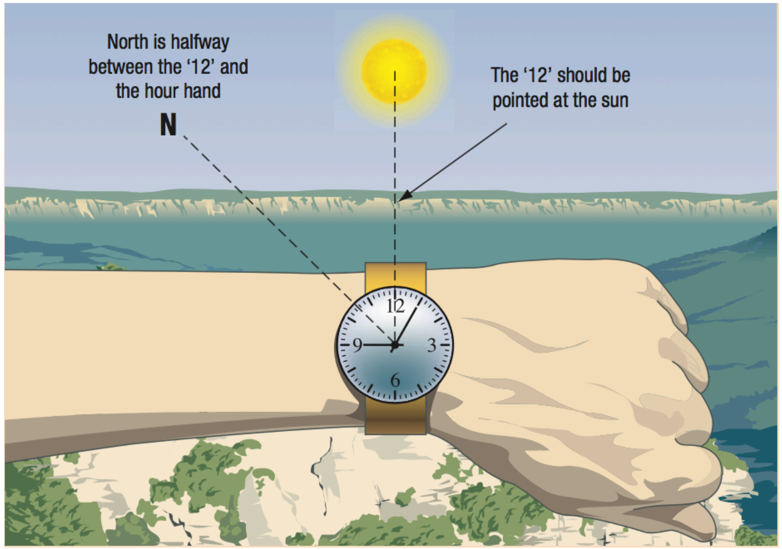




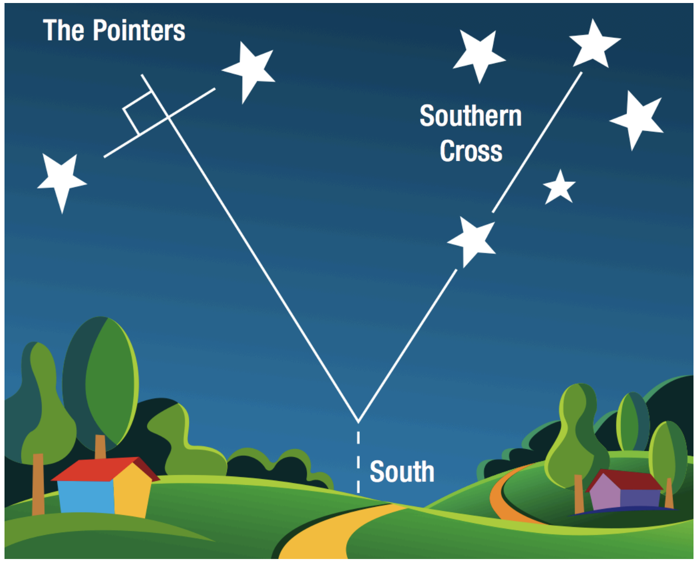
Bearing O–A: 65˚

Finding direction

Determining direction using the sun

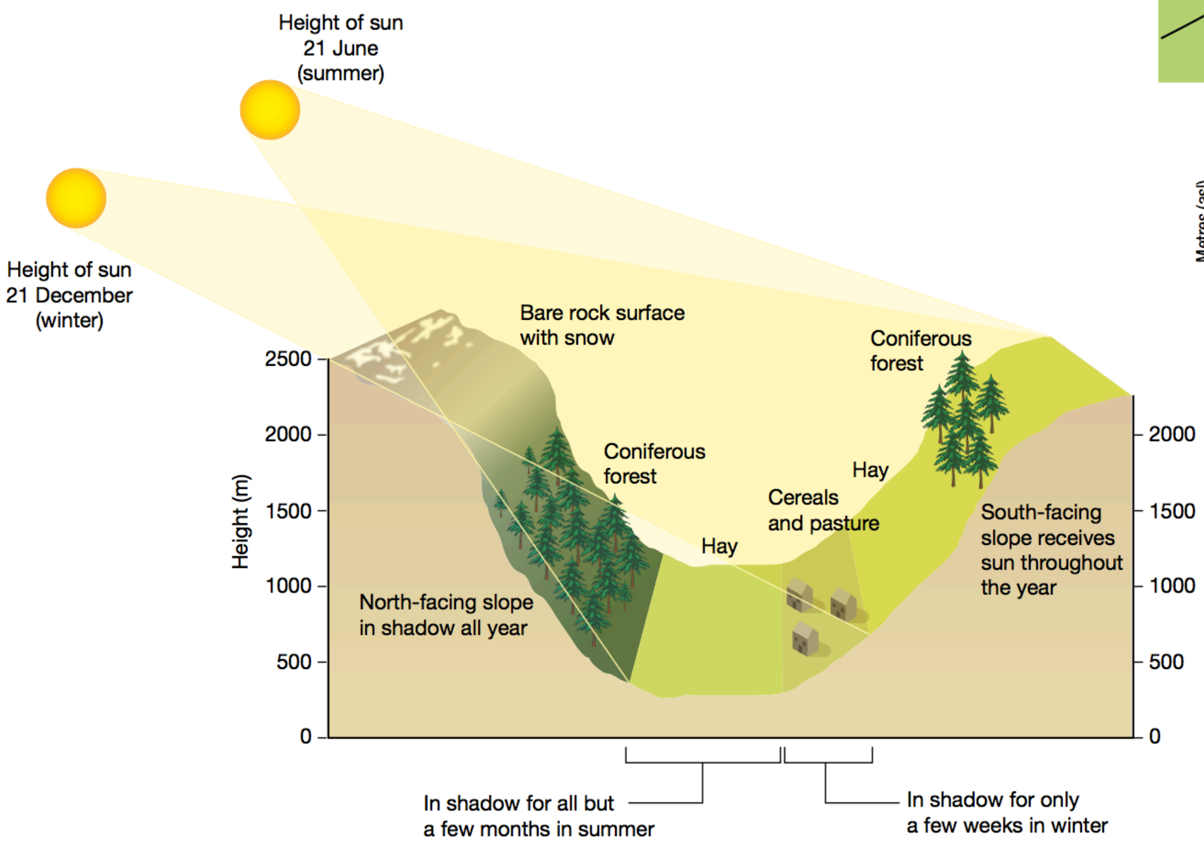


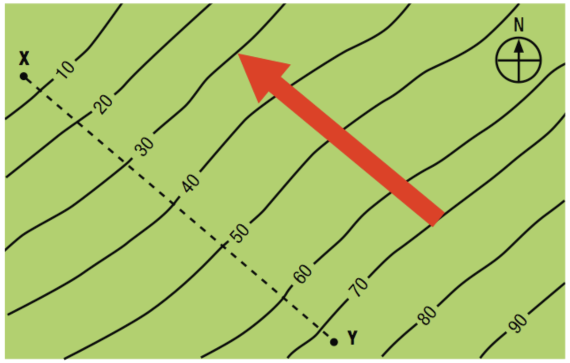
Determining direction at night

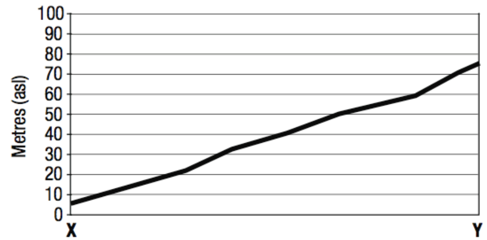


Aspect

Northern Hemisphere







North-west
aspect

Activities:

Direction

11. What is the direction of the Charlotte Pass ski resort (GR 195670) from Guthega ski resort (AR 2372)?

12. In what direction is Spencers Creek flowing in AR 2169?

13. What is the bearing of Mount Townsend (AR 1268) from Carruthers Peak (AR 1569)?

Aspect

14. What is the aspect of the slope in AR 2060?

Scale

To draw a map of any part of the Earth's surface, the area must be reduced in size, or scaled down, so that it can fit on a sheet of paper. There is, therefore, a direct relationship between the size of features on a map and their actual size on the ground. In other words, maps are actually a scaled- down representation of part of the Earth's surface. To determine how large the real area is, it is always necessary for the map to indicate the scale at which it has been drawn. Scale is expressed as the ratio of distances on the map to distances on the ground.

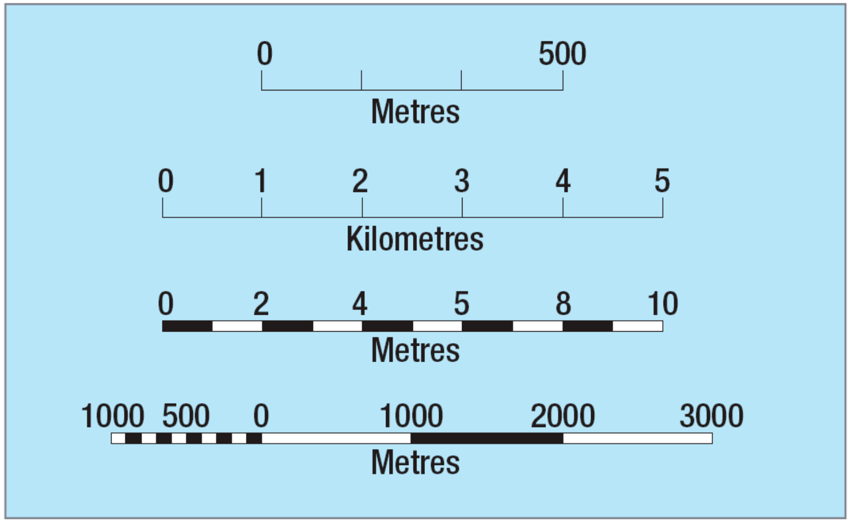
Scale can be expressed in three ways:

1. As a statement for examples '1 cm represents 100 000 cm' or '1 cm represents 1 km'.
2. As a ratio or representative fraction; for example, 1:100 000 or

$$\frac{1}{100\,000}$$

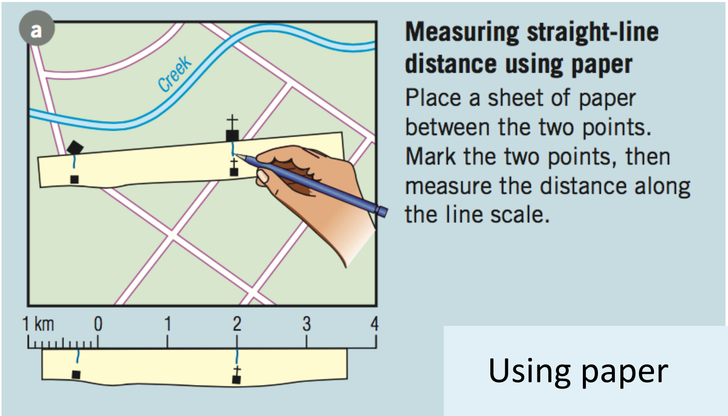
3. As a linear scale.

