Section 2.6: Applying the Trigonometric Ratios

Where do we start when solving right triangles?

The order in which unknown measurements are found will depend on the specific problem and your personal choice.

A few guidelines. You should:

- Sketch, label and place all known information correctly on the triangle.
- Use the information to select the correct trigonometric ratio and/ or apply the Pythagorean theorem.
- Apply the knowledge that the sum of the angles in a triangle equals 180°.

NOTE: DO NOT solve for an angle or a side length, approximate the measurement and then use that approximation in another calculation. This approximation of an angle or side length will lead to less accurate answers. Use given information whenever possible.

You should also verify your work.

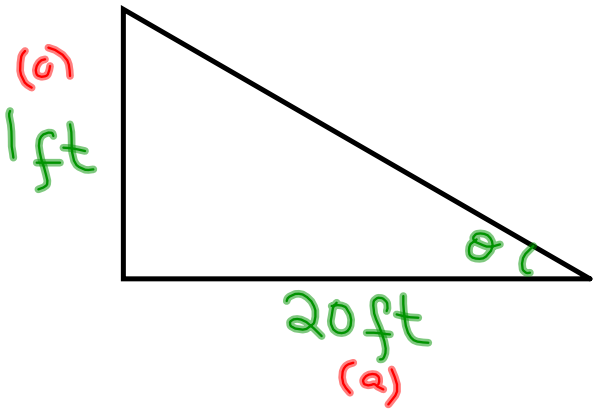
- If trigonometry was used to find the lengths of the missing sides, then the Pythagorean theorem can be used to verify the results.
- When verifying angle measurements, ensure that the sum of the angles equals 180°.also check the reasonableness of their answers by ensuring that the smallest angle, for example, is opposite the shortest side.

Examples:

1. David is designing a wheelchair accessibility ramp for his sister.
   He knows these data:

- The ramp will rise 1 ft. from the level ground to the door of the house.
- The horizontal distance from the start of the ramp at the sidewalk to the door is 20 ft.
- The building code states that the angle of inclination of the ramp must be less than 5°.

Determine whether David's design will comply with the building code.



$\tan\theta = \frac{o}{a}$

$\tan\theta = \frac{1}{20}$

$\theta = \tan^{-1}\left(\frac{1}{20}\right)$

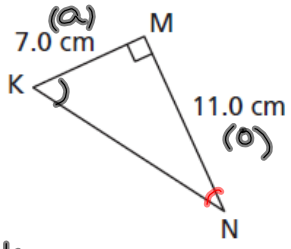
$\theta = 2.9^\circ$

Since $2.9^\circ < 5.0^\circ$, the ramp complies with the building code.

2. Solve this triangle. Give the measures to the nearest tenth.

Solving a triangle means to determine the measures of all the angles and the lengths of all the sides in the triangle.

A)



① Find KN.

$c^2 = a^2 + b^2$

$c^2 = 7^2 + 11^2$

$c^2 = 49 + 121$

$c^2 = 170$

$c = \sqrt{170} = 13.0$

② Find $\angle K$

$\tan \angle K = \frac{o}{a}$

$\tan \angle K = \frac{11}{7}$

$\angle K = \tan^{-1}(11/7)$

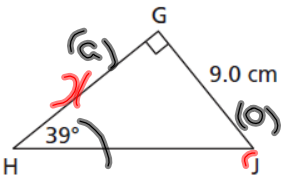
$\angle K = 32.5°$

③ Find N

$\angle N = 90° - 32.5°$

$= 57.5°$

B)



y (h)

