AUSTRALIAN EDITION

PreCalculus

Lesson 6 **Angles of Elevation and Depression**

(1) Pre Calculus Instruction Manual - Lesson 6
(2) Pre Calculus Student Text - Lesson 6
(3) Pre Calculus Test booklet - Lesson 6
(4) Pre Calculus Solutions - Lesson 6
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(6) Pre Calculus Honors Solutions - Lesson 6

In Pre-Calculus students master trigonometry, identities, polar equations, logarithms, sequences, limits and other topics to prepare for Calculus. In Geometry, students master points, lines, planes, angles, circles, triangles, quadrilaterals, Pythagorean Theorem, conic sections, proofs and more topics.

These Pre-Calculus Sample Pages will give you an idea of Math-U-See's unique method of instruction. Lesson-by-Lesson videos, Comprehensive Instruction Manuals, Student materials and Honours Pages are fully integrated to support your student in mastering this material.

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To Your Success!!

AUSTRALIAN EDITION

Math·U·See

Instruction Manual: Lesson 6 - Angles of Elevation and Depression

Now we get a chance to apply all of our newly acquired skills in real life applications, otherwise known as word problems. The first section is in elevation and depression problems. I first encountered these in a Boy Scout Handbook many years ago. There was a picture of a tree, a man, and several lines.

How tall is the tree?

tree

2 m

5 m   7 m
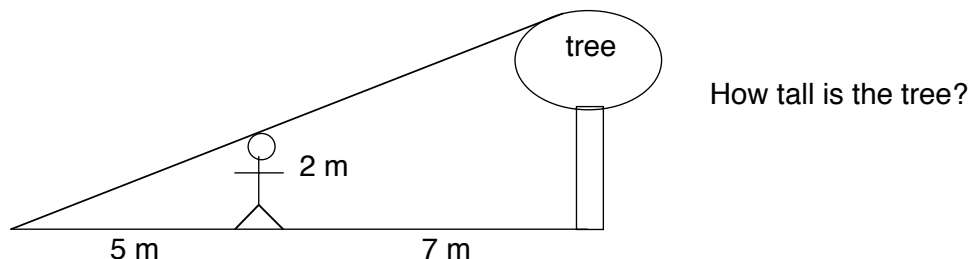
Separating the picture into two triangles helps to clarify our ratios.

2

θ

5

X

θ

12
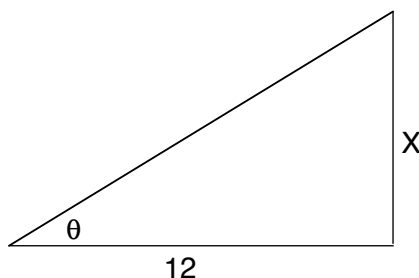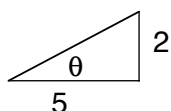
We could solve this with a proportion (two ratios) as

$$\frac{2}{5} = \frac{X}{11}$$ and solve for X.

Using our trig. abilities:

in the "man" triangle $\tan θ = \dfrac{2}{5} = .4$

We find that θ = 21.8°

For the large triangle $\tan 21.8° = \dfrac{X}{12}$

$(12)(.4) = X$

$4.8\ m = X$

The tree is 4.8 metres tall.

One of the key components in being a good problem solver is drawing a picture using all the data given. It turns a one dimensional group of words into a two dimensional picture.

It is pretty obvious by the words themselves that an angle of elevation measures up, and an angle of depression down. Look at Figure 1.

Figure 1

elevation

depression
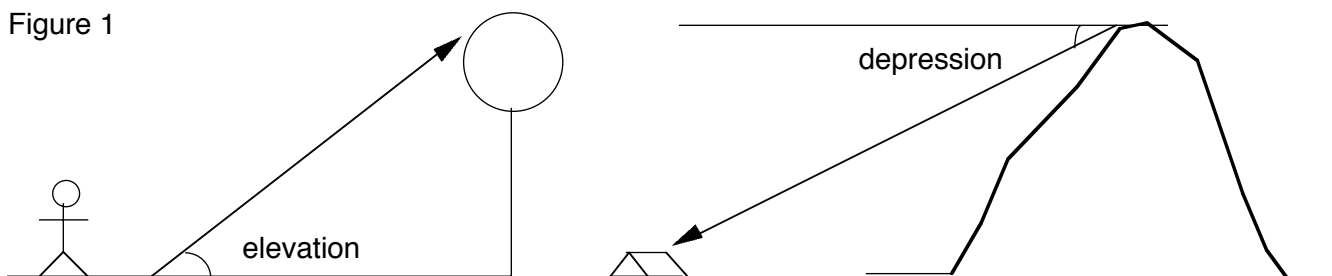
We assume that the line where the angle begins is perfectly flat, or horizontal.

Example 1   A campsite is 9.41 km from a point directly below the mountain top. If the angle of elevation is 12° from the camp to the top of the mountain, how high is the mountain?
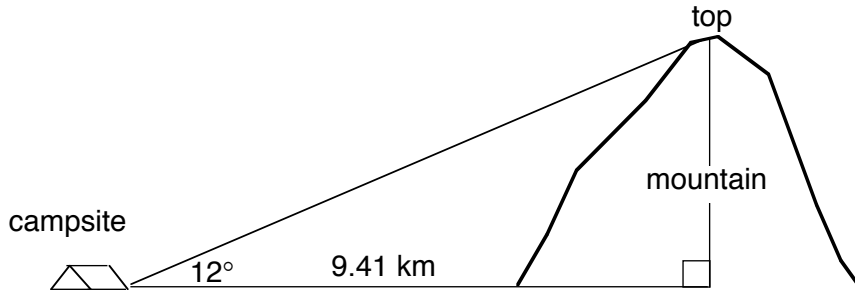
You can now see a right triangle, with the side adjacent to the 12° being 9.41 km long. To find the height of the mountain, which is the side opposite the 12° angle, the tangent is the best choice.