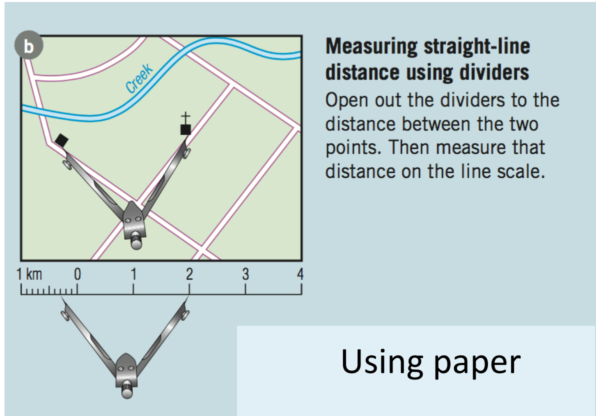
	Scale	Distance on the ground shown by 1 cm on the map
	1:10 000	100 m
	1:25 000	250 m
Larger-scale	1:50 000	500 m
	1:100 000	1 km
Smaller-scale	1:250 000	2.5 km
	1:1 000 000	10 km
	1:5 000 000	50 km



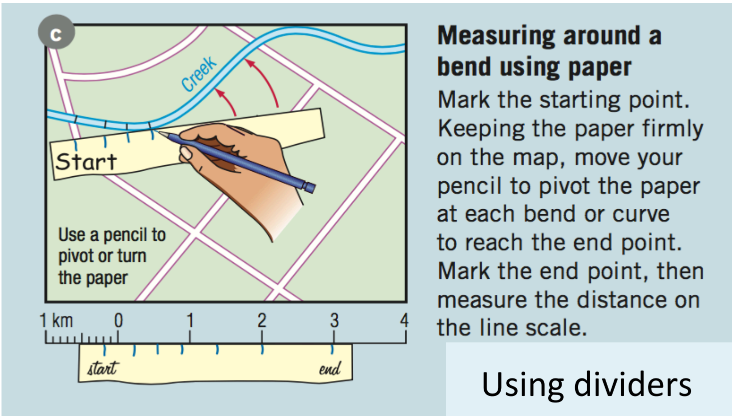
Measuring distances on a map

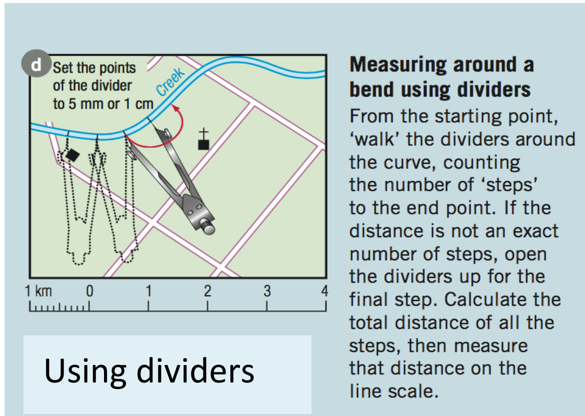
Straight-line distances



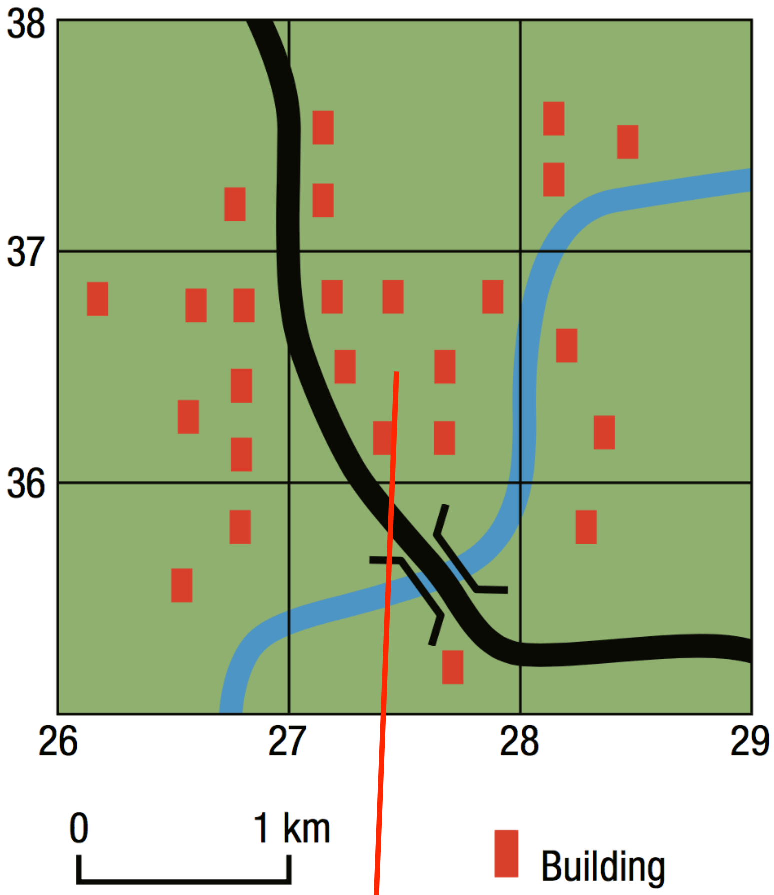


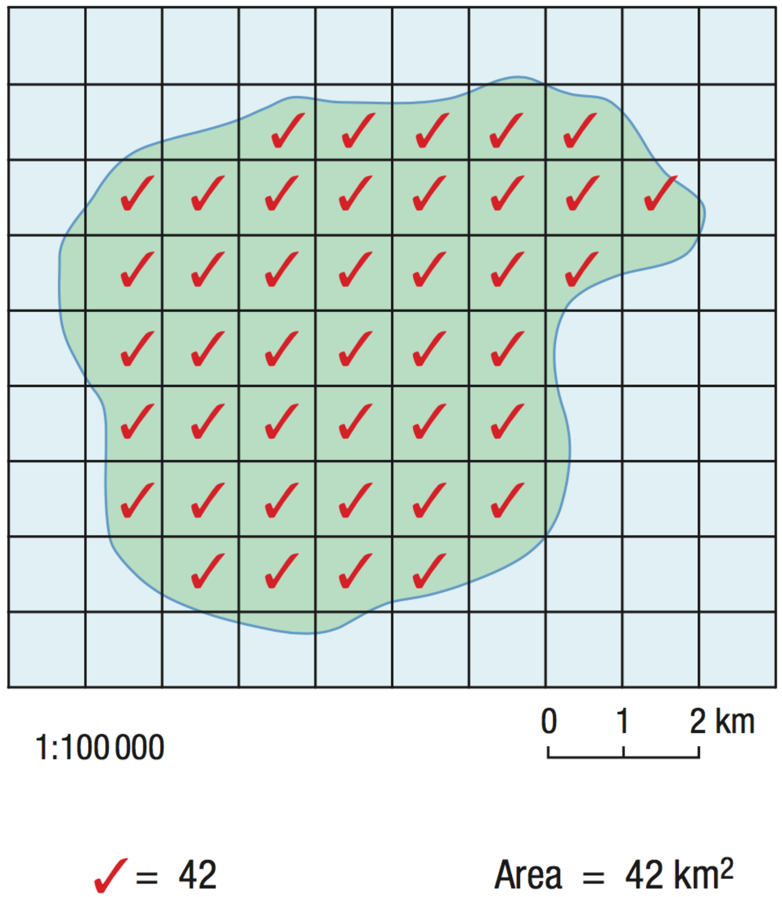
Distances along a curve



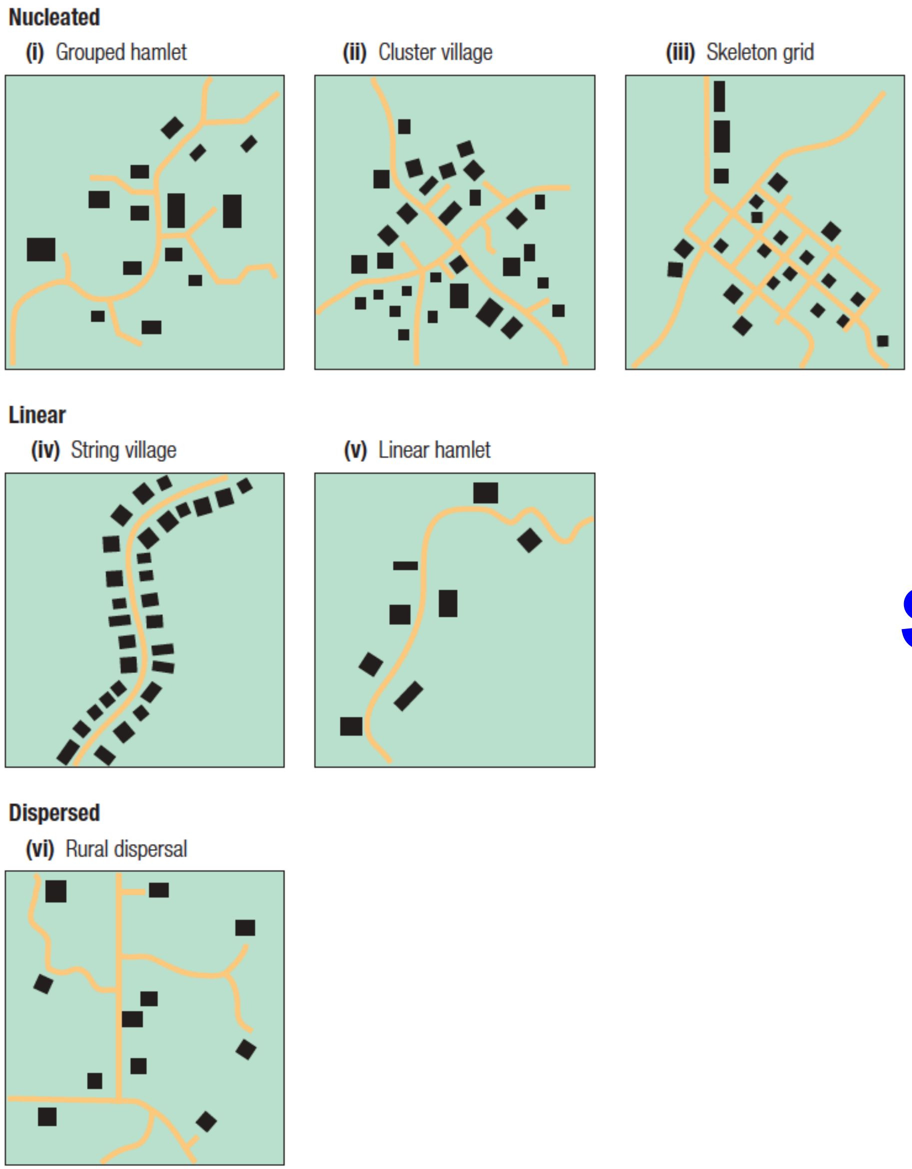


Density & Area





7 per square kilometre



Settlement patterns

Activities:

Scale

15. Estimate the straight-line distance between the summit of Mount Townsend (AR 1268) and Carruthers Peak (AR 1569).

16. Estimate the distance from the top of the Kosciuszko Express chair lift in AR 1560 to the summit of Mt Kosciuszko walking track.

17. Calculate the time it would take to walk the track between the top of the Kosciuszko Express chair lift and the summit of Mt Kosciuszko at an average speed of 5km per hour.

