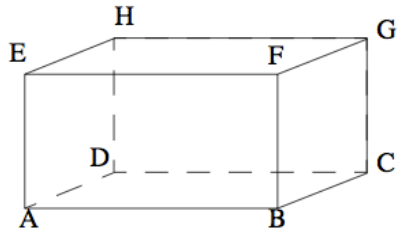
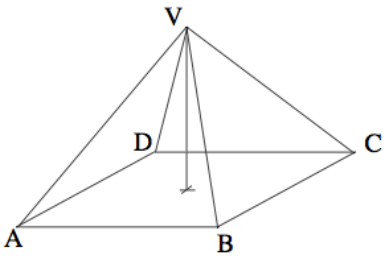
Right Angles in 3-Dimensions

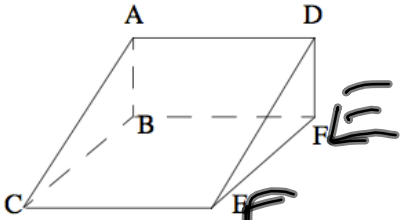
Examples of figures you may have to draw



Cuboid ABCD, EFGH



Right Pyramid V, ABCD



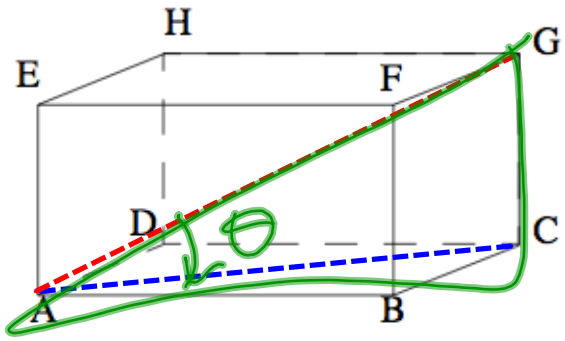
Wedge ABC, DEF

A cube ABCD, EFGH has a side length measuring 6 cm.

(a) Find the length of the segment $[AC]$.

(b) The length of the diagonal $[AG]$.

(c) The angle that the diagonal $[AG]$ makes with the base.