$$\tan 12° = \frac{\text{height}}{9.41 \text{ km}}$$

$$(9.41)(\tan 12°) = \text{height}$$

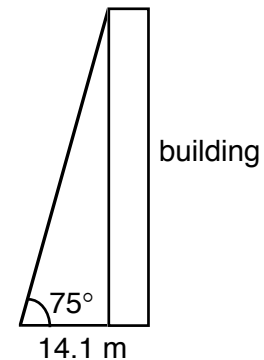$$(9.41)(.2126) = \text{height}$$

$$2 \text{ km} = \text{height}$$

Example 2   At a point 14.1 m from the base of a building, the angle of elevation of the top is 75°. How tall is the building?

$$\tan 75° = \frac{\text{height}}{14.1 \text{ m}}$$

$$(14.1)(\tan 75°) = \text{height}$$

$$(14.1)(3.7321) = \text{height}$$
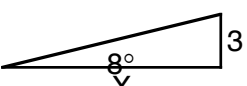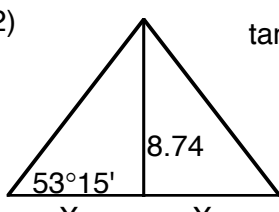
$$52.62 \text{ m} = \text{height of building}$$

Practice Problems

1)   How far from the door must a ramp begin in order to rise 3 metres with an 8° angle of elevation?

2)   An A-frame cabin is 8.74 metres high at the center and the angle the floor makes with the base is 53°15'. How wide is the base?
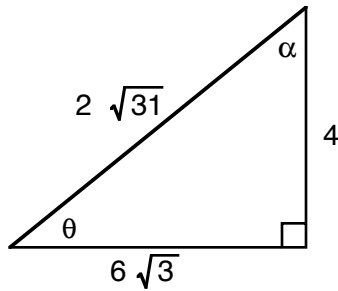
Solutions

1)

$$\tan 8° = \frac{3}{X}$$

$$X \tan 8° = 3$$

$$X = \frac{3}{\tan 8°}$$

$$X = \frac{3}{.1405}$$

$$X = 21.35 \text{ m}$$

2)

$$53°15' = 53.25$$

$$\tan 53.25° = \frac{8.74}{X}$$

$$X = \frac{8.74}{\tan 53.25°}$$

$$X = \frac{8.74}{1.3392}$$

$$X = 6.53 \quad 2X = 13.06 \text{ m}$$

Student Text: Lesson Practice 6A

1) Isaac's camp is 1 760 metres from a point directly beneath Mt. Monadnock. What is the hiking distance along the ridge if the angle of elevation is 25° 16'?

2) How many metres higher is the top of the mountain than his campsite?

Express as a fraction.

3) csc θ = ——

4) sec θ = ——

5) cot θ = ——

6) csc α = ——

7) sec α = ——

8) cot α = ——
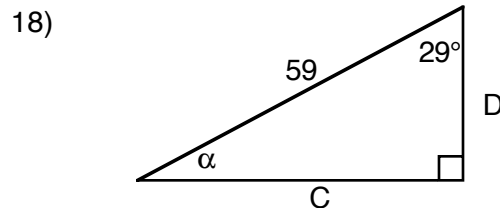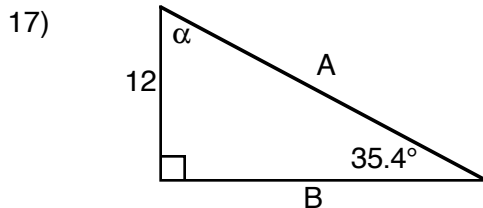
Express as a decimal.

9) sin θ =

10) cos θ =

11) tan θ =

12) sin α =

13) cos α =
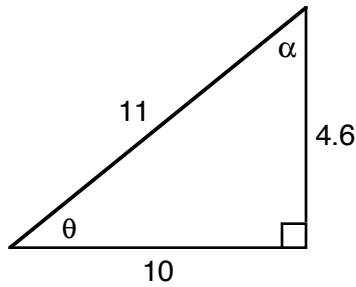
14) tan α =

15) Use your answers in no. 9-11 to find the measure of θ.

16) Use your answers in no. 12-14 to find the measure of α.

Solve for the lengths of the sides and the measures of the angles.

17)

18)

19)

20)
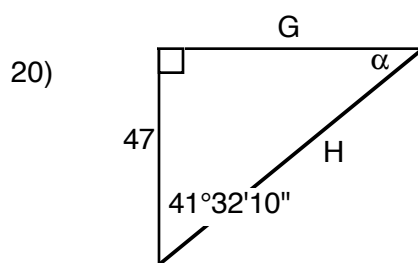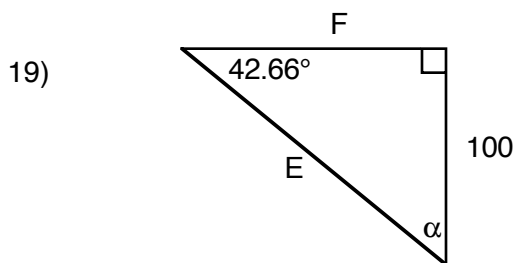
Student Text: Lesson Practice 6B

1) The side of a lake has a uniform angle of elevation of 15°30'. How far up the side of the lake does the water rise if, during the flood season, the height of the lake increases by 2.4 metres?

2) A building casts a shadow of 110 metres. If the angle of elevation from that point to the top of the building is 29°3', find the height of the building.

Express as a fraction.

3) csc θ = ——

4) sec θ = ——

5) cot θ = ——

6) csc α = ——

7) sec α = ——

8) cot α = ——

Express as a decimal.

9) sin θ =

10) cos θ =

11) tan θ =

12) sin α =

13) cos α =

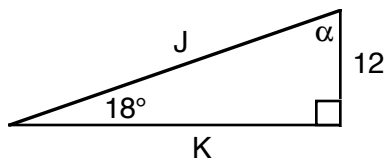14) tan α =
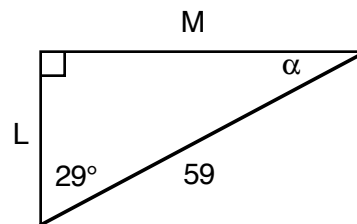
15) Use your answers in no. 9-11 to find the measure of θ.

16) Use your answers in no. 12-14 to find the measure of α.

