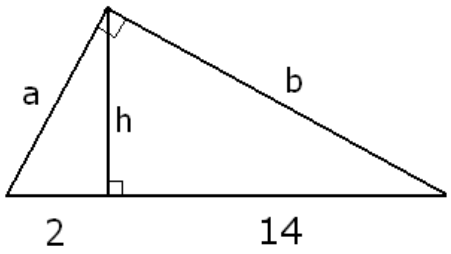
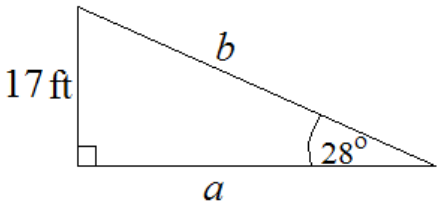
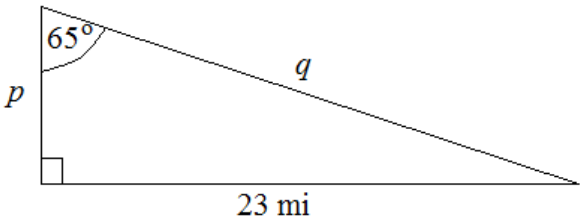
1. a) Given the picture, find the exact value and approximate values of a, b, and h.
   b) Find the exact value and an approximate value for the measure of the smallest angle in the triangle.



2. Find the measure of an inner angle in a regular polygon with 10 sides.

3. Compute the exact value and the approximate value for each of a, b, p, and q, based on the picture below.





4. A right triangle has sides 5 ft, 12 ft, and 13 ft long.
   a) State the value of all six trigonometric functions of α if α is the angle opposite the 5 ft long side.
   b) State the value of all six trigonometric functions of β if β is the angle opposite the 12 ft long side.

5. The hypotenuse of a right triangle is 31 cm long. One angle in the triangle measures 42°.
   a) Find the exact value of the length of the missing sides in the triangle.
   b) Find an approximate value of the length of the missing sides in the triangle. Round your answer to four or more decimal places.

6. Draw a square with sides 1 unit long and draw in one of the diagonals. Use the isosceles right triangle you obtained to find all trigonometric function values of 45°.

7. Compute the exact value of each of the following.

   a) $\sin 60°$
   b) $\cos 45°$
   c) $\tan 30°$
   d) $\csc 60°$
   e) $\sec 45°$
   f) $\cot 30°$
   g) $\tan 60° - \tan 30°$
   h) $\sin 30° \cos 60°$
   i) $\tan 30° \cos 60° - \tan 60°$

8. Use your calculator to find an approximate value of the smallest angle in a right triangle with sides 84 unit, 85 unit, and 13 units long. Present your answer in degrees, accurate up to four or more decimals. (That means at least four digits after the decimal point).

9. Use your calculator to find the three-digit decimal approximation for each of the following.
   a) $\sin 17°$ b) $\sin 57°$ c) $\tan 45°$ d) $\sin^2 37° + \cos^2 37°$

10. Find the three-digit decimal approximation for the acute angle α, in degrees, given that $\sin \alpha = \frac{3}{4}$.

11. Find the distance between $(4, -11)$ and $(-16, 10)$.

12. The sides of a rectangle are 20 ft and 21 ft long. Find the length of the diagonal.

13. Find the exact value of the length of the main diagonal in a rectangular prism with sides 4, 7, and 10 units.

14. The hypotenuse of a right triangle is 74 units. The difference between the lengths of the other two sides is 46 units.

    a) How long are the sides of this triangle?

    b) Use your calculator to find an approximate value of the smallest angle in the triangle. Present your answer in degrees, accurate up to four or more decimals.

