

# a MATHEMATICAL

# point



In 2006, this sign on the ground floor of Taipei 101 was correct. Since then, however, the record has been broken.

**1** (a) Suppose the footprint of the building is a square (see figure 1, right).

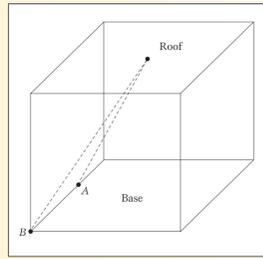


Fig. 1 Aerial view

**USE** the information in the yellow plaque (see photograph, left) to find the length of a side of this square.

(b) Suppose it is possible to stand in the center of the building's roof and look down through the building at points A and then B at its base. For each of these points, **FIND** the angle of depression from your position.

(c) If the dimensions of the square base of the building were doubled, **WOULD** the angles of depression found in part (b) be twice as large, be twice as small, change in some other way, or not change at all?

**2** (a) If the building's elevator rises at 1010 m/min. and the 90th floor is 386 m high, **DETERMINE** how long it would take for the elevator to go from the ground floor to the 89th floor. (Assume the change in elevation per floor is constant at that height.)

(b) Find a building (possibly your school) and time your walk up a flight of about 25 stairs. **ESTIMATE** how high you have climbed, and use that estimate to calculate how long it would take you to walk up to the 89th floor of Taipei 101.

**3** (a) In the "Ask a Journalist" column of the Sept. 20, 2002, issue of Toronto's *Globe and Mail*, a reader asked a question about why tall guys find it easier to get dates. The response referred to a simple formula for determining distance to the horizon: "Robert Matthews, a physicist at

Britain's Aston University, claims that to find the distance (in kilometers) to the horizon from any vantage point, **MULTIPLY** your height in meters by 10, add on one-third of the result, and take the square root of that. Thus, a six-footer can see 4.939 km compared with the 4.690 km for someone 5'5" tall."

**USE** the formula given in the newspaper column to find how far you would be able to see if you visited the outdoor observation deck on the 91st floor (390 m) of Taipei 101.

(b) Another way to calculate the distance  $d$  (in km) to the horizon from any vantage point is to use the formula

$$d = \sqrt{2rh},$$

where  $r$  is the radius of the earth ( $\approx 6378$  km) and  $h$  is the height of the vantage point (in km).

**WHERE** does this formula come from? **WHY** do we get pretty much the same estimate from this formula as we do from the one in the newspaper column?



Taipei 101  
Taipei City, Taiwan

All photography by Ron Lancaster

**TAIPEI 101** has 101 floors above ground and five floors below. It was the first building in the world to be taller than half a kilometer and, from 2004 to 2010, it was the tallest building in the world. Taipei 101 set several records, including having the world's fastest elevator. It is one of the most stable buildings ever made, able to withstand gale winds of up to 134 miles per hour and very strong earthquakes. There is a great deal of symbolism in the name of the building. The new century dawned with the construction of the building, and the number 101 represented the past century and the new year. The number 100 is often considered to be a symbol of perfection; 101 represents improvement on perfection.



M A T H I S A L L A R O U N D U S