ST. JEAN DE BREBEUF
MATHEMATICS

CHAPTER 2.5

SOLVE PROBLEMS USING RIGHT TRIANGLES

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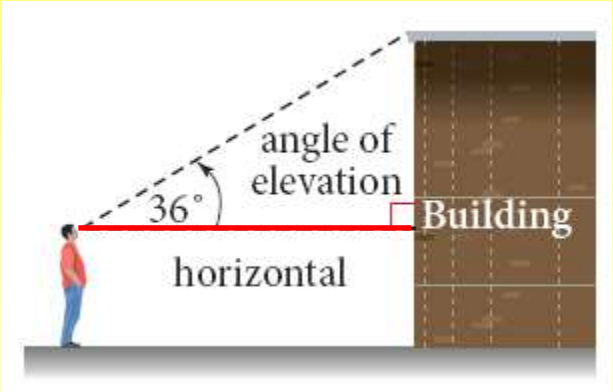
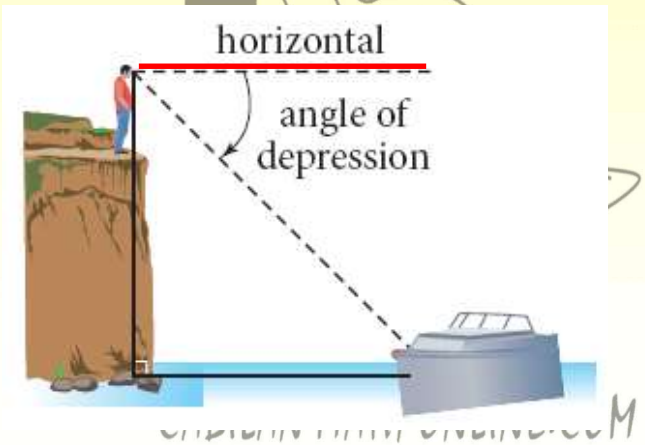
KEY CONCEPTS

The **trigonometric ratios** and **angles of elevation** or **depression** can be used to find hard-to-measure distances.

Angle of elevation
→the angle between the **horizontal** and the **line of sight up to an object**
→also known as an **angle of inclination**

Angle of depression
→the angle between the **horizontal** and the **line of sight down to an object**.





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KEY CONCEPTS

When solving problems involving right triangles
→sketch and label a diagram
→identify the angle of interest
→identify the **hypotenuse**, **opposite** and **adjacent** side with respect to the angle of interest.

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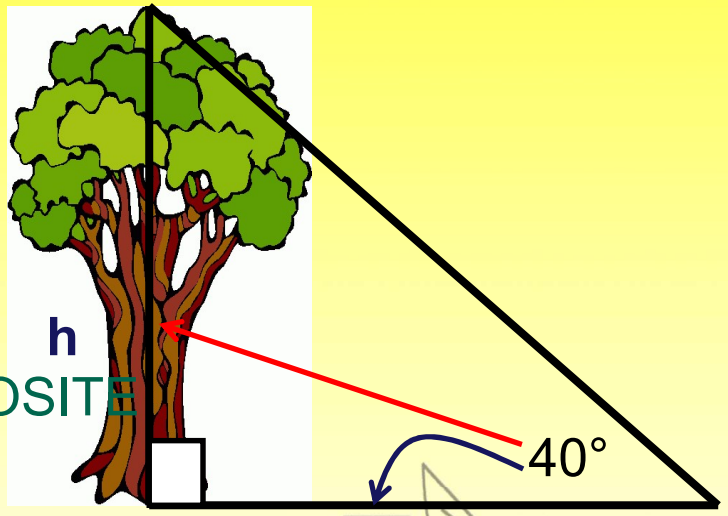
$$\sin A = \frac{OPPOSITE}{HYPOTENUSE} \qquad \cos A = \frac{ADJACENT}{HYPOTENUSE} \qquad \tan A = \frac{OPPOSITE}{ADJACENT}$$

EXAMPLE 1

Finding the Height of a Tree

From a point **10 metres** from the base of a tree, the *angle of elevation* to the top of the tree is **40°**.



Find the **height of the tree** to <u>one decimal place</u>.

