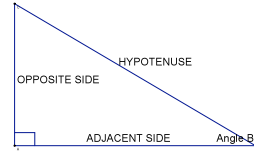


T3.2 - Review of Right Triangle Trigonometry, Sine Law and Cosine Law

IB Math SL1 – Santowski

1

(A) Review of Right Triangles



- In a right triangle, the primary trigonometric ratios (which relate pairs of sides in a ratio to a given reference angle) are as follows:
 - sine A = opposite side/hypotenuse side
 - cosine A = adjacent side/hypotenuse side
 - tangent A = opposite/adjacent side side
- recall SOHCAHTOA as a way of remembering the trig. ratio and its corresponding sides

2

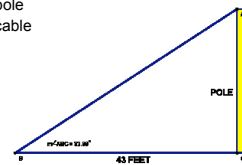
(B) Examples – Right Triangle Trigonometry

- Using the right triangle trig ratios, we can solve for unknown sides and angles:
 - ex 1. Find a in $\triangle ABC$ if $b = 2.8$, $C = 90^\circ$, and $A = 35^\circ$
 - ex 2. Find A in $\triangle ABC$ if $b = 4.5$ and $a = 3.5$ and $B = 90^\circ$
 - ex 3. Solve $\triangle ABC$ if $b = 4$, $a = 1.5$ and $B = 90^\circ$

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(B) Examples – Right Triangle Trigonometry

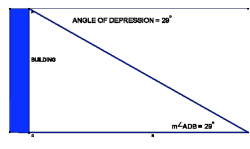
- A support cable runs from the top of the telephone pole to a point on the ground 43 feet from its base. If the cable makes an angle of 32.98° with the ground, find (rounding to the nearest tenth of a foot):
 - a. the height of the pole
 - b. the length of the cable



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(B) Examples – Right Triangle Trigonometry

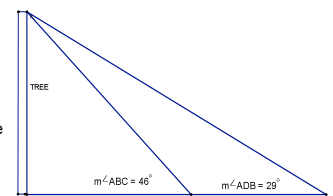
- Mr Santowski stands on the top of his apartment building (as part of his super-hero duties, you know) and views a villain at a 29° angle of depression. If the building I stand upon is 200 m tall, how far is the villain from the foot of the building?



5

(B) Examples – Right Triangle Trigonometry

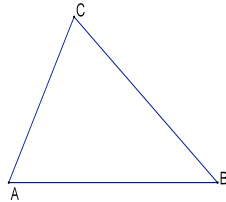
- You are hiking along a river and see a tall tree on the opposite bank. You measure the angle of elevation of the top of the tree and find it to be 46.0° . You then walk 50 feet directly away from the tree and measure the angle of elevation. If the second measurement is 29° , how tall is the tree? Round your answer to the nearest foot.



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(C) Review of the Sine Law

- If we have a non right triangle, we cannot use the primary trig ratios, so we must explore new trigonometric relationships.



- One such relationship is called the Sine Law which states the following:

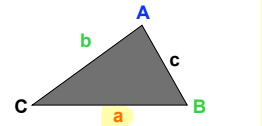
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad \text{OR} \quad \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

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Law of Sines: Solve for Sides

Have: two angles, one side opposite one of the given angles

Solve for: **missing side** opposite the other given angle



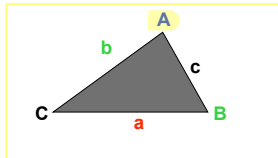
Missing Side

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

Law of Sines: Solve for Angles

Have: two sides and one of the opposite angles

Solve for: **missing angle** opposite the other given angle



Missing Angle

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

(D) Examples Sine Law

- We can use these new trigonometric relationships in solving for unknown sides and angles in acute triangles:

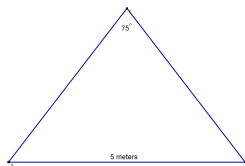
- ex 4. Find A in ABC if $a = 10.4$, $c = 12.8$ and $C = 75^\circ$
- ex 5. Find a in ABC if $A = 84^\circ$, $B = 36^\circ$, and $b = 3.9$
- ex 6. Solve EFG if $E = 82^\circ$, $e = 11.8$, and $F = 25^\circ$

- There is one limitation on the Sine Law, in that it can only be applied if a side and its opposite angle is known. If not, the Sine Law cannot be used.