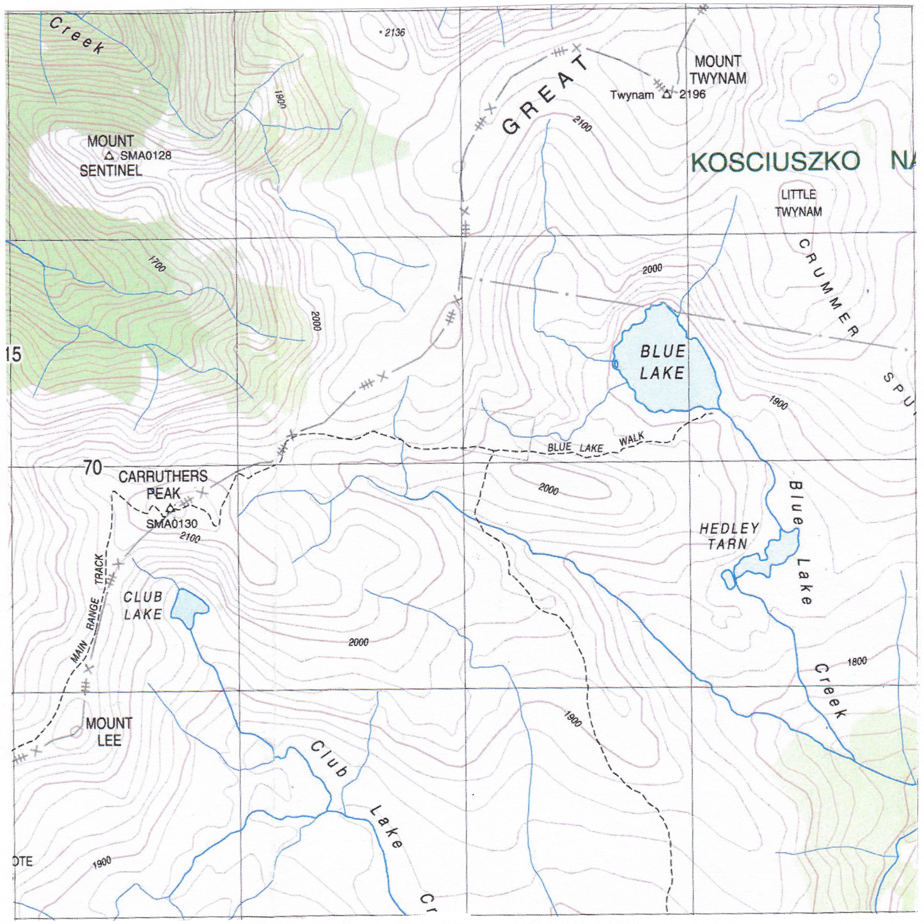
18. What is the length of Thredbo's Gunbarrel Express chair lift?

Estimating area

19. Estimate the area of Blue Lake.

Density

20. What is the density of buildings in AR 3065?



Area of Blue Lake:
Approx. 0.2km

Showing relief on topographic maps

Relief is a term geographers use to describe the shape of the land, including its height above sea level (asl) and the steepness of its slopes.

Because maps are usually drawn on flat sheets of paper it has been necessary for cartographers (map makers) to develop ways of showing what the landscape is like. These techniques include the use of spot heights, shading, colour layering and contour lines.

Showing relief on maps:

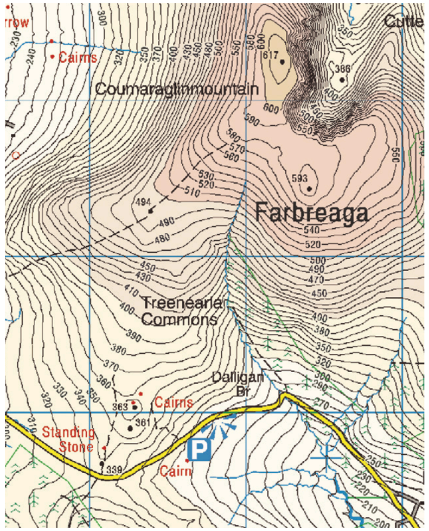
- **Spot heights:** A *spot height* is usually shown on a map as a black dot with the height written next to it. It gives the exact elevation (or height) above sea level of a particular location or feature.

- **Shading:** Map *shading* is a very effective method of highlighting landform features. The shading makes the landform features 'stand out' from the map, creating a three-dimensional effect.

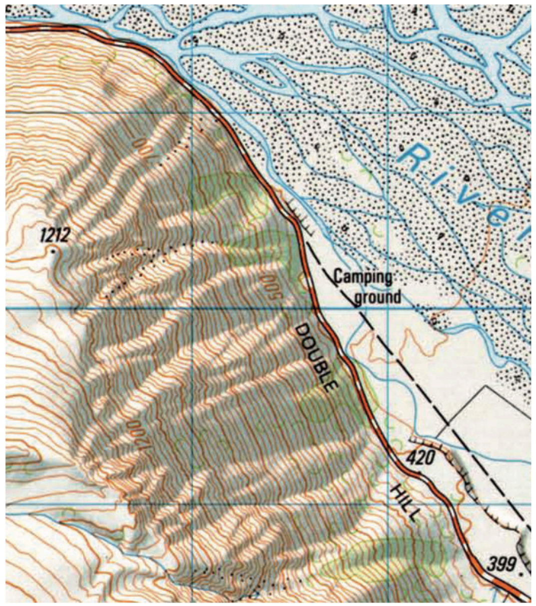
- **Colour layering:** Some cartographers use colour layering to distinguish between different elevations.

- **Contour lines:** The most effective way to show relief on a map involves the use of contour lines. *Contour lines* join places of equal height above sea level. Below sea level the lines are referred to as marine contours (or *bathytherms*). Being able to interpret contour lines provides geographers with information about the:

- *shape* of the land
- *slope* of the land
- *height* of features above sea level.