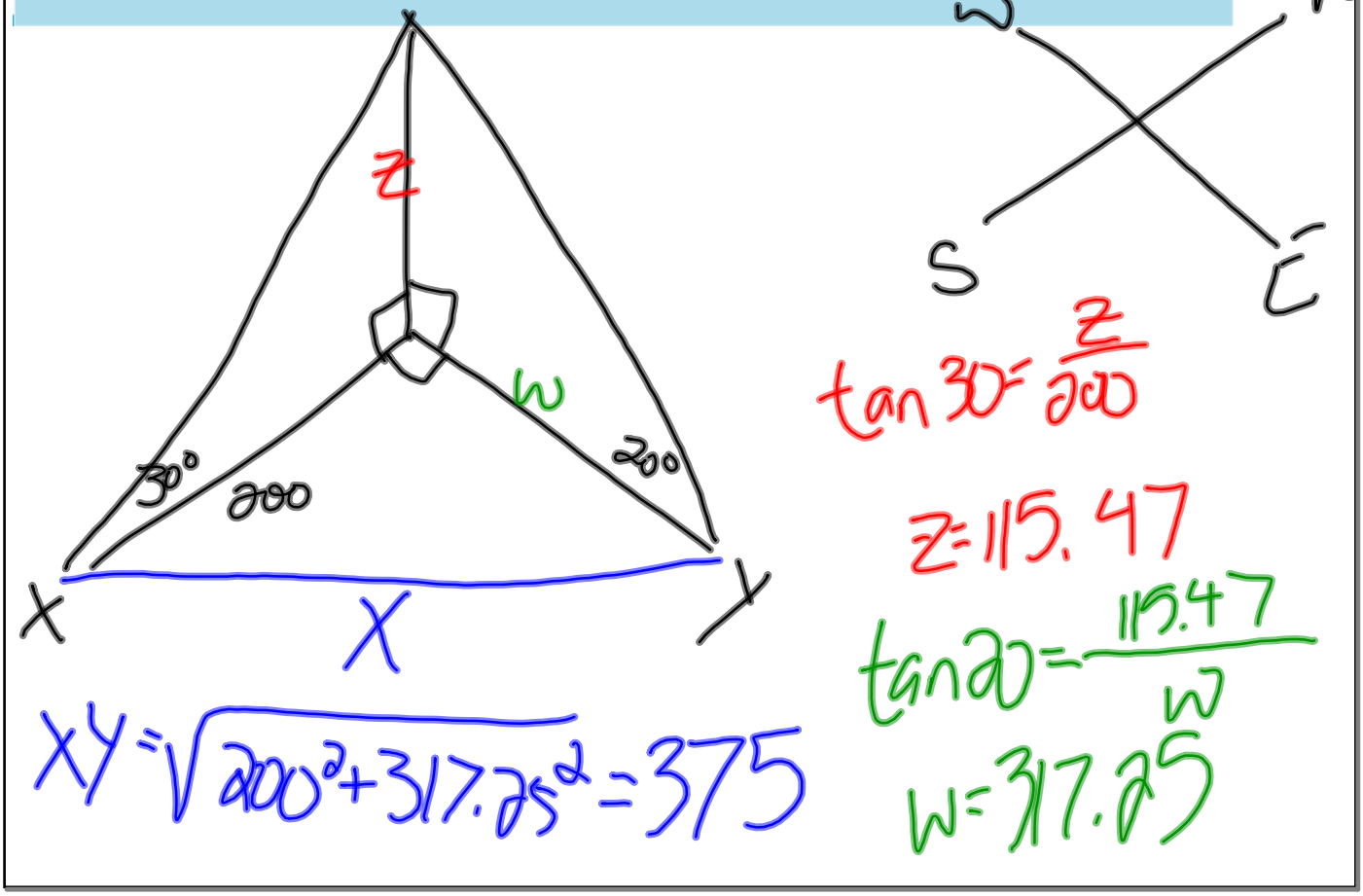
$\tan\theta = \frac{6}{6\sqrt{2}}$

a) $AC = 6\sqrt{2} = \sqrt{72}$

b) $AG = \sqrt{108}$

c) 35.3

From a point X, 200 m due South of a cliff, the angle of elevation of the top of the cliff is 30°. From a point Y, due East of the cliff, the angle of elevation of the top of the cliff is 20°. How far apart are the points X and Y?



A right pyramid with a rectangular base and a vertical height of 60 cm is shown in the diagram alongside. The points X and Y are the midpoints of the sides [AB] *and* [BC] *respectively*

Find

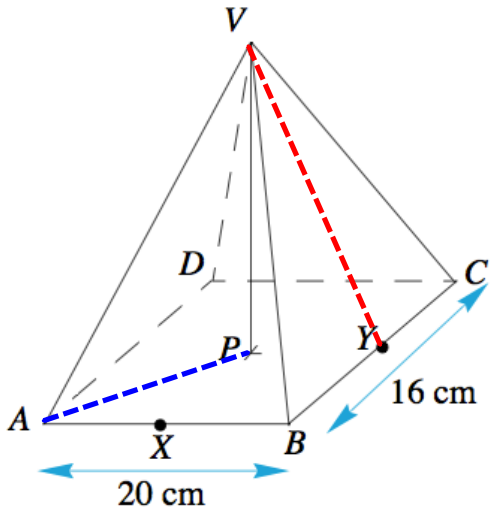
(a) the length, AP.

(b) the length of the edge [AV].

(c) the angle that the edge AV makes with the base ABCD.

(d) the length, YV .

(e) The angle that the plane BCV makes with the base.