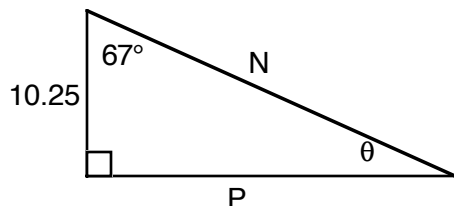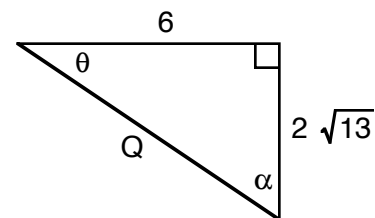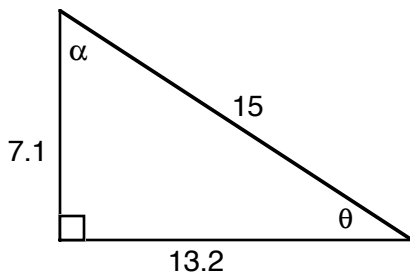*Solve for the lengths of the sides and the measures of the angles.*

17)

18)

19)

20)

Student Text: Lesson Practice 6C

1) From a point 40 metres from the base of a church, the angles of elevation of the top of the building and the top of a cross on the building are 38° and 43° respectively. Find the height to the top of the cross. (The ground is flat.)

2) Find the height of the building as well as the height of the cross itself.

Express as a fraction.

3) csc θ = ——

4) sec θ = ——

5) cot θ = ——

6) csc α = ——

7) sec α = ——

8) cot α = ——

Express as a decimal.

9) sin θ =

10) cos θ =

11) tan θ =

12) sin α =

13) cos α =

14) tan α =

15) Use your answers in no. 9-11 to find the measure of θ. They may vary slightly.

16) Use your answers in no. 12-14 to find the measure of α. They may vary slightly.

Solve for the lengths of the sides and the measures of the angles.

17)

18)

19)

20)
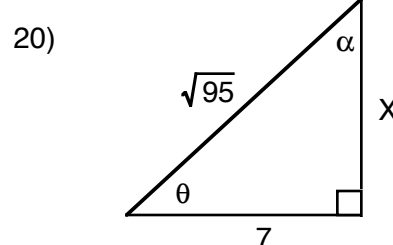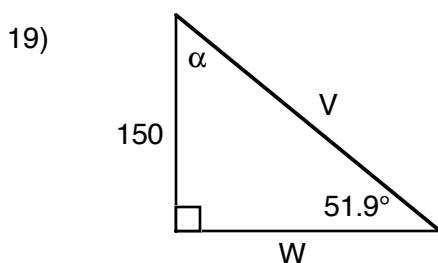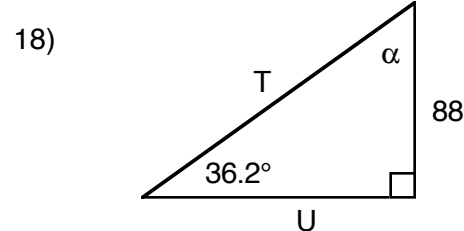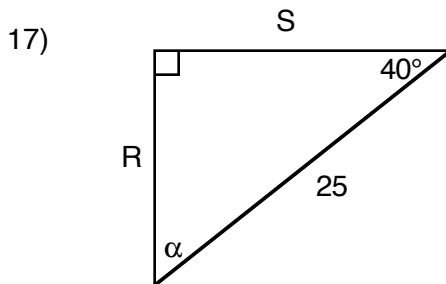
Student Text: Lesson Practice 6D

1) A campsite is 20.6 kilometres from a point directly below Mt. Adams. If the angle of elevation is 15.5° from the camp to the top of the mountain, how high is the mountain?

2) At a point 20.2 metres from the base of a building, the angle of elevation from that point to the top is 64.75°. How tall is the building?

Express as a fraction. First find X.

3) csc θ = ——

4) sec θ = ——

5) cot θ = ——

Express as a decimal.

9) sin θ =

10) cos θ =

11) tan θ =

6) csc α = ——

7) sec α = ——

8) cot α = ——

12) sin α =

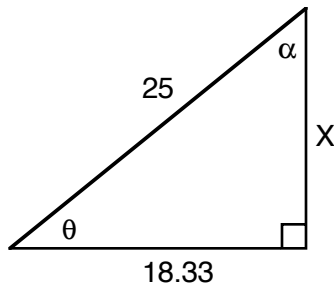13) cos α =

14) tan α =

15) Use your answers in no. 9-11 to find the measure of θ.

16) Use your answers in no. 12-14 to find the measure of α.

Solve for the lengths of the sides and the measures of the angles.

17)

18)

19)

20)
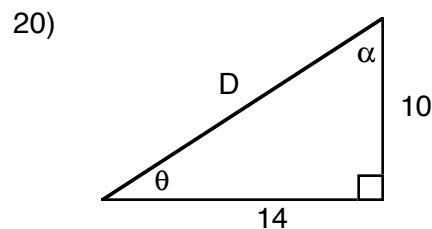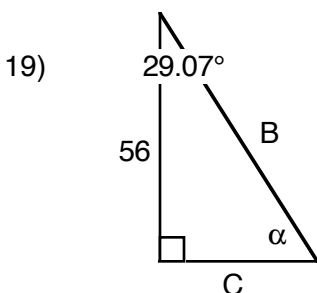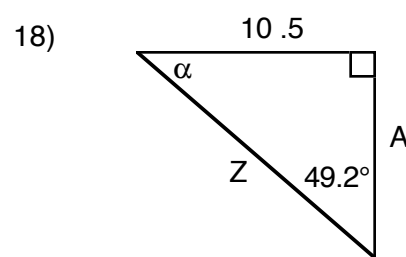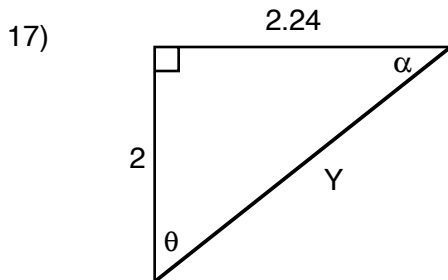
Test Booklet: Lesson 6 Test

Use for questions 1-4: Devan stands 926 m from a point directly below the peak of a mountain. The angle of elevation between him and the top of the mountain is 42°.

1) Which equation can be used to find the height of the mountain (X)?

