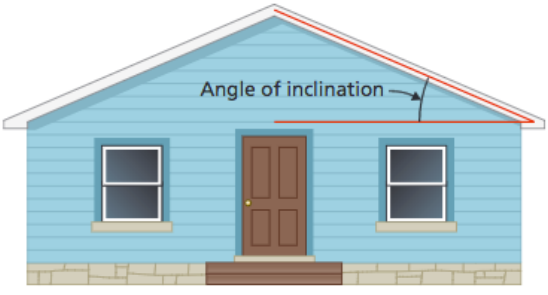
LG 3, 4 & 5 Trigonometry

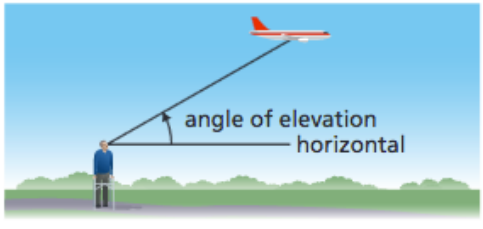
- applying the Pythagorean Theorem
- solving problems using properties of similar polygons
- solving problems involving ratios

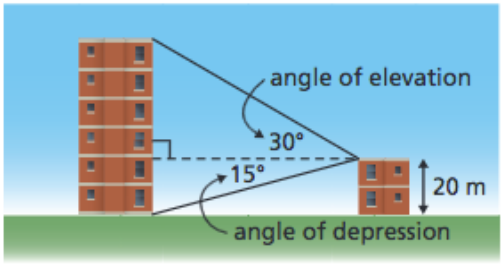
NEW VOCABULARY

- angle of inclination
- tangent ratio
- indirect measurement
- sine ratio
- cosine ratio
- angle of elevation
- angle of depression



The **angle of elevation** of an object above the horizontal is the angle between the horizontal and the line of sight from an observer.





September 04, 2016

The Tangent Ratio
The Sine and Cosine Ratios

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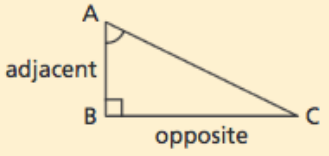
The Tangent Ratio

If $\angle A$ is an acute angle in a right triangle, then

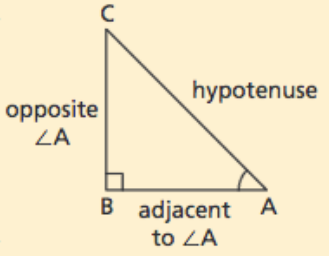
$$\tan A = \frac{\text{length of side opposite } \angle A}{\text{length of side adjacent to } \angle A}$$



The Sine Ratio

If $\angle A$ is an acute angle in a right triangle, then

$$\sin A = \frac{\text{length of side opposite } \angle A}{\text{length of hypotenuse}}$$



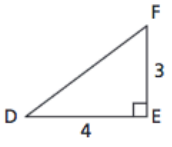
The Cosine Ratio

If $\angle A$ is an acute angle in a right triangle, then

$$\cos A = \frac{\text{length of side adjacent to } \angle A}{\text{length of hypotenuse}}$$

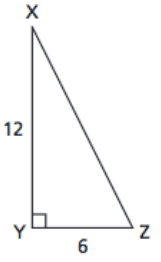
Example 1 Determining the Tangent Ratios for Angles

Determine tan D and tan F.



CHECK YOUR UNDERSTANDING

1. Determine tan X and tan Z.

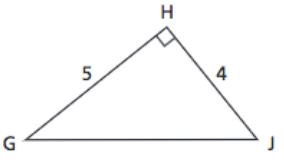


[Answer: tan X = 0.5; tan Z = 2]

FINDING ANGLE?

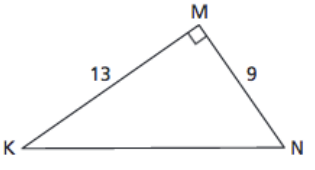
Example 2 Using the Tangent Ratio to Determine the Measure of an Angle

Determine the measures of ∠G and ∠J to the nearest tenth of a degree.



CHECK YOUR UNDERSTANDING

2. Determine the measures of ∠K and ∠N to the nearest tenth of a degree.



[Answer: ∠K ≐ 34.7°; ∠N ≐ 55.3°]

Example 4 Using the Tangent Ratio to Solve a Problem

FINDING ANGLE?

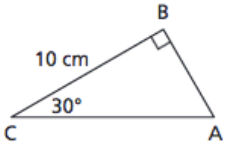
A 10-ft. ladder leans against the side of a building with its base 4 ft. from the wall.

What angle, to the nearest degree, does the ladder make with the ground?

FINDING SIDE?

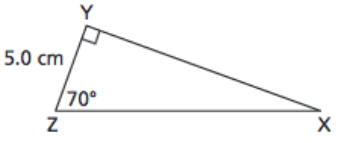
Example 1 Determining the Length of a Side Opposite a Given Angle

Determine the length of AB to the nearest tenth of a centimetre.



CHECK YOUR UNDERSTANDING

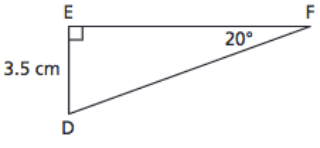
1. Determine the length of XY to the nearest tenth of a centimetre.