Let "h" represent the height of the tree

$$\tan A = \frac{OPPOSITE}{ADJACENT}$$

$$h = 10 \tan 40°$$

$$h = 8.4\,m$$

The tree is **8.4 m** tall.

* Put over "1" → $\tan 40° = \frac{h}{10}$

*Cross-multiply $\frac{\tan 40°}{1} = \frac{h}{10}$

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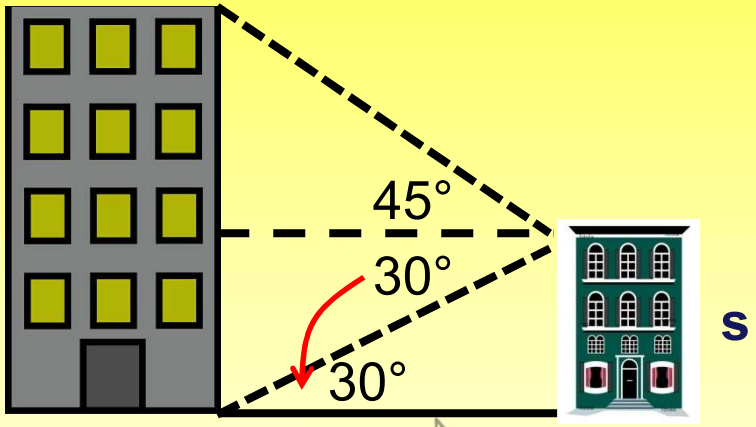
EXAMPLE 2

Finding the Heights of Two Buildings

Two buildings are **125 feet** apart.

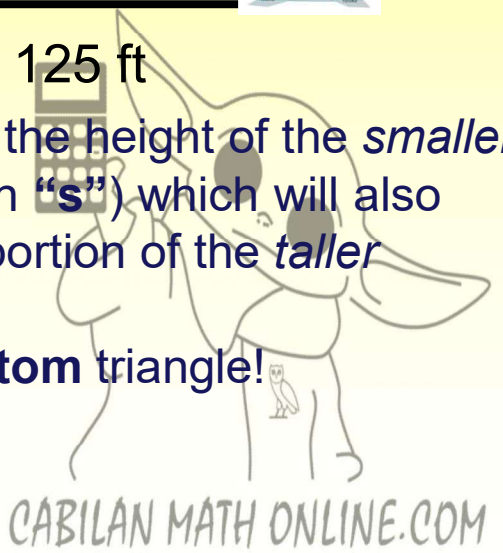
From the roof of the shorter building, the *angle of elevation* to the top of the taller building is **45°** and the *angle of depression* to the base of the taller building is **30°**.

Find the heights of <u>both</u> buildings to <u>one decimal place</u>.



First, we can solve for the height of the *smaller* building (represent with **"s"**) which will also represent the <u>bottom</u> portion of the *taller* building

→ We will use the **bottom** triangle!



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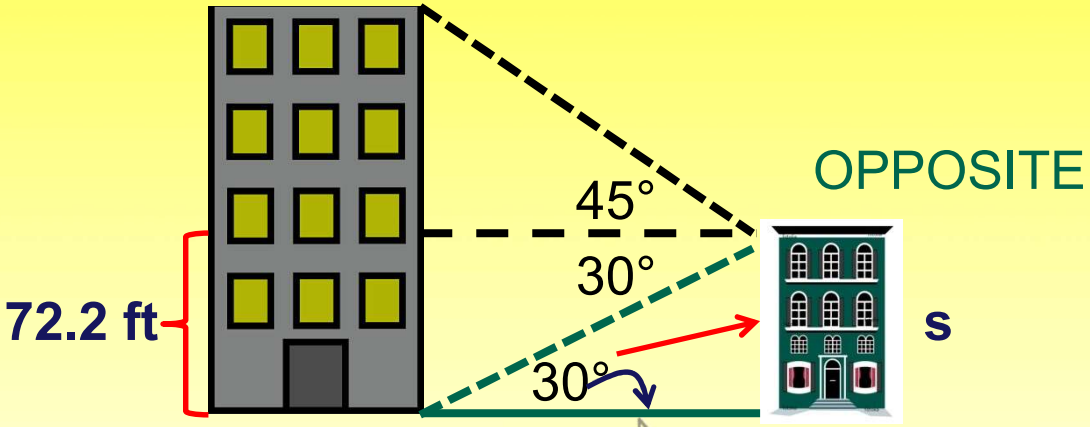

$$\tan A = \frac{OPPOSITE}{ADJACENT}$$

$$\tan 30° = \frac{s}{125}$$

$$\frac{\tan 30°}{1} = \frac{s}{125}$$

$$s = 125 \tan 30°$$

$$s = 72.2\ ft$$

The smaller building is **72.2 ft** tall.

