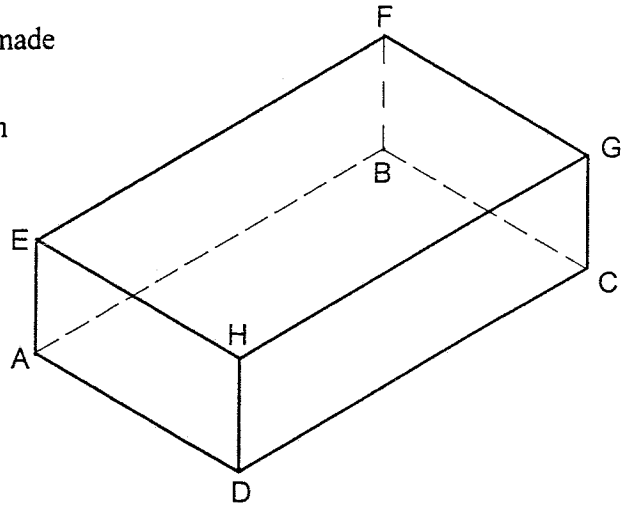
Drawings on this sheet are NOT to scale.

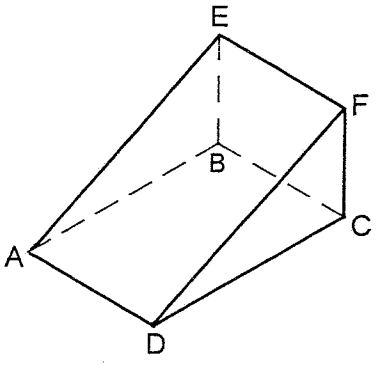
1. The drawing on the right represents a cuboidal shape made of wire with its vertices identified as ABCDEFGH.
Sizes are: AD = 15 cm AE = 10 cm CD = 25 cm
Calculate

(a) ∠GDC
(b) ∠EDA
(c) ∠EFH
(d) length of face diagonal DG
(e) length of face diagonal BD
(f) length of space diagonal DF
(g) ∠FDG
(h) ∠FDB



2. A cube has an edge-length of 10 cm.
Calculate the angle between its space diagonal, and one of its face diagonals.

3.

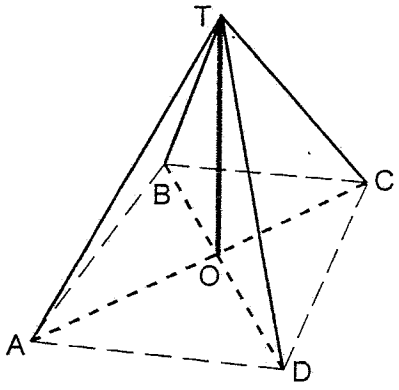


The drawing on the left shows a wedge ABCDEF.
Faces ABCD and BEFC are both rectangles and are at right angles to each other.
AB = 20 cm AD = 10 cm ∠FDC = 18°
Calculate

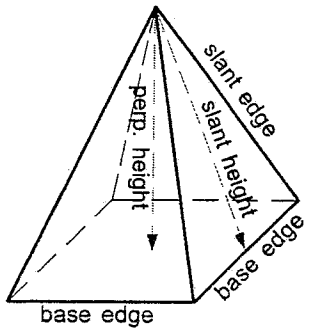
(a) the height CF
(b) the length of edge DF
(c) ∠CAD
(d) the length of diagonal AF
(e) ∠FAC

4. The drawing on the right shows a television mast OT which has 4 stay-wires fastened to its top (at T) and to the ground at points A, B, C and D.
ABCD form a square and point O is its centre.
AD = 32 metres
The angle of elevation of T from A is 57°
Calculate (a) distance AO

(b) height of the mast OT
(c) length of one stay-wire
(d) angle of elevation of the top of the mast from a point E which midway between C and D.



5.



A right square-based pyramid has a base-edge of length 17 cm and a perpendicular height of 28 cm.
Calculate

(a) the length of a slant edge
(b) its slant height
(c) the angle between a slant edge and the base
(d) the area of one triangular face

3D Trigonometry

Excellent work! Su-Min Lin

See corrections on page 2.