A) $\sin 42° = \dfrac{X}{926}$

B) $\tan 42° = \dfrac{926}{X}$

C) $\cos 48° = \dfrac{926}{X}$

D) $\tan 42° = \dfrac{X}{926}$

2) What is the height of the mountain?

A) 833.8 m

B) 1028.4 m

C) 619.6 m

D) 1383.9 m

3) A tower 50 m high is built on top of the mountain. What is the angle of elevation from Devan's position to the top of the tower? (round decimal degrees to tenths)

A) 40°14'44"

B) 43°42'

C) 57°15'

D) 46°20'08"

4) If a bird flew from Devan's position to the top of the mountain, how many metres would it travel?

A) 408.4 m

B) 1246.1 m

C) 1383.9 m

D) 1280 m

Use for questions 5-8: From a point 80 m from the base of a building to the top of the building the angle of elevation is 51°. From the same point to the top of a flag staff on the building the angle of elevation is 54°.

5) What equation can be used to find the combined height (Y) of building and flagpole?

A) Y = 80 tan 51°

B) Y = 80 sin 54°

C) Y = 80 tan 54°

D) Y = $\dfrac{\tan 51°}{80}$

6) What is the height of the building alone?

A) 98.8 m

B) 110.1 m

C) 64.8 m

D) 58.1 m

7) What is the height of the flagpole alone?

A) 15.1 m

B) 45.3 m

C) 4.2 m

D) 11.3 m

8) How long must a cable be in order to stretch from the observation point to the top of the building?

A) 102.9 m

B) 127.1 m

C) 136.1 m

D) 50.3 m

Use for questions 9-10: A car traveled a distance of 100 metres up a ramp to a bridge. The angle of elevation of the ramp was 10°.

9) How high was the bridge above road level?

A) 17.4 m

B) 98.5 m

C) 10 m

D) 100 m

10) What is the actual distance from the start of the ramp to the base of the bridge?

A) 575 m

B) 98.5 m

C) 89.4 m

D) 17.4 m

- -

11) $\dfrac{\sqrt{3}}{3}$ is the ratio for

A) cos 45°

B) cos 30°

C) tan 60°

D) tan 30°

12) Arcsin .8192 =

A) 1.22

B) 35°

C) 55°

D) .9999

13) 46°21'02" =

A) 46.21°

B) 46.12°

C) 46.35°

D) 46.4°

14) $\dfrac{\sin \alpha}{\cos \alpha}$ is equal to

A) tan α

B) cot α

C) sec α

D) csc α

15) $\dfrac{1}{\cos \alpha}$ is equal to

A) csc α

B) sec α

C) sin α

D) cos α

Solutions: Lesson 6A

1)

$\text{Cos } 25°16' = \dfrac{1760}{D}$

$D = \dfrac{1760}{.9043}$

$D = 1946.26 \text{ m}$

2)

$\text{Tan } 25°16' = \dfrac{M}{1760}$

$1760 \text{ Tan } 25°16' = M$

$830.70 \text{ m} = M$
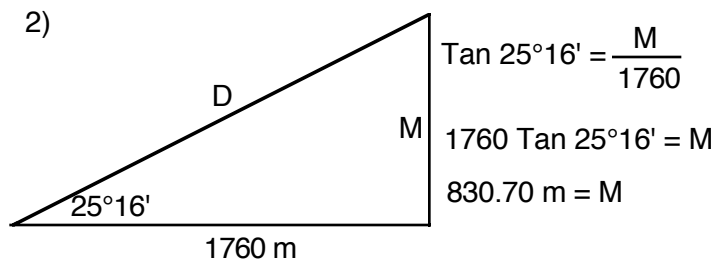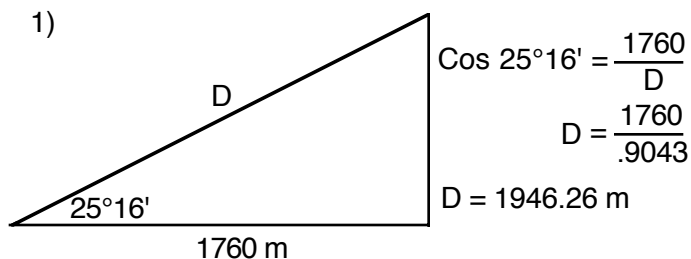
Express as a fraction.

3) $\csc \theta = \dfrac{2\sqrt{31}}{4} = \dfrac{\sqrt{31}}{2}$
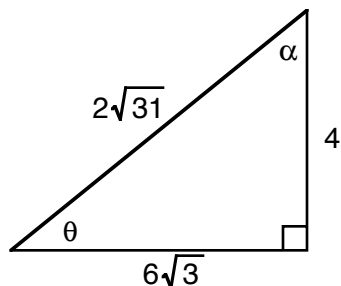
4) $\sec \theta = \dfrac{2\sqrt{31}}{6\sqrt{3}} = \dfrac{\sqrt{93}}{9}$

5) $\cot \theta = \dfrac{6\sqrt{3}}{4} = \dfrac{3\sqrt{3}}{2}$

6) $\csc \alpha = \dfrac{\sqrt{93}}{9}$

7) $\sec \alpha = \dfrac{\sqrt{31}}{2}$

8) $\cot \alpha = \dfrac{2\sqrt{3}}{9}$

Express as a decimal.

