Trig Ratio Applications Practice

Header: Key

(2)

1. Your school is building a *raked stage*. The stage will be 30 feet long from front to back, with a total rise of 2 feet. You want the rake (angle of elevation) to be 5° or less for safety. Is the raked stage within your desired range?

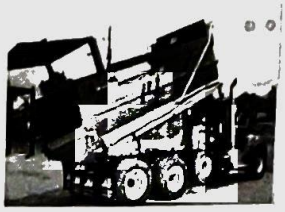
$\sin(x) = \frac{2}{30}$

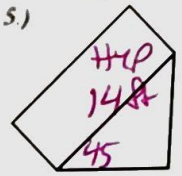
$x = \sin^{-1}\left(\frac{2}{30}\right)$

$x = 3.82°$

Yes the raked stage is within ~~the~~ desired range of 5° or less, so it is safe.

2. **PROBLEM SOLVING** In order to unload clay easily, the body of a dump truck must be elevated to at least 45°. The body of a dump truck that is 14 feet long has been raised 8 feet. Will the clay pour out easily? Explain your reasoning. *(See Example 5.)*





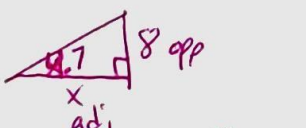
$\sin(45) = \frac{x}{14}$

$14 \cdot \sin(45) = x$

$x = 9.89$ ft

No, the clay will not pour out easily because the bed is not raised high enough.

3. **MODELING WITH MATHEMATICS** The Uniform Federal Accessibility Standards specify that a wheelchair ramp may not have an incline greater than 4.76°. You want to build a ramp with a vertical rise of 8 inches. You want to minimize the horizontal distance taken up by the ramp. Draw a diagram showing the approximate dimensions of your ramp.



$x \cdot \tan(4.7) = \frac{8}{x} \cdot x$

$\frac{x \tan(4.7)}{\tan(4.7)} = \frac{8}{\tan(4.7)}$

$x = \frac{8}{\tan(4.7)}$

$x = 97.3$ in

4. **PROBLEM SOLVING** You are standing on a footbridge that is 12 feet above a lake. You look down and see a duck in the water. The duck is 7 feet away from the footbridge. What is the angle of elevation from the duck to you?

angle of elevation same as angle of depression

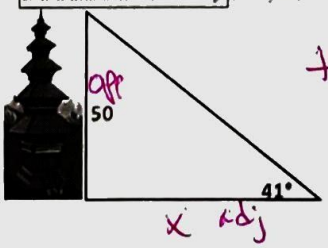
$\tan(x) = \frac{12}{7}$

$x = \tan^{-1}\left(\frac{12}{7}\right)$

$x = 59.74°$

the angle of elevation from duck to you is 59.74°

5. A building is 50 feet high. At a distance away from the building, an observer notices that the angle of elevation to the top of the building is 41°. To the nearest foot, how far is the observer from the base of the building? *Round your answer to the nearest foot.*



$\tan(41) = \frac{50}{x}$

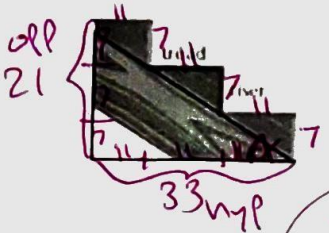
$x \cdot \tan(41) = 50$

$x = \frac{50}{\tan(41)}$

$x = 57.5$ ft

6. **MODELING WITH MATHEMATICS** The horizontal part of a step is called the *tread*. The vertical part is called the *riser*. The recommended riser-to-tread ratio is 7 inches : 11 inches.

a. Find the value of x for stairs built using the recommended riser-to-tread ratio.



$\tan(x) = \frac{21}{33}$

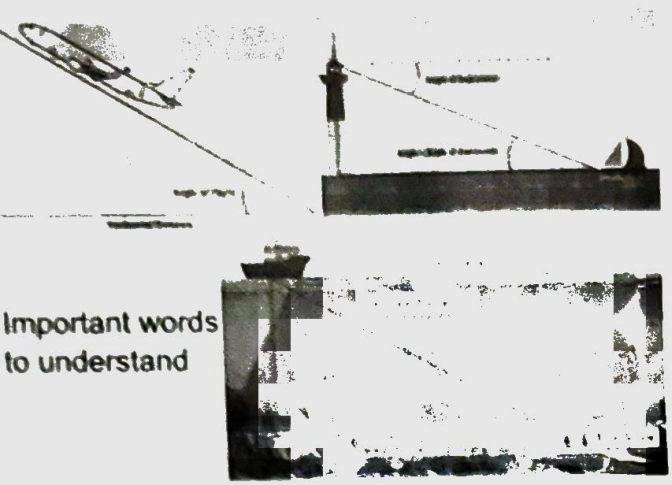
$x = \tan^{-1}\left(\frac{21}{33}\right)$

$x = 32.4°$

The stairs need to be built at a 32.4° angle.