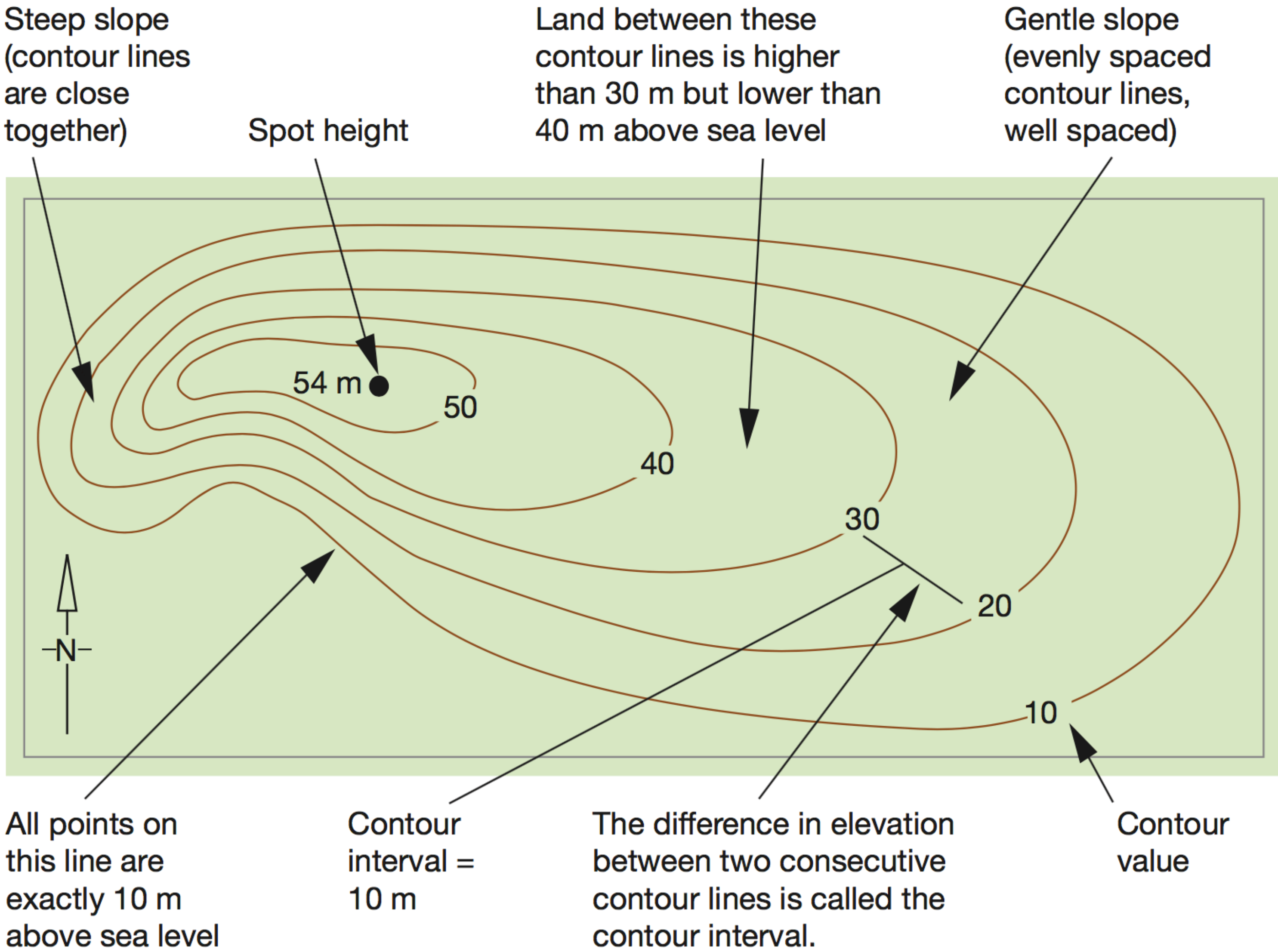


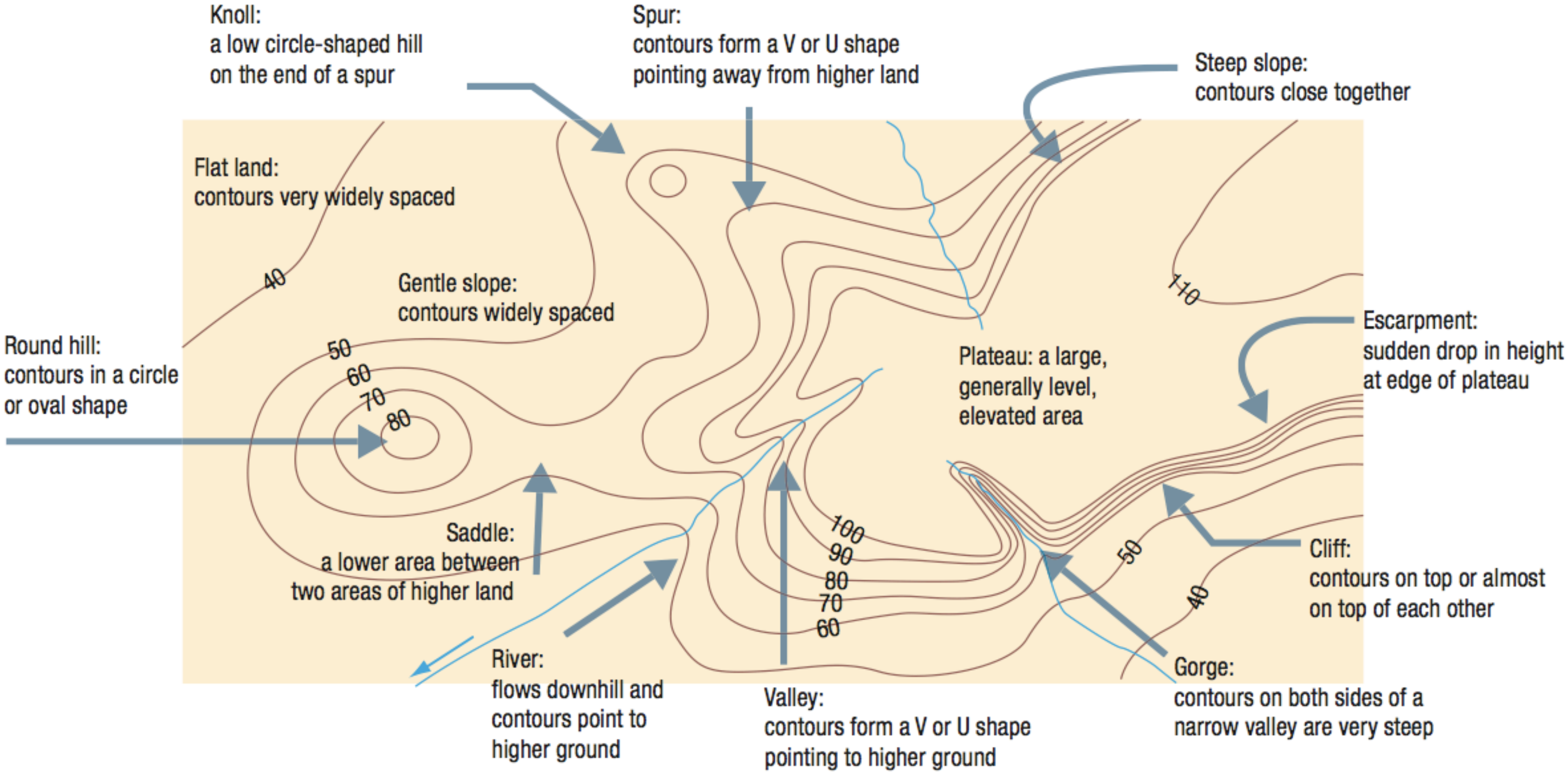
Colour layering

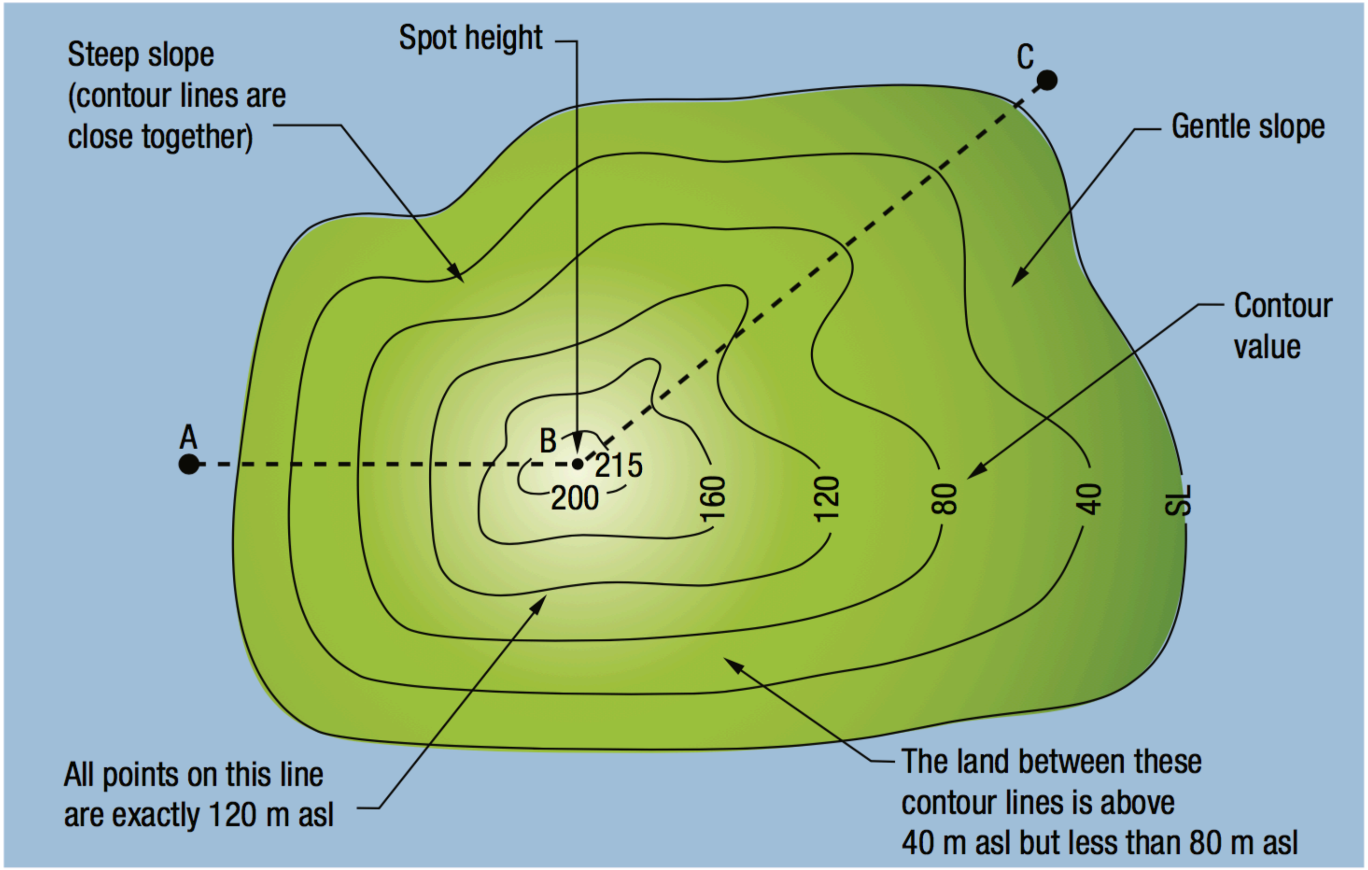


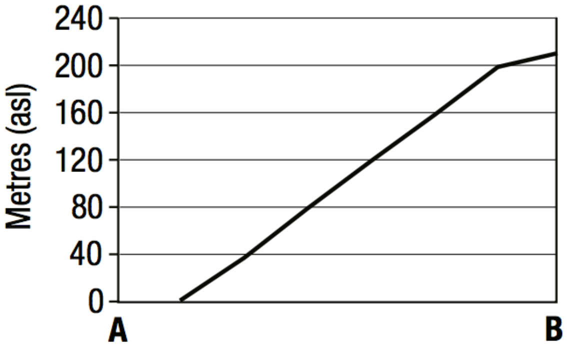
Shading

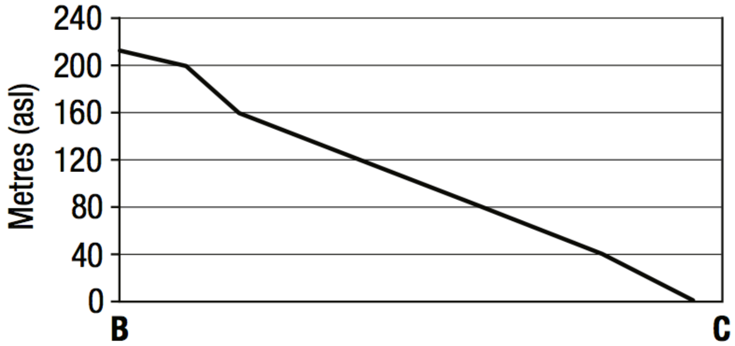
Contour lines



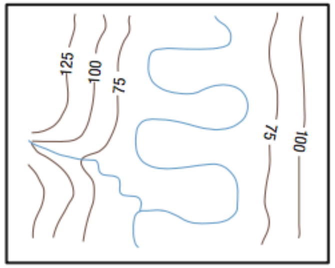

Knoll:
a low circle-shaped hill
on the end of a spur
Spur:
contours form a V or U shape
pointing away from higher land
Steep slope:
contours close together
Flat land:
contours very widely spaced
40
Gentle slope:
contours widely spaced
110
Escarpment:
sudden drop in height
at edge of plateau
Round hill:
contours in a circle
or oval shape
50
60
70
80
Plateau: a large,
generally level,
elevated area
100
90
80
70
60
Saddle:
a lower area between
two areas of higher land
50
40
Cliff:
contours on top or almost
on top of each other
River:
flows downhill and
contours point to
higher ground
Valley:
contours form a V or U shape
pointing to higher ground
Gorge:
contours on both sides of a
narrow valley are very steep


Steep slope
(contour lines are
close together)
Spot height
C
Gentle slope
Contour
value
A
B
215
200
160
120
80
40
SL
All points on this line
are exactly 120 m asl
The land between these
contour lines is above
40 m asl but less than 80 m asl