15. Consider a regular polygon with 12 sides that is drawn into a circle with radius 10 feet. Compute the exact value and approximate value of each of the following.

    a) the perimeter of the polygon

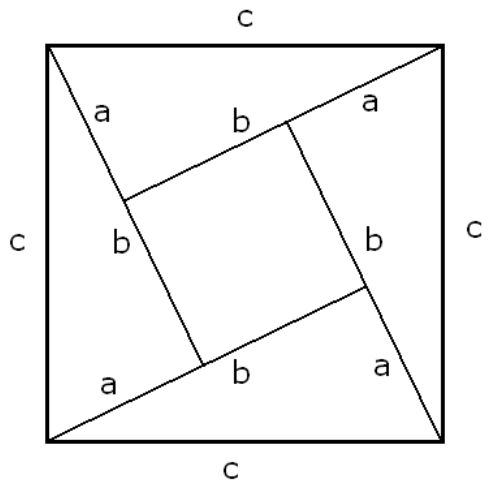
    b) the area of the polygon

16. All edges of a square-based pyramid are 20 meters long. What is the height of the pyramid?

17. Find the exact value and an approximate value for the angle that is formed between the line $y = \frac{2}{3}x - 5$ and the positive part of the $x-$axis.

18. (Enrichment) Find the area of the triangle ABC, where $A\,(-4, -3)$, $B\,(8, 1)$, and $C\,(-5, 1)$.

19. (Enrichment) This is a proof of the Pythagorean Theorem. Let ABC be a right triangle, with $\gamma = 90°$. We use four identical triangles to construct the following picture.



    a) Find the area of the big square in terms of its sides.

    b) Find the area of the small rectangle in the middle.

    c) Find the area of the big rectangle as the following sum: the areas of the four right triangles and the area of the small rectangle in the middle.

20. (Enrichment) Suppose that α is any acute angle. Prove that $\sin\alpha + \cos\alpha > 1$.

Answers

1. a) $a = 4\sqrt{2} \approx 5.657$ $b = 4\sqrt{14} \approx 14.967$ $h = 2\sqrt{7} \approx 5.292$ b) $\alpha = \sin^{-1}\left(\frac{\sqrt{2}}{4}\right) \approx 20.704\,811°$
2. $144°$
3. $a = \frac{17}{\tan 28°}\,\text{ft} \approx 31.972\,35\,\text{ft}$ $b = \frac{17}{\sin 28°}\,\text{ft} \approx 36.210926\,\text{ft}$ $p = \frac{23}{\tan 65°}\,\text{mi} \approx 10.72507614\,\text{mi}$ $q = \frac{23}{\sin 65°}\,\text{mi} \approx 25.377\,692\,\text{mi}$
4. a) $\sin\alpha = \frac{5}{13}$ $\cos\alpha = \frac{12}{13}$ $\tan\alpha = \frac{5}{12}$ $\csc\alpha = \frac{13}{5}$ $\sec\alpha = \frac{13}{12}$ $\cot\alpha = \frac{12}{5}$
   b) $\sin\beta = \frac{12}{13}$ $\cos\beta = \frac{5}{13}$ $\tan\beta = \frac{12}{5}$ $\csc\beta = \frac{13}{12}$ $\sec\beta = \frac{13}{5}$ $\cot\beta = \frac{5}{12}$
5. a) $(31\sin 42°)$ cm and $(31\cos 42°)$ cm b) $20.743\,0488$ cm and $23.037\,49$ cm
6. $\sin 45° = \frac{1}{\sqrt{2}}$ $\cos 45° = \frac{1}{\sqrt{2}}$ $\tan 45° = 1$ $\csc 45° = \sqrt{2}$ $\sec 45° = \sqrt{2}$ $\cot 45° = 1$
7. a) $\frac{\sqrt{3}}{2}$ b) $\frac{\sqrt{2}}{2}$ c) $\frac{\sqrt{3}}{3}$ d) $\frac{2\sqrt{3}}{3}$ e) $\sqrt{2}$ f) $\sqrt{3}$ g) $\frac{2\sqrt{3}}{3}$ h) $\frac{1}{4}$ i) $-\frac{5\sqrt{3}}{6}$
8. $8.797\,41°$
9. a) 0.292 b) 0.839 c) 1 d) 1
10. $\sin^{-1} 0.75 \approx 48.590\,377\,890\,73$
11. 29 units
12. 29 ft
13. $\sqrt{165}$
14. a) 24, 70, and 74 units long b) $18.924\,644\,42°$
15. a) $P = 240\sin 15°\,\text{ft} \approx 62.116\,57\,\text{ft}$ b) $A = 300\,\text{ft}^2$
16. $10\sqrt{2}\,\text{m}$
17. exact value: $\tan^{-1}\left(\frac{2}{3}\right)$ approximation: $33.690067526°$

Last revised: February 3, 2015