

Math 10

Lesson 7–4 Applying the trigonometry ratios – part 1

I. Determining lengths of sides

In Lessons 7–1 and 7–2 we learned how to:

- find an angle if we were given any two sides of a right triangle.
- calculate a side of a triangle if we are given an angle and another side.

Now we will use the three primary trig ratios (sin cos tan) and the Pythagorean equation ($c^2 = a^2 + b^2$) to solve other, perhaps more interesting, problems.

Example 1 Solving a right triangle

Solve $\triangle FGH$. Give the measures to the nearest tenth.

Solution

When we **solve a triangle**, we are being asked to calculate the measures of all the angles and all the lengths of the triangle. For this triangle we need to find sides GH and FG and angle G. Since the angles of a triangle add up to 180°

$$\angle F + \angle G + \angle H = 180$$

$$25 + \angle G + 90 = 180$$

$$\angle G = 180 - 25 - 90$$

$$\angle G = 65$$

To find GH, note that the side 12 is adjacent to $\angle F$ and that GH is opposite $\angle F$. Opposite and adjacent are related in the tangent function.

$$\tan F = \frac{\text{opp}}{\text{adj}}$$

$$\tan 25 = \frac{GH}{12}$$

$$12 \tan 25 = GH$$

$$5.6 = GH$$

To calculate FG, note that the side 12 is adjacent to $\angle F$ and that FG is the hypotenuse. Adjacent and hypotenuse involve the cosine function.

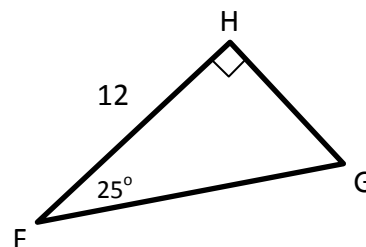
$$\cos F = \frac{\text{adj}}{\text{hyp}}$$

$$\cos 25 = \frac{12}{FG}$$

$$FG \cos 25 = 12$$

$$FG = \frac{12}{\cos 25}$$

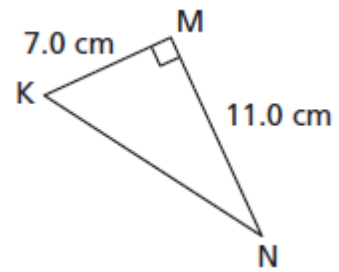
$$FG = 13.2$$



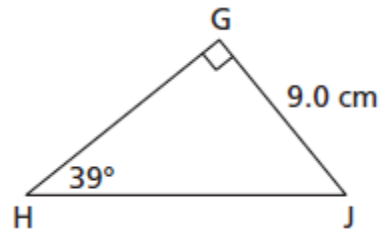
It is important to note that the sides and angles can often be calculated in a number of ways. For example, we could have used our calculated value for GH and side 12 to calculate FG using $c^2 = a^2 + b^2$. However, if we had made a mistake calculating GH the mistake would have been carried into our FG calculation. Therefore, unless a calculated value is needed for a further calculation, **wherever possible always use the original values given in the problem for any calculations.**

Question 1

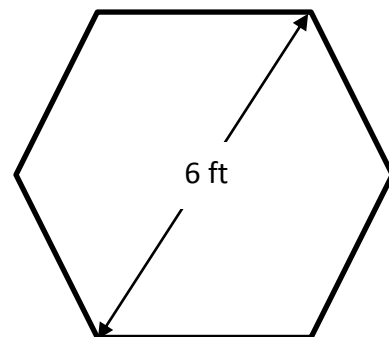
Solve this triangle. Give the measures to the nearest tenth.