a) $AP = \frac{1}{2}AC = \frac{1}{2}\sqrt{656}$

b) $AV = \sqrt{\left(\frac{1}{2}\sqrt{656}\right)^2 + 60^2} = 61.4$

c) $\tan\theta = \frac{60}{\frac{1}{2}\sqrt{656}} = 76.0°$

d) $YV = \sqrt{60^2 + 10^2} = \sqrt{3700}$

e) $\tan\beta = \frac{60}{10}$

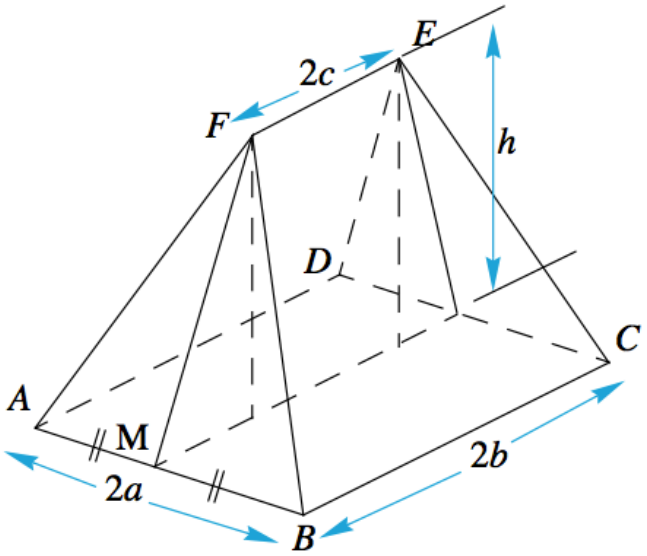
$\beta = 80.5°$

The angle of depression from the top of a tower to a point X South of the tower, on the ground and 120 m from the foot of the tower is 24°. From point Y due West of X the angle of elevation to the top of the tower is 19°.

(a) Illustrate this information on a diagram.
(b) Find the height of the tower.
(c) How far is Y from the foot of the tower?
(d) How far apart are the points X and Y?

A symmetrical sloping roof has dimensions as shown in the diagram. Find

(a) the length of [FM].
(b) the angle between the plane BCEF and the ground.
(c) the angle between the plane ABF and the ground
(d) the total surface area of the roof.



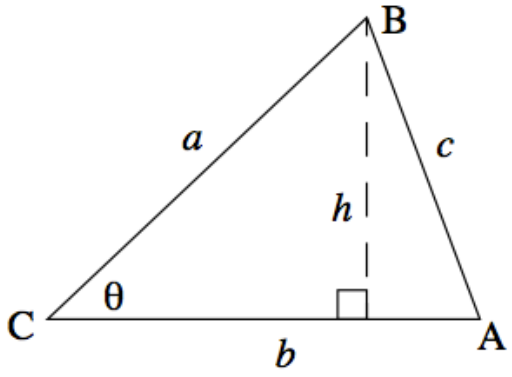
A camera sits on a tripod with legs 1.5 m long. The feet rest on a horizontal flat surface and form an equilateral triangle of side lengths 0.75 m. Find

(a) the height of the camera above the ground.

(b) the angles made by the legs with the ground.

(c) the angle between the sloping faces formed by the tripod legs.

Area of a Triangle



For ANY triangle, given sides a, b and the included angle θ

We know: $A = \frac{1}{2}bh$

But what if we don't have h?

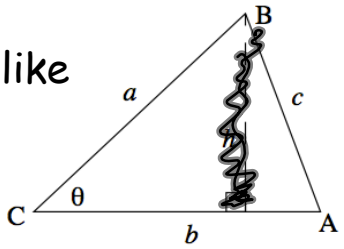
$\sin\theta = \frac{h}{a}$

$h = a\sin\theta$

$A = \frac{1}{2}ba\sin\theta$

Therefore the area formula for ANY triangle is: $A = \frac{1}{2}b \times a \times \sin\theta$

Because triangles are typically labeled like



θ might be replaced by C

$A = \frac{1}{2}ab\sin C$ *this is in your booklet!

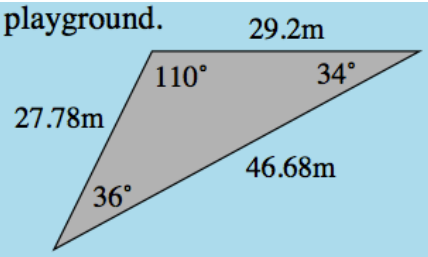
Write the area formula using the two other combinations of sides and angles.

$A = \frac{1}{2}bc\sin A$

$A = \frac{1}{2}ac\sin B$

Find the area of the triangle PQR given that PQ = 9 cm, QR = 10 cm and $\angle PQR = 40°$.

The diagram shows a triangular children's playground.
Find the area of the playground



$A = 381\ m^2$

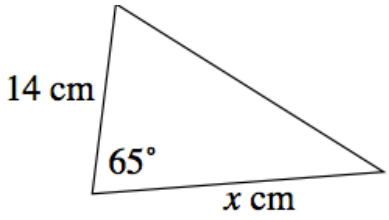
NORMAL FLOAT AUTO REAL DEGREE MP

```
.5*27.78*29.2sin(110)
                381.1280507
.5*27.78*46.68sin(36)
                381.1112584
.5*29.2*46.68sin(34)
                381.1056211
```

Find the areas of these triangles that are labelled using standard notation.

