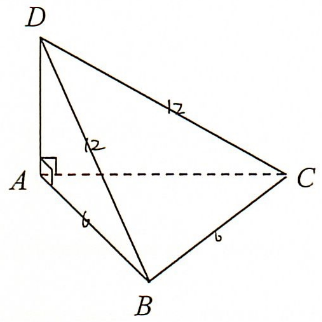
Hwa Chong Institution 华侨中学
Mathematics (SMTP)

Name: Wm Rm Hm (27) Class: 3I1 Date: 5th Sept

MA304.4.X1 – Angle of Inclined Plane

S1. *ABCD* is a tetrahedron such that the face *BCD* is isosceles with $BD = CD = 12$ cm, and *D* is directly above *A*, with *A*, *B* and *C* on level ground. If $AB = 6$ cm and *ABC* forms an equilateral triangle, find



(a) the angle of elevation of *D* from *B*

Angle of elevation $= \cos^{-1}\left(\frac{6}{12}\right)$
$= 60°$

(b) the angle θ made between the two planes *BCD* and *ABC*

Let the center point of BC be E.

DE $= \sqrt{12^2 - 3^2}$ cm
$= \sqrt{135}$ cm

AE $= \sqrt{6^2 - 3^2}$ cm
$= \sqrt{27}$ cm

$\theta = \cos^{-1}\left(\frac{\sqrt{27}}{\sqrt{135}}\right)$
$= 63.4°$ (1d.p.)

(c) the area of triangles ABC and BCD

Area of $\Delta ABC = \sqrt{27} \times 3$ cm^2

$= 15.6$ cm^2 (3s.f.)

Area of $\Delta BCD = \sqrt{135} \times 3$ cm^2

$= 34.9$ cm^2 (3s.f.)

Hence show that area of $\Delta ABC =$ area of $\Delta BCD \times \cos\theta$.

$15.6 = 34.9 \cos(63.4°)$ (shown)

In general, we have the following result:

Given a plane with area A which is inclined at an angle θ to the horizontal, the area of its projection vertically onto the horizontal is $A\cos\theta$.

S2. The projection of an inclined plane onto the ground is such that the area of the projected plane is 30 cm^2 and the area of the inclined plane is 45 cm^2. Find the angle of inclination of the plane above the ground.

$30 = 45 \cos\theta$

$\cos\theta = \frac{2}{3}$

$\theta = \cos^{-1}\left(\frac{2}{3}\right)$

$= 48.2°$ (1d.p.)