240
200
160
120
80
40
0
Metres (asl)
A
B

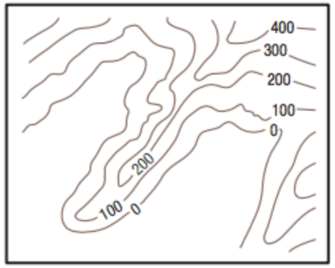

240
200
160
120
80
40
0
Metres (asl)
B
C

Floodplain

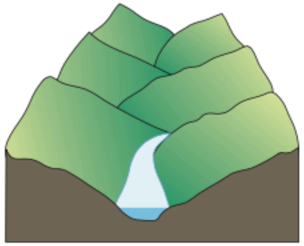


Contour interval (CI) = 25 m

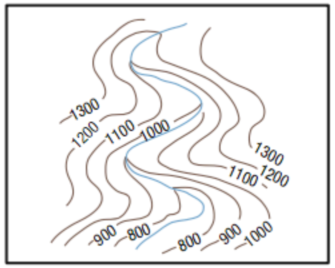
Drowned coastline



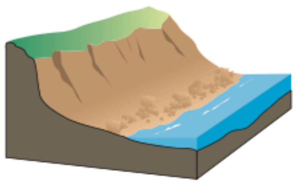
CI = 100 m



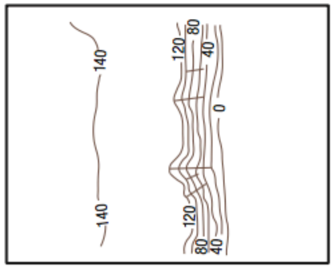
Interlocking spurs



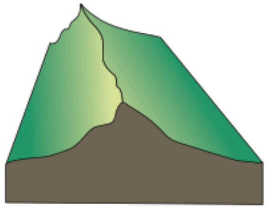
CI = 100 m



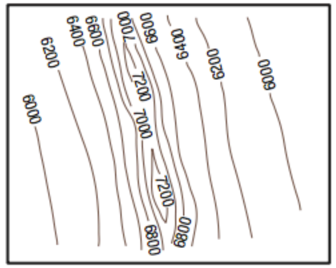
Cliffed beach



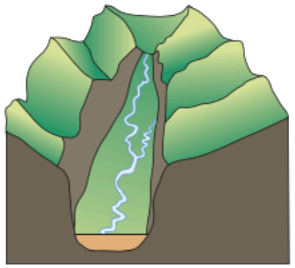
CI = 20 m



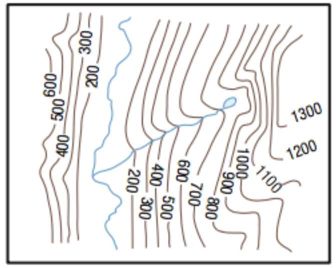
Ridge



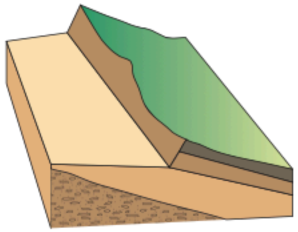
CI = 200 m



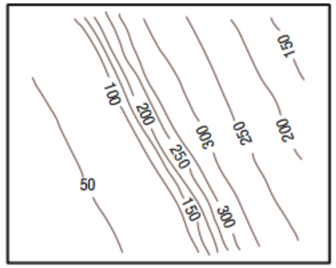
Truncated spurs



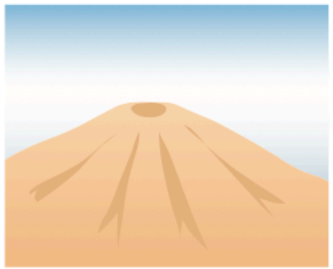
CI = 100 m



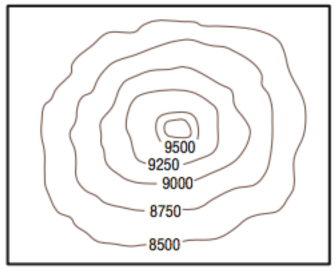
Scarp



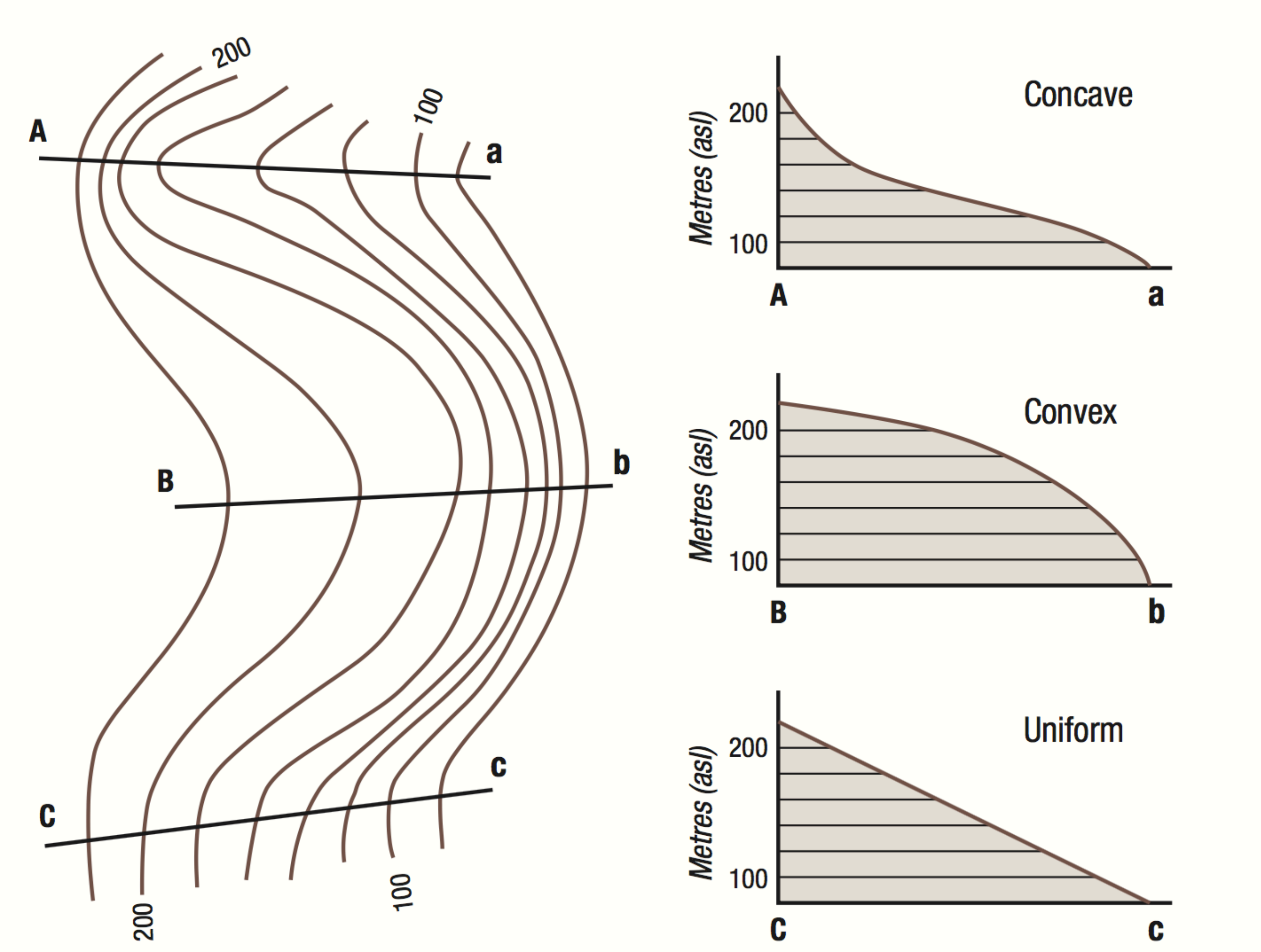
CI = 50 m



Conical mountain

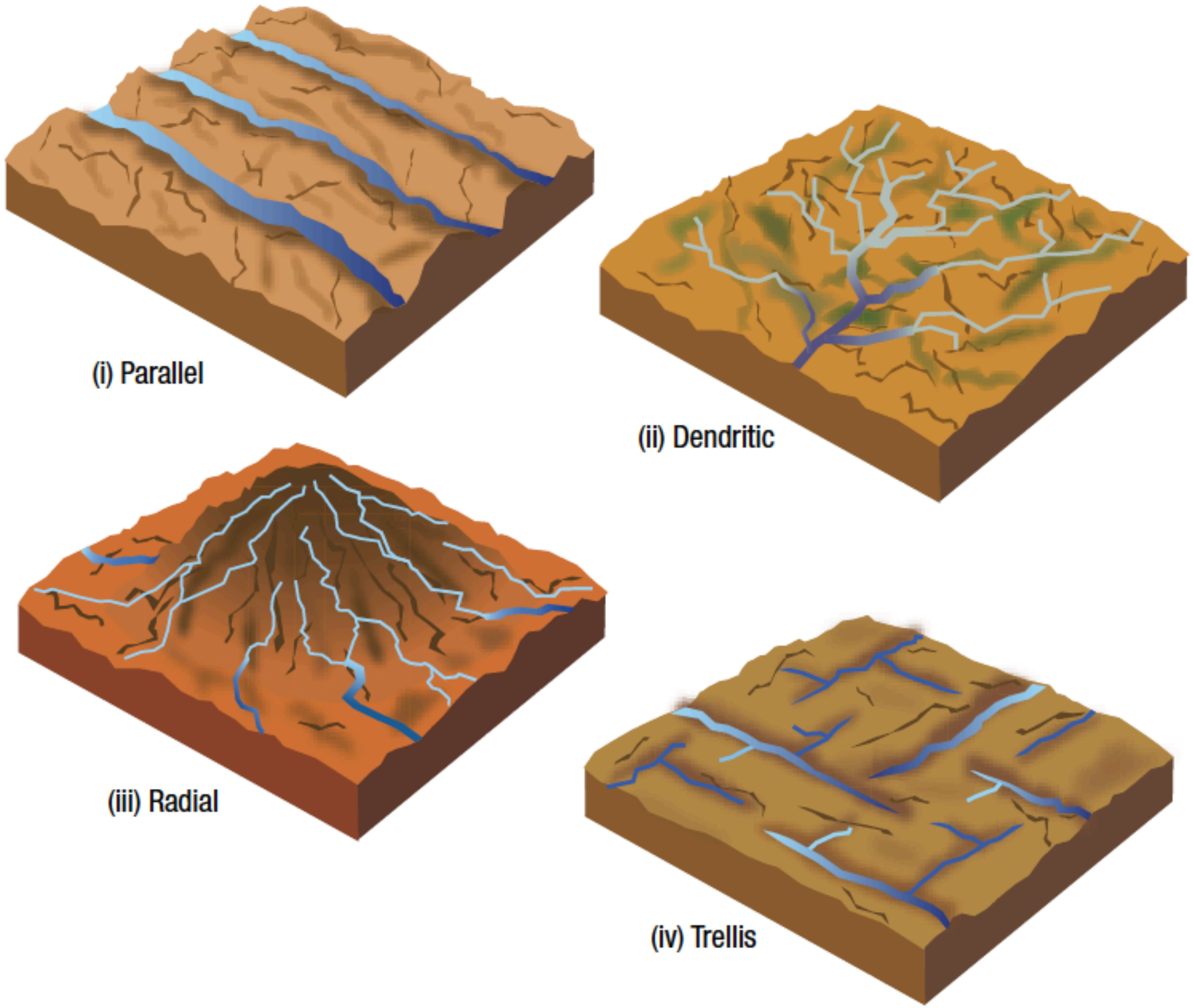


CI = 250 m

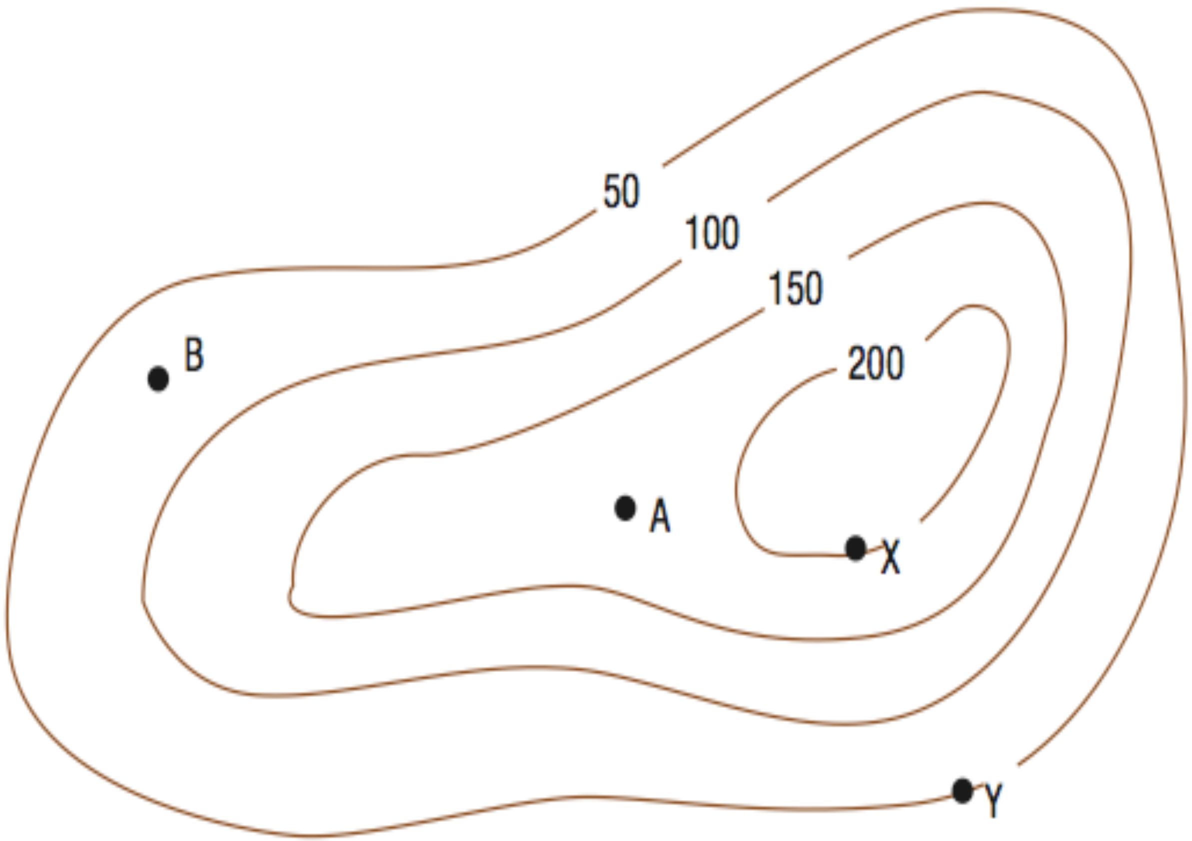


200
100
A
a
B
b
C
c
200
100
Concave
Metres (asl)
200
100
A
a
Convex
Metres (asl)
200
100
B
b
Uniform
Metres (asl)
200
100
C
c