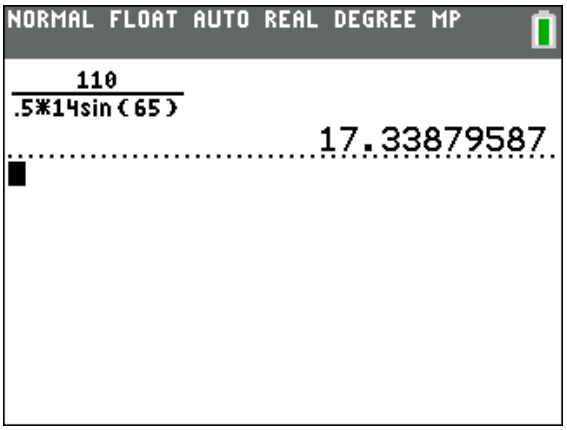
	a cm	b cm	c cm	A	B	C
(a)	35.94	128.46	149.70	12°	48°	120°
(b)	35.21	54.55	81.12	20°	32°	128°
(c)	46.35	170.71	186.68	14°	63°	103°

The triangle shown has an area of 110 cm^2 . Find x.

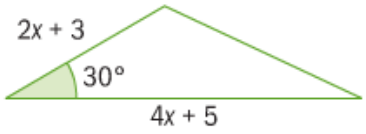


$110 = \frac{1}{2}(14)(x)\sin 65$

$x = 17.3$



5 The triangle shown has an area of 30 cm^2. Find the value of x.



$30 = \frac{1}{2}(2x+3)(4x+5)\sin 30$

$30 = \frac{1}{2}(2x+3)(4x+5)\left(\frac{1}{2}\right)$

$120 = 8x^2 + 22x + 15$

$0 = (4x+21)(2x-5)$

$x = -\frac{21}{4}, \frac{5}{2}$

Homework

3D Right Angled Trig & Area of a Triangle WS

Extra Practice

Chapter 11.6 - 11J

Homework Answers

1. (a) 39°48' (b) 64°46' **2.** (a) 12.81 cm (b) 61.35 cm (c) 77°57' (d) 60.83 cm (e) 80° 32'
3. (a) 21°48' (b) 42°2' (c) 26°34' **4.** (a) 2274 (b) 12.7° **5.** 251.29 m **6.** (a) 103.5 m (b) 35.26°
(c) 39.23° **7.** (b) 53.43 (c) 155.16 m (d) 145.68 m **8.** (b) 48.54 m **9.** (a) $\sqrt{(b-c)^2+h^2}$
(b) $\tan^{-1}\left(\frac{h}{a}\right)$ (c) $\tan^{-1}\left(\frac{h}{b-c}\right)$ (d) $2(b+c)\sqrt{h^2+a^2}+2a\sqrt{(b-c)^2+h^2}$ **10.** 82.80 m
11. (a) 40.61 m (b) 49.46 m **12.** (a) 10.61 cm (b) 75° 58' (c) 93° 22' **13.** (a) 1.44 m (b) 73° 13'
(c) 62° 11'

1. (a) 1999.2 cm^2 (b) 756.8 cm^2 (c) 3854.8 cm^2 (d) 2704.9 cm^2 (e) 538.0 cm^2 (f) 417.5 cm^2
(g) 549.4 cm^2 (h) 14.2 cm^2 (i) 516.2 cm^2 (j) 281.5 cm^2 (k) 918.8 cm^2 (l) 387.2 cm^2
(m) 139.0 cm^2 (n) 853.7 cm^2 (o) 314.6 cm^2 **2.** 69345 m^2 **3.** $100\pi - 6\sqrt{91}$ cm^2 **4.** 17.34 cm
5. (a) 36.77sq units (b) 14.70 sq units (c) 62.53 sq units **6.** 52.16 cm^2 **7.** 27° 2'
8. $\frac{(b+a\times\tan\theta)^2}{2\tan\theta}$ **9.** Area of Δ ACD = 101.78 cm^2, area of Δ ABC = 61.38 cm^2