3 Bisecting Lines and Angles
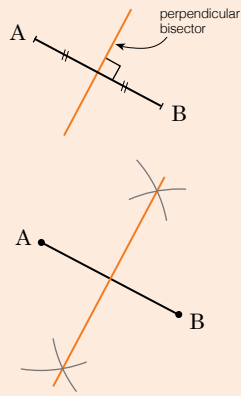
A Perpendicular Bisector

The **perpendicular bisector** of the line segment $\overline{AB}$ has 2 properties.

1) it makes a right angle with $\overline{AB}$.
2) it cuts $\overline{AB}$ in half.

Another word for perpendicular bisector is **mediator**.

Construction Method :

Open the compass wider than half of $\overline{AB}$ and keep that setting fixed. With the compass point at A draw an arc either side of the line. Repeat with the point at B. Join the arc crossing to draw the perpendicular bisector.
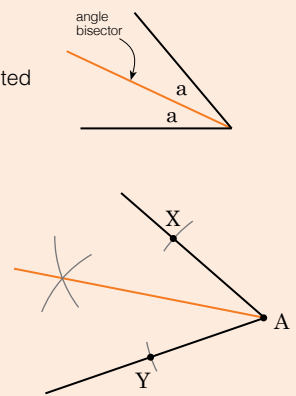

1 Construct the perpendicular bisector of $\overline{PQ}$ and of $\overline{RS}$.

a)

b)

2 Construct the mediator of $\overline{KL}$.

3 Construct the midpoint of line $\overline{AB}$, label this point with M.

B Angle Bisector

An **angle bisector** cuts an angle into two angles of equal size.
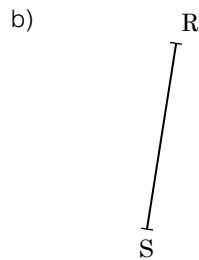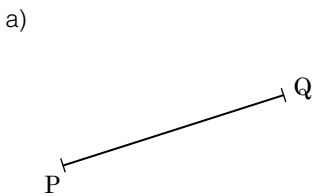
An angle bisector can be constructed using a compass and a ruler.

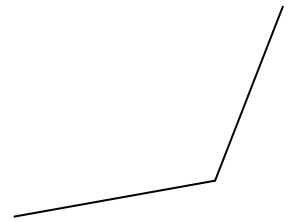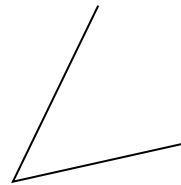This is how you do it. Keep the compass at a fixed opening.

Place the point first in A and draw two arcs which cross the arms of the angle at X and Y.

Place the compass point in turn in X (draw an arc) and in Y (draw an arc-crossing). Join A with the arc-crossing to form the angle bisector.
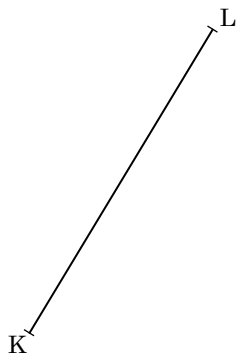

1 Bisect these angles.

2 Construct the angle bisectors of angles a and b.

3 Cut this angle into 4 equal parts.
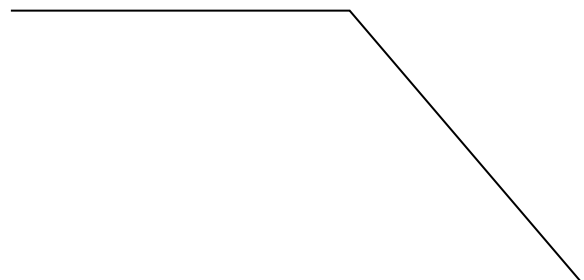
A   Making 3D Shapes

A **net** is a pattern which, when cut and folded, makes a 3D shape.