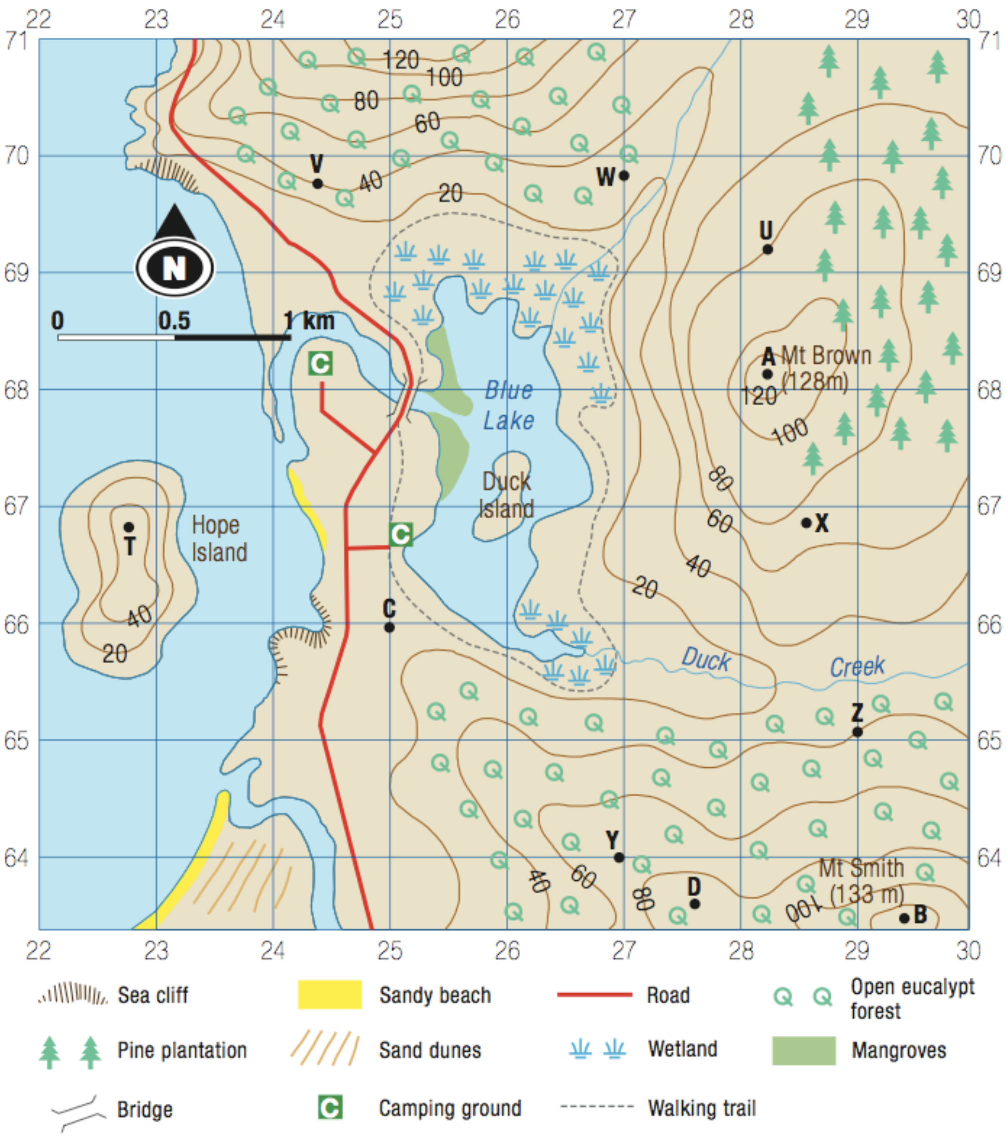
Drainage patterns



Height of landform features (1)

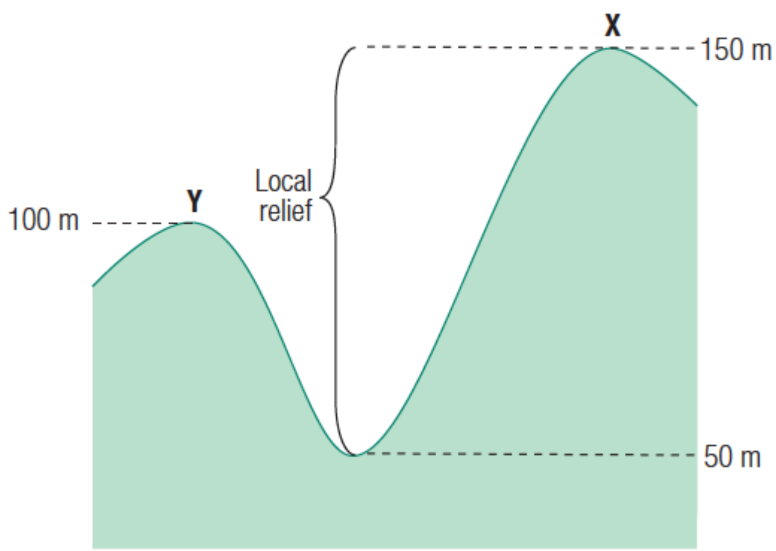


Height of landform features



A	128m
B	133m
C	<20m
D	>80m<100m
U	80m
V	40m
W	>20<40m
X	>60<80m
Y	>60<80m

Local relief



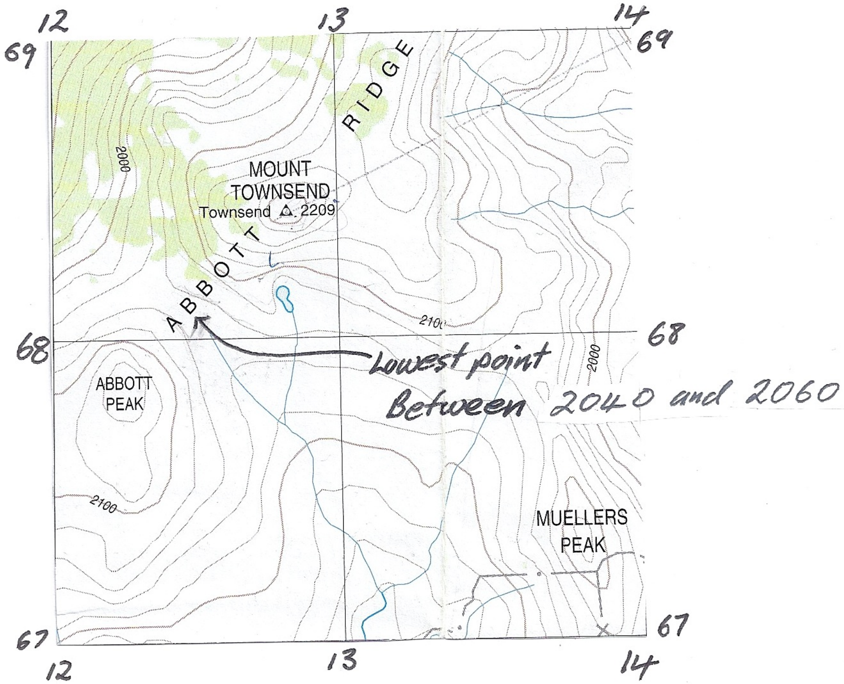
Local relief is the variation in the height over a relatively small, defined area. It is determined by calculating the difference in height between the highest and lowest points in the area.

Example: Calculate the local relief between points X and Y.

150 m – 50 m = 100 m

(highest point: X) (Lowest Point) (Local relief)

Note: Always ensure you include the appropriate unit of measurement with your answer.



- Mount Townsend 2209m
- Abbott Peak >2140m <2160m

Approximation

2209m	2209m
2041m	2059m
168	150m

Acceptable range of answers 150 – 168m

Activities:

Elevation and relief

21. Estimate the height of the following landform features:

a. Knob Hill (AR 2159)

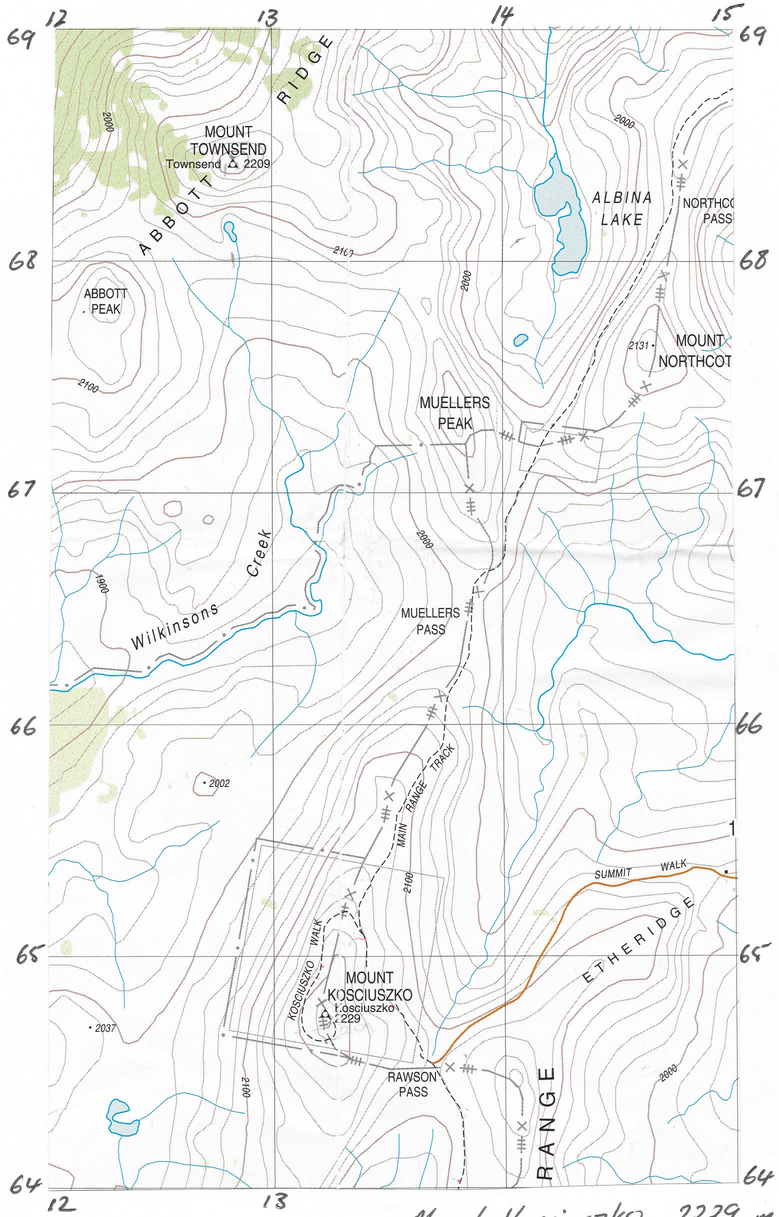
b. Mount Clark (AR 1567)

c. Abbot Peak (AR 1267)