9) $\sin \theta = \dfrac{4}{2\sqrt{31}} = .3592$

10) $\cos \theta = \dfrac{6\sqrt{3}}{2\sqrt{31}} = .9333$

11) $\tan \theta = \dfrac{4}{6\sqrt{3}} = .3849$

12) $\sin \alpha = \dfrac{6\sqrt{3}}{2\sqrt{31}} = .9333$

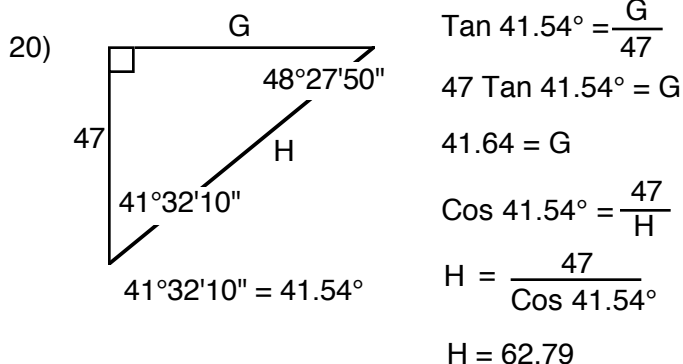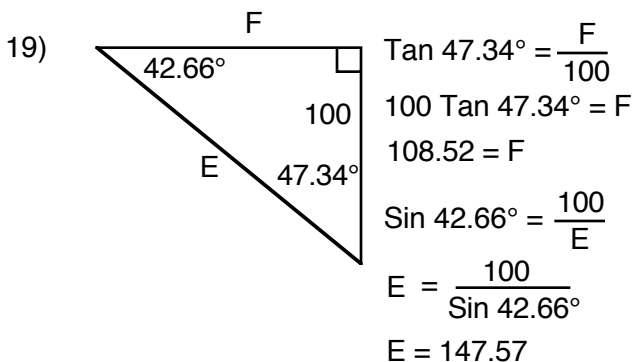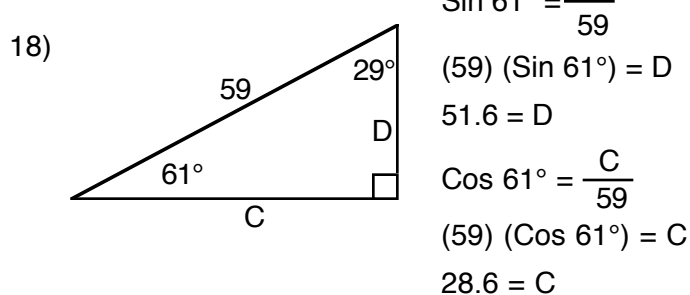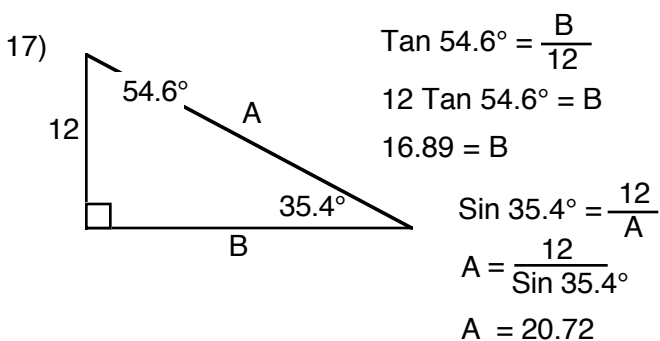13) $\cos \alpha = \dfrac{4}{2\sqrt{31}} = .3592$

14) $\tan \alpha = \dfrac{6\sqrt{3}}{4} = 2.5981$

Answers to 15 and 16 may vary slightly.

15) The measure of θ is 21.05°.

16) The measure of α is 68.95°.

Solve for the lengths of the sides and the measures of the angles.

17)

$\text{Tan } 54.6° = \dfrac{B}{12}$

$12 \text{ Tan } 54.6° = B$

$16.89 = B$

$\text{Sin } 35.4° = \dfrac{12}{A}$

$A = \dfrac{12}{\text{Sin } 35.4°}$

$A = 20.72$

18)

$\text{Sin } 61° = \dfrac{D}{59}$

$(59)(\text{Sin } 61°) = D$

$51.6 = D$

$\text{Cos } 61° = \dfrac{C}{59}$

$(59)(\text{Cos } 61°) = C$

$28.6 = C$

19)

$\text{Tan } 47.34° = \dfrac{F}{100}$

$100 \text{ Tan } 47.34° = F$

$108.52 = F$

$\text{Sin } 42.66° = \dfrac{100}{E}$

$E = \dfrac{100}{\text{Sin } 42.66°}$

$E = 147.57$

20)

$41°32'10'' = 41.54°$

$\text{Tan } 41.54° = \dfrac{G}{47}$

$47 \text{ Tan } 41.54° = G$

$41.64 = G$

$\text{Cos } 41.54° = \dfrac{47}{H}$

$H = \dfrac{47}{\text{Cos } 41.54°}$

$H = 62.79$

Solutions: Lesson 6B

1) $15°30' = 15.5°$

2.4 m

X $15°30'$ D
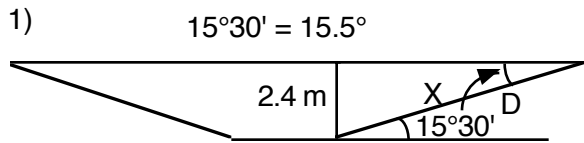
$\sin 15.5 = \dfrac{2.4}{X}$

$X = \dfrac{2.4}{\sin 15.5}$

$X = 8.98$ m

2) $29°3' = 29.05°$

B

$29°3'$

36.7 m

$\text{Tan } 29.05° = \dfrac{B}{36.7}$

$36.7\ (\text{Tan } 29.05°) = B$
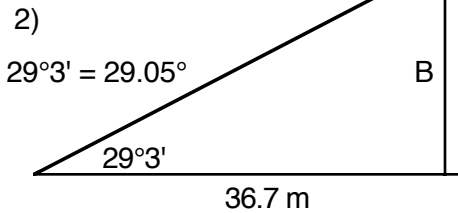
20.39 m $= B$

Express as a fraction.

3) $\csc \theta = \dfrac{11}{4.6}$

4) $\sec \theta = \dfrac{11}{10}$

5) $\cot \theta = \dfrac{10}{4.6}$

6) $\csc \alpha = \dfrac{11}{10}$

7) $\sec \alpha = \dfrac{11}{4.6}$

8) $\cot \alpha = \dfrac{4.6}{10}$

α

11   4.6

θ

10

Express as a decimal.

9) $\sin \theta = \dfrac{4.6}{11} = .4182$

10) $\cos \theta = \dfrac{10}{11} = .9091$

11) $\tan \theta = \dfrac{4.6}{10} = .46$

12) $\sin \alpha = \dfrac{10}{11} = .9091$

13) $\cos \alpha = \dfrac{4.6}{11} = .4182$

14) $\tan \alpha = \dfrac{10}{4.6} = 2.1739$
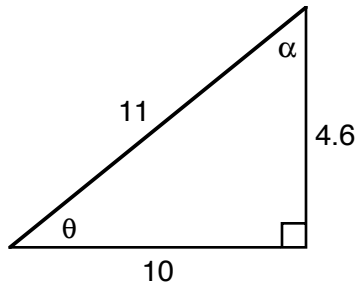
15) The measure of θ is 24.7°.