① $\angle J = 90° - 39° = 51°$

② $\tan H = \frac{o}{a}$

$\frac{\tan 39°}{1} = \frac{9}{x}$

$\frac{x \tan 39°}{\tan 39°} = \frac{9}{\tan 39°}$

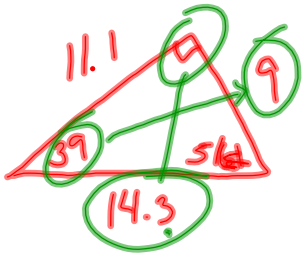
$x = 11.1$ cm

③ $\sin H = \frac{o}{h}$

$\frac{\sin 39°}{1} = \frac{9}{y}$

$\frac{y \sin 39°}{\sin 39°} = \frac{9}{\sin 39°}$

$y = 14.3$ cm



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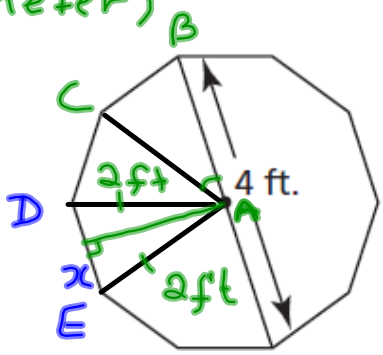
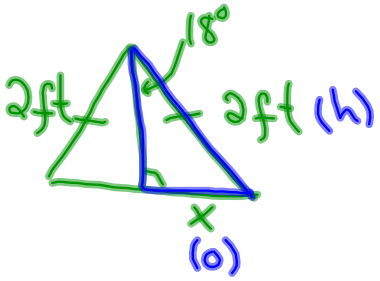
3. A window has the shape of a regular decagon. The distance from one vertex to the opposite vertex, measured through the centre of the window, is approximately 4 ft. Determine the length of the wood moulding material that forms the frame of the window, to the nearest foot. (Perimeter)



$\angle BAC = 360^\circ \div 10$

$= 36^\circ$



$\frac{\sin 18^\circ}{1} = \frac{x}{2}$

$x = 2 \sin 18^\circ$

$x = 0.62$ ft

$DE = 2 \times 0.62$

$DE = 1.24$ cm

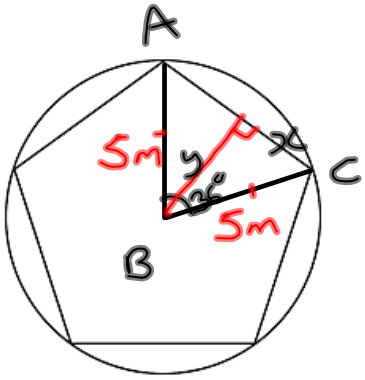
The length of wood required

$= 10 \times 1.24$

$= 12.4$ ft

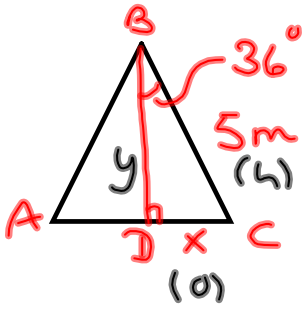
$\doteq 12$ ft

4. A regular pentagon is inscribed in a circle with a radius of 5 m. Determine the area of the pentagon.



$\angle ABC = 360° \div 5$

$\angle ABC = 72°$



$$\frac{\sin 36°}{1} = \frac{x}{5}$$

$x = 5 \sin 36°$

$x = 2.94$ m

$\therefore AC = 2 \times 2.94$

$= 5.88$ m

Need to find height (BD)

$$\frac{\cos 36°}{1} = \frac{y}{5}$$

$y = 5 \cos 36°$

$y = 4.05$ m

Area of $\Delta ABC = \frac{1}{2}bh$

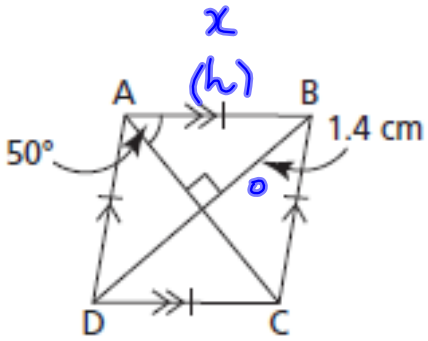
$= \frac{1}{2}(5.88)(4.05)$

$= 11.91\ m^2$

Area of Pentagon $= 5 \times 11.91$ m

$= 59.6\ m^2$

5. Determine the perimeter of this rhombus to the nearest tenth of a centimeter.



$\frac{\sin 50^\circ}{1} = \frac{1.4}{x}$

$\frac{x \sin 50^\circ}{\sin 50^\circ} = \frac{1.4}{\sin 50^\circ}$

$x = 1.83 \text{ cm}$

Perimeter $= 4 \times 1.83$
$= 7.32 \text{cm}$

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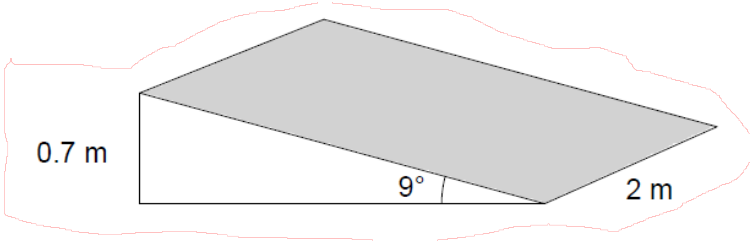
6. Using a rectangular piece of plywood (shaded region), a ramp was built with the dimensions as shown. Approximate the area of the plywood to the nearest tenth of a square meter.



7. Identify the error(s) in the following calculations. Determine the correct solution and explain how the person doing this question could have easily discovered that there was an error.

$\sin 25^\circ = \frac{16}{x}$

$x = 16(\sin 25^\circ)$

$x = 6.8$ cm