

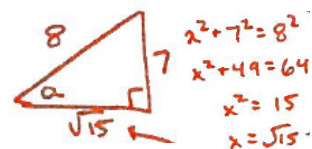
4.8 Solving Problems with Trig

Target 5F: Evaluate inverse and composite trigonometric functions and expressions using the unit circle

Review of Prior Concepts

If $\sin a = \frac{7}{8}$, what is the value of $\cos a$?

$$\begin{aligned} \cos a &= \frac{\text{adj}}{\text{hyp}} \\ &= \frac{\sqrt{15}}{8} \end{aligned}$$



More Practice

Trigonometry

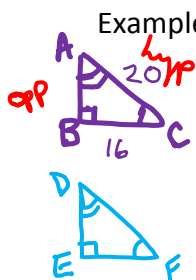
- <https://www.khanacademy.org/math/trigonometry/trigonometry-right-triangles>
- <http://www.mathsisfun.com/algebra/trigonometry.html>
- <http://www.regentsprep.org/regents/math/algebra/at2/ltrig.htm>
- <http://www.mathgoodies.com/lessons/vol2/circumference.html>
- <https://www.youtube.com/watch?v=SqFQZWRALGc>
- <https://www.youtube.com/watch?v=Jsiy4TxgIME>



SAT Connection

Passport to Advanced Math

14. Use structure to isolate or identify a quantity of interest in an expression



Example: In triangle ABC , the measure of $\angle B$ is 90° , $BC = 16$, and $AC = 20$. Triangle DEF is similar to triangle ABC , where vertices D , E , and F correspond to vertices A , B , and C , respectively, and each side of triangle DEF is $\frac{1}{3}$ the length of the corresponding side of triangle ABC . What is the value of $\sin F$?

$$\begin{aligned} (AB)^2 + 16^2 &= 20^2 \\ (AB)^2 + 256 &= 400 \\ (AB)^2 &= 144 \\ AB &= 12 \\ \sin F &= \sin C \\ \sin F &= \frac{12}{20} \\ &= \frac{3}{5} \end{aligned}$$

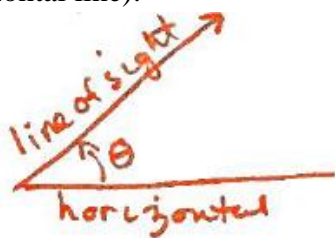
3	15		
/	●	○	
.	○	○	○
0	○	○	○
1	○	○	○
2	○	○	○
3	●	○	○
4	○	○	○
5	○	○	○
6	○	○	○
7	○	○	○
8	○	○	○
9	○	○	○

NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

Solution

Terminology

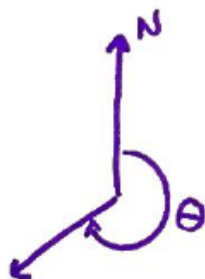
Angle of elevation (measure with respect to a horizontal line):



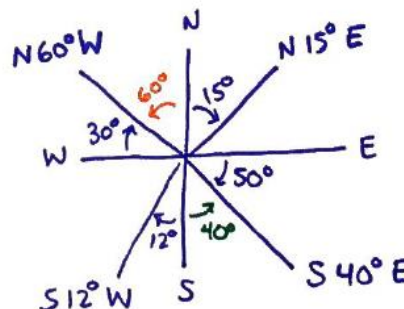
Angle of depression (measure with respect to a horizontal line):



Navigational angle (measure with respect to north, positive direction is clockwise):

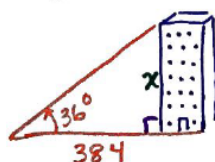


Surveying, bearing angle (the acute angle at which the direction varies to the east or west from the north-south line):



Examples

- 1) From a point 384 ft in a horizontal line from the base of a building, the angle of elevation to the top of the building is 36° . How tall is the building?



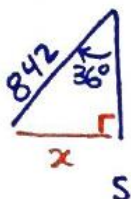
$$\tan 36^\circ = \frac{x}{384}$$

$$384 \tan 36^\circ = x$$

$$278.992 = x$$

The building is
278.992 ft tall

- 2) A certain piece of land is in the shape of a right triangle. The longest side is 842 meters and bears $S 36^\circ W$. If one of the sides runs north-south, how long is the side that runs east-west?



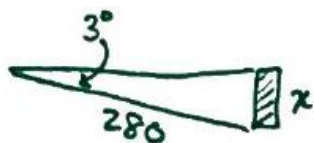
$$\sin 36^\circ = \frac{x}{842}$$

$$842 \sin 36^\circ = x$$

$$494.915 = x$$

The side that runs east-west
is 494.915 meters

- 3) A piece of land slopes at an angle of 3° and runs for 280 ft in the direction of the slope. In order to level the land, a retaining wall is to be built at the lower end of the property so that fill-dirt can level the property. How high must the wall be?