Example :   Draw a net for this triangular prism. Top and bottom are right angled triangles.
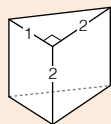
Working :   i)   start with the 2 by 2 square.
ii)   draw a triangle on top and on the bottom.
iii)   then draw the other two rectangles.

use a compass to get these the same size.
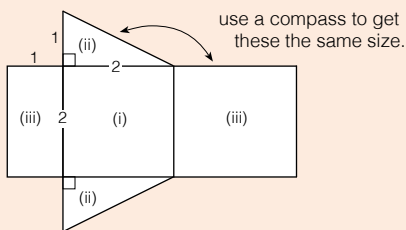
1   Draw exact nets for these solids. The grid makes the construction easier but a compass is needed at times. All measurement units are the same as the grid units.

a)

regular
triangular
prism

b)

regular
four-sided
pyramid

c)

d)

regular
six-sided
prism
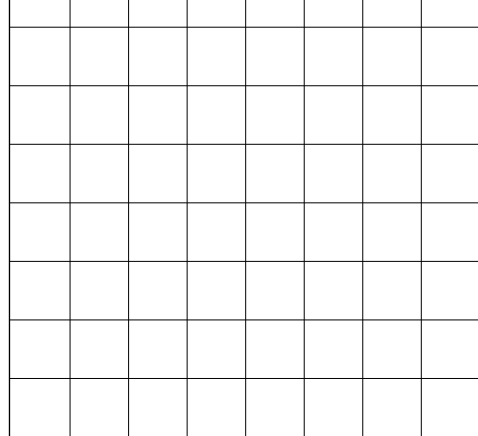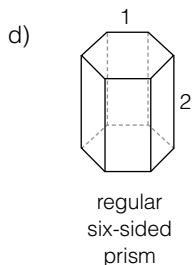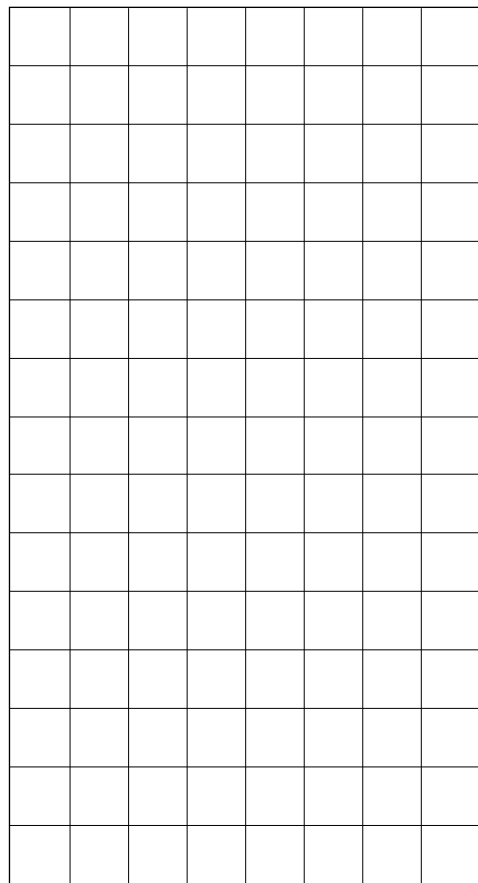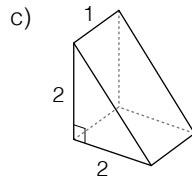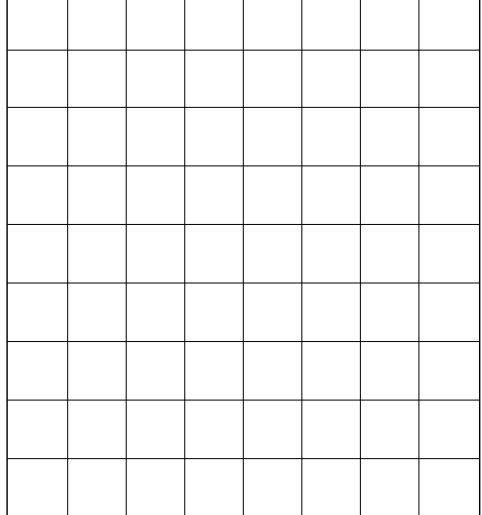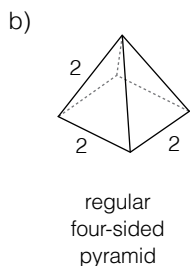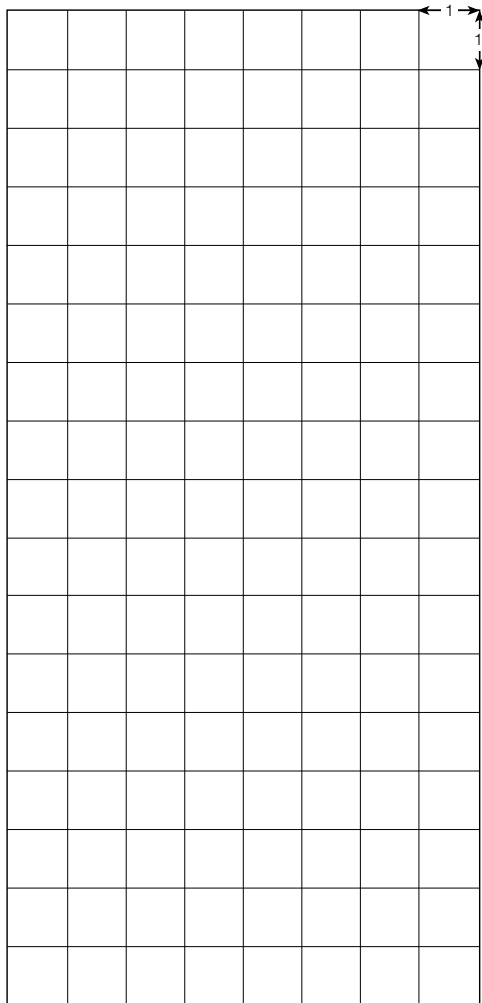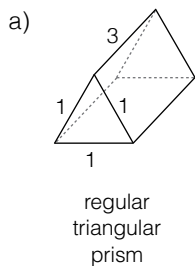
2   Draw a net for this prism.
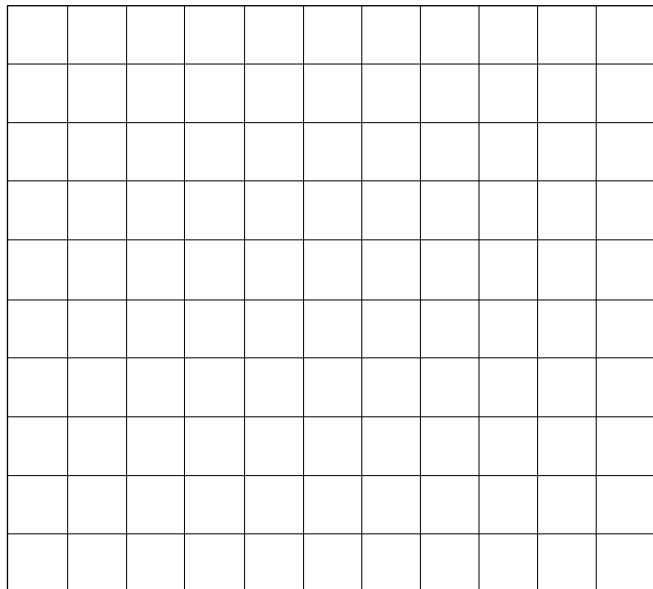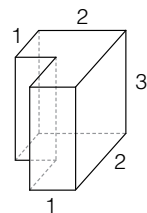
A Latitude and Longitude

