## Math 10 C: Trigonometry

## C1 \& C2 Basic Skills and Working with Trig Ratios

## Vocabulary \& Key Concepts

## Pythagorean Theorem

In a right triangle the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the other two sides in a right triangle.


$$
(\text { hypotenuse })^{2}=(\text { one side })^{2}+(\text { other side })^{2}
$$

## Trig Ratios

The ratios in right triangles have a special name depending on what two sides are divided (forming the fraction/ratio). The trigonometric ratios are as follows:

$$
\sin \theta=\frac{\text { opposite }}{\text { hypotenuse }} \quad \cos \theta=\frac{\text { adjacent }}{\text { hypotenuse }} \quad \tan \theta=\frac{\text { opposite }}{\text { adjacent }}
$$

## Skills

## Pythagorean Theorem

## Example \#1

Determine the value of $x$ for each of the following triangles. Round to the nearest tenth.
(a)

Solution: $\quad x^{2}=9^{2}+13^{2}$
$x=\sqrt{9^{2}+13^{2}}$
$x=15.8 m$

## Working with Trig Ratios

## Example \#2

Determine the sine, cosine, and tangent ratios for the reference angle in each triangle.
(a)

Solution: $\sin \theta=\frac{4}{5}$
$\cos \theta=\frac{3}{5}$
$\tan \theta=\frac{4}{3}$

## Example \#3

Determine the unknown side for each of the following triangles.
(a)


Solution: $\cos 26^{\circ}=\frac{x}{10}$
$x=10 \times \cos 26^{\circ}$
$x=9.0$
(b)


## Example \#4

Determine the unknown angle for each of the following.
(a)

Solution: $\cos \theta=\frac{6.5}{12.7}$
$\angle \theta=\cos ^{-1} \frac{6.5}{12.7}$
$\angle \theta=59^{\circ}$


## C3 \& C4: Problem Solving Using Trigonometry

## Vocabulary and Key Concepts

Angle of Elevation: when looking up, the angle that your line of sight makes with the horizontal.
For example: A person looks up to the top of the flagpole. The angle to the top of the flagpole would be referred to as an angle of elevation.


Angle of Depression: when looking down, the angle that your line of site makes with the horizontal.

For example: A person looks down from the top of a building to his car below. The angle at which the person looks down, from the horizon is referred to as an angle of depression.


## Skills

## Solving a Triangle

## Example \#1

Solve triangle DEF, shown below.
D


## Given:

## Steps:

1. Make a list of all sides and angles.
2. Fill in the ones you know.
3. Solve for all missing sides and angles. (Note: whenever possible, use the information provided in the question)
4. Check your answers using pythagoreas theorem and other trig ratios.

$$
\begin{array}{llr}
\angle D=70.5^{\circ} & d= & \text { Solve for } \angle F \rightarrow \\
\angle E=\angle D+\angle E+\angle F=180^{\circ} \\
\angle E=90^{\circ} & e=58.3 & \angle F=180^{\circ}-70.5-90 \\
& \angle F=19.5^{\circ}
\end{array}
$$

$\angle F=\quad f=$
Solve for side $d \rightarrow \sin 70.5^{\circ}=\frac{d}{58.3}$

$$
d=55.0
$$

Solve for side $f \rightarrow \cos 70.5^{\circ}=\frac{f}{58.3}$
$f=19.5$

## Angle of Elevation and Depression

## Example \#2

Katrina is flying a kite and lets out 150 m of string. The string is taut and makes an angle of $62^{\circ}$ with the horizontal. If Katrina's hand is 1.69 m above the ground, determine the height of the kite.


Solution: $\sin 62^{\circ}=\frac{x}{150}$

$$
\begin{aligned}
& x=150 \sin 62^{\circ} \\
& x=132.44
\end{aligned}
$$

Height of the kite $=132.44+1.69=134.13 \mathrm{~m}$

The kite's is 134.1 m above the ground.

## Solving Problems Using More Than One Right Triangle

## Example \#3

(a) Two trees are 200 m apart. From a point midway between the two trees, the angles of elevation to the top of each tree are $12^{\circ}$ and $9^{\circ}$, respectively. Determine how much taller one tree is than the other?


$$
\text { Solution: } \begin{aligned}
\tan 12^{\circ} & =\frac{x}{100} & & \tan 9^{\circ}=\frac{y}{100} \\
x & =100 \tan 12^{\circ} & & y=100 \tan 9^{\circ} \\
x & =21.26 & & y=15.84
\end{aligned}
$$

Tree $1-$ Tree $2=21.26-15.84=5.4 \mathrm{~m}$