[Answer: XY ≐ 13.7 cm]

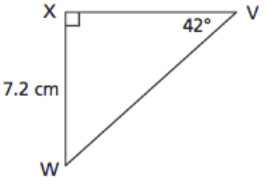
Example 2 Determining the Length of a Side Adjacent to a Given Angle

Determine the length of EF to the nearest tenth of a centimetre.



CHECK YOUR UNDERSTANDING

2. Determine the length of VX to the nearest tenth of a centimetre.

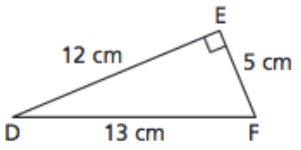


[Answer: VX ≐ 8.0 cm]

Example 1 Determining the Sine and Cosine of an Angle

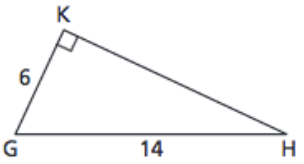
a) In $\triangle DEF$, identify the side opposite $\angle D$ and the side adjacent to $\angle D$.

b) Determine sin D and cos D to the nearest hundredth.



Example 2 Using Sine or Cosine to Determine the Measure of an Angle

Determine the measures of $\angle G$ and $\angle H$ to the nearest tenth of a degree.



Example 3 Using Sine or Cosine to Solve a Problem

A water bomber is flying at an altitude of 5000 ft. The plane's radar shows that it is 8000 ft. from the target site. What is the **angle of elevation** of the plane measured from the target site, to the nearest degree?

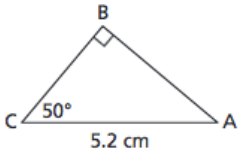
CHECK YOUR UNDERSTANDING

3. An observer is sitting on a dock watching a float plane in Vancouver harbour. At a certain time, the plane is 300 m above the water and 430 m from the observer. Determine the angle of elevation of the plane measured from the observer, to the nearest degree.

[Answer: approximately 44°]

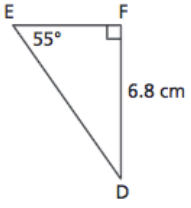
Example 1 Using the Sine or Cosine Ratio to Determine the Length of a Leg

Determine the length of BC to the nearest tenth of a centimetre.



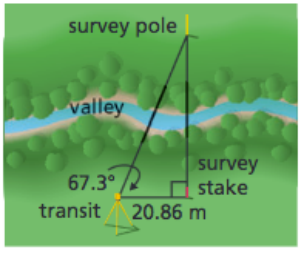
Example 2 Using Sine or Cosine to Determine the Length of the Hypotenuse

Determine the length of DE to the nearest tenth of a centimetre.



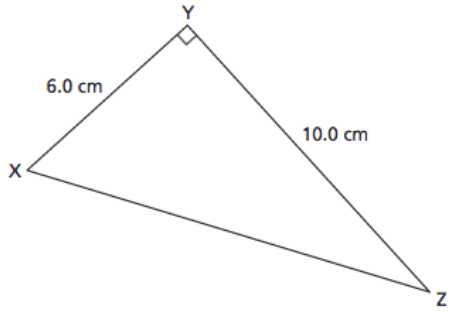
Example 3 Solving an Indirect Measurement Problem

A surveyor made the measurements shown in the diagram. How could the surveyor determine the distance from the transit to the survey pole to the nearest hundredth of a metre?



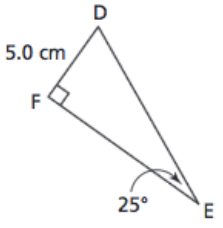
Example 1 Solving a Right Triangle Given Two Sides

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



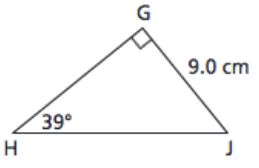
Example 2 Solving a Right Triangle Given One Side and One Acute Angle

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



CHECK YOUR UNDERSTANDING

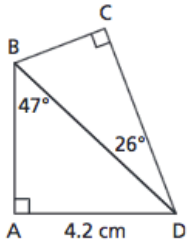
2. Solve this triangle. Give the measures to the nearest tenth where necessary.



[Answers: $\angle J = 51°$; GH $\doteq$ 11.1 cm; HJ $\doteq$ 14.3 cm]

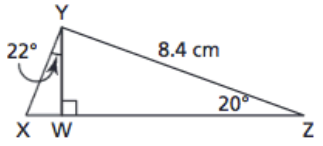
Example 1 Calculating a Side Length Using More than One Triangle

Calculate the length of CD to the nearest tenth of a centimetre.



CHECK YOUR UNDERSTANDING

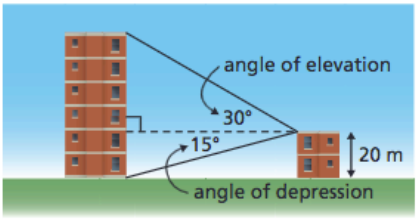
1. Calculate the length of XY to the nearest tenth of a centimetre.



[Answer: XY ≐ 3.1 cm]

Example 2 Solving a Problem with Triangles in the Same Plane

From the top of a 20-m high building, a surveyor measured the angle of elevation of the top of another building and the **angle of depression** of the base of that building. The surveyor sketched this plan of her measurements. Determine the height of the taller building to the nearest tenth of a metre.



CHECK YOUR UNDERSTANDING

2. A surveyor stands at a window on the 9th floor of an office tower. He uses a clinometer to measure the angles of elevation and depression of the top and the base of a taller building. The surveyor sketches this plan of his measurements. Determine the height of the taller building to the nearest tenth of a metre.