Global grid lines are used to locate a position.

Latitude lines are parallel to the equator. They are numbered from 0˚ (equator) to 90˚ north (the North Pole) and 90˚ south (the South Pole).

Longitude lines are drawn from pole to pole and always run north south. Longitude lines are not parallel, they are furthest apart at the equator and meet at the poles.

The zero line runs through the town of Greenwich (England), the 180˚ line runs through the Pacific Ocean. [New Zealand is south of the equator and east of Greenwich.]

Example : Use the map of the North Island (below) to find the latitude and longitude of Mount Ruapehu. Give your reading to the nearest tenth of a degree.

Answer : Read off the map. Mt Ruapehu is at 39.3˚S and 175.6˚E (1 dp).

1 Read off the latitude and longitude (to 1 dp) of . . .

a) Hamilton   ....

b) Wellington   ....

c) New Plymouth   ....

2a) Use the scale to find the straight line distance between Auckland and Tauranga.

....

....

....

b) Measure the bearing of Tauranga from Auckland. ....
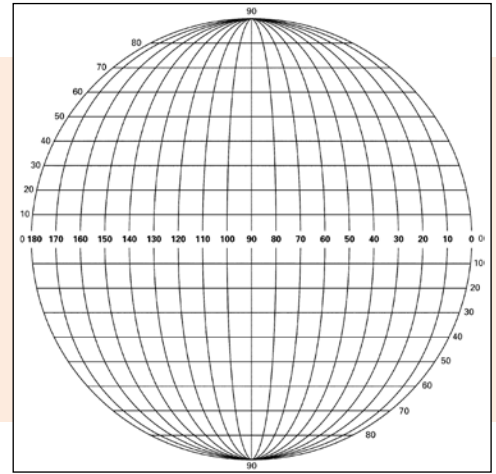
c) What is the bearing of Auckland from Tauranga? ....

3 John sails his yacht *Esprit* out of Tauranga Harbour. He sails for 195 km on a bearing of 344˚. Then he sails for 100 km on a bearing of 280˚. Show this journey on the map. Which port is *Esprit* bound for?

....

4 Paulette has just passed her pilot's licence and is making her first solo cross-country flight. Complete the table for the flight, giving bearings and distance for each leg.

leg	bearing	distance
a) Wellington - New Plymouth	....	....
b) New Plymouth - Taupo	....	....
c) Taupo - Tauranga	....	....

North Island of New Zealand

PACIFIC OCEAN

TASMAN SEA

scale   1 : 7 500 000
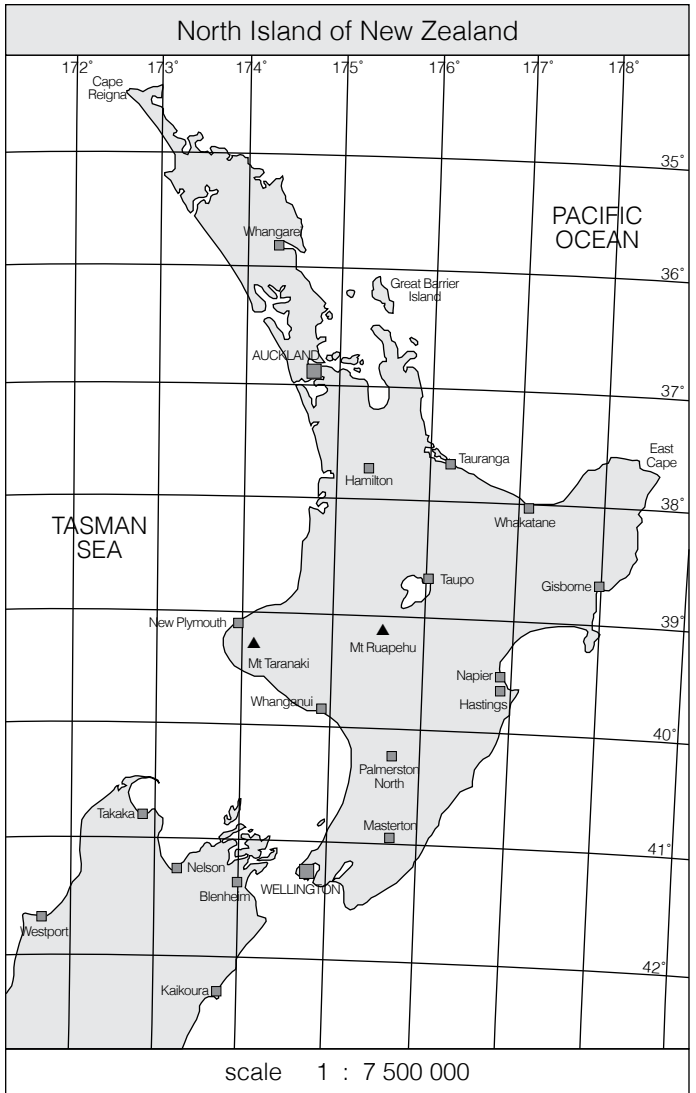
5 A yacht is sailing towards New Plymouth on a bearing of 154˚. The distance to New Plymouth is 210 km.

a) Mark the position of the yacht on the map.   b) Give the approximate latitude and longitude of that position.