**Question 2**

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

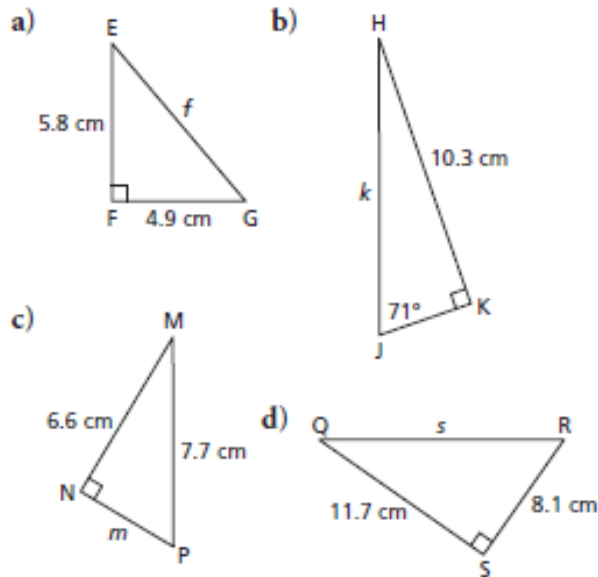
**Question 3**

For the hexagon, calculate the perimeter length and the area.

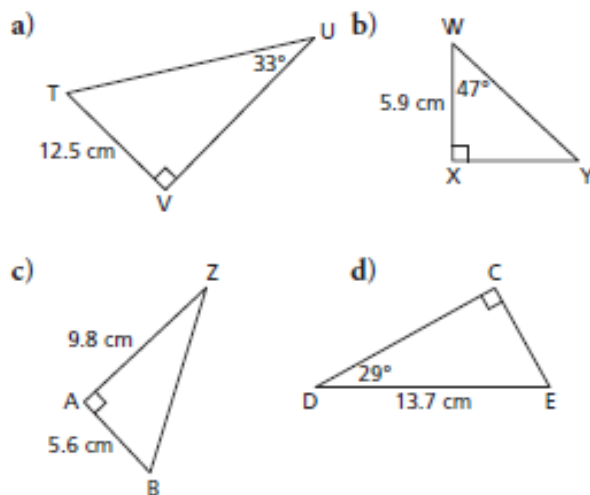


II. Assignment

1. To determine the length of each indicated side, which strategy would you use? Why?



2. Solve each right triangle. Give the measures to the nearest tenth.



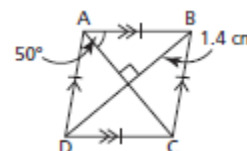
3. The world's tallest totem pole is in Alert Bay, B.C., home of the Nimpkish First Nation. Twenty feet from the base of the totem pole, the angle of elevation of the top of the pole is 83.4° . How tall is the totem pole to the nearest foot?
4. A helicopter leaves its base, and flies 35 km due west to pick up a sick person. It then flies 58 km due north to a hospital.
- When the helicopter is at the hospital, how far is it from its base to the nearest kilometre?
 - When the helicopter is at the hospital, what is the measure of the angle between the path it took due north and the path it will take to return directly to its base? Write the angle to the nearest degree.

5. A road rises 1 m for every 15 m measured along the road.
- What is the angle of inclination of the road to the nearest degree?
 - How far does a car travel horizontally when it travels 15 m along the road? Give the answer to the nearest tenth of a metre.

6. A roof has the shape of an isosceles triangle with equal sides 7 m long and base 12 m long.
- What is the measure of the angle of inclination of the roof to the nearest degree?
 - What is the measure of the angle at the peak of the roof to the nearest degree?

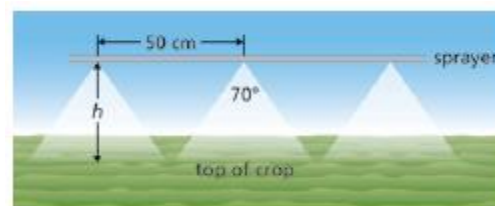


7. Determine the perimeter of this rhombus to the nearest tenth of a centimetre.



8. A candle has the shape of a right prism whose bases are regular polygons with 12 sides. On each base, the distance from one vertex to the opposite vertex, measured through the centre of the base, is approximately 2 in. The candle is 5 in. high.
- What is the area of the base, to the nearest square inch?
 - What is the volume of wax in the candle, to the nearest cubic inch?

9. To irrigate crops, a farmer uses a boom sprayer pulled by a tractor. The nozzles are 50 cm apart and spray at an angle of 70° . To the nearest centimetre, how high should the sprayer be placed above the crops to ensure that all the crops are watered?



10. Determine the perimeter and area of this isosceles trapezoid. Give the measures to the nearest tenth.

