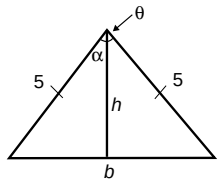


25.



$$\theta = \frac{360^\circ}{5} = 72^\circ, \alpha = \frac{72^\circ}{2} = 36^\circ$$

$$\cos 36^\circ = \frac{h}{5}$$

$$h = 5 (\cos 36^\circ)$$

$$h = 4.05 \text{ cm}$$

$$b^2 = 5^2 + 5^2 - 2(5)(5)\cos 72^\circ$$

$$b^2 = 34.549 150 28$$

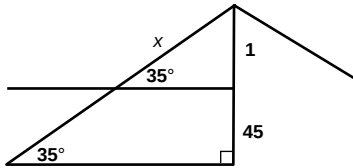
$$b = 5.88$$

$$A_{\text{triangle}} = \frac{1}{2}bh = (5.88 \times 4.05) \div 2 = 11.907 \text{ cm}^2$$

$$A_{\text{pentagon}} = 5 \times 11.907 = 59.5 \text{ cm}^2$$

Practise, Apply, Solve 6.2, page 522

1.



$$\sin 35^\circ = \frac{46}{x}$$

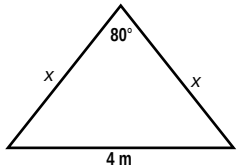
$$x \sin 35^\circ = 46$$

$$x = \frac{46}{\sin 35^\circ}$$

$$x = 80.2 \text{ m}$$

$\therefore$ Morana must let out 80.2 m of line.

2.



$$4^2 = x^2 + x^2 - 2(x)(x) \cos 80^\circ$$

$$16 = 2x^2 - 0.347 296 355 3x^2$$

$$16 = 1.652 703 645x^2$$

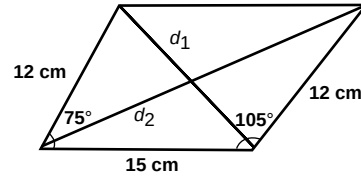
$$x^2 = 9.681 106 502$$

$$x = 3.11$$

$$\therefore 3.1 + 0.5 = 3.6 \text{ m}$$

$\therefore$ each rafter must be 3.6 m long.

3. (a)



$$d_1^2 = 12^2 + 15^2 - 2(12)(15) \cos 75^\circ$$

$$d_1^2 = 275.825 143 8$$

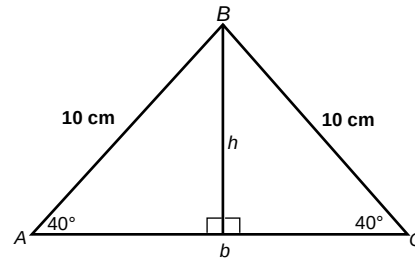
$$d_1 = 16.6 \text{ cm}$$

(b) $d_2^2 = 15^2 + 12^2 - 2(15)(12) \cos 105^\circ$

$$d_2^2 = 462.174 856 2$$

$$d_2 = 21.5 \text{ cm}$$

4.



$$\sin 40^\circ = \frac{h}{10}$$

$$10 (\sin 40^\circ) = h$$

$$6.4 \text{ cm} = h$$

$$\angle ABC = 180^\circ - (40^\circ + 40^\circ) = 100^\circ$$

$$b^2 = 10^2 + 10^2 - 2(10)(10) \cos 100^\circ$$

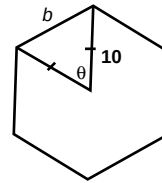
$$b^2 = 234.729 635 5$$

$$b = 15.3 \text{ cm}$$

$$A_{\text{triangle}} = \frac{1}{2}bh = (15.3 \times 6.4) \div 2 = 49.0 \text{ cm}^2$$

$\therefore$ the height of the triangle is 6.4 cm and the area of the triangle is 49.0 cm^2 .

5.

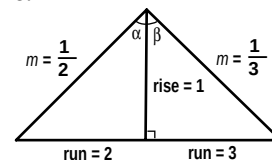


$$\theta = \frac{360^\circ}{6} = 60^\circ$$

$\therefore$ each triangle is an equilateral triangle $\Rightarrow b = 10 \text{ cm}$

$$P = 6 \times 10 = 60 \text{ cm}$$

6.



$$m = \frac{1}{2}$$

$$m = \frac{1}{3}$$

$$\text{run} = 2$$

$$\text{run} = 3$$

$$\tan \alpha = \frac{2}{1} \quad \tan \beta = \frac{3}{1}$$

$$\alpha = 63.4^\circ \quad \beta = 71.6^\circ$$

$$\text{Angle} = \alpha + \beta = 63.4^\circ + 71.6^\circ = 135^\circ$$

$\therefore$ the angle at the peak of the roof measures 135° .