$$\sin 3^\circ = \frac{x}{280}$$

$$280 \cdot \sin 3^\circ = x$$

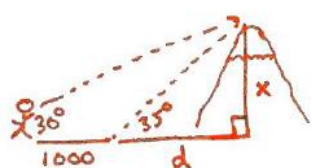
$$14.654 = x$$

The wall must be
14.654 ft tall

4) p.433 #14



While hiking on a level path toward Colorado's Front Range, Otis Evans determines that the angle of elevation to the top of Long's Peak is 30° . Moving 1000 ft closer to the mountain, Otis determines the angle of elevation to be 35° . How much higher is the top of Long's Peak than Otis' elevation?



$$d \cdot \tan 35^\circ = \frac{x}{d} \cdot d$$

$$d \tan 35^\circ = x$$

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

$$\tan 30^\circ = \frac{x}{1000 + d}$$

$$\tan 30^\circ = \frac{x}{1000 + \frac{x}{\tan 35^\circ}}$$

$$\tan 30^\circ \cdot \left(1000 + \frac{x}{\tan 35^\circ}\right) = x$$

$$1000 \tan 30^\circ + \tan 30^\circ \cdot \frac{x}{\tan 35^\circ} = x$$

$$1000 \tan 30^\circ + \tan 30^\circ \cdot \tan 35^\circ + x \tan 30^\circ = x \tan 35^\circ$$

$$1000 \tan 30^\circ + \tan 30^\circ \cdot \tan 35^\circ = x \tan 35^\circ - x \tan 30^\circ$$

$$1000 \tan 30^\circ + \tan 30^\circ \cdot \tan 35^\circ = x (\tan 35^\circ - \tan 30^\circ)$$

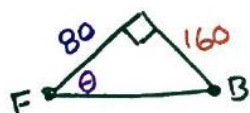
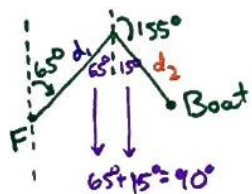
$$\frac{1000 \tan 30^\circ + \tan 30^\circ \cdot \tan 35^\circ}{\tan 35^\circ - \tan 30^\circ} = x$$

$$\boxed{3290.526 \text{ ft}} = x$$

5) p. 434 #18



The *Cerrito Lindo* travels at a speed of 40 knots from Fort Lauderdale on a course of 65° for 2 hours and then changes to a course of 155° for 4 hours. Determine the distance and the bearing from Fort Lauderdale to the boat.



knots = speed, hrs = time

$$\text{distance} = (\text{rate})(\text{time})$$

$$= (\text{knots})(\text{hrs})$$

$$d_1 = (40)(2)$$

$$= 80 \text{ nautical miles}$$

$$d_2 = (40)(4)$$

$$= 160 \text{ nautical miles}$$

$$FB^2 = 160^2 + 80^2$$

$$FB = \sqrt{160^2 + 80^2}$$

$$= 178.885 \text{ nautical miles}$$

$$\tan \theta = \frac{160}{80}$$

$$\theta = \tan^{-1}\left(\frac{160}{80}\right) = 63.435^\circ$$

$$65^\circ + 63.435^\circ$$

$$\boxed{128.435^\circ \text{ bearing}}$$

More Practice

Trigonometric Ratios

<http://www.regentsprep.org/regents/math/algtrig/att1/trigsix.htm>

<http://www.themathpage.com/atrig/solve-right-triangles.htm>

<http://www.mathguide.com/lessons/RightTriTrig.html>

<https://www.youtube.com/watch?v=15VbdqRjTXc>

Homework Assignment

p.432 #3,7,9,13,15,16,17,23,25

SAT Connection**Solution**

The correct answer is $\frac{3}{5}$ or .6. Triangle ABC is a right triangle with its right angle at B . Thus, \overline{AC} is the hypotenuse of right triangle ABC , and \overline{AB} and \overline{BC} are the legs of right triangle ABC . By the Pythagorean theorem, $AB = \sqrt{20^2 - 16^2} = \sqrt{400 - 256} = \sqrt{144} = 12$. Since triangle DEF is similar to triangle ABC , with vertex F corresponding to vertex C , the measure of angle F equals the measure of angle C . Thus, $\sin F = \sin C$. From the side lengths of triangle ABC , $\sin C = \frac{\text{opposite side}}{\text{hypotenuse}} = \frac{AB}{AC} = \frac{12}{20} = \frac{3}{5}$. Therefore, $\sin F = \frac{3}{5}$. Either $\frac{3}{5}$ or its decimal equivalent, .6, may be gridded as the correct answer.

Unit 5 (Chapter 4): Trigonometric Functions

DATE: _____
Pre-Calculus 2016-2017

Unit 5 (Chapter 4): Trigonometric Functions

Choice C is correct. Since the angles are acute and $\sin(a^\circ) = \cos(b^\circ)$, it follows from the complementary angle property of sines and cosines that $a + b = 90$. Substituting $4k - 22$ for a and $6k - 13$ for b gives $(4k - 22) + (6k - 13) = 90$, which simplifies to $10k - 35 = 90$. Therefore, $10k = 125$, and $k = 12.5$.

Choice A is incorrect and may be the result of mistakenly assuming that $a + b$ and making a sign error. Choices B and D are incorrect because they result in values for a and b such that $\sin(a^\circ) \neq \cos(b^\circ)$.