16) The measure of θ is 65.3°.

Solve for the lengths of the sides and the measures of the angles.

17)

J   72° 12

18°

K

$\text{Tan } 72° = \dfrac{K}{12}$

$12\ \text{Tan } 72° = 36.93$

$\text{Sin } 18° = \dfrac{12}{J}$

$J = \dfrac{12}{\text{Sin } 18°} = 38.83$

18)

M   61°

L

29°   59

$\text{Sin } 29° = \dfrac{M}{59}$

$59\ \text{Sin } 29° = M$

$28.6 = M$

$\text{Cos } 29° = \dfrac{L}{59}$

$59\ \text{Cos } 29° = L$

$51.6 = L$

19)

67°   N

10.25

23°

P

$\text{Sin } 23° = \dfrac{10.25}{N}$

$N = \dfrac{10.25}{\text{Sin } 23°} = 26.23$

$\text{Tan } 67° = \dfrac{P}{10.25}$

$10.25\ \text{Tan } 67° = P$

$24.15 = P$

20)

6

50.24°

Q $2\sqrt{13}$

39.76°

$2\sqrt{13} = 7.2111$

$\text{Tan } \theta = \dfrac{7.211}{6}$
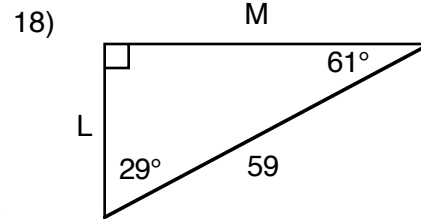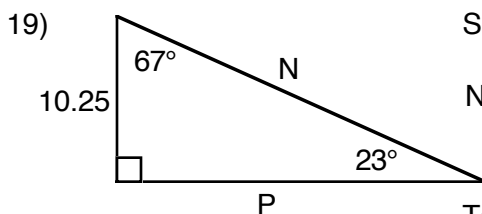
$\arctan \theta = 1.202$

$\theta = 50.24°$

$\alpha = 39.76°$

$(2\sqrt{13})^2 + (6)^2 = Q$

$2\sqrt{22} = Q^2$

Solutions: Lesson 6C
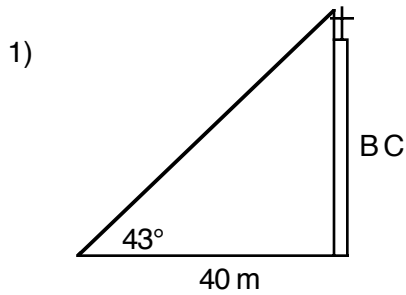
1)

$$\text{Tan } 43° = \frac{BC}{40}$$

$$BC = 40 \text{ Tan } 43°$$

$$BC = 37.30 \text{ m}$$

2)

$$\text{Tan } 38° = \frac{B}{40}$$

$$B = 40 \text{ Tan } 38°$$
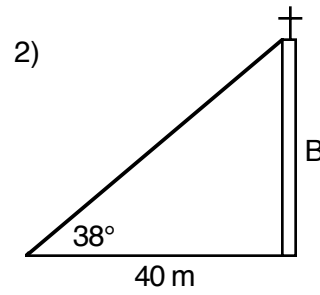
$$B = 31.25 \text{ m}$$

$$37.30 - 31.25 = 6.05 \text{ m}$$

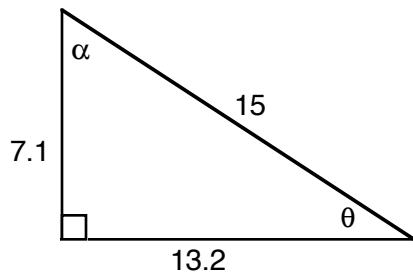*Express as a fraction.*

3) $\csc \theta = \dfrac{15}{7.1}$

4) $\sec \theta = \dfrac{15}{13.2}$

5) $\cot \theta = \dfrac{13.2}{7.1}$

6) $\csc \alpha = \dfrac{15}{13.2}$

7) $\sec \alpha = \dfrac{15}{7.1}$

8) $\cot \alpha = \dfrac{7.1}{13.2}$

Express as a decimal.

9) $\sin \theta = \dfrac{7.1}{15} = .4733$

10) $\cos \theta = \dfrac{13.2}{15} = .8800$

11) $\tan \theta = \dfrac{7.1}{13.2} = .5379$

12) $\sin \alpha = \dfrac{13.2}{15} = .8800$
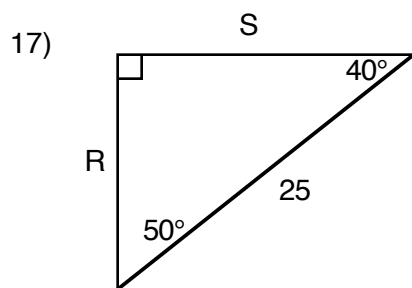
13) $\cos \alpha = \dfrac{7.1}{15} = .4733$
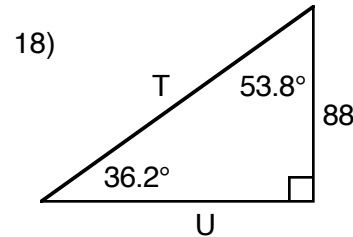
14) $\tan \alpha = \dfrac{13.2}{7.1} = 1.8592$

15)   The measure of θ is 28.25°.
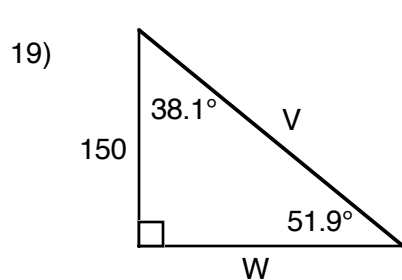
16)   The measure of θ is 61.75°.

Solve for the lengths of the sides and the measures of the angles.