d. Blue Lake

22. What is the difference in elevation of Mount Townsend (AR 1268) and Mount Kosciuszko (AR 1364)?

23. Estimate the local relief experienced on a traverse from the summit of Mount Townsend to the summit of Abbott Peak?



Mount Kosciuszko 2229 m

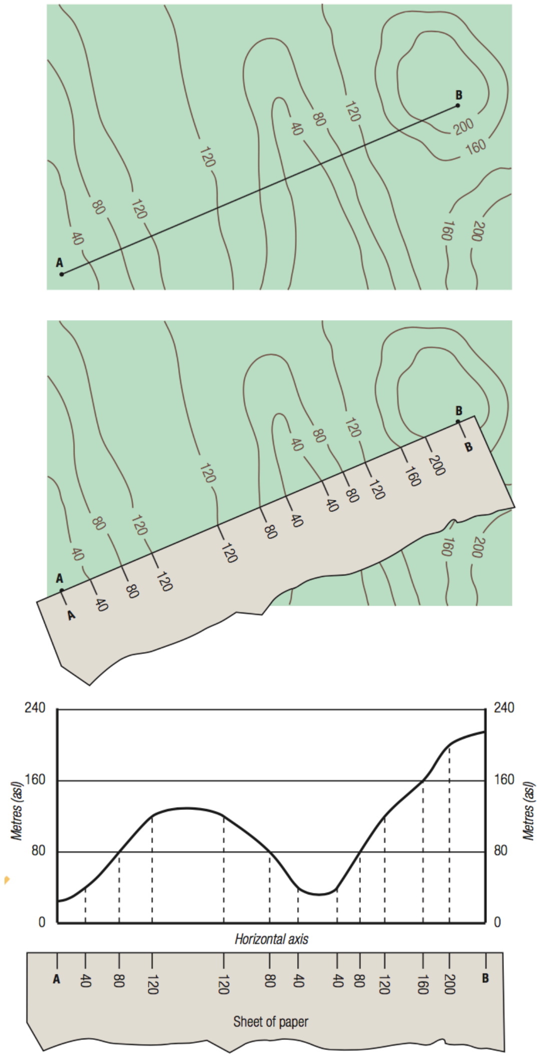
Mount Townsend 2209 m

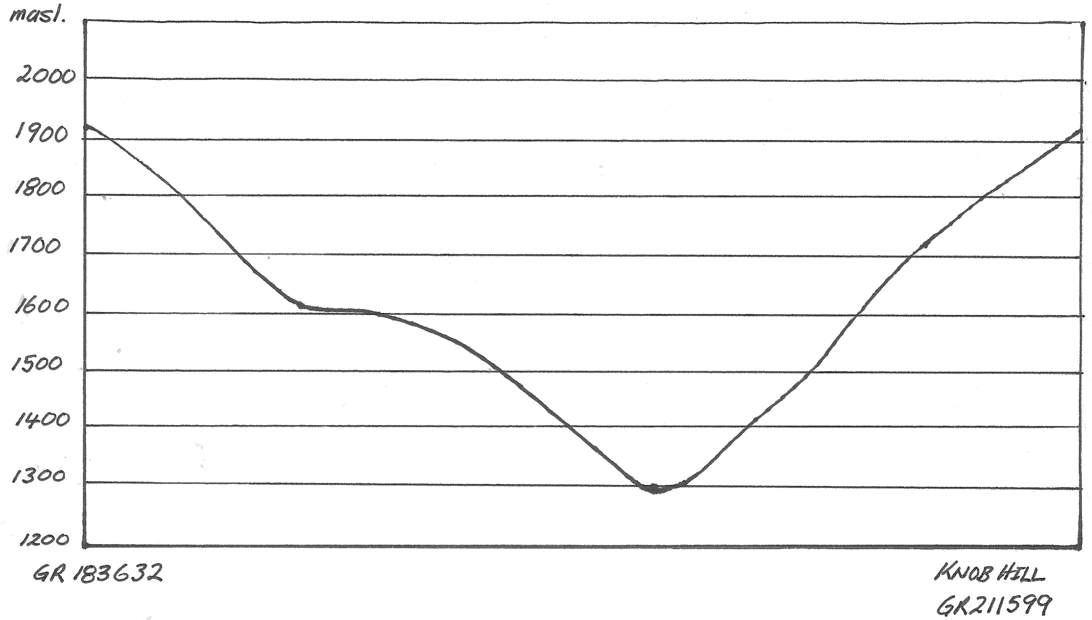
20 m

Drawing cross-sections

Drawing a cross-section involves the following steps:

1. Place the straight edge of a sheet of paper along a line joining points A and B. Mark points A and B on your sheet of paper.
2. Starting from point A, mark the position where the edge of your sheet of paper cuts each contour line. Write the value of each contour on your sheet of paper.
3. Draw the horizontal and vertical axes for your cross-section. The length of the horizontal axis should equal the length of the line A–B. The vertical axis, showing the height of the land above sea level, should use a scale appropriate to your needs.
4. Place your sheet of paper along the horizontal axis and then plot the contour points and heights as if you were drawing a line graph.
5. Join the dots with a single smooth, curved line and then shade in the area under the line to highlight the relief.





$$VE = \frac{VS}{HS} \quad \frac{1cm = 100m}{1cm = 25{,}000\,cm} = \frac{\frac{1}{100m}}{\frac{1}{250m}}$$

$$= \frac{1}{100} \times \frac{250}{1}$$

$$= \frac{250}{100}$$

$$= 2.5 \text{ times}$$

Vertical exaggeration

When a cross-section is drawn from a topographic map, the relief (or shape) of the land is often exaggerated so that relatively small variations in the landscape are clearly visible. To accurately interpret a cross- sectional profile we need to determine how much exaggeration has occurred. To do this we measure the number of times the vertical scale of the cross-section has been exaggerated (or ‘stretched’) compared with the actual shape. We call this calculation *vertical exaggeration*.

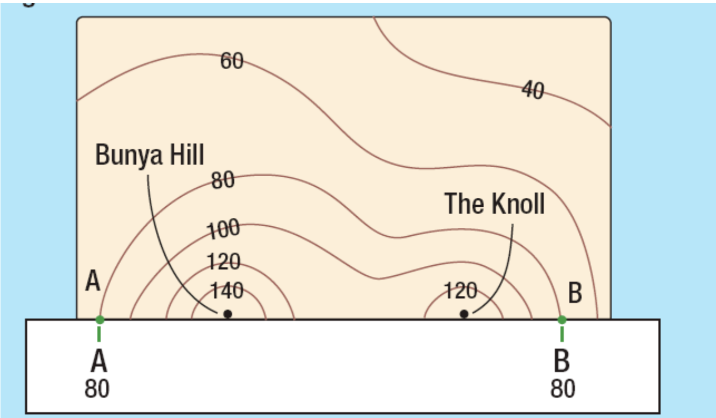
The formula used to calculate vertical exaggeration (VE) is shown below.

$$VE = \frac{\text{Vertical scale (VS)}}{\text{Horizontal scale (HS)}}$$

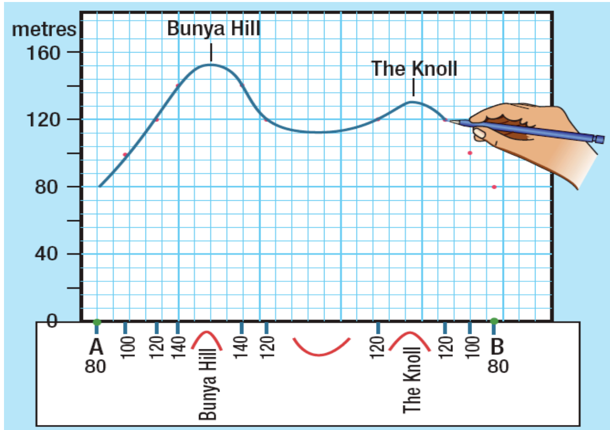
The *vertical scale* is the scale used on the vertical axis of the cross-section. The *horizontal scale* is the scale of the map from which the cross-section was drawn. The most common error students make is not converting the vertical and horizontal scales to a common unit of measurement; for example, metres. Answers must be expressed as a single number. Vertical exaggeration has no units of measurement nor is it expressed as a fraction.

Vertical exaggeration (2)

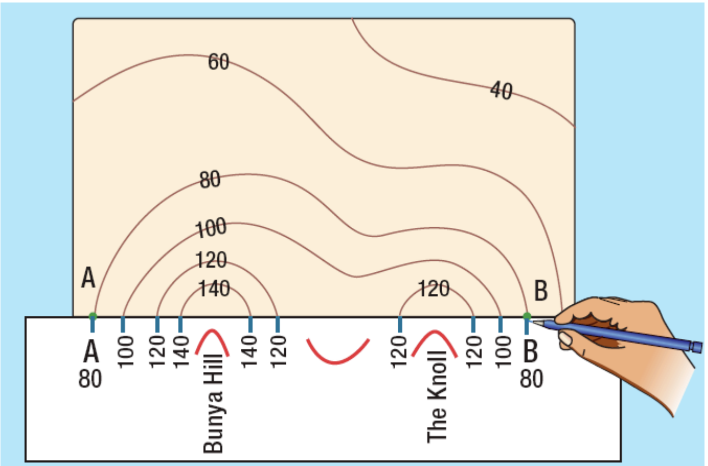
1



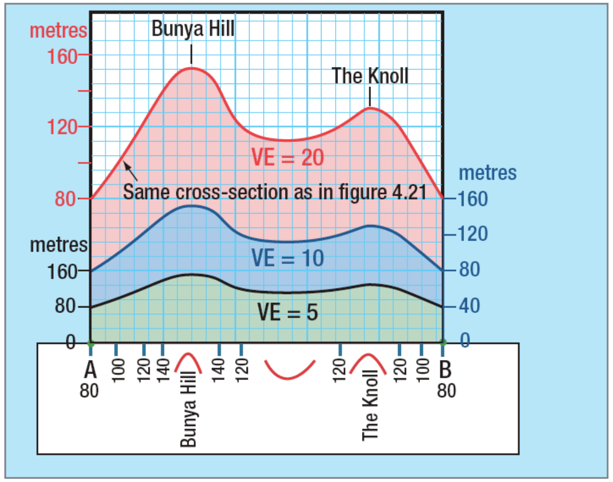
3



2



4



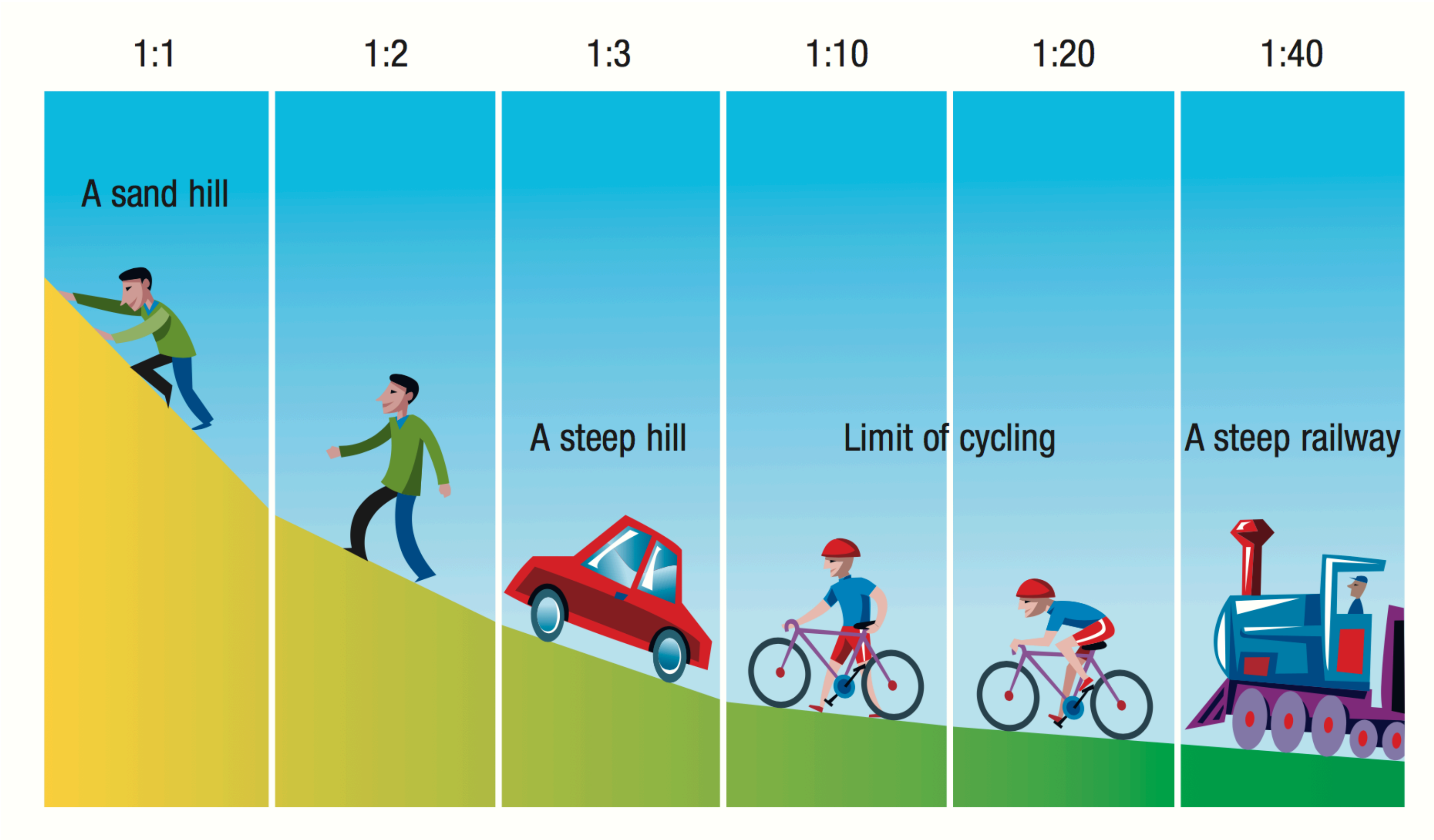
Activities:

