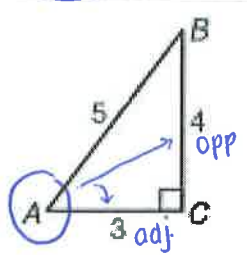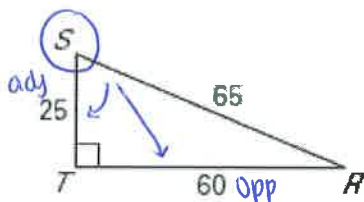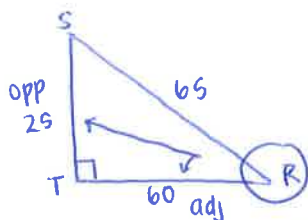| Tangent Ratio Ratio of side lengths	
Let $\triangle ABC$ be a right triangle with acute $\angle A$, then the tangent of $\angle A$ (abbreviated tanA) is defined as: across from ↑ $\tan A = \dfrac{\text{length of leg opposite } \angle A}{\text{length of leg adjacent to } \angle A}$ ↓ next to	B 5 4 opp A 3 adj C $\tan A = \dfrac{opp}{adj} = \dfrac{4}{3}$ OR $\tan A = 1.3333$

↑ "starting" angle

* opp and adj are never the hypotenuse!

Example 1 :

Find tan S and tan R. Write each answer as a fraction and as a decimal rounded to four places.

S   adj 25   65   T   60 opp   R

S   opp 25   65   T   60 adj   R

simplify
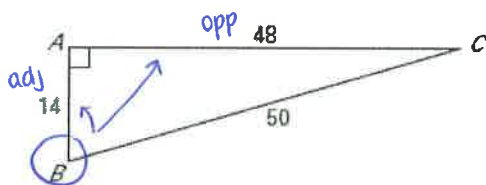
$\tan S = \dfrac{60}{25} = \dfrac{12}{5}$

$\tan S = 2.4$
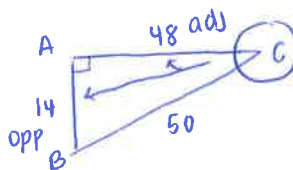
simplify

$\tan R = \dfrac{25}{60} = \dfrac{5}{12}$

$\tan R = .4167$

Example 2 :

Find tan B and tan C. Write each answer as a fraction and as a decimal rounded to four places.

A   opp 48   C <br> adj 14   50   B

A   48 adj   C
 14 opp   50   B

$\tan B = \dfrac{48}{14} = \dfrac{24}{7}$
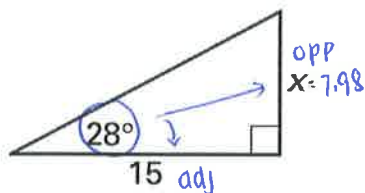
$\tan B = 3.4286$

$\tan C = \dfrac{14}{48} = \dfrac{7}{24}$

$\tan C = .2917$

When given an acute angle in a right triangle along with the length of one leg, we can use the tangent ratio to find the length of a missing leg ☺ *make sure your calculator is in DEGREE mode!*
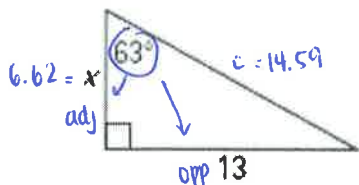
Example 3: Find a leg length
Find the value of x.

opp
$x = 7.98$

$28°$

15 adj

angle measure

$\tan 28° = \dfrac{x}{15}$ ← cross mult. to solve

$x = 15 \cdot \tan 28°$

$\boxed{x = 7.98}$

Example 4 : Find the perimeter and area
Find the perimeter and area of the triangle. Round to the nearest tenth.

$63°$

$6.62 = x$
adj

$c = 14.59$

opp 13

$\tan 63 = \dfrac{13}{x}$

$\dfrac{13 = x \cdot \tan 63}{\tan 63 \quad \tan 63}$

$x = \dfrac{13}{\tan 63} \approx 6.62$

To find hypotenuse, use Pythag. Thm :

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

$(6.62)^2 + (13)^2 = c^2$

$212.82 = c^2$

$c = \sqrt{212.82}$

$c \approx 14.59$

$\boxed{P = 6.62 + 13 + 14.59 = 34.21 \text{ units}}$

$\boxed{A = \dfrac{1}{2}(13)(6.62) = 43.03 \text{ units}^2}$

Example 5 : Estimate height using tangent
Find the height h of the lighthouse to the (nearest foot.)

$\tan 62 = \dfrac{h}{100}$

$h = 100 \cdot \tan 62$

$h = 188.01 \approx \boxed{188 \text{ feet tall}}$

h

opp

$62°$

100 ft adj