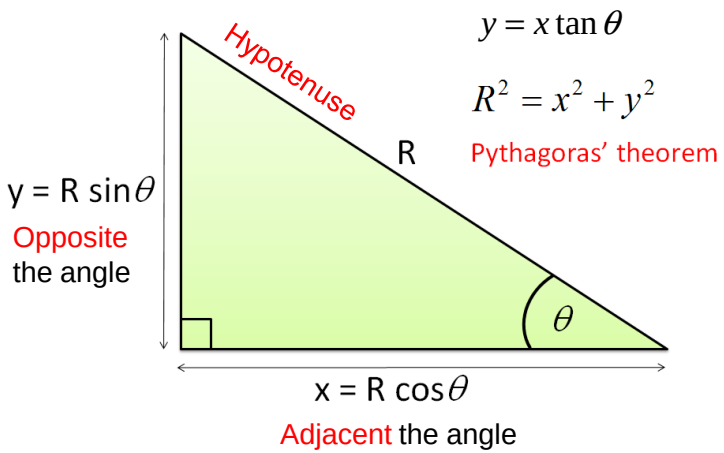
Trigonometry: Sine, Cosine, Tangent as *multipliers*

opposite = hypotenuse x $\sin\theta$
adjacent = hypotenuse x $\cos\theta$
opposite = adjacent x $\tan\theta$

Memory aid: **"Opposite goes with SIN"**



$y = x\tan\theta$

$R^2 = x^2 + y^2$ Pythagoras' theorem

Sine, Cosine and Tangent are *functions*. The angle is the *input*, the *output* is the ratio of sides of a right angled triangle.