17)

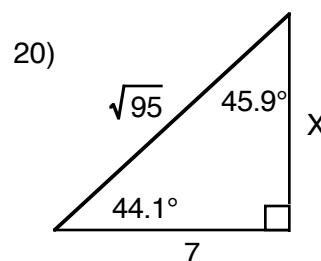$$\text{Sin } 40° = \frac{R}{25}$$

$$25 \text{ Sin } 40° = R$$

$$R = 16.07$$

$$\text{Cos } 40° = \frac{S}{25}$$

$$25 \text{ Cos } 40° = S$$

$$S = 19.15$$

18)

$$\text{Tan } 53.8° = \frac{U}{88}$$

$$88 \text{ Tan } 53.8° = U$$

$$U = 120.24$$

$$\text{Sin } 36.2° = \frac{88}{T}$$

$$T = \frac{88}{\text{Sin } 36.2°}$$

$$T = 149.00$$

19)

$$\text{Tan } 38.1° = \frac{W}{150}$$

$$150 \text{ Tan } 38.1° = W$$

$$W = 117.62$$

$$\text{Sin } 51.9° = \frac{150}{V}$$

$$V = \frac{150}{\text{Sin } 51.9°}$$

$$V = 190.61$$

20)

$$7^2 + X^2 = (\sqrt{95})^2$$

$$49 + X^2 = 95$$

$$X = 46$$

$$X = \sqrt{46} \quad \text{or } 6.78$$

$$\text{Tan } \theta = \frac{6.78}{7}$$

$$\text{arctan } .97 = 44.1$$

$$\alpha = 90 - 44.1 = 45.9°$$

Solutions: Lesson 6D

1)

$\text{Tan } 15.5° = \dfrac{M}{20.6}$

$M = 5.71 \text{ km}$

2)
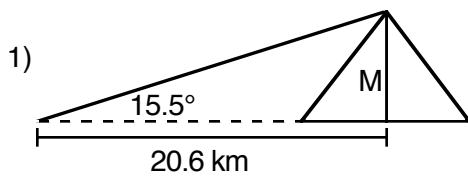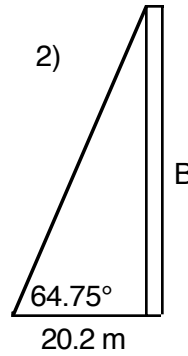
$\text{Tan } 64.75° = \dfrac{B}{20.2}$

$B = 42.8 \text{ m}$

$(18.33)^2 + X^2 = 25^2$

$336 + X^2 = 625$

$X^2 = 625$

$X = 17$

Express as a fraction.

3) $\csc \theta = \dfrac{25}{17}$

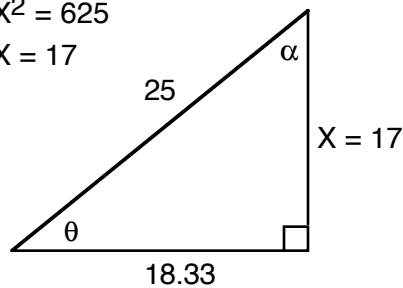4) $\sec \theta = \dfrac{25}{18.33}$

5) $\cot \theta = \dfrac{18.33}{17}$

6) $\csc \alpha = \dfrac{25}{18.33}$

7) $\sec \alpha = \dfrac{25}{17}$

8) $\cot \alpha = \dfrac{17}{18.33}$

Express as a decimal.

9) $\sin \theta = \dfrac{17}{25} = .6800$

10) $\cos \theta = \dfrac{18.33}{25} = .7332$

11) $\tan \theta = \dfrac{17}{18.33} = .9274$
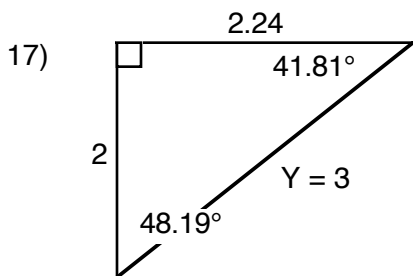
12) $\sin \alpha = \dfrac{18.33}{25} = .7332$

13) $\cos \alpha = \dfrac{17}{25} = .6800$

14) $\tan \alpha = \dfrac{18.33}{17} = 1.0782$

15)   The measure of θ is 42.84°.

16)   The measure of θ is 47.16°.

Solve for the lengths of the sides and the measures of the angles.

17)

$2^2 + (2.24)^2 = Y^2$

$3 = Y$

$\text{Cos } \theta = \dfrac{2}{3} = .6667$

$\arccos .6667 = 48.19°$

$\alpha = 90 - 48.19 = 41.81°$

18)

$\text{Tan } 40.8° = \dfrac{A}{10.5}$

$10.5 \text{ Tan } 40.8° = A$

$9.06 = A$

$\text{Sin } 49.2° = \dfrac{10.5}{Z}$

$Z = \dfrac{10.5}{\text{Sin } 49.2°}$

$Z = 13.87$

19)

$\text{Tan } 29.07° = \dfrac{C}{56}$
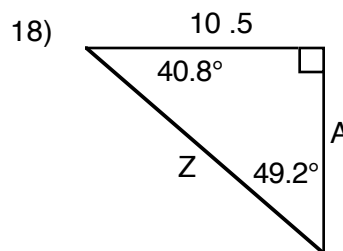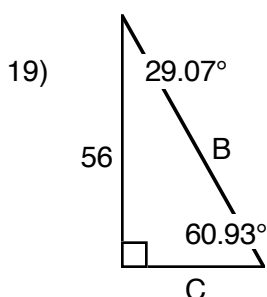
$56 \text{ Tan } 29.07° = C$

$31.13 = C$

$(56)^2 + (31.13)^2 = B^2$

$64.07 = B$

20)
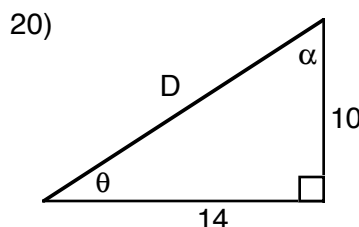
$\text{Tan } \theta = \dfrac{10}{14}$

