BECA / Dr. Huson / Geometry
Unit 10: Trigonometry
28 April 2023

Name: $Solutions$
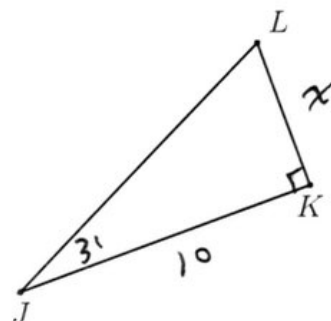
10.6 Homework: Tangent applications

CCSS.HSG.SRT.C.8

For a right triangle, $\tan\theta = \dfrac{\text{opposite}}{\text{adjacent}}$

1. Do Now: Given right $\triangle JKL$ with $\overline{JK} \perp \overline{KL}$, $JK = 10$, $m\angle J = 31°$. Let x be the length of the side opposite $\angle J$, $x = KL$.

   (a) Mark up the triangle.

   (b) Find x.

$$\tan 31 = \frac{x}{10}$$
$$x = 10\,\tan 31$$
$$= 6.0086\ldots$$
$$\approx 6.01$$

2. $\triangle ABC$ is shown with $m\angle C = 90°$ and the lengths of the triangle's sides are $AC = 8$, $BC = 15$. (not drawn to scale)

   (a) Write down the value of $\tan A$.

$$\tan A = \frac{15}{8}$$

   (b) Find the measure of $\angle A$.

$$m\angle A = \tan^{-1}\left(\frac{15}{8}\right) = 61.9275\ldots$$
$$\approx 62°$$

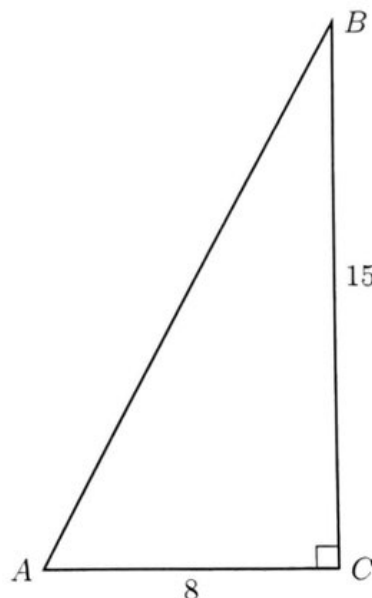   (c) Write down the value of $\tan B$.

$$\tan B = \frac{8}{15}$$

   (d) Find the measure of $\angle B$ two different ways.

$$m\angle B = \tan^{-1}\left(\frac{8}{15}\right) = 28.0724\ldots \approx 28°$$

   (e) Find AB.

$$m\angle B = 180 - 62$$
$$= \cancel{31}\ 28$$

Pythagorean triple
8-15-17

$$AB = \sqrt{15^2 + 8^2}$$
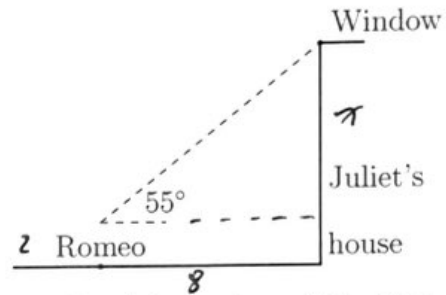$$= \sqrt{225 + 64} = \sqrt{289} = 17$$

3. Romeo is standing 8 meters away from Juliet's house, looking up at Juliet's window. He is two meters tall and looks up at a 55° angle.

Find the height of Juliet's window ledge to the *nearest meter*.   (not drawn to scale)

$\tan 55 = \dfrac{x}{8}$

$x = 8 \tan 55 = 11.42518\ldots$

$h = 2 + 11.4251\ldots$

$= 13.4251\ldots \approx 13\,m$

Window

x

Juliet's

55°

2 Romeo

house

8

4. From the top of a lighthouse, a ship is visible at an angle of depression of 3°. If the lighthouse is 1000 meters tall, determine the distance of the ship from the lighthouse, x, to the *nearest kilometer*.