$30^\circ \rightarrow$ **sin** $\rightarrow \frac{1}{2}$

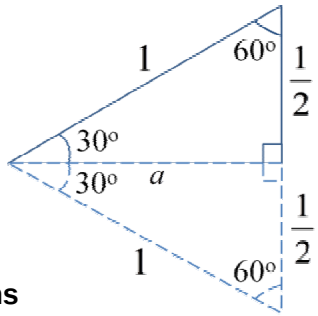
Inverse trigonometric functions

$\theta = \sin^{-1}\left(\frac{y}{R}\right)$

$\theta = \cos^{-1}\left(\frac{x}{R}\right)$

$\theta = \tan^{-1}\left(\frac{y}{x}\right)$

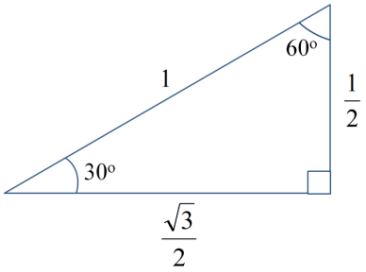
Special triangles

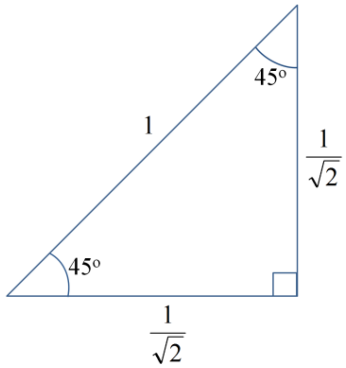


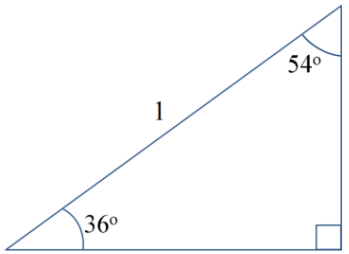
$1 = a^2 + \left(\frac{1}{2}\right)^2$

$\frac{3}{4} = a^2$

$\frac{\sqrt{3}}{2} = a$



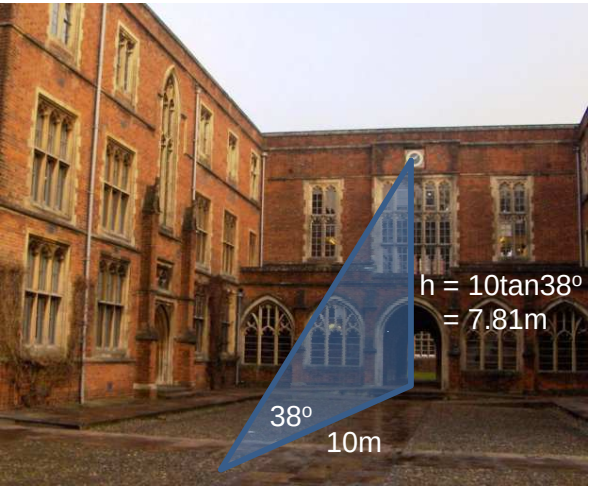




$\frac{1}{2}\phi = \frac{1+\sqrt{5}}{4}$

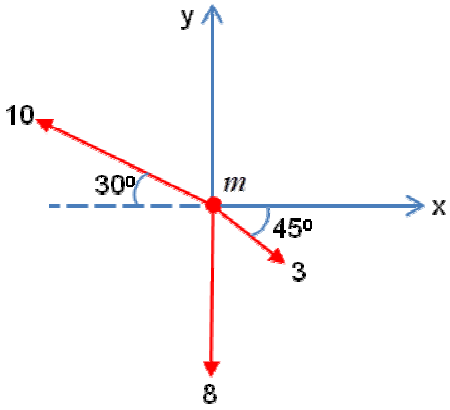
GOLDEN RATIO $\phi = \frac{1+\sqrt{5}}{2}$

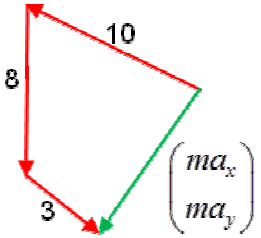
Practical applications of trigonometry



Use an angle measuring device, a tape measure and tan to calculate heights that may be difficult to measure directly

Resolving forces





$$\begin{pmatrix} ma_x \\ ma_y \end{pmatrix} = \begin{pmatrix} -10\cos 30^\circ + 3\cos 45^\circ \\ 10\sin 30^\circ - 3\sin 45^\circ - 8 \end{pmatrix} = \begin{pmatrix} -5\sqrt{3} + \frac{3}{\sqrt{2}} \\ -3 - \frac{3}{\sqrt{2}} \end{pmatrix}$$

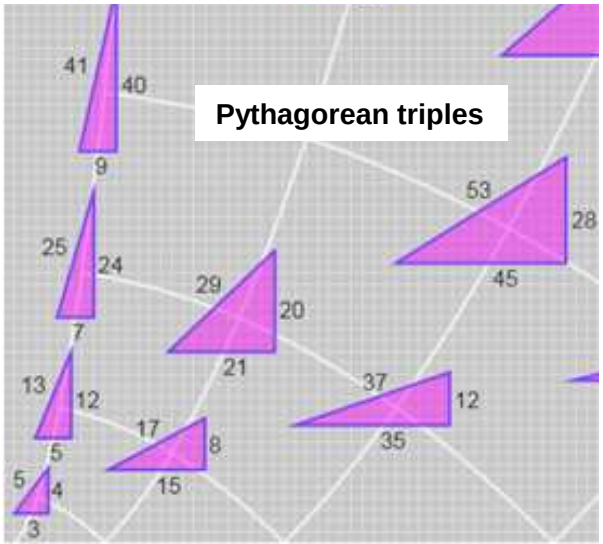


Figure 3.7: Clifftop view of Pukearuhe beach demonstrating the seismic line and access road along the banks of the Tongaporutu river.

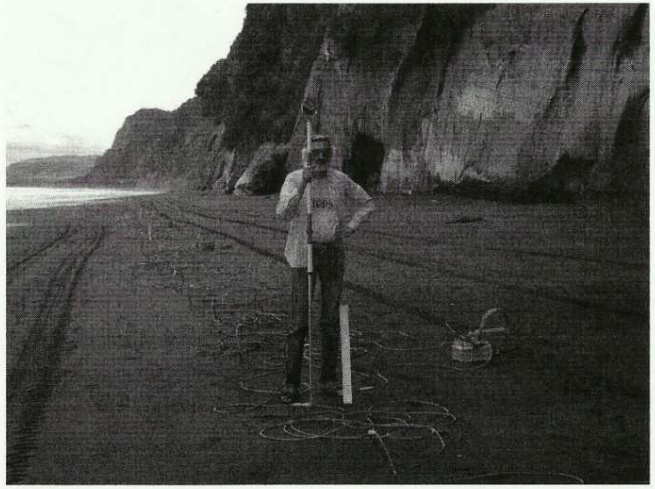


Figure 3.9: Staff mounted prism used to reflect the rangefinding laser.