Cross-sections and vertical exaggeration

24. Construct the cross-section from (GR 183632) to the summit of Knob Hill at GR 211599.

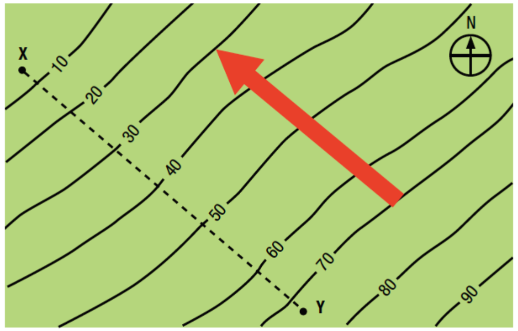
25. Calculate the vertical exaggeration of the cross-section you have constructed.

Gradient



1:1
1:2
1:3
1:10
1:20
1:40
A sand hill
A steep hill
Limit of cycling
A steep railway

Calculating gradient



Using the contour lines and scale on a map, it is possible to calculate the average gradient, or steepness, of a slope, road or river. The gradient is usually expressed as a fraction or ratio. It is calculated by dividing the difference in height (or vertical interval) between the two points by the horizontal distance between them.

Calculating the gradient between two points involves the two following steps.

STEP 1

Determine the two pieces of information required to complete the calculation.

- The first piece of information required is the difference in height between the two points. This is called the *vertical interval*, or *rise*. Find this by subtracting the lowest point from the highest point.
- The second piece of information required is the *horizontal distance* between the two points. This is sometimes referred to as the *run*. Find this by measuring the distance between the two points on the map and then using the scale to determine the actual distance.

STEP 2

To calculate the gradient of a slope use the following formula.

$$\text{Gradient} = \frac{\text{Vertical interval (rise)}}{\text{Horizontal distance (run)}}$$

Note: Because the gradient of a slope is expressed as a ratio, the measurements for the rise (numerator) and run (denominator) must be in the same unit of measurement; for example, metres.

Example: Gradient of the slope between X and Y.

$$\text{Gradient} = \frac{\text{Vertical interval (rise)}}{\text{Horizontal Distance (run)}}$$

$$= \frac{70\text{ m}}{4500\text{ m}}$$

$$= \frac{7\text{ (numerator)}}{450\text{ (denominator)}}$$

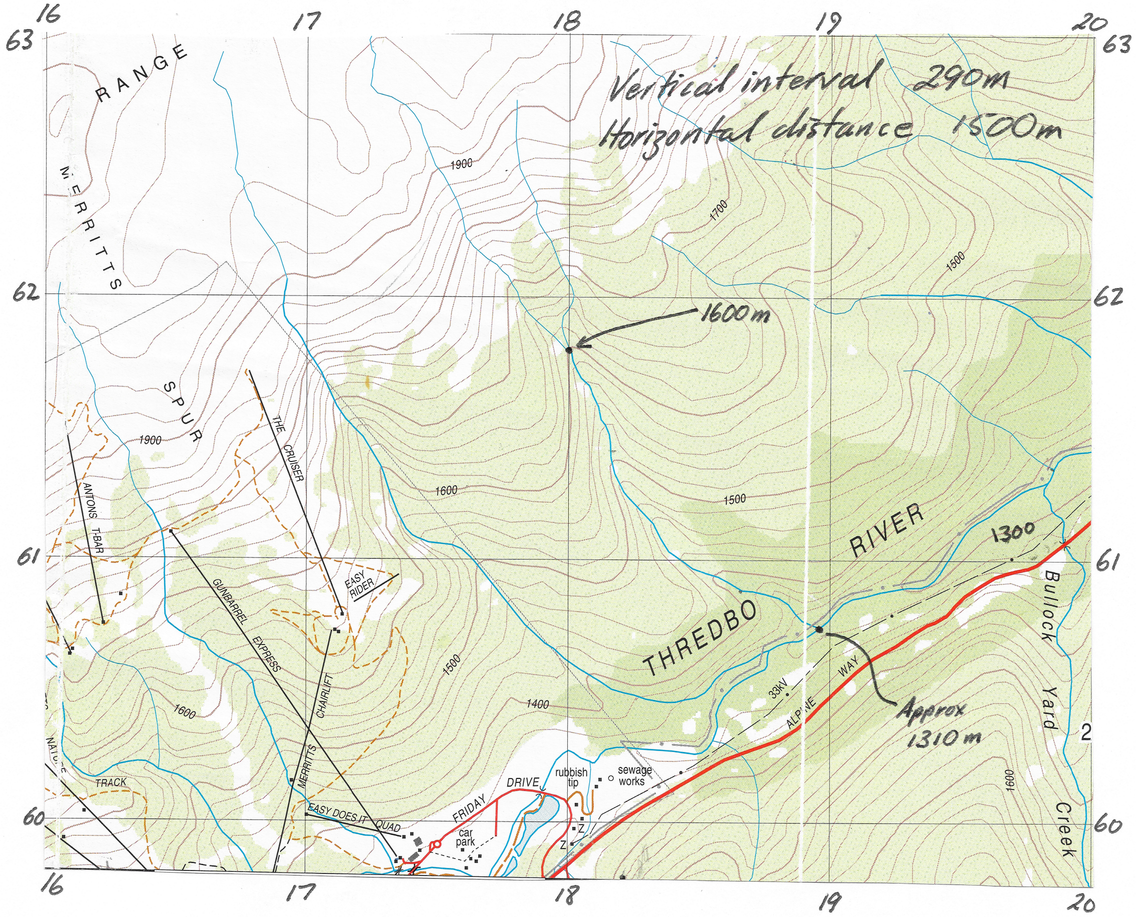
= 1 in 64 or 1:64

This means that for every 64m travelled in a horizontal direction. You go up 1 m. If you refer to the previous slide you will see that this is quite a gentle slope. The average person would be able to cycle up such a slope.

Activity

Gradient

26. What is the gradient of the creek between GR 180618 and the Thredbo River at GR 189607?

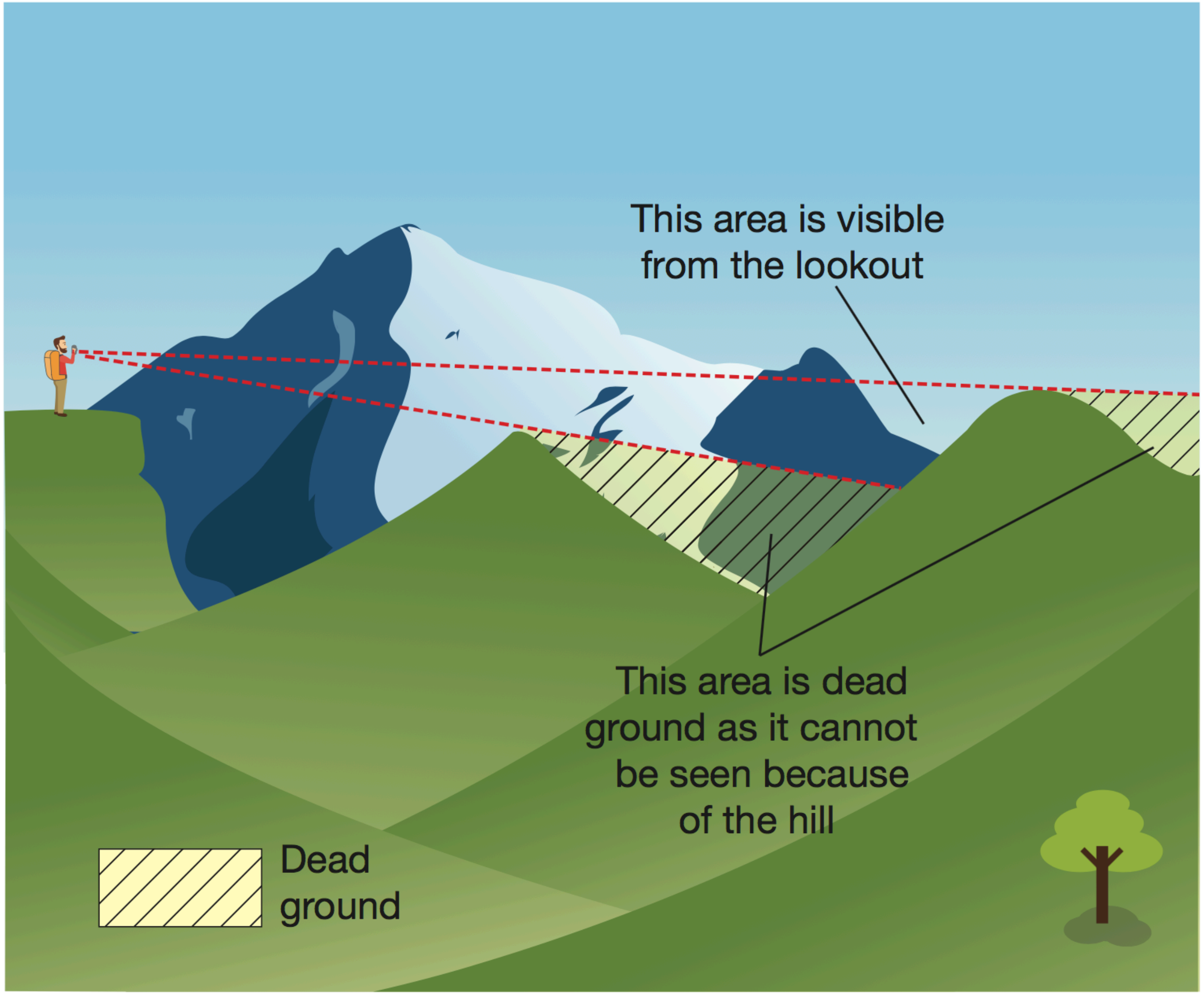


$$\text{GRADIENT} = \frac{VI \ (\text{Rise})}{HD \ (\text{Run})} = \frac{290\text{m}}{1500\text{m}}$$

$$= \frac{29}{150}$$

$$= 1 \text{ in } 5$$

Intervisibility (line of sight)



Activity

Intervisibility

27. Is Lake Cootapatamba (AR 1363) visible from the summit of Mount Townsend (GR 1268)?