$$7. \text{ (a) } \tan 35^\circ = \frac{DF}{15} \quad \sin 45^\circ = \frac{10.5}{x}$$

$$15(\tan 35^\circ) = DF \quad x = \frac{10.5}{\sin 45^\circ}$$

$$x = 15 \text{ cm}$$

$$(b) \quad y^2 = 15^2 + 15^2 - 2(15)(15) \cos 70^\circ$$

$$y^2 = 296.090 \ 935 \ 5$$

$$y = 17.2$$

$$\sin 27^\circ = \frac{17.2}{x}$$

$$x = \frac{17.2}{\sin 27^\circ}$$

$$x = 38 \text{ cm}$$

$$(c) \quad (DB)^2 = 10^2 + 14^2 - 2(10)(14) \cos 115^\circ$$

$$(DB)^2 = 414.333 \ 113$$

$$DB = 20.36 \text{ cm}$$

$$\frac{EB}{\sin 55^\circ} = \frac{20.36}{\sin 65^\circ} \quad \sin 70^\circ = \frac{18.4}{x}$$

$$EB = \frac{20.36 \sin 55^\circ}{\sin 65^\circ} \quad x = \frac{18.4}{\sin 70^\circ}$$

$$EB = 18.4 \text{ cm} \quad x = 20 \text{ cm}$$

$$(d) \quad (BC)^2 = 18^2 + 14^2 - 2(18)(14) \cos 95^\circ$$

$$(BC)^2 = 563.926 \ 494 \ 3$$

$$BC = 23.75 \text{ cm}$$

$$(AB)^2 = 15^2 + 18^2 \quad (AC)^2 = 15^2 + 14^2$$

$$(AB)^2 = 549 \quad (AC)^2 = 421$$

$$AB = 23.43 \text{ cm} \quad AC = 20.52 \text{ cm}$$

$$(23.75)^2 = (23.43)^2 + (20.52)^2 - 2(23.43)(20.52) \cos \angle BAC$$

$$\cos \angle BAC = \frac{(23.75)^2 - (23.43)^2 - (20.52)^2}{-2(23.43)(20.52)}$$

$$\angle BAC = \cos^{-1}(0.422 \ 199 \ 093 \ 3)$$

$$\angle BAC = 65^\circ$$

8. Example: Kristy is shingling at the peak of the roof of her house when she hears Trevor calling her for lunch. Kristy's house is 35 feet high. If Trevor is standing 10 feet from the house and Kristy looks over the peak of the roof at an angle of depression of 50° , can she see what Trevor is bringing her for lunch?

$$\tan 50^\circ = \frac{35}{d}$$

$$d = \frac{35}{\tan 50^\circ}$$

$$d = 29.37 \text{ feet}$$

$\therefore$ no, at that angle of depression, Kristy cannot see what Trevor is bringing her for lunch.

9.



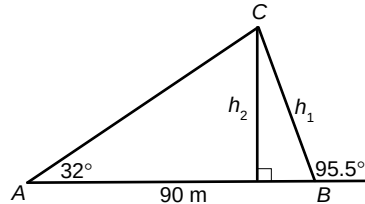
$$\angle A = 180^\circ - (23^\circ + 19^\circ) = 138^\circ$$

$$\frac{\sin 138^\circ}{10.4} = \frac{\sin 19^\circ}{b} \quad \frac{\sin 138^\circ}{10.4} = \frac{\sin 23^\circ}{c}$$

$$b = \frac{10.4 \sin 19^\circ}{\sin 138^\circ} \quad c = \frac{10.4 \sin 23^\circ}{\sin 138^\circ}$$

$$b = 5.1 \text{ m} \quad c = 6.1 \text{ m}$$

10. (a)



$$\angle ACB = 180^\circ - (32^\circ + 84.5^\circ) = 63.5^\circ$$

$$\frac{h_1}{\sin 32^\circ} = \frac{90}{\sin 63.5^\circ}$$

$$h_1 = \frac{90 \sin 32^\circ}{\sin 63.5^\circ}$$

$$h_1 = 53.3 \text{ m}$$

$\therefore$ the slant height of the tower is 53.3 m

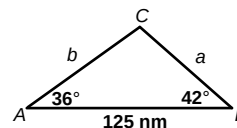
$$(b) \quad \sin 84.5^\circ = \frac{h_2}{53.3}$$

$$h_2 = 53.3(\sin 84.5^\circ)$$

$$h_2 = 53.1 \text{ m}$$

$\therefore$ the tip of the tower is 53.1 m above the ground.