Ratio Applications Practice

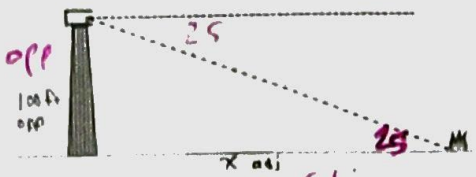
Header:



Important words to understand

7. From the top of a 100-foot lookout tower, a forest fire was spotted at an angle of depression of 25°.

How far was the fire from the base of the lookout?



$\tan(25) = \frac{100}{x}$

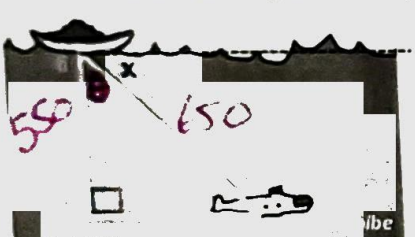
$x \tan(25) = 100$

$x = \frac{100}{\tan(25)}$

$x = 214.45$ ft

The fire is 214.45ft away.

8. At what angle θ would the ship want to send a torpedo down to hit the submarine? What would be the angle x of depression?



$\cos(\theta) = \frac{550}{650}$

$\theta = \cos^{-1}\left(\frac{550}{650}\right)$

$\theta = 32.2°$

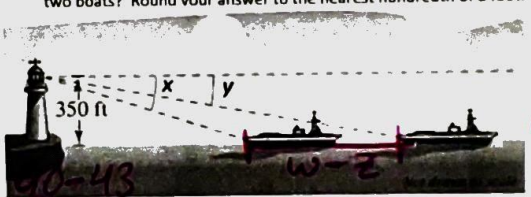
$x = 40 - 32.2$

$x = 57.8°$

the torpedo should be at the angle of 32.2° and an angle of depression of 57.8°

9. **Note:** Angles of depression are always measured down from a line horizontal to the starting point.

Problem: A 350 foot tall lighthouse observes two ships in the distance. The angle of depression from the top of the lighthouse to the closest boat (shown in the diagram as *x* degrees) is $43°$. The angle of depression to the farthest boat (shown as *y* degrees) is $31°$. Using this information, how far apart are the two boats? Round your answer to the nearest hundredth of a foot.



$\tan(47) = \frac{w}{350}$

$w = 350 \cdot \tan(47)$

$w = 375.3$ ft

$\tan(31) = \frac{350}{z}$

$z \tan(31) = 350$

$z = \frac{350}{\tan 31}$

$z = 582.5$ ft

$w - z$

$582.5 - 375.3$

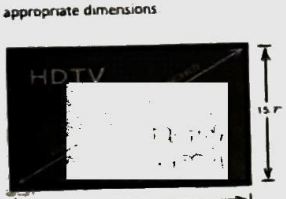
207.2 ft

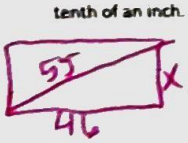
The boats are 207.2ft apart

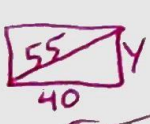
10. TV televisions are advertised in many stores and have become much larger over the past few years. But many people do not realize the false advertising that goes into selling the size of a television. When a TV is advertised as being 43 inches, they are not talking about the length or width of the TV. They are actually giving you the diagonal distance from a lower corner to an upper corner. This means the TVs are not as large as most people assume. Answer the following question knowing this information. Include a diagram and label the appropriate dimensions.

Problem:

Part 1: Several new big screen TVs are advertised as being 55 inches. If the length along the bottom of the TVs measures between 40 and 46 inches, what are the minimum and maximum possible dimensions for the height of the TVs? Round your answers to the nearest tenth of an inch.







$x^2 + 46^2 = 55^2$

$x^2 = 55^2 - 46^2$

$x^2 = 1000$

$x = 31.6$ in (min)

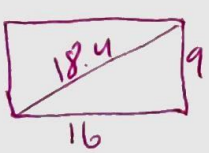
$y^2 + 40^2 = 55^2$

$y^2 = 55^2 - 40^2$

$y^2 = 1,425$

$y = 37.7$ in (max)

Part 2: Newer televisions have an *aspect ratio* of 16:9. This means the ratio of the width to the height of the TV is 16:9. Find the dimensions of a 55 inch TV with a 16:9 aspect ratio. List your answer in inches rounded to the nearest tenth.



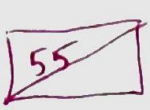
$16^2 + 9^2 = c^2$

$256 + 81 = c^2$

$337 = c^2$

$\sqrt{337} = c$

$c = 18.4$



scale factor $\frac{55}{18.4} = 2.989$

$9 \cdot 2.989 = 26.9$ in by

$16 \cdot 2.989 = 47.8$ in