Angle of depression = 3°
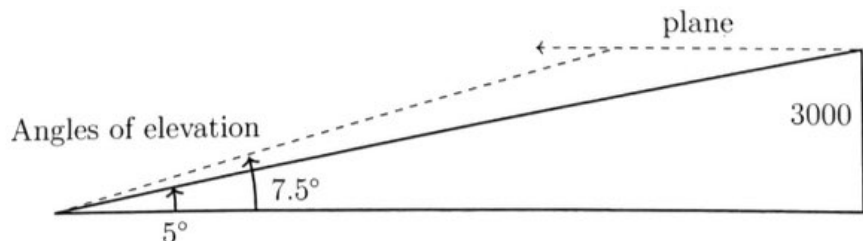
height = 1000 meters

3°

Ship

x
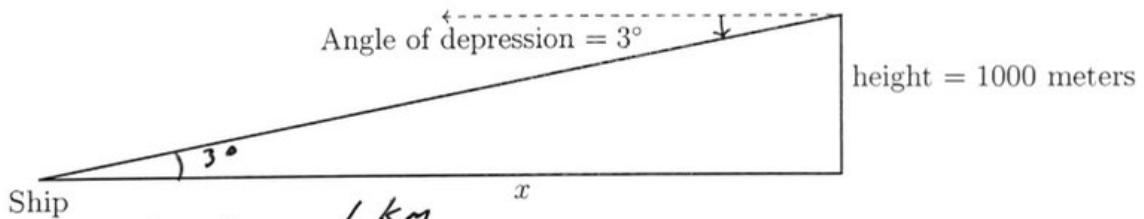
$\tan 3 = \dfrac{1\,km}{x}$

$x = \dfrac{1}{\tan 3°} = 19.0811\ldots \approx 19\,Km$

5. An airplane flying at an altitude of 3,000 meters is observed twice. The first time the angle of elevation is 5° and exactly one minute later the angle of elevation is 7.5°.

Find the distance the plane flies over the minute and its speed in kilometers per hour.

plane

Angles of elevation

3000

7.5°

5°

$\tan \theta = \dfrac{3000}{d}$

$d = \dfrac{3000}{\tan \theta}$

$d_1 = \dfrac{3000}{\tan 5°} = 34,290.15\ldots$

$d_2 = \dfrac{3000}{\tan 7.5°} = 22,787.262\ldots$

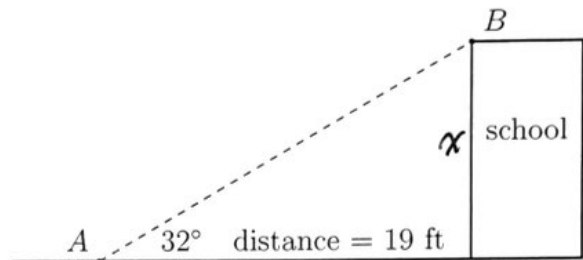$\Delta d = 34,290 - 22,787 = 11,502.85\ldots$

$S = 11,502 \times \dfrac{60\ minutes}{hour} \times \dfrac{1km}{1000m} = 690.175\ldots$

$690 \dfrac{km}{hr}$

6. Shown is a building with student A on the ground waving up to student B. Point A is 19 feet from the base of the building, and the angle of elevation from A to B is 32°.