11. (a)



$$\angle ACB = 180^\circ - (36^\circ + 42^\circ) = 102^\circ$$

$$\frac{a}{\sin 36^\circ} = \frac{125}{\sin 102^\circ} \quad \frac{b}{\sin 42^\circ} = \frac{125}{\sin 102^\circ}$$

$$a = \frac{125 \sin 36^\circ}{\sin 102^\circ} \quad b = \frac{125 \sin 42^\circ}{\sin 102^\circ}$$

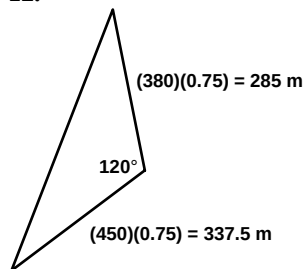
$$a = 75.1 \text{ n} \cdot \text{m (Ship B)} \quad b = 85.5 \text{ n} \cdot \text{m (Ship A)}$$

$\therefore$ the *Argus* is 85.5 nautical miles from the lifeboat; the *Baffin* is 75.1 nautical miles away.

$$(b) \quad t = \frac{d}{v}, t_A = \frac{85.2}{9.7} = 8.78 \text{ h}, t_B = \frac{75.1}{9.4} = 7.99 \text{ h}$$

$\therefore$ the *Baffin* will reach the lifeboat first.

12.



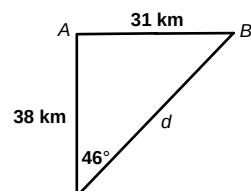
$$l^2 = 285^2 + 337.5^2 - 2(285)(337.5) \cos 120^\circ$$

$$l^2 = 291\,318.75$$

$$l = 540 \text{ m}$$

The swamp is approximately 540 m in length.

13.



$$\frac{\sin B}{38} = \frac{\sin 46^\circ}{31}$$

$$\sin B = \frac{38 \sin 46^\circ}{31}$$

$$\angle B = 61.9^\circ$$

$$\angle A = 180^\circ - (46^\circ + 61.9^\circ) = 72.1^\circ$$

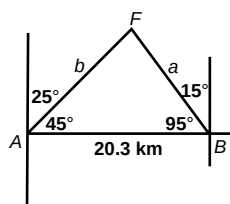
$$\frac{d}{\sin 72.1^\circ} = \frac{31}{\sin 46^\circ}$$

$$d = \frac{31 \sin 72.1^\circ}{\sin 46^\circ}$$

$$d = 41.0 \text{ km}$$

Assuming that both planes are flying at the same speed and altitude, plane Able will land first. It is 3 km closer to the airstrip.

14.



$$\angle AFB = 180^\circ - (45^\circ + 95^\circ) = 40^\circ$$

$$\frac{20.3}{\sin 40^\circ} = \frac{a}{\sin 45^\circ}$$

$$a = \frac{20.3 \sin 45^\circ}{\sin 40^\circ}$$

$$a = 22.3 \text{ km}$$

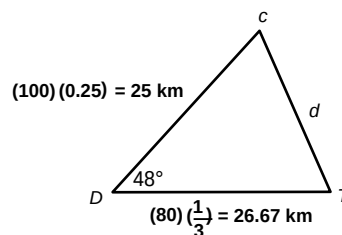
$$\frac{20.3}{\sin 40^\circ} = \frac{b}{\sin 95^\circ}$$

$$b = \frac{20.3 \sin 95^\circ}{\sin 40^\circ}$$

$$b = 31.5 \text{ km}$$

The fire is 22.3 km away from B and 31.5 km away from A.

15.



$$d^2 = (26.67)^2 + (25)^2 - 2(26.67)(25) \cos 48^\circ$$

$$d^2 = 444.003\,236\,4$$

$$d = 21.1 \text{ km}$$

The car and truck are 21.1 km apart at this time.

16. (a) $\angle C = 180^\circ - (72.418^\circ + 63.283^\circ) = 44.299^\circ$

(b)

$$\frac{DC}{\sin 63.283^\circ} = \frac{4.35}{\sin 44.299^\circ}$$

$$DC = \frac{4.35 \sin 63.283^\circ}{\sin 44.299^\circ}$$

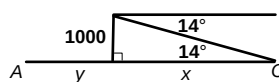
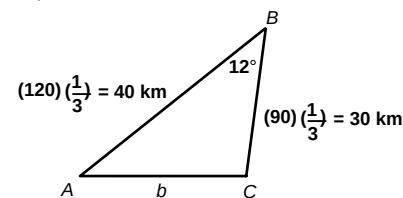
$$DC = 5.56 \text{ km}$$