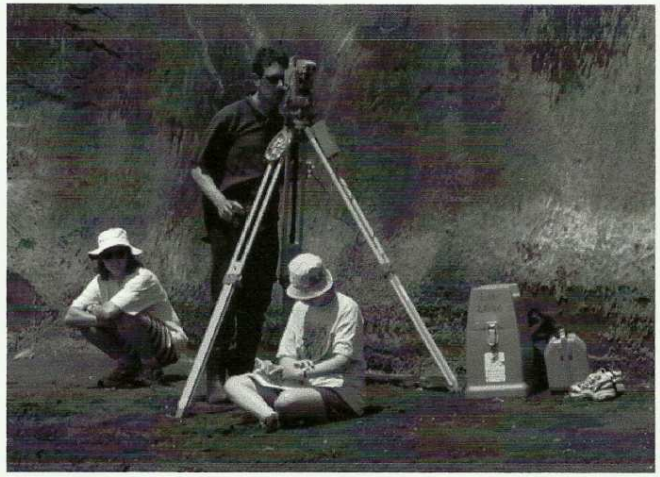


Figure 3.8: Tripod mounted theodolite and laser rangefinder are used to survey shot and geophone positions.

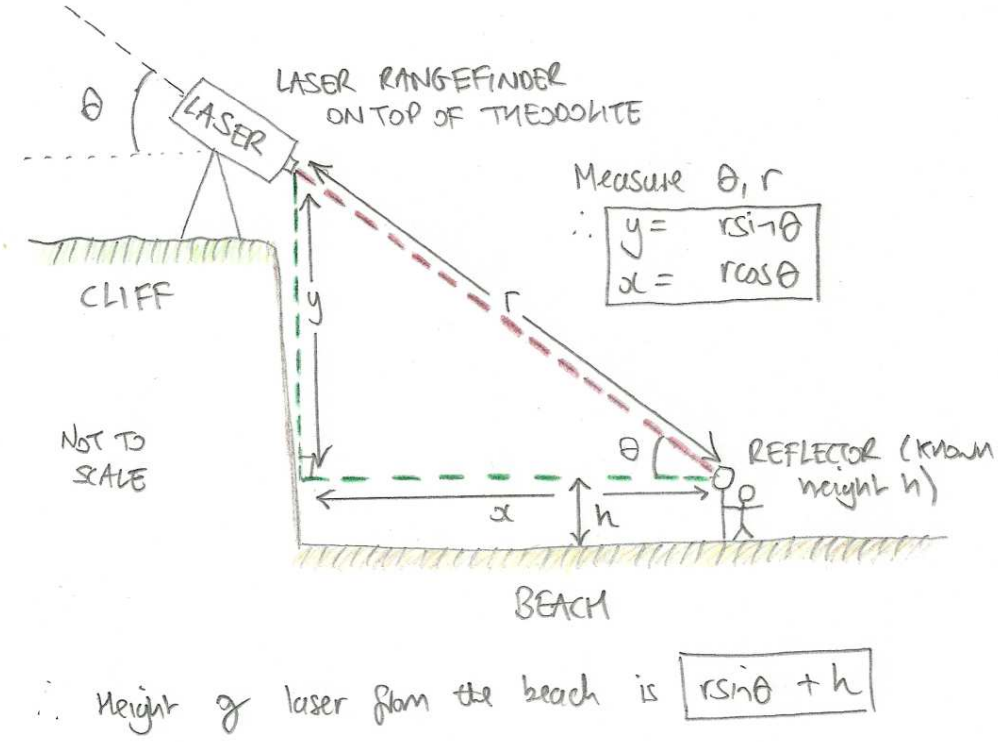


Figure 3.10: Global Positioning System (GPS) used to locate a fixed reference point from which all positions were calculated relative to.

Trigonometry was used to determine the positions of *geophones* during a seismic survey of a beach in New Zealand.
(Cambridge University Earth Sciences, 2001).