1. a) $\tan \angle GDC = \frac{10}{25} = \frac{2}{5}$ ✓

$\angle GDC = 21.8°$ (to 1dp) ✓

b) $\tan \angle EDA = \frac{10}{15} = \frac{2}{3}$ ✓

$\angle EDA = 33.7°$ (to 1dp) ✓

c) $\tan \angle EFH = \frac{15}{25} = \frac{3}{5}$ ✓

$\angle EFH = 31.0°$ (to 1dp) ✓

d) $DG = \sqrt{25^2 + 10^2} = \sqrt{725} = 5\sqrt{29}$ ✓

e) $BD = \sqrt{25^2 + 15^2} = \sqrt{850} = 5\sqrt{34}$ ✓

f) $DF^2 = 10^2 + (\sqrt{850})^2 = 950$

$DF = \sqrt{950} = 5\sqrt{38}$ ✓

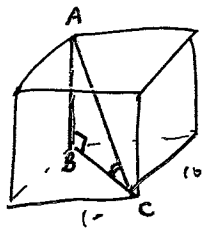
g) $\sin FDG = \frac{15}{5\sqrt{38}} = \frac{3}{\sqrt{38}}$ ✓

$\angle FDG = 29.1°$ (to 1dp) ✓

h) $\tan FDB = \frac{10}{5\sqrt{34}}$ ✓

$\angle FDB = 18.9°$ (to 1dp) ✓

2.



BC = Diagonal $= \sqrt{10^2+10^2} = \sqrt{200} = 10\sqrt{2}$ ✓

AC = Space diagonal $= \sqrt{(10\sqrt{2})^2+10^2} = \sqrt{300} = 10\sqrt{3}$ ✓

$\cos B\hat{C}A = \frac{BC}{AC} = \frac{10\sqrt{2}}{10\sqrt{3}} \Rightarrow B\hat{C}A = 35.3°$ (to 1dp).

3. a) $\tan 18 = \frac{CF}{20}$ ✓

$20\tan 18 = CF \doteq 6.5$ cm (to 1dp) ✓

b) $DF = \sqrt{(20\tan 18)^2+20^2} \doteq 21.0$ cm (to 1dp) ✓

c) $\tan CAD = \frac{20}{10} = 2$ ✓

$\angle CAD \doteq 63.4°$ (to 1dp) ✓

d) $AF^2 = (20\tan 18)^2 + \left(\sqrt{20^2+10^2}\right)^2$ ✓

$= 400\tan^2 18 + 500$ ✓

$AF \doteq 23.3$ cm (to 1dp) ✓

e) $\tan FAC = \frac{20\tan 18}{\sqrt{500}}$ ✓

$\angle FAC \doteq 16.2°$ (to 1dp) ✓

4. a) $AO = \frac{\sqrt{32^2+32^2}}{2} \doteq 22.6$ cm (to 1dp) ✓

b) $\tan 57 = \frac{OT}{AO}$ ✓

$\frac{\sqrt{32^2+32^2}}{2} \times \tan 57 = OT \doteq 34.8$ m (to 1dp) ✓

c) $AO^2 + OT^2 = l^2$ ✓

$512 + 1214.096\ldots = l^2$ ✓

$l \doteq 41.5\text{m}$ (to 1dp) ✓

d) $\tan\theta = \frac{OT}{16}$ ✓

$\theta \doteq 65.3°$ (to 1dp) ✓

5.b) $l^2 = 28^2 + \left(\frac{17}{2}\right)^2$ ✓

$l \doteq 29.3\text{ cm}$ (to 1dp) ✓

a) $h^2 = 28^2 + \left(\frac{\sqrt{17^2+17^2}}{2}\right)^2$ ✓

$= 928.5$ ✓

$h \doteq 30.5\text{ cm}$ (to 1dp) ✓

c) $\tan\theta = \frac{28}{\frac{\sqrt{17^2+17^2}}{2}} = 2.3292\ldots$ ✓

$\theta \doteq 66.8°$ (to nearest °) ✓

d) $\frac{1}{2} \times 17 \times \sqrt{856.25} \doteq 248.7\text{ cm}^2$ ✓ (to 1dp)