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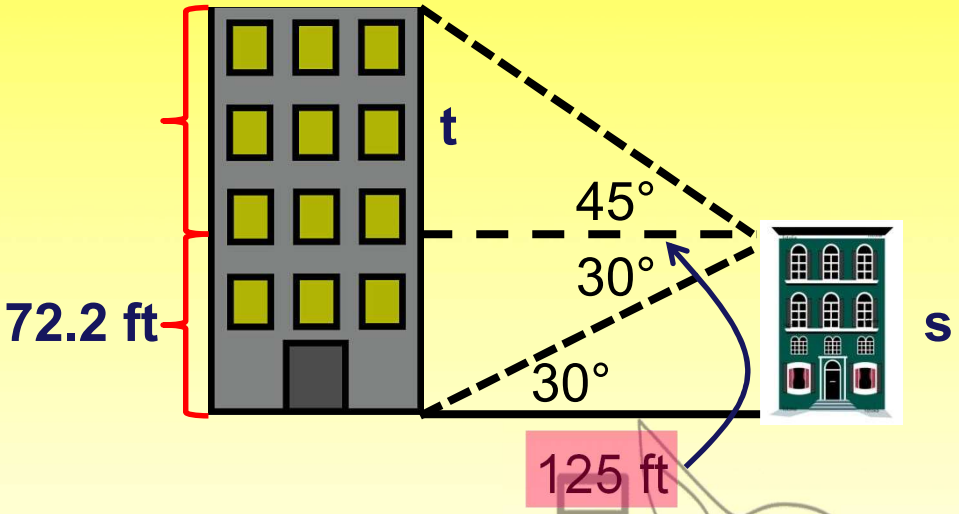

Now, we can find the height of the *taller* building by using the top triangle

Let **"t"** represent the height of the taller building

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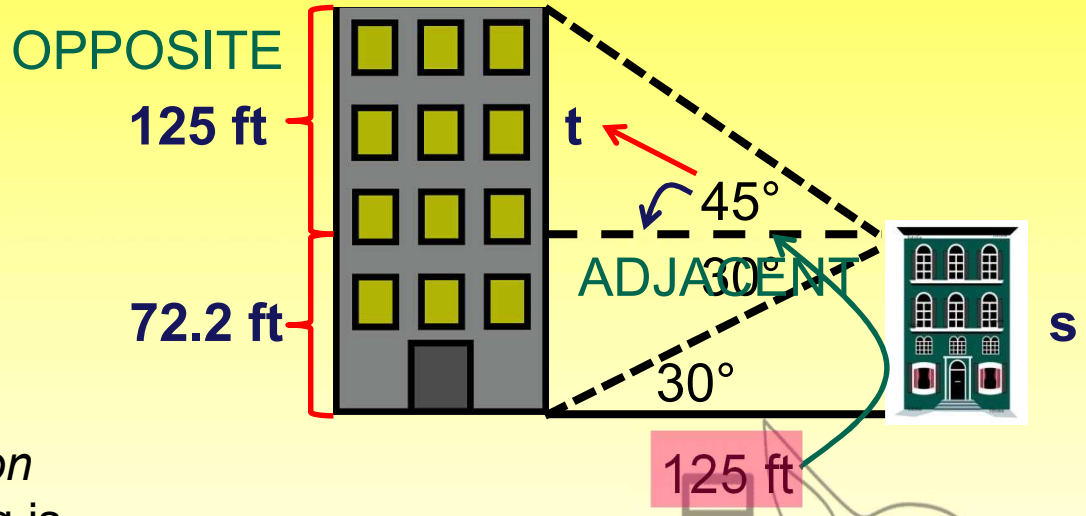