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A The Writing Is On the Wall

1   Follow these instructions to paint a logo onto the wall of a sports complex. The wall is rectangular and is 20 m long and 12 m high. The logo fits inside a rectangle which is 5 m long and 3 m high.

These are instructions to get the rectangle in the correct position on the wall.

a) Imagine a coordinate grid on the wall with squares of size 50 cm by 50 cm, and the origin at the bottom left hand side. So the x-axis runs from (0, 0) to (40, 0) and the y-axis runs from (0, 0) to (0, 24). The rectangle with the logo is labelled OPQR, with O(4, 14) at the bottom left hand corner.
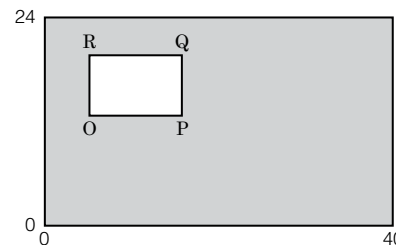
What are the coordinates of P, Q and R? P is at (…….,…………), Q at (…….,…………), R at (…….,…………).

b) A scale diagram of rectangle OPQR is shown below. What is the scale of the diagram?

………..

R   Q

O(4, 14)   P
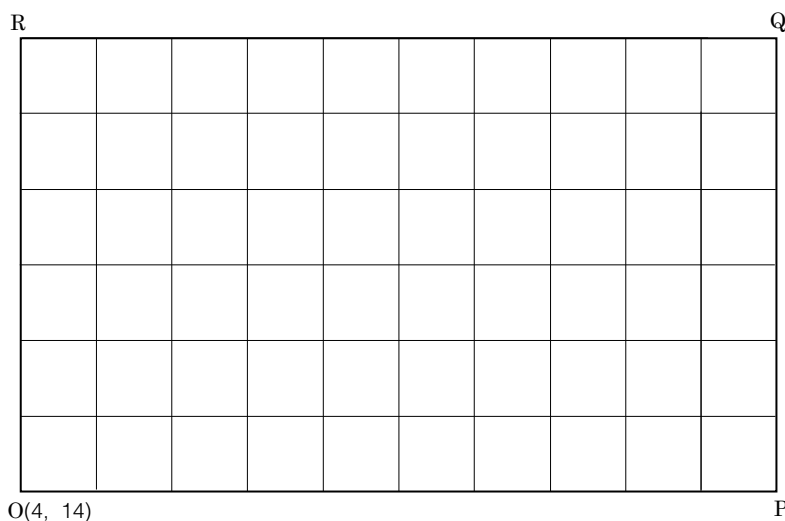
2   Instructions to draw the logo inside rectangle OPQR.

a) Draw line segment $\overline{AB}$ with A(5, 14) and B(11, 14). Make a 45° angle with AB as one of its arms. Label the other arm m.

b) Draw the angle bisector of the 45° angle. Label the angle bisector n.

c) Mark with C the point on line n, which has an x-coordinate of 11. The y-coordinate of C is not a whole number.

Measure on the diagram and complete :   C is at (11, ………….).

d) Draw a circle with centre C and radius $\overline{CB}$.

e) Label D the intersection of the circle and m.

f) Draw the locus of points at distance 1 unit from C.

3   Colouring the logo.

a) Inside ∠DAB, colour grey the locus of points that are closer to line AD than to line AB and more than 2.5 units from C. Colour black the locus of points that are closer to line AB than to line AD, and more than 2.5 units from C.

b) Colour red the locus of points that are between 1 and 2.5 units from C.