Find how high up student B is from the ground to the *nearest foot*.   (not to scale)

$$\tan 32 = \frac{x}{19}$$
$$x = 19 \tan 32°$$
$$= 11.8725\ldots$$
$$\approx 12 \text{ ft.}$$

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                                          B
                                        ,·
                                   ,·'  |
                              ,·'       |
                         ,·'          x | school
                    ,·'                 |
         A ,·'  32°   distance = 19 ft  |
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7. From the top of a subway station, a person is visible at an angle of depression of 21°. If the subway station is 60 feet tall, determine the distance from the person to the base of the subway station, x, to the *nearest foot*.

$$\tan 21 = \frac{60}{x}$$
$$x = \frac{60}{\tan 21} = 156.3053\ldots$$
$$\approx 156 \text{ ft.}$$

Angle of depression = 21°

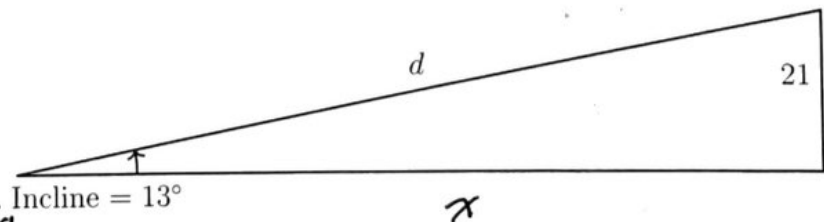$h = 60$

Person 60 21° x
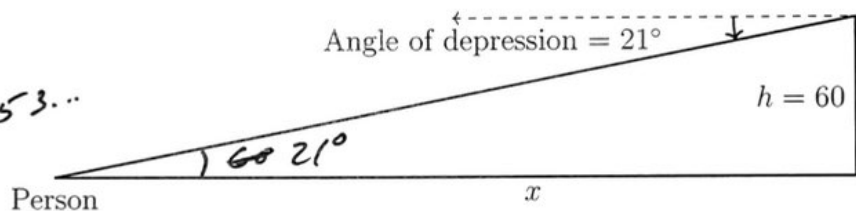
8. A child sleds from the top of a hill to a group of friends standing at the base of the hill. The hill is 21 feet tall, and the hill's incline is 13°. Find the distance, d, from the sledder to the group of friends to the *nearest foot*.

(hint: First find the horizontal distance, the base of the triangle. Then use the Pythagorean theorem to find the hypotenuse, d.)
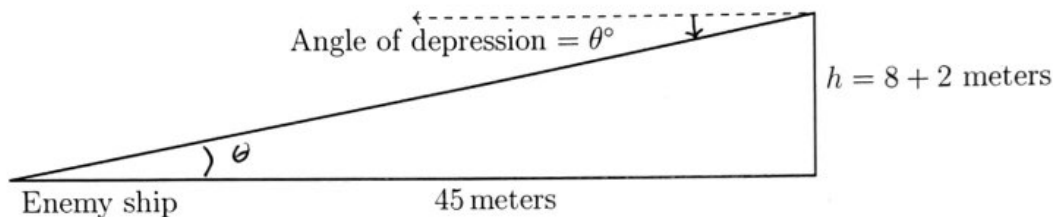
$$\tan 13 = \frac{21}{x}$$
$$x = \frac{21}{\tan 13} = 90.960\ldots$$

$$d = \sqrt{21^2 + 90.96\ldots^2}$$
$$= 93.353\ldots \approx 93 \text{ ft.}$$

d 21

Incline = 13° x

9. A pirate, who is two meters tall, is standing on a mast 8 meters tall. Looking down, the pirate sees an enemy ship 45 meters away.

Find the angle of depression to the nearest degree.

Angle of depression $= \theta°$

$h = 8 + 2$ meters

θ

Enemy ship   45 meters

$$\tan \theta = \frac{10}{45}$$

$$\theta = \tan^{-1}\left(\frac{10}{45}\right) = 12.5288...$$

$$\approx 13°$$

10. A snowman is standing 10 meters away from the base of a set of monkey bars, looking up at a boy 3 meters off the ground. The snowman is 1 meter tall.

(a) Mark the triangle.

(b) Find the angle from the snowman's head to the boy, θ, to the nearest tenth degree.

(not drawn to scale)

$$\tan \theta = \frac{2}{10}$$

$$\theta = \tan^{-1}\left(\frac{2}{10}\right)$$

$$= 11.3099...$$

$$\approx 11.3°$$

Boy

$\theta°$

2

3

Monkey

Bars

1

10 m