$\arctan .7143 = 35.54°$

$\alpha = 90 - 35.54 = 54.46°$

$10^2 + 14^2 = D^2$

$17.2 = D$

Solutions: Lesson 6 Test

Test 6

1) D: $\tan 42° = \dfrac{X}{926}$

2) A: $926 \times \tan 42° = 926\,(.9004) = 833.8\text{ m}$

3) B: $\tan \theta = \dfrac{883.8}{926} = .9544$

   $\theta = 43.7°$

   $.7° \times 60 = 42'$; so $43°\ 42'$

4) B: $926^2 + 883.8^2 =$

   $857,476 + 781,102 = 1,638,578$

   $\sqrt{1,638,578} = 1,280\text{ m}$

5) C: $\tan 54° = \dfrac{Y}{80}$;

   $Y = 80\tan 54°$

6) A: $\tan 51° = \dfrac{B}{80}$; $B = 98.8\text{ m}$

7) D: $Y = 80\tan 54°$;

   $Y = 110.1\,(\text{complete distance})$;

   $110.1 - 98.8 = 11.3\text{ m}$

8) B: $80^2 + 98.8^2 = 6,400 + 9,761 = 16,161$

   $\sqrt{16,161} = 127.1\text{ m}$

9) A: $\sin 10° = \dfrac{Y}{100}$; $Y = 17.4\text{ m}$

10) B: $\sin 80° = \dfrac{X}{100}$; $X = 98.5\text{ m}$

11) D: $\tan 30° = \dfrac{1}{\sqrt{3}} = \dfrac{\sqrt{3}}{3}$

12) C: $\arcsin .8192 = 55°$

13) C: $\dfrac{2}{60} = .03$; $\dfrac{21.03}{60} = .35$;

   $46 + .36 = 46.35°$

14) A

15) B

Honors Booklet (Extra Practice): Lesson 6

Here are some more applications of trig functions. In some of these you may need to find a missing side, and, in others, a missing angle.

Use the skills you have learned so far to answer the questions. Always begin by making a drawing and labelling the known information.

1) If a girl 1.6 metres tall stands on level ground, and the elevation of the sun is 60° above the horizon, what will the length of her shadow be?

2) If the girl in no. 1 casts a shadow that is 1 metre long, what is the elevation of the sun?

3) A stairway forms an angle with the floor from which it rises. This angle may be called the angle of inclination. What is the angle of inclination of a stairway if the steps have a tread of 20 centimetres and a rise of 16 centimetres?

Some problems require more of your algebra skills. The first one is done for you.

4) An observation balloon is attached to the ground at point A. On a level with A and in the same straight line, the points B and C were chosen so that BC equals 100 metres. From the points B and C the angle of elevation of the balloon is 40° and 30° respectively. Find the height of the balloon.

First, make a drawing. We do not have enough information to find X using either the angle at B or the angle at C. However, we can make two equations using X and Y.
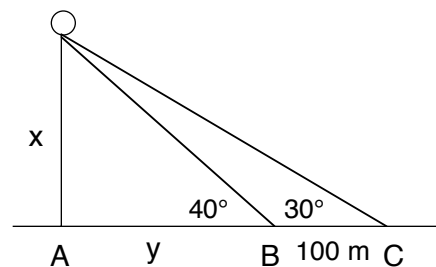
$$\tan 40° = \frac{X}{Y} \qquad \tan 30° = \frac{X}{Y + 100}$$

$$.8391 = \frac{X}{Y} \qquad .5774 = \frac{X}{Y + 100}$$

Replace tan with actual ratio.

$$X = .8391\,Y \qquad .5774 = \frac{.8391\,Y}{Y + 100}$$

Solve first equation for X and substitute for X in second equation.

$.5774(Y + 100) = .8391\,Y \Rightarrow .5774\,Y + 57.74 = .8391\,Y$ Solve for Y.

$57.74 = .2617\,Y \Rightarrow Y = 220.6$ (rounded)

$X = .8391\,(220.6) = 185.1$ m Solve for X, which is the height of the balloon.

5) Tom wished to find the width of a river. He observed a tree directly across the river on the bank. The angle of elevation to the top of the tree was 32°. Then Tom moved directly back from the bank 50 metres and found that the angle of elevation to the top of the tree was 21°. What was the width of the river?

6) In the side of a hill that slopes upward at an angle of 32°, a tunnel is bored sloping downward at an angle of 12°15' from the horizontal. How far below the surface of the hill is a point 38 metres down the tunnel?
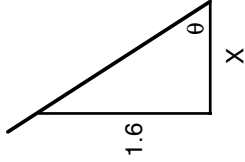
Honors Booklet (Extra Practice) Solutions: Lesson 6

Lesson 6

1) $\tan 60° = \dfrac{1.6}{X}$

$1.7321 = \dfrac{1.6}{X}$

$1.7321X = 1.6$

$X = .9237$ m

2) $\tan\theta = \dfrac{1.6}{1} = 1.6$

$\theta \approx 58°$

3) $\tan\theta = \dfrac{16}{20}$

$\tan\theta = .8000$

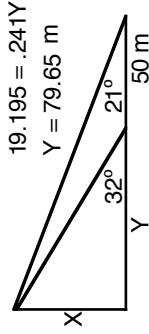$\theta = 38.7°$

4) done

5) $\tan 32° = \dfrac{X}{Y}$

$.6249 = \dfrac{X}{Y}$

$X = .6249Y$

$\tan 21° = \dfrac{X}{Y+50}$

$.3839 = \dfrac{.6249Y}{Y+50}$

$(Y+50)(.3839) = .6249Y$

$.3839Y + 19.195 = .6249Y$

$19.195 = .241Y$

$Y = 79.65$ m

6) $12° \; 15' = 12.25°$
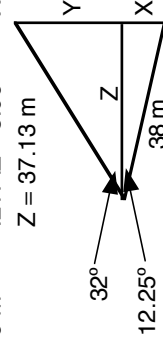
$\sin 12.25° = \dfrac{Y}{38}$

$.2122 = \dfrac{Y}{38}$

$Y = 8.06$ m

$\tan 12.25° = \dfrac{8.06}{Z}$

$.2171 = \dfrac{8.06}{Z}$

$.2171Z = 8.06$

$Z = 37.13$ m

$\tan 32° = \dfrac{X}{37.13}$

$.6249 = \dfrac{X}{37.13}$

$X = 23.20$ m

$X + Y = 23.20 + 8.06 = 31.26$ m

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