(c) $\tan 15.217^\circ = \frac{h}{5.56}$

$$h = 5.56 (\tan 15.217^\circ)$$

$$h = 1.51 \text{ km}$$

17.



$$b^2 = 40^2 + 30^2 - 2(40)(30) \cos 12^\circ$$

$$b^2 = 152.445\,758\,2$$

$$b = 12.35 \text{ km}$$

$$\tan 14^\circ = \frac{1}{x}$$

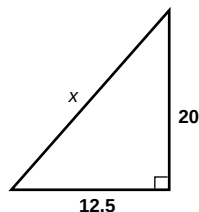
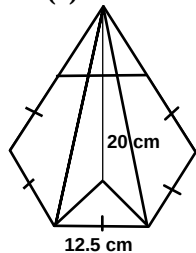
$$x = \frac{1}{\tan 14^\circ}$$

$$x = 4.01$$

$$y = 12.35 - 4.01 = 8.34 \text{ km}$$

$\therefore$ the horizontal distance from the helicopter to the faster car is 8.34 km.

18. (a)



$$\theta = \frac{360^\circ}{6} = 60^\circ \Rightarrow \text{each base triangle is equilateral}$$

$$x^2 = 20^2 + 12.5^2$$

$$x^2 = 556.25$$

$$x = 23.58 \text{ cm}$$

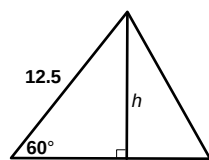
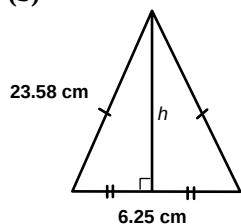
$$12.5^2 = 23.58^2 + 23.58^2 - 2(23.58)(23.58)\cos \alpha$$

$$\cos \alpha = \frac{12.5^2 - 2(23.58)^2}{-2(23.58)}$$

$$\cos \alpha = 0.8594915546$$

$$\alpha = 30.7^\circ$$

(b)



$$23.58^2 = 6.25^2 + h^2$$

$$h^2 = 23.58^2 - 6.25^2$$

$$h^2 = 516.9539$$

$$h = 22.74 \text{ cm}$$

$$\sin 60^\circ = \frac{h}{12.5}$$

$$h = 12.5 (\sin 60^\circ)$$

$$h = 10.83 \text{ cm}$$

$$SA_{\text{pyramid}} = A_{\text{triangle}} + A_{\text{base}}$$

$$SA_{\text{pyramid}} = 6\left(\frac{12.5 \times 22.74}{2}\right) + 6\left(\frac{12.5 \times 10.83}{2}\right)$$

$$SA_{\text{pyramid}} = 852.75 + 406.125$$

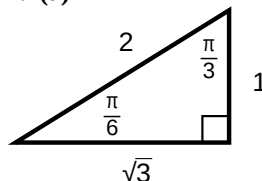
$$SA_{\text{pyramid}} = 1258.875 \text{ cm}^2$$

$$(c) V_{\text{pyramid}} = \frac{A_{\text{base}} \times h}{3} = \frac{406.125 \times 20}{3} = 2707.5 \text{ cm}^3$$

19. The essential thing that you must do in order to solve each trigonometric problem is to draw a diagram. If the triangle is a right triangle, use primary trigonometric ratios. If two angles and any side are known or if two sides and any angle are given, use the sine law. If two sides and a contained angle are given or three sides are given, use the cosine law.

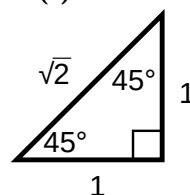
Practise, Apply, Solve 6.3, page 532

1. (a)



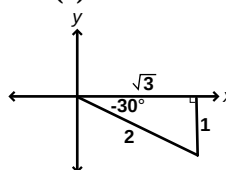
(b) 1 is the shortest side and must lie opposite the smallest angle, which is 30° . 2 is the largest side and must lie opposite the largest angle, which is 90° . $\sqrt{3}$ must then lie opposite the 60° angle.

2. (a)



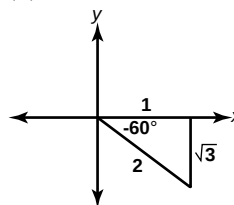
(b) The triangle is isosceles. $\sqrt{2}$ is the largest side and must lie opposite the largest angle, which is 90° . Therefore, the two equal sides lie opposite the 45° angles.

3. (a)



$$\cos \theta = \frac{x}{r}, \cos(-30^\circ) = \frac{\sqrt{3}}{2}$$

(b)



$$\tan \theta = \frac{y}{x}, \tan(-60^\circ) = \frac{-\sqrt{3}}{1} = -\sqrt{3}$$