$$\tan A = \frac{OPPOSITE}{ADJACENT}$$

$$\tan 45° = \frac{t}{125}$$

$$\frac{\tan 45°}{1} = \frac{t}{125}$$

$$t = 125 \tan 45°$$

$$t = 125\ ft$$

For total height of taller building
= 125 + 72.2
= **197.2 feet**

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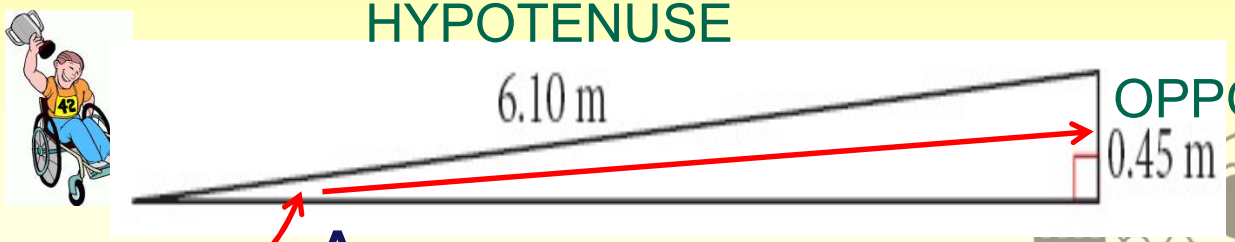
EXAMPLE 3 *Finding Angles*

A wheelchair ramp is needed at the entrance of a restaurant. The ramp is to be **6.10 m** long and have a rise of **0.45 m**.

Calculate the **angle of elevation** of the ramp. Round your answer to the nearest whole number.



Let **"A"** represent the angle of elevation

$$\sin A = \frac{OPPOSITE}{HYPOTENUSE}$$

$$\sin A = \frac{0.45}{6.10}$$

$$\sin A = 0.07377$$

$$\angle A = \sin^{-1}(0.07377)$$

$$\angle A = 4°$$

INVERSE SINE →**2nd/SHIFT** then **SIN**

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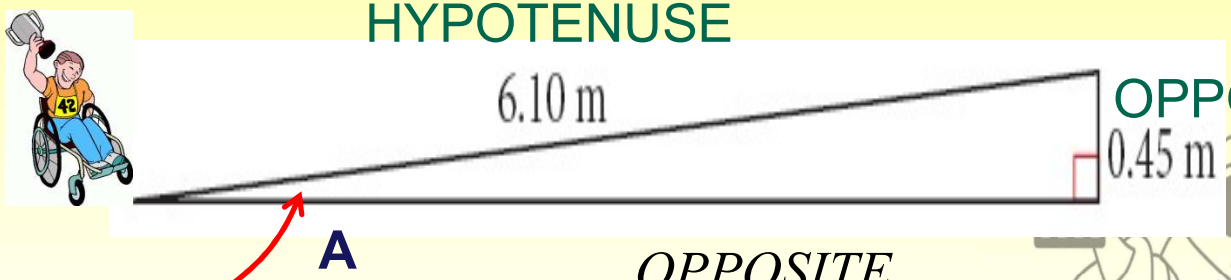

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The *angle of elevation* is **4°**.

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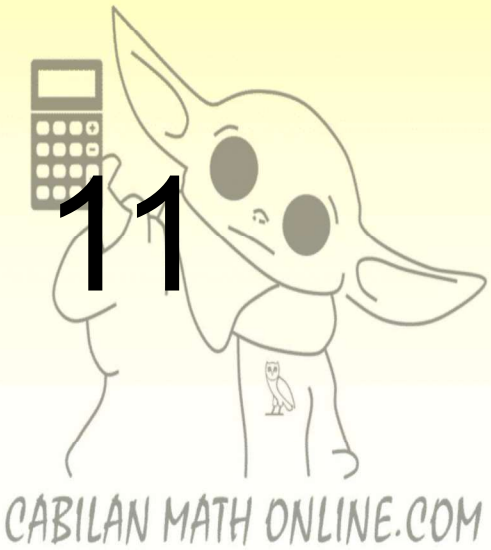
Homework:

Page 86 – 87

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