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(D) Examples Sine Law

- Mark is a landscaper who is creating a triangular planting garden. The homeowner wants the garden to have two equal sides and contain an angle of 75° . Also, the longest side of the garden must be exactly 5 m.



- (a) How long is the plastic edging that Mark needs to surround the garden?
- (b) Determine the area of the garden.

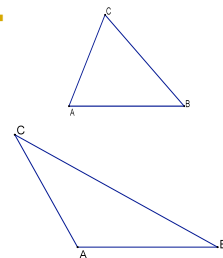
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(E) Cosine Law

- The Cosine Law is stated the following:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

- We can use the Cosine Law to work in triangles in which the Sine Law does not work - triangles in which we know all three sides and one in which we know two sides plus the contained angle.

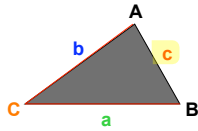


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Law of Cosines: Solve for Side

Have: two sides,
included angle

Solve for: missing side



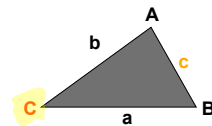
$$c^2 = a^2 + b^2 - 2ab \cos C$$

(missing side)² = (one side)² + (other side)² - 2(one side)(other side) cos(included angle)

Law of Cosines: Solve for Missing Angle

Have: three sides

Solve for: missing angle



$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Missing Angle Side Opposite Missing Angle

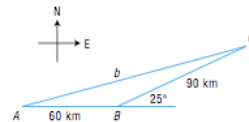
(F) Examples Cosine Law

- We can use these new trigonometric relationships in solving for unknown sides and angles in acute triangles:
- ex 7. Find c in CDE if $C = 56^\circ$, $d = 4.7$ and $e = 8.5$
- ex 8. Find G in GHJ if $h = 5.9$, $g = 9.2$ and $j = 8.1$
- ex 9. Solve $\triangle CDE$ if $D = 49^\circ$, $e = 3.7$ and $c = 5.1$

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(F) Examples Cosine Law

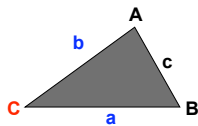
- A boat travels 60 km due east. It then adjusts its course by 25° northward and travels another 90 km in this new direction. How far is the boat from its initial position to the nearest kilometre?



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Area Formula:

Have:
two sides, included angle



$$K = \frac{1}{2} ab \sin C$$

two sides included angle

(G) Links

- For help with right triangle trig: <http://id.mind.net/~zona/mmts/trigonometryRealms/introduction/rightTriangle/trigRightTriangle.html>
- For help with the Sine Law
<http://www.themathpage.com/aTrig/law-of-sines.htm>
- For help with the Cosine Law
<http://www.themathpage.com/aTrig/law-of-cosines.htm>

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(H) Homework

■ **10CDEF - Right Angled Trig Review**

- HW
- Ex 10C #1be, 2, 5, 6;
- Ex 10D #1ae, 3c, 4b, 5b, 6a, 7ac, 11,12;
- Ex 10E #2, 6, 8;
- Ex 10F #1bc, 2b,3a

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(H) Homework

■ **12AC - Area, Cosine Rule** ■ **12D - Sine Law,**

- | | |
|---------------------------|----------------------|
| ■ HW | ■ HW |
| ■ Ex 12A #1ac, 2, 3; | ■ Ex 12D.1 #1ac, 2c; |
| ■ Ex 12C #1a, 2, 4; | ■ Ex 12D.2 #1, 2; |
| ■ Ex 12E #1, 3, 8, 10, 11 | ■ Ex 12E #7; |
| | ■ IB Packet #1 - 5 |

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